

Test Report

Product	Desktop Collaboration Unit		
Name and address of the applicant	Cisco Systems Norway AS Philip Pedersens vei 1 1366 Lysaker, Norway		
Name and address of the manufacturer	Cisco Systems, Inc. 170 West Tasman Drive San Jose CA 95134, USA		
Model	07-100577		
Rating	100 – 240 V _{AC}		
Trademark	Cisco		
Serial number	FOC2528NJ5W		
Additional information	WiFi, BT Classic, BLE		
Tested according to	Parts of FCC Part 15.247 Frequency Hopping Transmitters Parts of ISED Canada RSS-247, Issue 2 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices		
Order number	437731		
Tested in period	2021-08-25 to 2021-08-27		
Issue date	2021-09-27		
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50  		
An accredited technical test executed under the Norwegian accreditation scheme			
 Prepared by [Frode Sveinsen]		 Approved by [G.Suhanthakumar]	
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1 INFORMATION

1.1 Test Item

Name	Cisco
Model Number	07-100577
FCC ID	LDK073002357
ISED ID	2461N-073002357
Serial number	FOC2528NJ5W
Hardware version	DV1
Software version	Room OS 10.6.0
Frequency Range	2402–2480 MHz, 1MHz Channel Separation
Number of Channels	79
Operating Modes	Bluetooth Classic
Type of Modulation	GFSK (1M Basic Rate) $\pi/4$ -DQPSK (2M EDR) 8-DPSK (3M EDR)
Conducted Output Power	1M BR: 9.86 mW 2M EDR: 2.32 mW 3M EDR: 2.45 mW
Antenna Connector	None
Number of Antennas	1
Diversity or Smart Antennas	No
Power Supply	Mains Powered (100-240V _{AC})

Description of Test Item

The EUT is a radio module with WiFi and BT/BLE module in a collaboration end-point system.

This Bluetooth part has been tested as a frequency hopping system and fulfils all requirements for FHSS systems.

The radio is a certified radio module. This test report only covers additional tests for use with new antennas.

Data for the original radio module				
Brand Name	FCC ID	IC ID	Original Test Report No	Radio Technology
muRata	VPYLBEE5XV1XA	772C-LBEE5XV1XA	ER-2020-90106	BT Classic
			ER-2020-90107	BT Low Energy
			ER-2020-90108	WLAN
			ER-2020-90109	UNII 2TX
			ER-2020-90110	DFS

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	120V 60Hz

The EUT was powered from a regulated Power Source during all tests.

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

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 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	Continuous TX, 1Mb Basic Rate, 2Mb EDR and 3Mb EDR
Additional information	EUT was controlled from a computer and programmed with test scripts from Putty. The following settings were used for all tests: Power Setting: Default Bit Pattern: PSRB Frame Type: DH1, 2-DH1, 3-DH1

1.6 Comments

The EUT uses the Bluetooth Classic protocol with Frequency Hopping.

It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

This test report covers only selected tests for new antennas, all other tests are covered by the original SGS Test Report.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable 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 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 FCC and ISED.

☐ New Submission

☒ Production Unit

☒ Class II Permissive Change

☐ Pre-production Unit

DSS Equipment Code

☐ Family Listing



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

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

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	Complies
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	N/T
Channel Separation and 20 dB BW	15.247(a)(1)	5.1 (4) (RSS-247)	7.8.2 (FHSS)	N/T
Number of Hopping Frequencies	15.31(m)	5.1 (6) (RSS-247)	7.8.3 (FHSS)	N/T
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	N/A (FHSS)	N/T
Time of Occupancy (dwell time)	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	7.8.4 (FHSS)	N/T
Occupied Bandwidth	15.247(a)(1)	5.1 (7) (RSS-247)	6.9.2 FHSS)	N/T
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	N/T
Peak Power Output	15.247(b)	5.4 (RSS-247)	11.9.1.1	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	6.7 7.8.6 (FHSS) 7.8.8 (FHSS)	N/T
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	Complies

Revision history

Revision	Date	Comment	Sign
00	2021-09-09	First edition	FS

3 TEST RESULTS

3.1 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	Field Strength (dBμV/m)	EIRP (dBm)	EIRP (mW)
2402	GFSK	107.6	12.4	17.3
	$\pi/4$ -DQPSK	105.8	10.6	11.4
	8-DPSK	106.2	11.0	12.5
2480	GFSK	107.7	12.5	17.7
	$\pi/4$ -DQPSK	106.5	11.3	13.4
	8-DPSK	106.8	11.6	14.4

Output Power reported is Maximum Peak Power.

