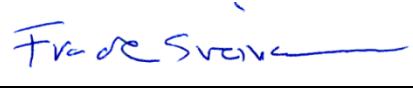




REP025649B

Test Report

Product	Reader and Communication Controller
Name and address of the applicant	ASSA ABLOY Global Solutions Norway AS P.O. Box 340, Anolitveien 1-3, N-1402 SKI - Norway
Name and address of the manufacturer	ASSA ABLOY Global Solutions Norway AS P.O. Box 340, Anolitveien 1-3, N-1402 SKI - Norway
Model	RCC 6470
Rating	Bluetooth low energy 2402 – 2480 MHz, Internal batteries (3x1.5V DC)
Trademark	vingcard ASSA ABLOY
Additional information	-
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Industry Canada RSS-247, Issue 3 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	PRJ0051915
Tested in period	2024-09-01 – 2024-09-10
Issue date	2025-03-06
Name and address of the testing laboratory	 Nemko Scandinavia AS Instituttveien 6 2007 Kjeller, Norway www.nemko.com
	 CAB Number: FCC: NO0001 ISED: NO0470 ISED No: 2040D-1
	 NORWEGIAN ACCREDITATION TEST 033
	<i>An accredited technical test executed under the Norwegian accreditation scheme</i>
	 Prepared by [Jan G Eriksen]
	 Approved by [Frode Sveinsen]
This report was originally distributed electronically with digital signatures. For more information, please contact Nemko Scandinavia AS.	

Template version: C

Revision history

Revision	Date	Comment	Sign
A	2024-10-29	First edition	JGER
B	2025-02-05	Corrections in table of used instruments	JGER
C	2025-03-06	Corrections in table of used instruments	JGER

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to ensure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is solely responsible for any modifications to the product that could result in non-compliance with the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither are opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence, that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in a separate clause in this report.

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1 INFORMATION

1.1 Test Item

Name	Reader and Communication Controller
Model/version	RCC 6470
FCC ID	Y7V-RCC6470C1
ISED ID	9514A-RCC6470C1
Serial number	Radiated tests: 2423 HAN 00061 Conducted tests: 2423 HAN 00045 / 101
Hardware identity and/or version	RCC6470C1
Software identity and/or version	Ver.1.4
Frequency Range	2402 – 2480 MHz
Number of Channels	40
Operating Modes	Bluetooth Low Energy <input checked="" type="checkbox"/> 1Mb <input type="checkbox"/> 2Mb
Type of Modulation	GFSK
Conducted Output Power	4.2 mW
Antenna Connector	None
Number of Antennas	1
Diversity or Smart Antennas	No
Power Supply	Battery 4.5 V during radiated tests. Regulated power supply 4.5 V DC during conducted tests.
Desktop Charger	NA

Description of Test Item

The tested device is a wireless module for transmission in the 2.4 GHz frequency band.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	4.5 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)?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
If detachable, is the antenna connector(s) non-standard?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
The tested equipment has only integral antennas. Conducted tests were performed with a temporary antenna connector.		

Requirement: FCC 15.203, 15.204

1.5 EUT Operating Modes

Description of operating modes	Radiated Emissions and Conducted measurements were performed with the EUT set to transmit at three channels (2402, 2440, and 2480 MHz) with a rated output power of +8 dBm. Conducted mains measurements were performed with the EUT set to transmit at 2440 MHz with a rated output power of +8 dBm.
Additional information	/

1.6 Comments

Conducted measurements were done with the EUT powered by regulated power supply at 4.5 V DC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

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



2 TEST REPORT SUMMARY

2.1 General

The tests were conducted on a sample of the equipment for demonstrating compliance with one or more of the following standards.

Standard	Description
FCC CFR 47 Part 15.247	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz
ISED RSS-247, Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ISED RSS-GEN Issue 5	General Requirements for Compliance of Radio Apparatus

The following standards and documents were used for one or more measurements:

Standard	Description
ANSI C63.4-2014	Unintentional Radiators
ANSI C63.10-2013	Intentional Radiators
FCC KDB 558074 D01	15.247 Measurement Guidance for DTS and Frequency Hopping Systems
FCC KDB 412172 D01	Determining ERP and EIRP

All measurements are traceable to national standards.

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

<input checked="" type="checkbox"/> New Submission	<input checked="" type="checkbox"/> Production Unit
<input type="checkbox"/> Class II Permissive Change	<input type="checkbox"/> Pre-production Unit
DTS Equipment Class	<input type="checkbox"/> Family Listing

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 3, 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	N/A
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	Pass
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)	Pass
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	6.7 11.11 (DTS)	Pass
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	3.3 (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 Occupied Bandwidth (99% BW)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2

Test Results: Complies

Measurement Data:

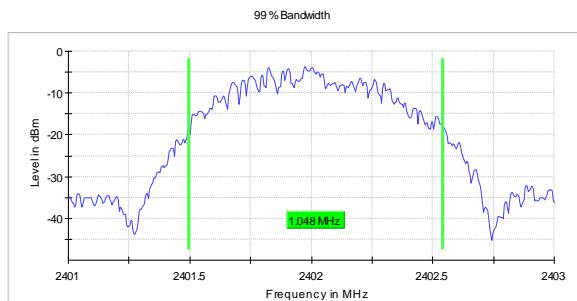
Carrier Frequency, Data Rate	Occupied Bandwidth (99% BW)
2402 MHz, 1Mb	1048 kHz
2440 MHz, 1Mb	1048 kHz
2480 MHz, 1Mb	1048 kHz

Occupied Bandwidth is the same for all channels

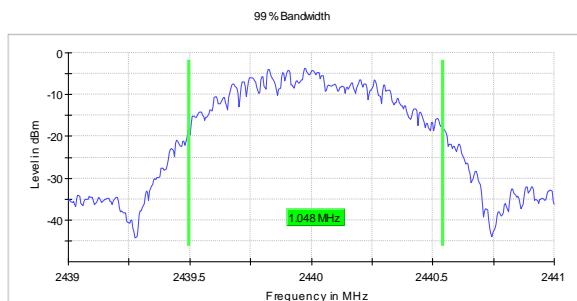
See attached plots

Requirements:

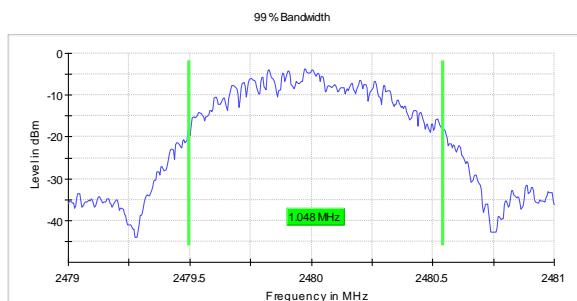
No requirement for 99% BW, reported for information only.