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

See attached plots.

Requirements:

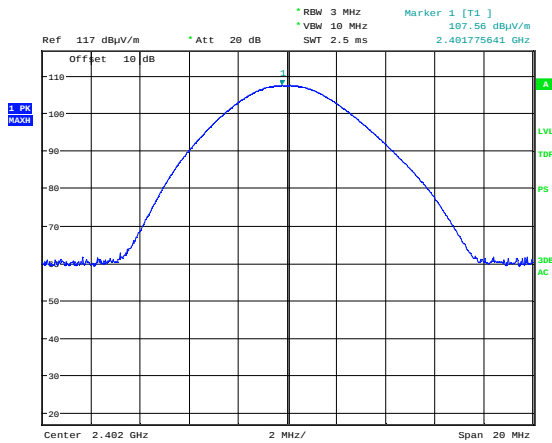
The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

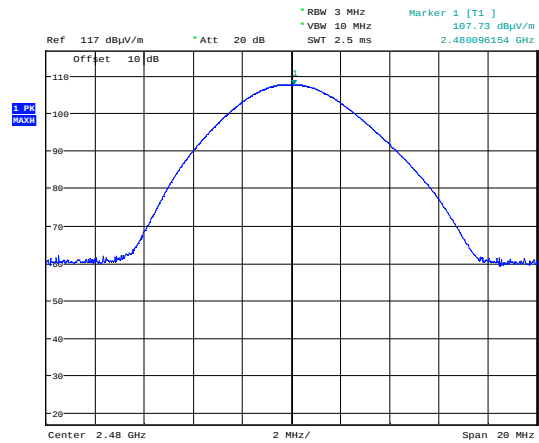
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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



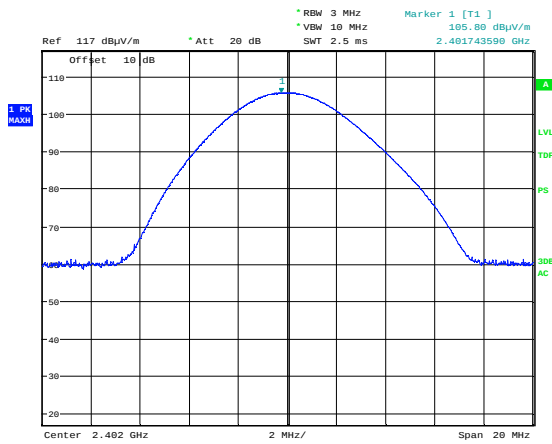
Date: 26.AUG.2021 10:08:26

Maximum Field Strength, 2402 MHz, GFSK



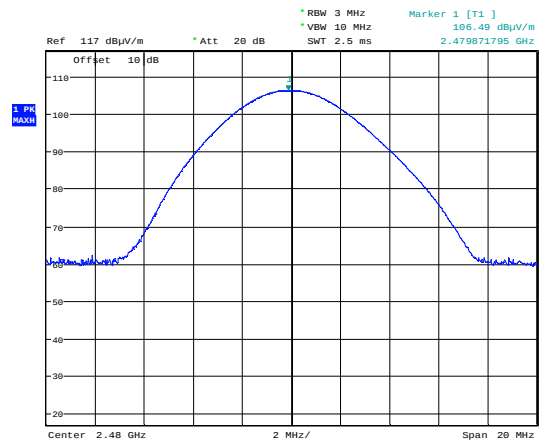
Date: 26.AUG.2021 10:14:28

Maximum Field Strength, 2480 MHz, GFSK



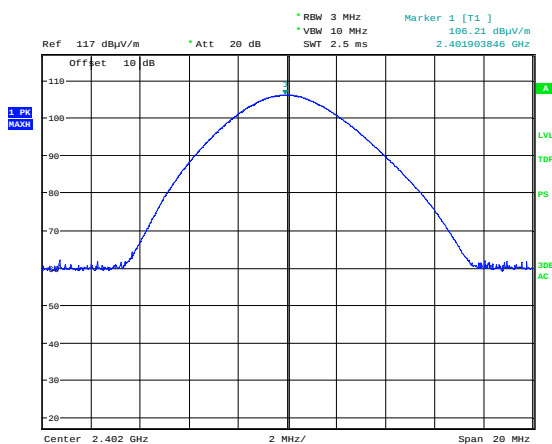
Date: 26.AUG.2021 10:10:00

Maximum Field Strength, 2402 MHz, π/4-DQPSK



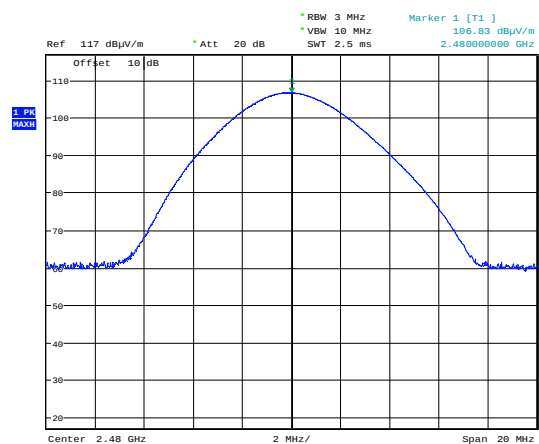
Date: 26.AUG.2021 10:18:18

Maximum Field Strength, 2480 MHz, π/4-DQPSK



Date: 26.AUG.2021 10:12:20

Maximum Field Strength, 2402 MHz, 8-DPSK



Date: 26.AUG.2021 10:20:00

Maximum Field Strength, 2480 MHz, 8-DPSK

3.2 Restricted Bands of operation

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

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

FCC (MHz)	ISED 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 ISSED, all other frequencies are common.

3.3 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:

Carrier Frequency and Modulation	Band Edge Frequency	Measured Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
		Peak Detector	Average Detector	Peak Det	Average Det	Peak Det	Average Det
2402MHz GFSK	2390MHz	56.9	36.9	74	54	17.1	17.1
2402MHz π/4-DQPSK	2390MHz	57.0	37.0			17.0	17.0
2402MHz 8-DPSK	2390MHz	57.1	37.1			16.9	16.9
2480MHz GFSK	2483.5MHz	66.4	46.4			7.6	7.6
2480MHz π/4-DQPSK	2483.5MHz	68.5	48.5			5.5	5.5
2480MHz 8-DPSK	2483.5MHz	68.2	48.2			5.8	5.8

Average Detector values are measured with Peak Detector and corrected for Duty Cycle.

Average Detector values are not reported when Peak value is below Average Limit.

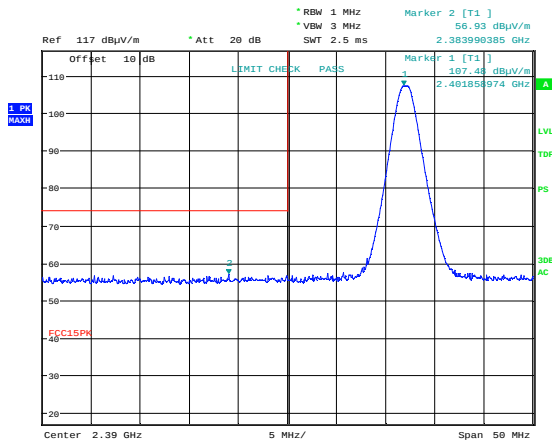
See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = slot length / (frame length * number of hopping frequencies)

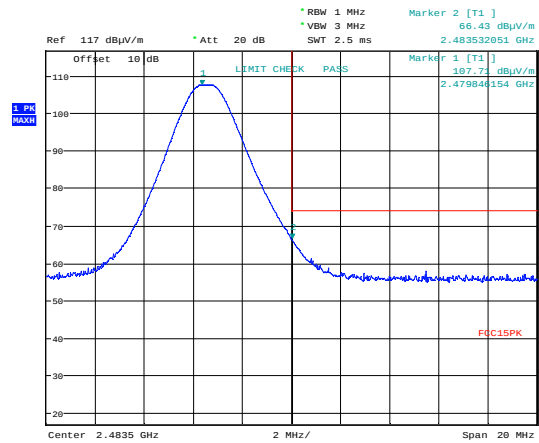
Duty Cycle Correction factor = $-20 \cdot \log(\text{Duty Cycle}) = 27.5 \text{ dB}$