2402 MHz: 99% Occupied BW, 1Mb



2440 MHz: 99% Occupied BW, 1Mb



2480 MHz: 99% Occupied BW, 1Mb

3.2 DTS Bandwidth

FCC Part 15.247 (a)(2)

ISED Canada RSS-247 Issue 3, Clause 5.2 (a)

Measurement procedure: ANSI C63.10-2013 Clause 11.8

Test Results: Complies

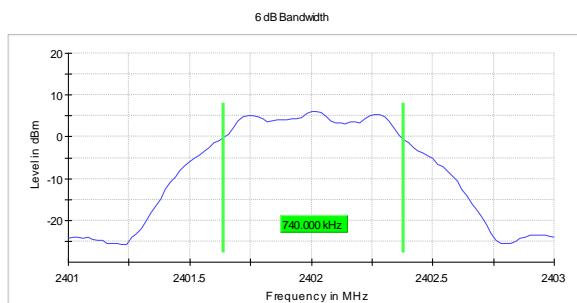
Measurement Data:

Modulation type and bitrate	Measured DTS Bandwidth (kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1 Mbps	740	740	740

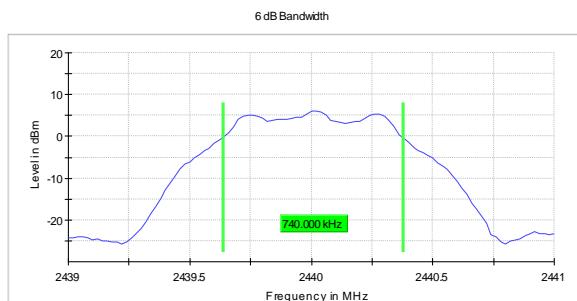
Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

Frequency Band	Requirement for systems using Digital Modulation
902-928 MHz	
2400-2483.5 MHz	The minimum 6 dB bandwidth shall be at least 500 kHz.
5725-5850 MHz	

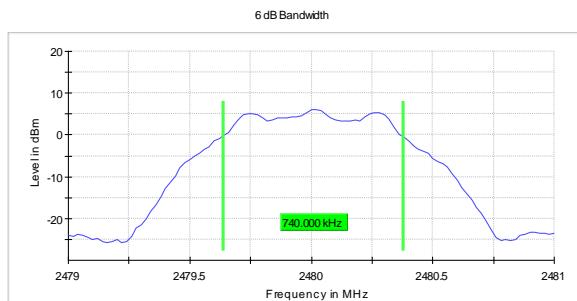
No requirements for Frequency Hopping Systems.



2402 MHz: DTS BW, 1M



2440 MHz: DTS BW, 1M



2480 MHz: DTS BW, 1M

3.3 Peak Power Output

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 3, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Carrier Frequency	Peak Conducted Power	Peak Field Strength @ 3m	Peak EIRP	Antenna gain
	dBm	dBuV/m	dBm	dB
2402 MHz	6.1	98.8	3.6	-2.5
2440 MHz	6.2	96.0	0.8	-5.4
2480 MHz	6.1	95.1	-0.1	-6.2

Output Power reported is Maximum Peak Power. The measurement is performed with the power meter function of the TS8996 test system.

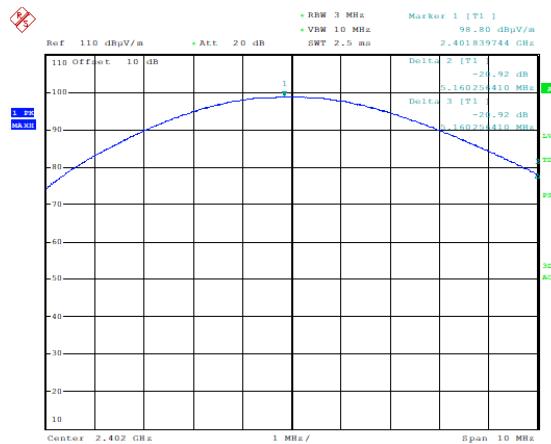
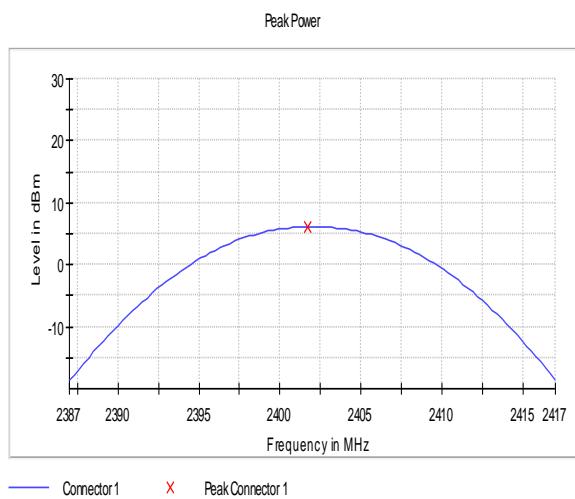
The Integrated Band Power Method was used to measure Output Power

Radiated Power was calculated from measured Field Strength (measured at 3 meters distance) using the method described in ANSI C63.10, Clause 9.5.

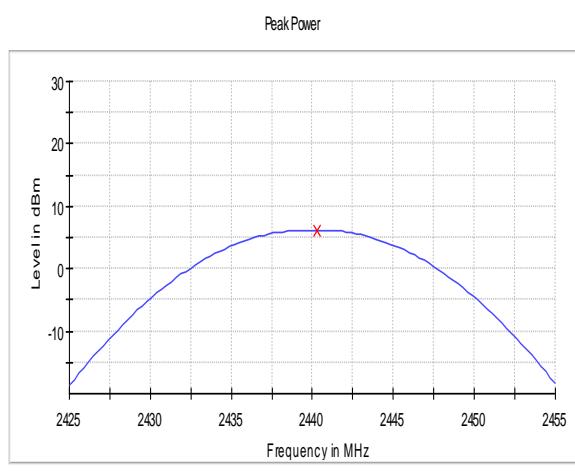
Antenna Gain is less than 6 dBi.

See attached plots.

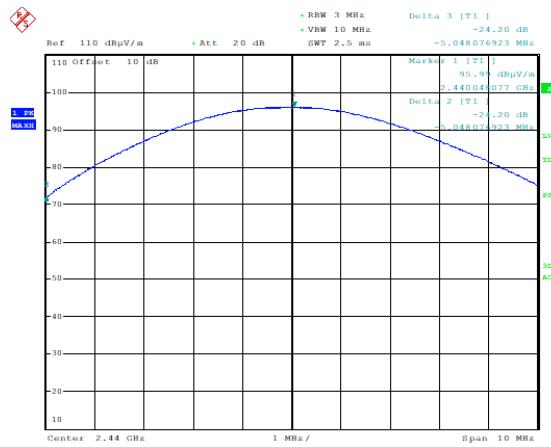
Requirements for Digital Modulation systems
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Maximum 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 <i>maximum conducted output power</i> 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.



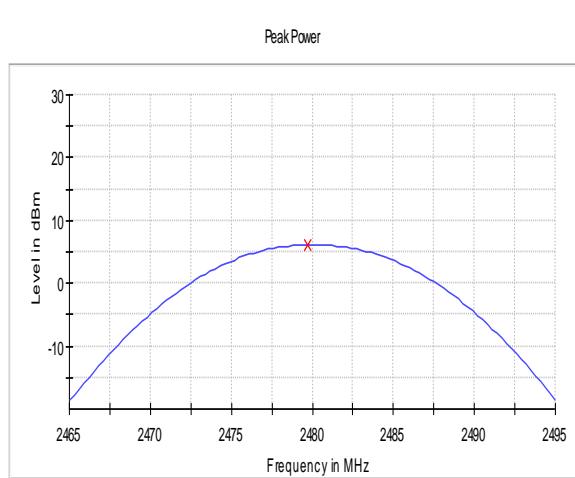
Peak Power, 2402 MHz, 1Mb



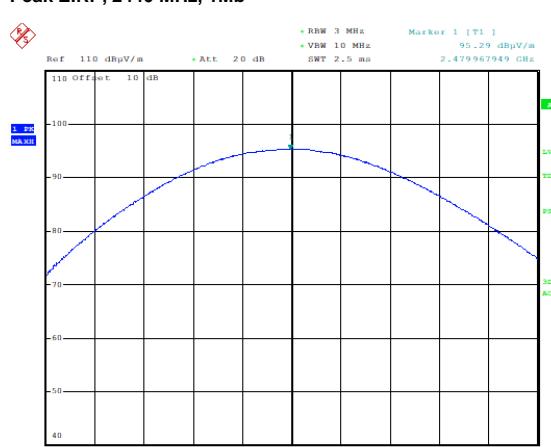
Peak EIRP, 2402 MHz, 1Mb



Peak Power, 2440 MHz, 1Mb



Peak EIRP, 2440 MHz, 1Mb



Peak Power, 2480 MHz, 1Mb

Peak EIRP, 2480 MHz, 1Mb



3.4 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

ISED Canada RSS-247 Issue 3, Clause 5.5

Measurement procedure: ANSI C63.10-2013 Clause 11.11

Test Results: Complies

Measurement Data:

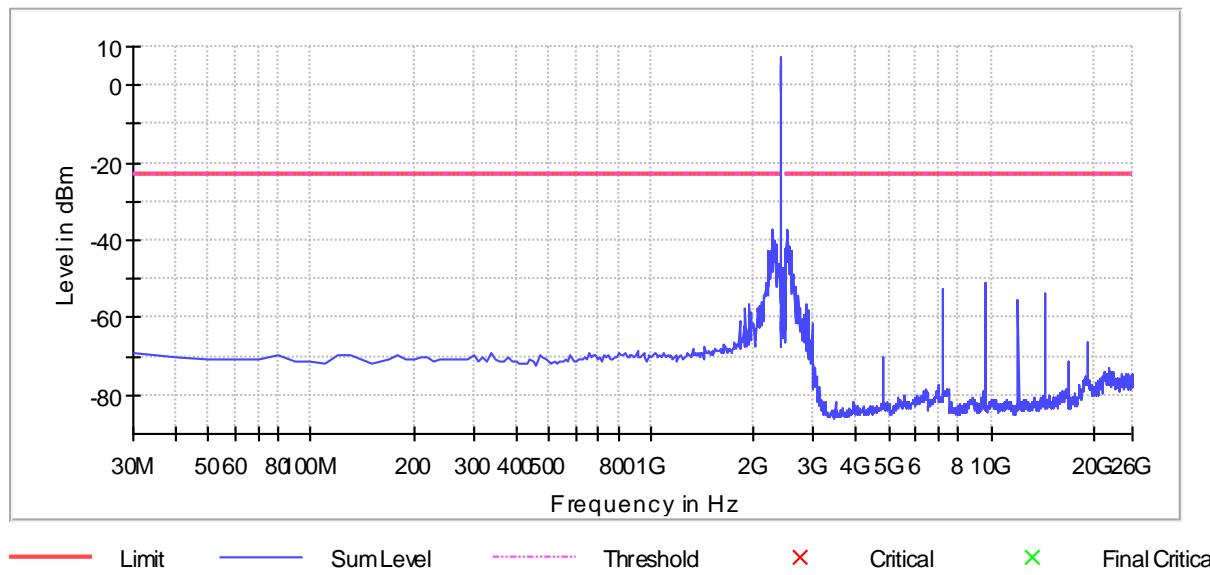
Carrier Frequency	Measured Peak TX level (dBm)	Highest Value (dBc)	Margin (dB)	Verdict
2402 MHz	7.2	44.5	14.6	Pass
2440 MHz	6.9	43.9	13.9	Pass
2480 MHz	6.4	43.4	13.4	Pass

Measured with Peak Detector and spectrum analyzer.

RF conducted power to 25 GHz: see attached plots.

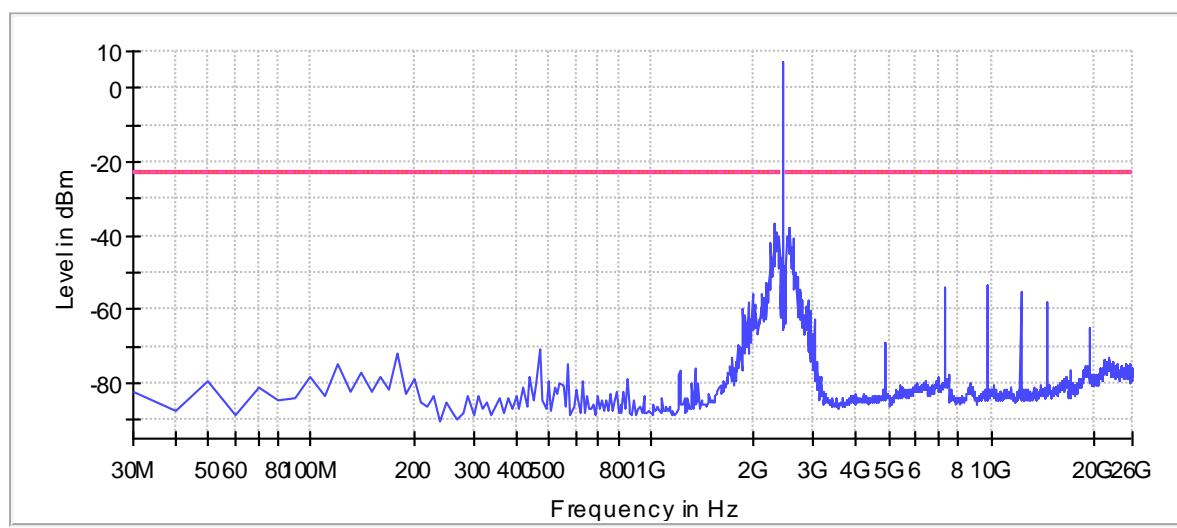
Requirements for all systems	
Peak measurement	RMS averaging (alternative measurement)
20 dB or more below carrier measured in 100 kHz bandwidth	30 dB or more below carrier measured in 100 kHz bandwidth
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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.	

Spurious



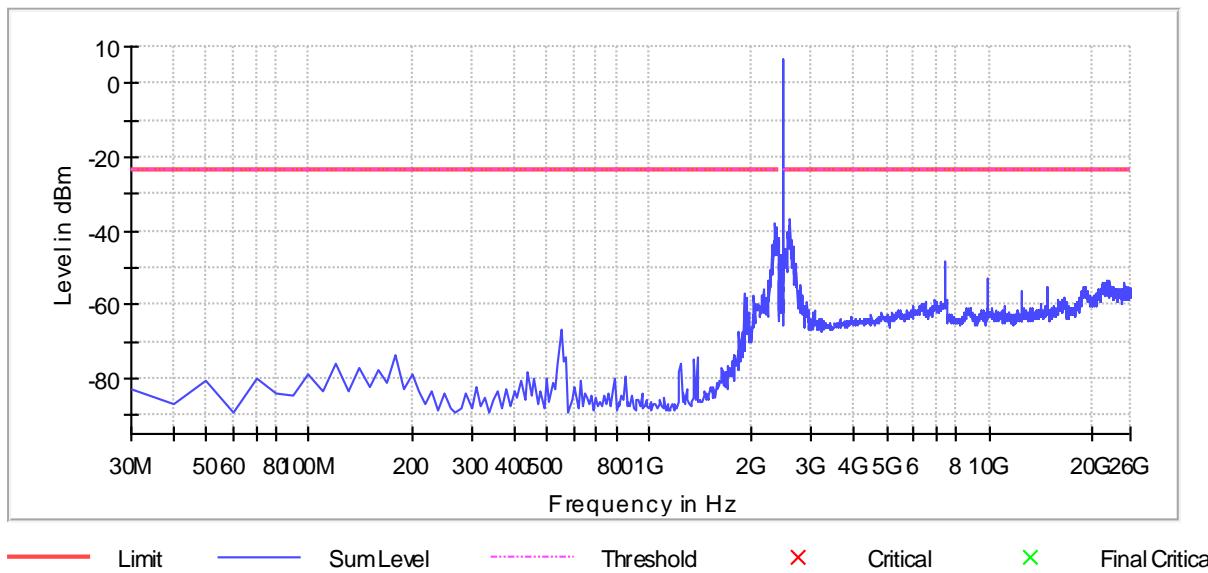
Conducted Emissions 30-26000 MHz, 2405 MHz, 1Mb

Spurious



Conducted Emissions 30-26000 MHz, 2440 MHz, 1Mb

Spurious



Conducted Emissions 30-26000 MHz, 2480 MHz, 1Mb

3.5 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 (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.