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



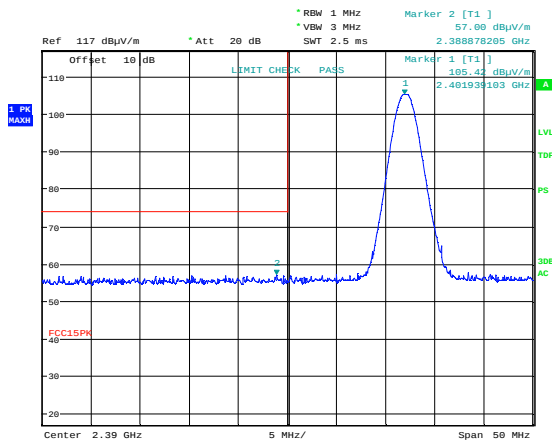
Date: 26.AUG.2021 10:09:15

Lower Band Edge 2402 MHz, GFSK, Peak



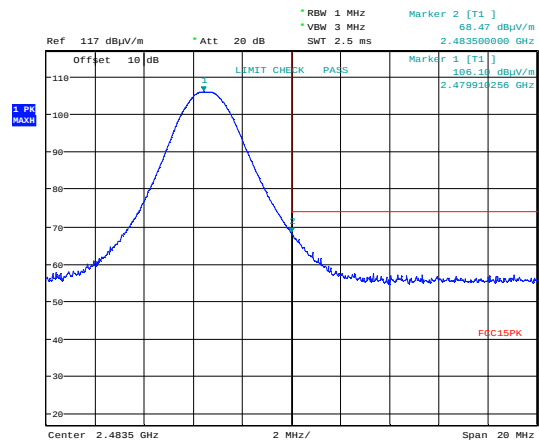
Date: 26.AUG.2021 10:16:11

Upper Band Edge 2480 MHz, GFSK, Peak



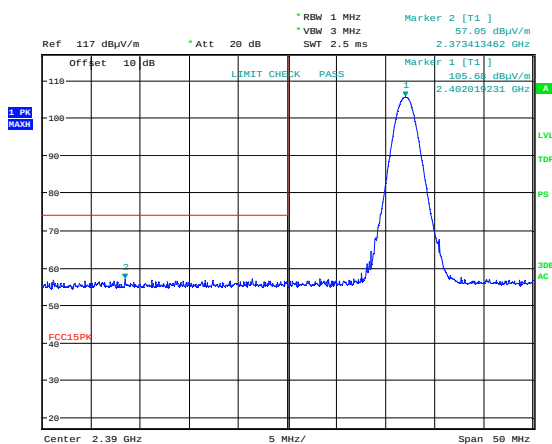
Date: 26.AUG.2021 10:11:20

Lower Band Edge 2402 MHz, $\pi/4$ -DQPSK, Peak



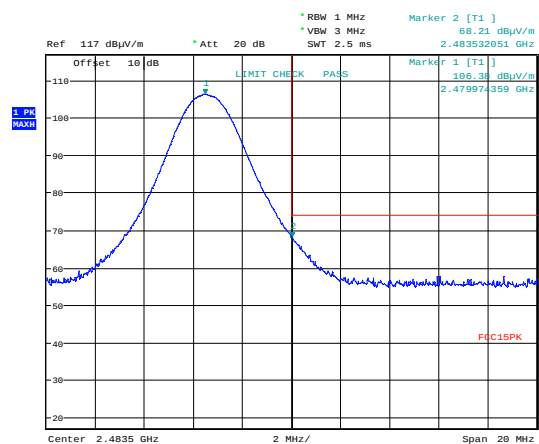
Date: 26.AUG.2021 10:17:17

Upper Band Edge 2480 MHz, $\pi/4$ -DQPSK, Peak



Date: 26.AUG.2021 10:13:18

Lower Band Edge 2402 MHz, 8-DPSK, Peak



Date: 26.AUG.2021 10:21:13

Upper Band Edge 2480 MHz, 8-DPSK, Peak

3.4 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 Detector for Pre-scan (Measurements with Quasi-Peak Detector)