3.6 Radiated Emissions, Band Edge

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:

Peak Detector		Measured field strength (dB μ V/m)		Limit	Margin
Modulation and Bitrate			dB	dB	
	2390 MHz	2483.5 MHz			
GFSK, 1Mb	57.2	58.9	74	16.8	15.1

Average Detector		Measured field strength (dB μ V/m) total Duty Cycle taken included		Limit	Margin
Modulation and Bitrate			dB	dB	
	2390 MHz	2483.5 MHz			
GFSK, 1Mb	27.9	31.7	54	26.1	22.3

Average values were measured using trace averaging as described in ANSI C63.10-2013 clause 11.12.2.5.1 (Duty Cycle \approx 62.5%) – see duty cycle plots below.

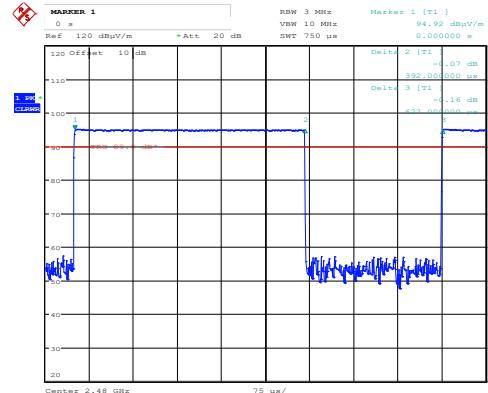
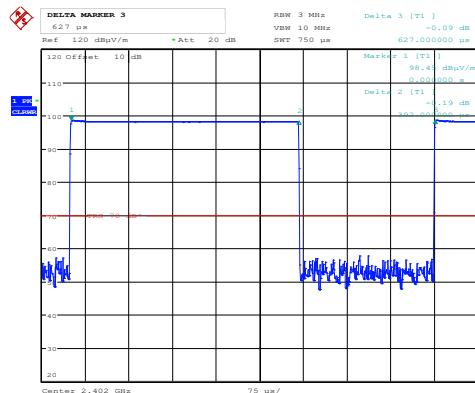
See attached plots on next page.

Calculated Average values:

Lower Band Edge: $45.9 - 18 = 27.9$

Higher Band Edge: $49.7 - 18 = 31.7$

Duty Cycle measurements:



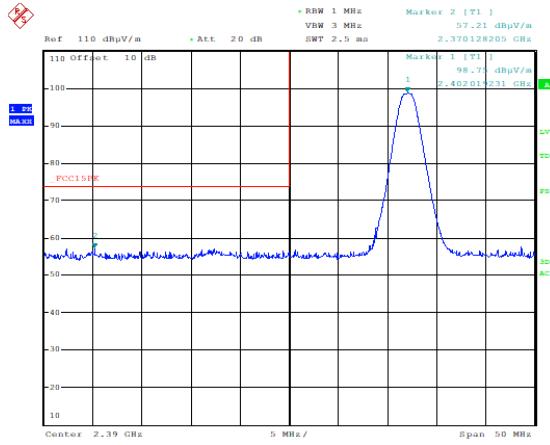
Date: 28.AUG.2024 07:21:13

Date: 28.AUG.2024 07:01:34

Duty cycle: Pulse period = 627μs. Pulse length = 392 μs. DC= 62.5% → DC correction factor = 2.0 dB which should be added to the average measurement values in plots below.

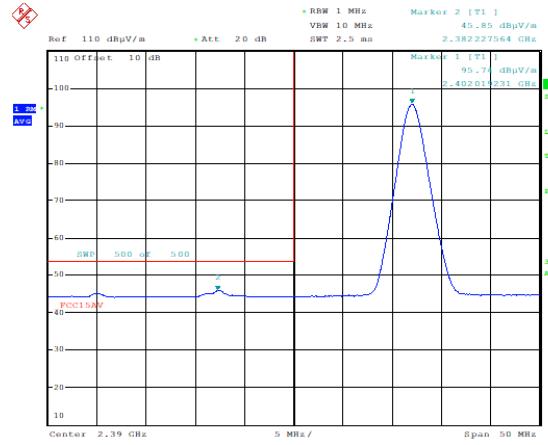
Also, according to the manufacturer the device will have a maximum CSMA/CA transmission period of 2.368 ms, and a Data Frame transmission of 4.256 ms – giving a maximum transmission time of 6.624 ms per 100 ms. This gives an additional Duty Cycle correction factor of 20 dB which is used to obtain the average Band Edge levels.

The total Duty Cycle correction factor is thus 18 dB which is used to calculate average detector values above.



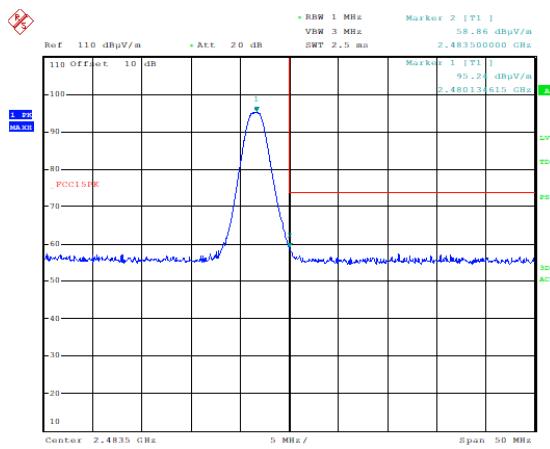
Date: 28.AUG.2024 07:17:20

Lower Band Edge, 2402 MHz, 1Mb, Peak



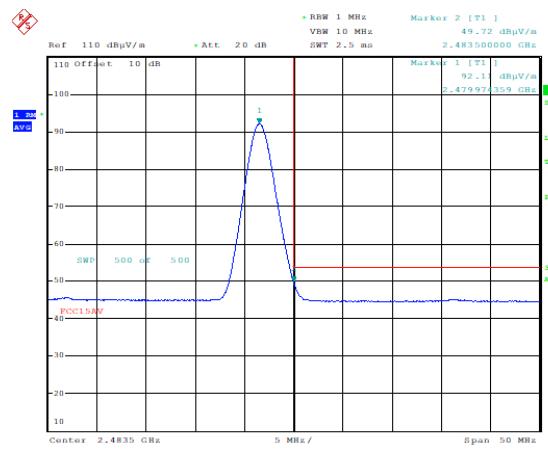
Date: 28.AUG.2024 07:18:27

Lower Band Edge, 2402 MHz, 1Mb, Average



Date: 28.AUG.2024 06:56:35

Upper Band Edge, 2480 MHz, 1Mb, Peak



Date: 28.AUG.2024 06:57:56

Upper Band Edge, 2480 MHz, 1Mb, Average



3.7 Radiated Emissions, 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: Quasi-Peak

Measuring distance 3m

Tested in test mode with EUT transmitting on ch19

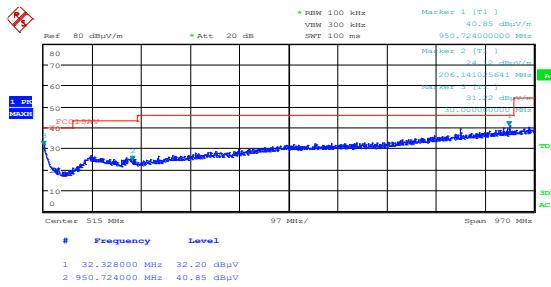
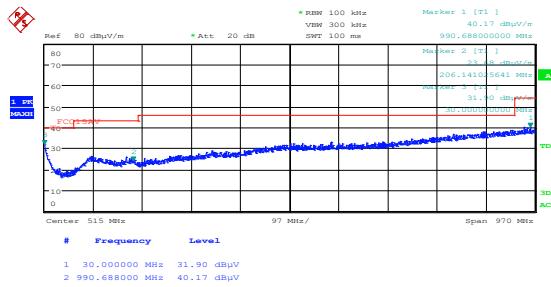
Measured Frequency (MHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
30 – 88	2402/2440/2480	GFSK	<35.0 *)	40.0	8.0
88 – 216	2402/2440/2480	GFSK	< 30.0 *)	43.5	18.9
216 – 960	2402/2440/2480	GFSK	< 40.0 *)	46.0	5.1
960 – 1000	2402/2440/2480	GFSK	< 45.0 *)	54.0	13.8

*) There is no functionality in the measurement software to find maximum levels with markers within specific frequency bands. Thus, it is slightly difficult to find the exact maximum spurious levels within the frequency bands in the table above and less than levels are indicated.

See attached plots

Requirements/Limit

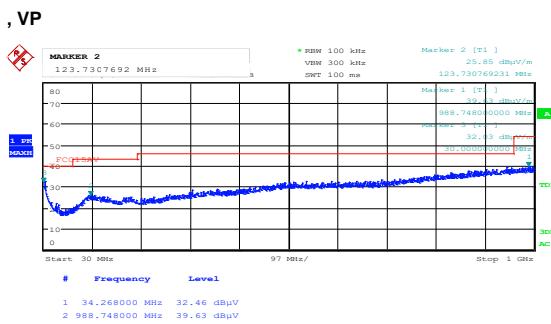
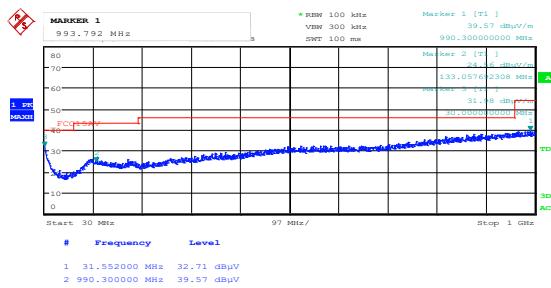
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 μ V/m	40.0 dB μ V/m
88 – 216 MHz	150 μ V/m	43.5 dB μ V/m
216 – 960 MHz	200 μ V/m	46.0 dB μ V/m
960 – 1000 MHz	500 μ V/m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



Date: 27.AUG.2024 08:38:29

Date: 27.AUG.2024 08:36:32

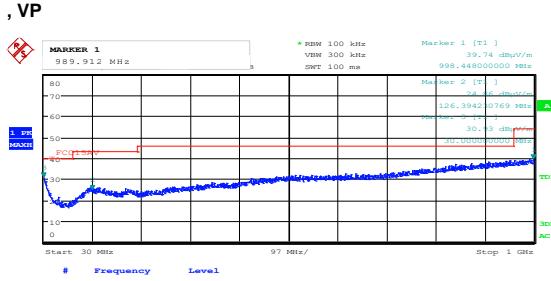
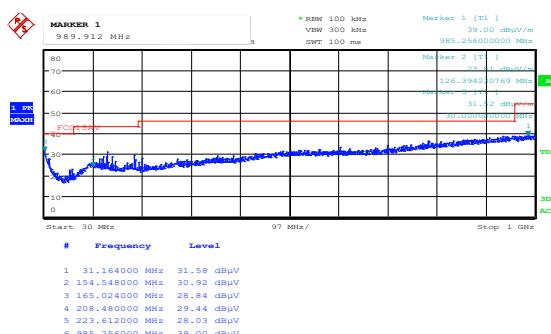
Radiated Emissions 30 - 1000 MHz, 2402 MHz, 1Mb, HP



Date: 27.AUG.2024 08:46:04

Date: 27.AUG.2024 08:44:07

Radiated Emissions 30 - 1000 MHz, 2440 MHz, 1Mb, HP



Date: 27.AUG.2024 09:00:44

Date: 27.AUG.2024 08:58:46

Radiated Emissions 30 - 1000 MHz, 2480 MHz, 1Mb, HP

, VP

3.8 Radiated Emissions, 1 – 26 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 – 18 GHz)

A pre-scan was performed above 18 GHz and no spurious emissions were detected.

RBW=1 MHz

Carrier Frequency (MHz)	Measured Frequency (GHz)	Mode	Measured Emissions (dB μ V/m)		Limit (dB μ V/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
2402	2 nd Harm	TX BLE1M	53.3	/	74	54	20.7	/
2402	3 rd Harm	TX BLE1M	62.8	42.8 *)	74	54	11.2	11.2
2440	2 nd Harm	TX BLE1M	53.0	/	74	54	21.0	/
2440	3 rd Harm	TX BLE1M	60.8	40.8 *)	74	54	13.2	13.2
2480	2 nd Harm	TX BLE1M	52.3	/	74	54	21.7	/
2480	3 rd Harm	TX BLE1M	62.8	42.8 *)	74	54	11.2	11.2

According to the manufacturer the device will have a maximum CSMA/CA transmission period of 2.368 ms, and a Data Frame transmission of 4.256 ms – giving a maximum transmission time of 6.624 ms per 100 ms. This gives a maximum Duty Cycle correction factor of 20 dB.

*) Average level not measured - the average level is calculated using the measured Peak level and reducing the value by Duty Cycle correction factor.

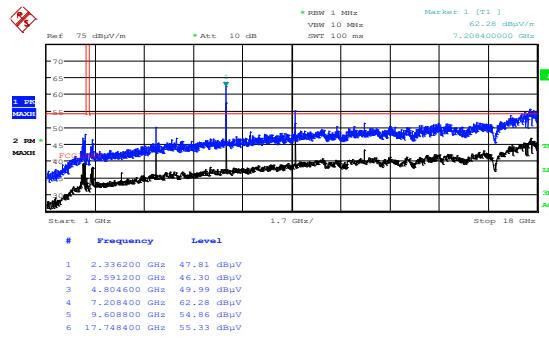
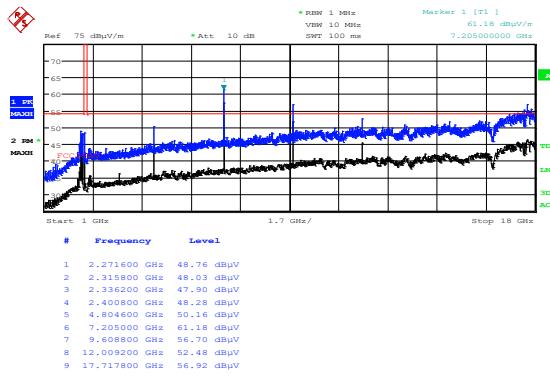
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

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

See plots.