Measuring distance 3m

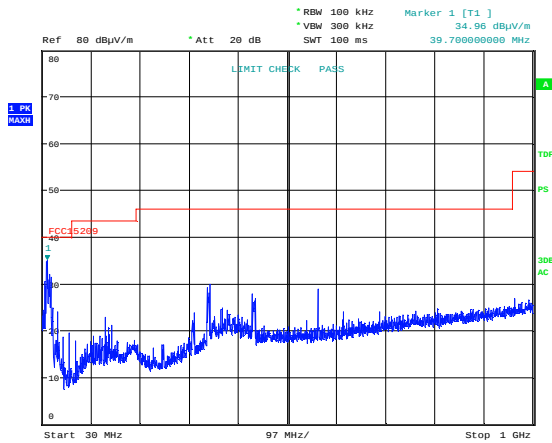
Tested with BT Active

Measured Frequency (MHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
30 – 88	2440	Any	< 30	40.0	> 10
88 – 216	2440	Any	< 30	43.5	> 13.5
216 – 960	2440	Any	< 30	46.0	> 16
960 – 1000	2440	Any	< 30	54.0	> 24
39.94	Any	Any	27.6	40.0	12.4
576.02	Any	Any	34.1	43.5	9.4

See attached plots.

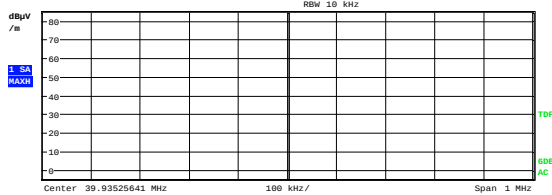
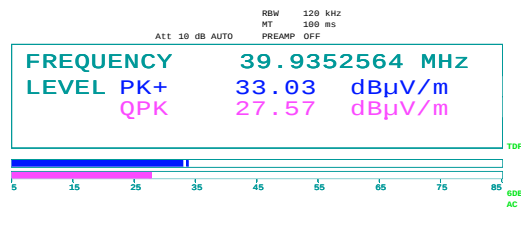
Requirements/Limit

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		



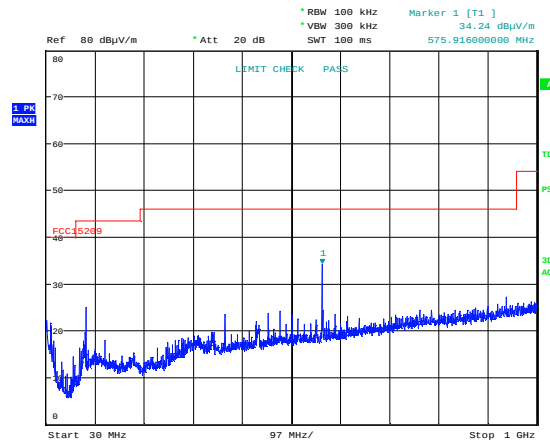
Date: 25.AUG.2021 11:06:05

Radiated Emissions 30 - 1000 MHz, GFSK, VP



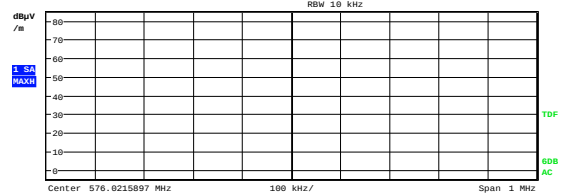
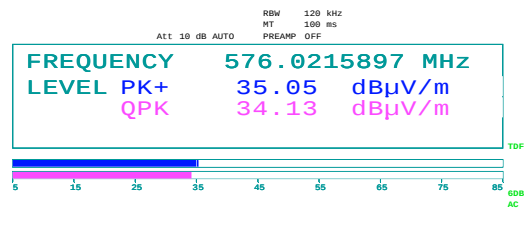
Date: 25.AUG.2021 10:30:52

Radiated Emissions 39.93 MHz, GFSK (Max: VP)



Date: 25.AUG.2021 11:08:16

Radiated Emissions 30 - 1000 MHz, GFSK, HP



Date: 25.AUG.2021 10:15:59

Radiated Emissions 576.02 MHz, GFSK (Max: HP)

3.5 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)
1m (18 – 26 GHz)

RBW=1 MHz

Carrier Freq.	Measured Freq. (GHz)	Modulation	Measured Emission (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
			Peak	Average	Peak	Average	Peak	Average
Any	1 – 26	Any	< 60	< 44	74	54	> 14	> 10

Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

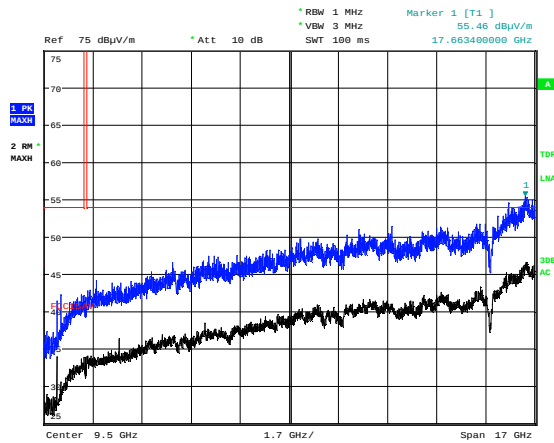
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz.

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

See plots.

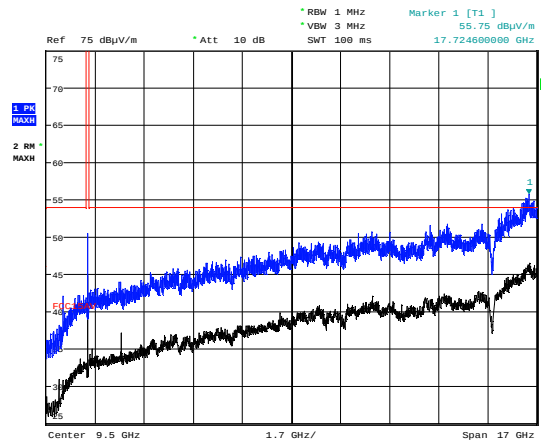
Requirements/Limit

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 dBμV/m	74.0 dBμV/m



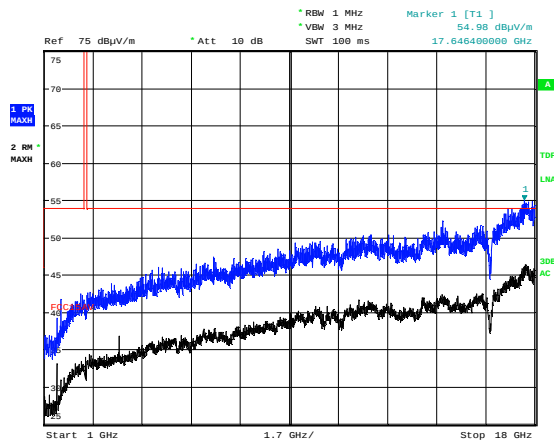
Date: 26.AUG.2021 09:24:47

Radiated Emissions 1 - 18 GHz, 2440 MHz, GFSK, VP



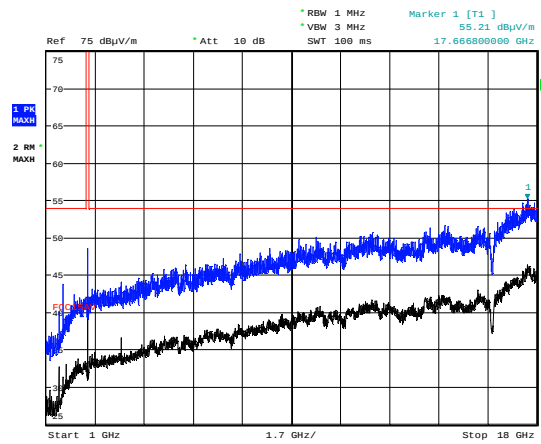
Date: 26.AUG.2021 09:27:00

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



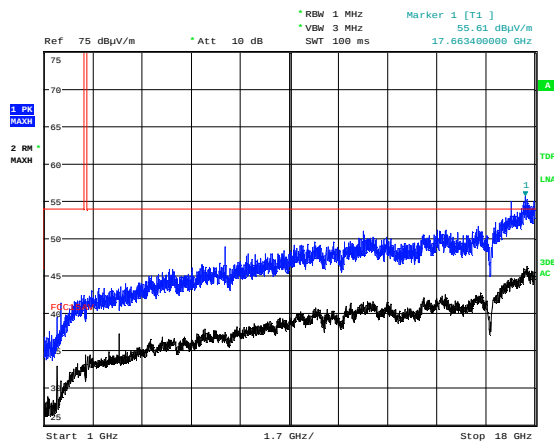
Date: 26.AUG.2021 09:31:57

Radiated Emissions 1 - 18 GHz, 2440 MHz, π/4-DQPSK, VP



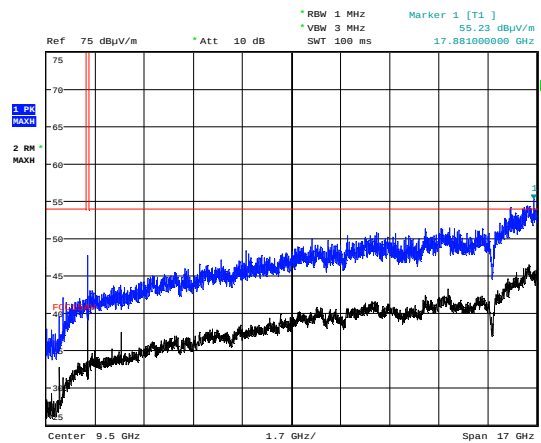
Date: 26.AUG.2021 09:33:46

Radiated Emissions 1 - 18 GHz, 2440 MHz, π/4-DQPSK, HP



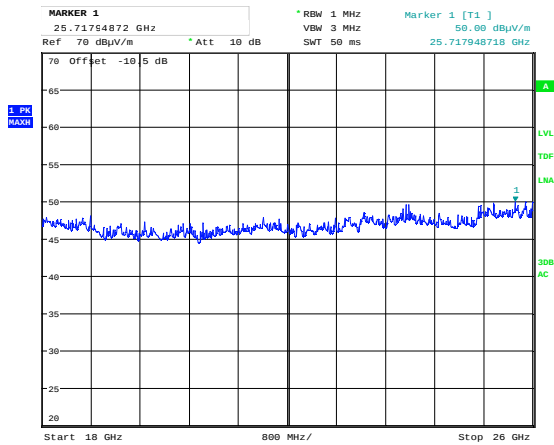
Date: 26.AUG.2021 09:38:25

Radiated Emissions 1 - 18 GHz, 2440 MHz, 8-DPSK, VP



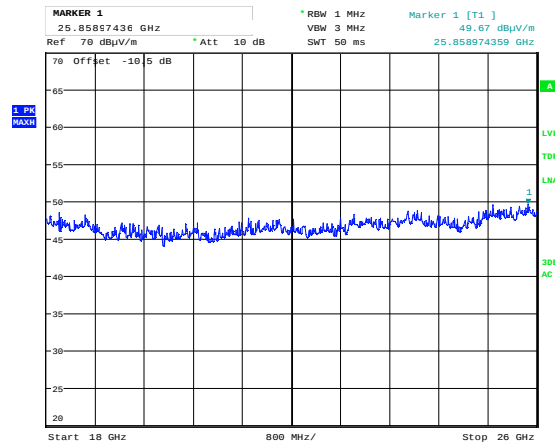
Date: 26.AUG.2021 09:40:16