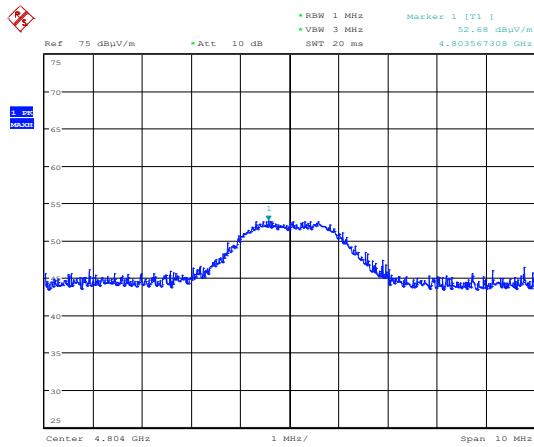
Requirements/Limit

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 dB μ V/m	74.0 dB μ V/m	



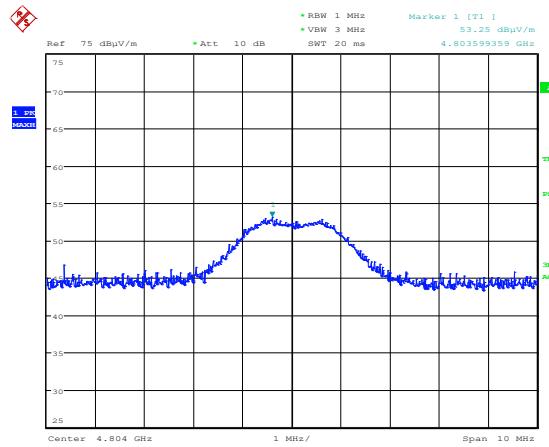
Date: 28.AUG.2024 09:30:49

Radiated Emissions 1 - 18 GHz, 2402 MHz, 1M, HP



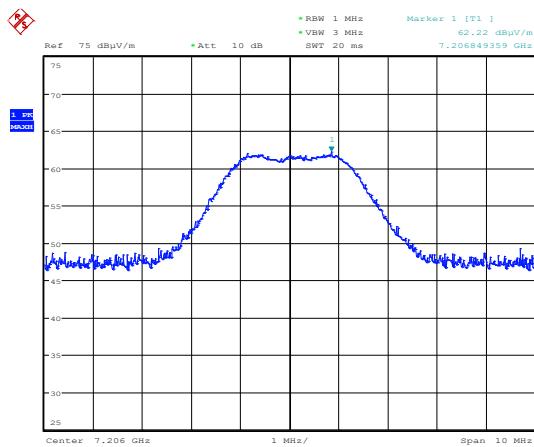
Date: 28.AUG.2024 09:28:52

, VP



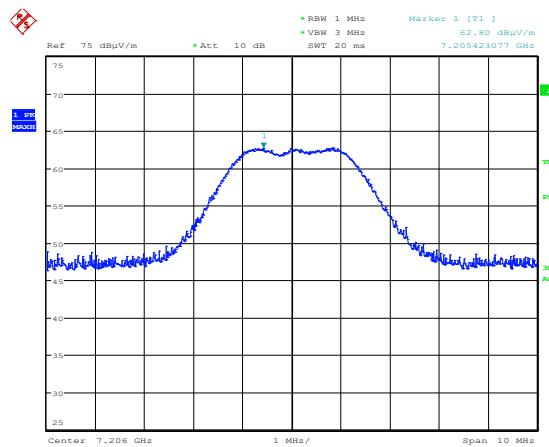
Date: 28.AUG.2024 10:00:31

Radiated Emissions 4804 MHz, 2402 MHz, 1M, HP



Date: 28.AUG.2024 09:58:38

, VP

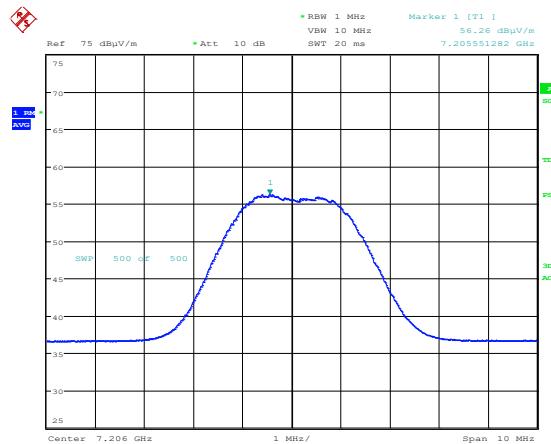


Date: 28.AUG.2024 09:46:13

Radiated Emissions 7206 MHz, 2402 MHz, 1M, HP

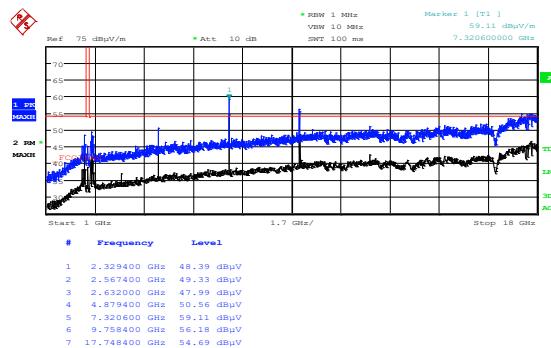
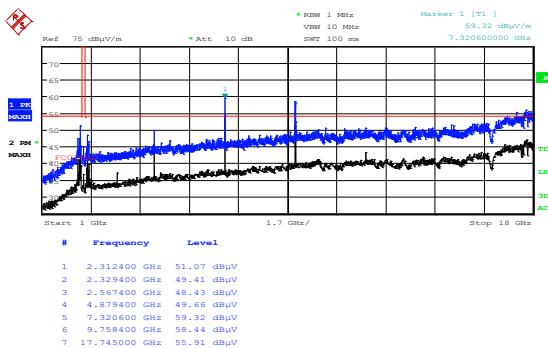
Date: 28.AUG.2024 09:47:40

, VP



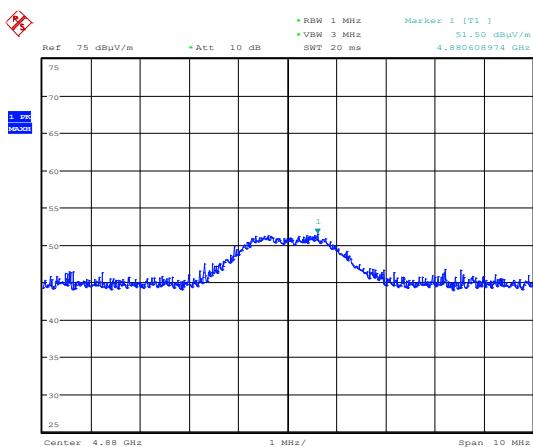
Date: 28.AUG.2024 09:48:29

Radiated Emissions 7206 MHz, 2402 MHz, 1M, VP - AVG Det.



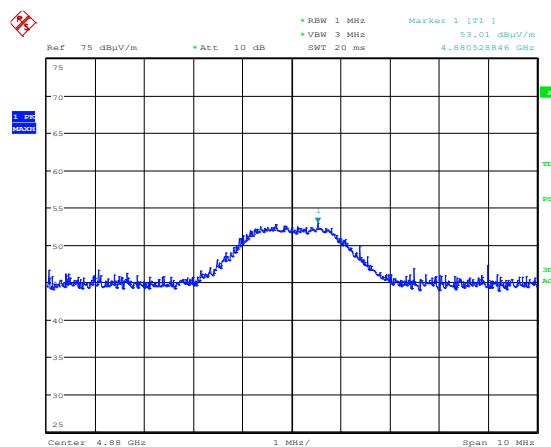
Date: 28.AUG.2024 07:55:55

Radiated Emissions 1 - 18 GHz, 2440 MHz, 1M, HP



Date: 28.AUG.2024 07:53:58

, VP

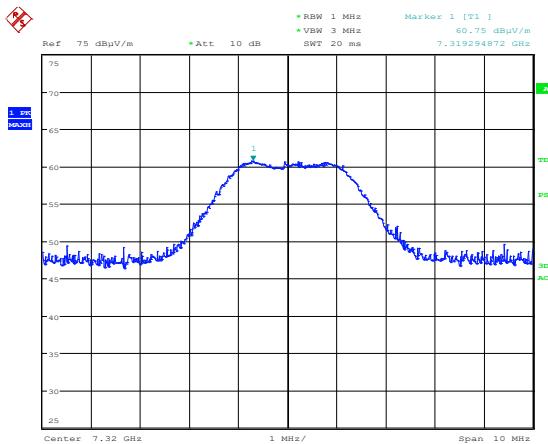


Date: 28.AUG.2024 08:32:01

Date: 28.AUG.2024 08:30:12

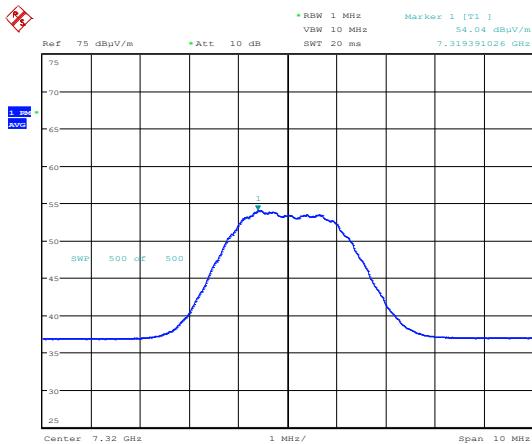
Radiated Emissions 4880 MHz, 2440 MHz, 1M, HP