Radiated Emissions 1 - 18 GHz, 2440 MHz, 8-DPSK, HP



Date: 27.AUG.2021 13:21:18

Radiated Emissions 18 - 26 GHz, 2440 MHz, GFSK, VP, @1m



Date: 27.AUG.2021 13:20:20

Radiated Emissions 18 - 26 GHz, 2440 MHz, GFSK, HP, @1m

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	2021-02	2022-02
2	6810-17B	Attenuator	Suhner	LR 1669	COU	
3	N0324415	BandStop Filter	Microwave Circuits	LR 1760	COU	
4	WLK5-1100-1485-7000-40SS	Low Pass Filter	Wainwright Inst.	LR 1761	COU	
5	317	Preamplifier	Sonoma Inst.	LR 1687	2021-08	2022-08
6	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2021-08	2022-08
7	3115	Horn Antenna	EMCO	LR 1330	2016-10	2021-10
8	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2021-08	2022-08
9	Model 638	Antenna Horn	Narda	LR 1480	N/A	
10	Model 87 V	Multimeter	Fluke	LR 1599	2021-01	2023-01
11	6812B	AC Power Source	Agilent	LR 1515	COU	
12	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2019-11	2021-11
14	ESCI3	Measuring Receiver	Rohde & Schwarz	N-4259	2019-10	2021-10
21	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

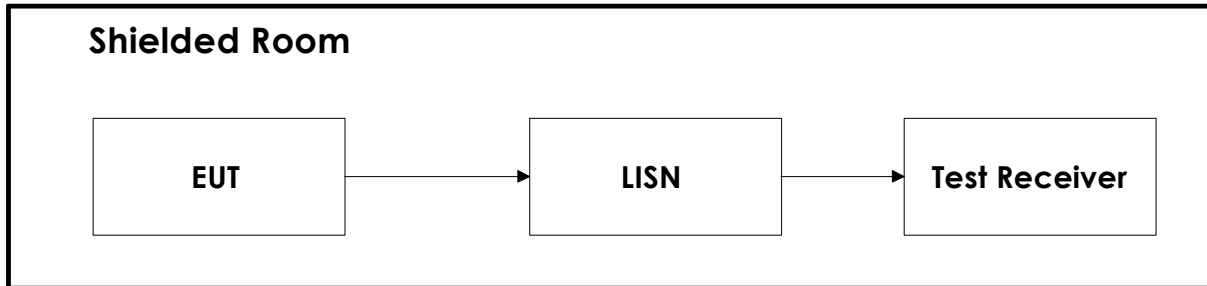
Note: COU – calibrate on use; N/A – Not Applicable

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

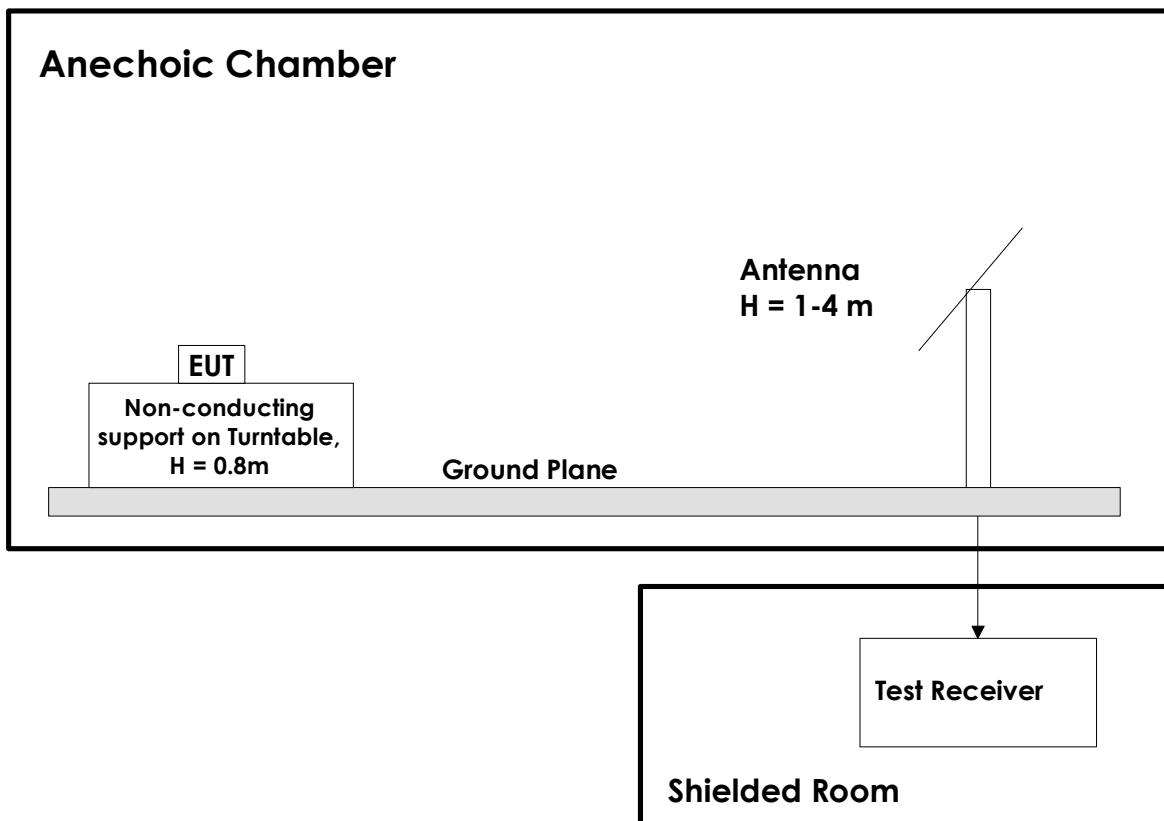
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.10	Power Line Conducted test software
2	Nemko AS	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

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.