, VP



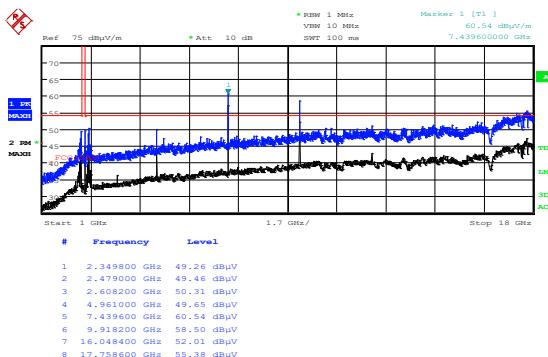
Date: 28.AUG.2024 08:10:00

Radiated Emissions 7320 MHz, 2440 MHz, 1M, HP



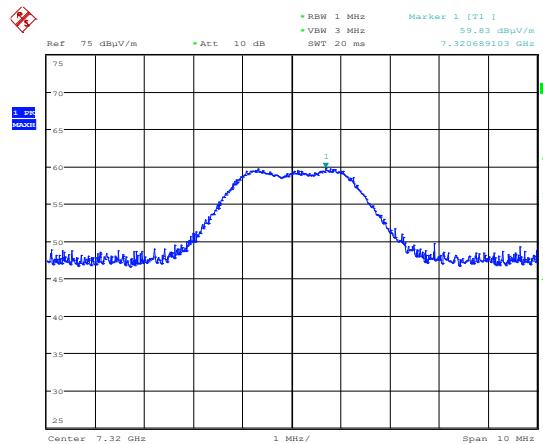
Date: 28.AUG.2024 08:16:10

Radiated Emissions 7320 MHz, 2440 MHz, 1M, HP – AVG Det



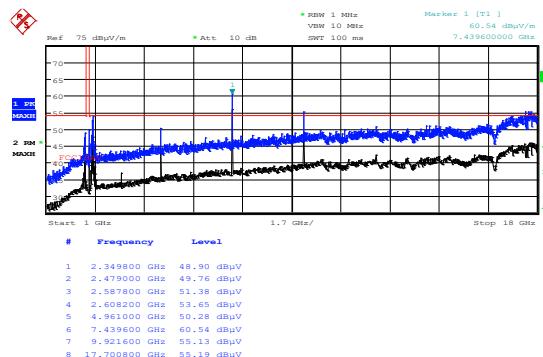
Date: 28.AUG.2024 08:53:24

Radiated Emissions 1 - 18 GHz, 2480 MHz, 1M, HP



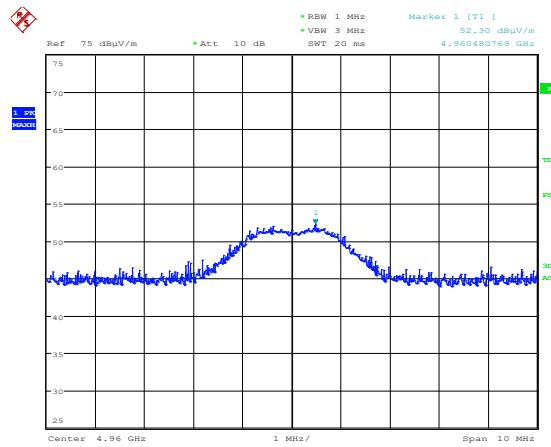
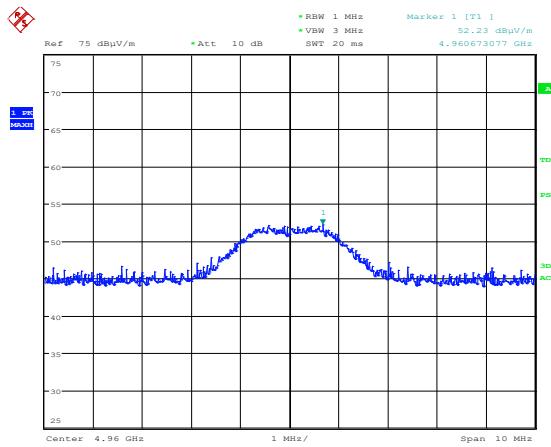
Date: 28.AUG.2024 08:08:10

, VP



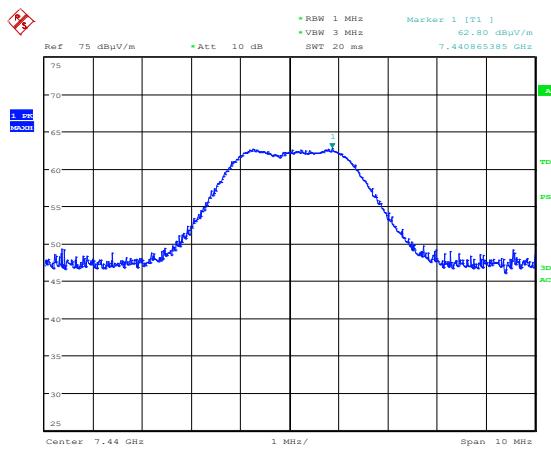
Date: 28.AUG.2024 08:51:27

, VP



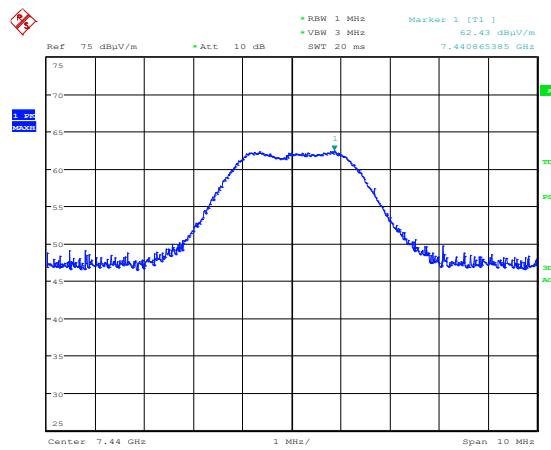
Date: 28.AUG.2024 09:17:29

Radiated Emissions 4960 MHz, 2480 MHz, 1M, HP



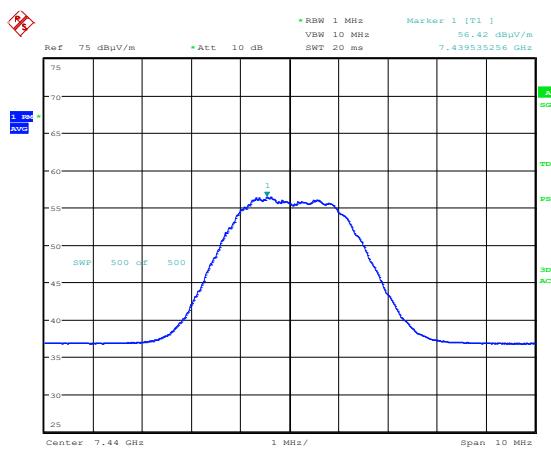
Date: 28.AUG.2024 09:19:00

, VP



Date: 28.AUG.2024 09:02:50

Radiated Emissions 7440 MHz, 2480 MHz, 1M, HP

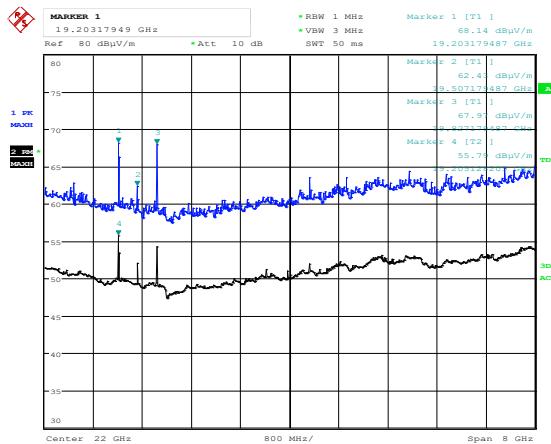


Date: 28.AUG.2024 09:04:34

, VP

Date: 28.AUG.2024 09:05:53

Radiated Emissions 7440 MHz, 2480 MHz, 1M, HP – AVG det.



This prescan was performed with the measurement antenna 5-10 cms above the module. Using 10 cms as distance the measured values should be decreased by 29.5 dB.

Thus, it is clear that both the peak and average measurement values are below the limits of 74 and 54 dB μ V/m respectively – even if average levels are increased by the 2 dB due to Duty Cycle during measurement (63.5%).

The average levels should also be decreased due to the actual transmission DC of 6.6% during 100 ms

Date: 28.AUG.2024 11:27:53



3.9 Power Spectral Density (PSD)

FCC part 15.247(d)

ISED Canada RSS-247 Issue 3, Clause 5.2 (2)

Measurement procedure: ANSI C63.10-2013 Clause 11.10

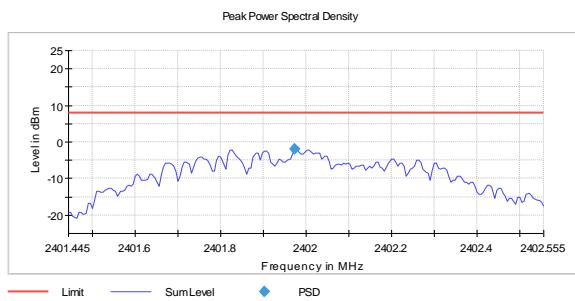
Test Results: Complies

Measurement Data:

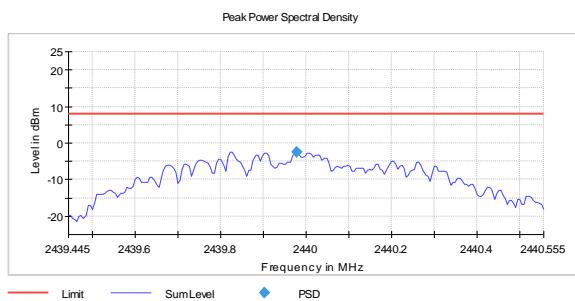
The measurement procedure PKPSD described in ANSI C63.10-2013 was used.

Modulation Type and Bitrate	Measured Power Spectral Density (dBm/3kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1Mb	-2.0	-2.4	-2.2

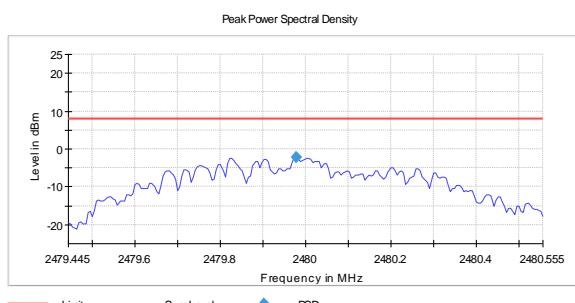
Requirement for systems using Digital Modulation
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
No requirements for Frequency Hopping Systems.



PSD, 2402 MHz, 1Mb



PSD, 2440 MHz, 1Mb



PSD, 2480 MHz, 1Mb

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 testhouse.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2024-02	2025-02
2	6810.17B	Attenuator	Suhner	LR 1669	COU	
3	JB3	Bilog Antenna	SunAR	N 4525	2023.04	2025.04
4	310	Preamplifier	Sonoma Inst.	LR 1686	2024-09	2025-09
5	NO324415	Band Reject Filter	Microwave Circuits	LR 1760	COU	
6	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2025-02	2028-05
7	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2024-06	2025-06
8	3115	Double Ridged Horn Antenna	EMCO	LR 1330	2022.11	2025.11
9	WLK5-1100-1485-7000-40SS	Low Pass Filter	Wainwright Inst.	LR 1761	COU	
10	Model 87V	Multimeter	Fluke	LR 1599	2023-04	2025-04
11	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
12	TS8997	Test System	Rohde & Schwarz	/		
12.1	FSVA3044	Spectrum analyzer	Rohde & Schwarz	LR 1808	2024.07	2026.01
12.2	OSP220	open switch and control platform	Rohde & Schwarz	LR 1806	2024.07	2026.08
12.3	OSP120	open switch and control platform	Rohde & Schwarz	LR 1793	2024.07	2026.08

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	Rohde & Schwarz	GPIBShot	2.7	Screenshots from R&S Spectrum Analyzers

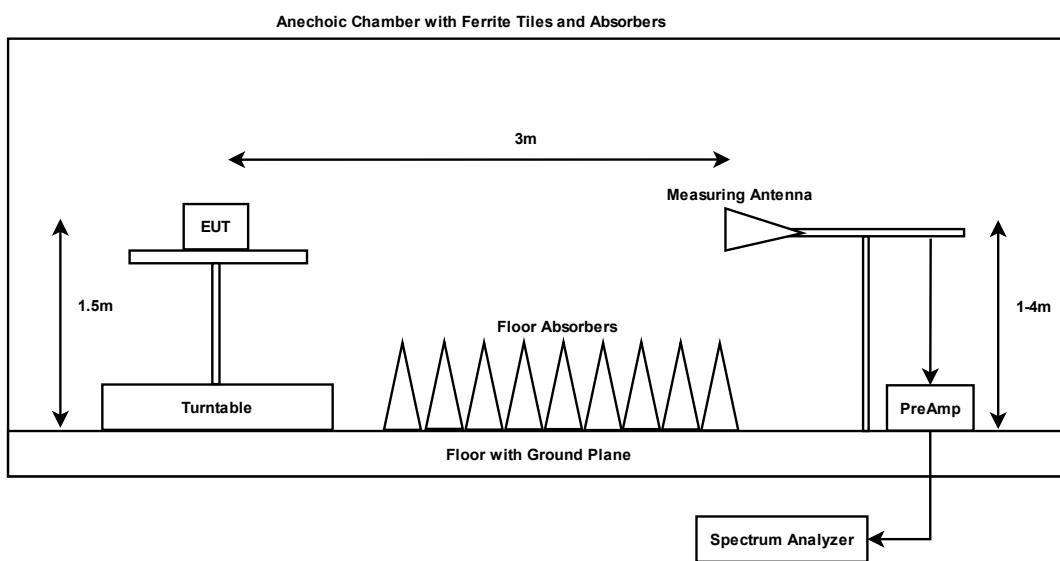
6 BLOCK DIAGRAMS OF TEST SET-UP

6.1 Conducted Tests



This test set-up is used for all Conducted tests.

6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests.

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.