

Test Report

Product	Bluetooth Transceiver in DECT Handset
Name and address of the applicant	Panasonic Corporation of North America Two Riverfront Plaza, 9 th Floor Newark, 07102-5490, NJ, USA
Name and address of the manufacturer	Panasonic Corporation 1006, Oaza Kadoma, Kadoma-shi Osaka 571-8501, Japan
Model	KX-TGDA99
Rating	2.4V _{DC} (2x AAA NiMH cells)
Trademark	Panasonic
Serial number	See clause 1.1
Additional information	DECT 6.0, Bluetooth Classic
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	452212
Tested in period	2021-10-22 to 2021-11-26
Issue date	2021-12-13
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 Sveisen]  Approved by [G.Suhanthakumar]	
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1 INFORMATION

1.1 Test Item

Name	Panasonic
Model/version	KX-TGDA99
FCC ID	ACJ96NKX-TGDA99
ISED ID	216A-KXTGDA99
Serial number	Radiated Sample: 4522120012 Conducted Sample: 4522120013
Hardware identity and/or version	S1
Software identity and/or version	SW200
Frequency Range	2402–2480 MHz
Number of Channels	79
Operating Modes	Bluetooth Basic Rate, Bluetooth 2-EDR and Bluetooth 3-EDR
Type of Modulation	BT Basic Rate: GFSK BT 2-EDR: $\pi/4$ -DPSK BT 3-EDR: 8-DPSK
Conducted Output Power	BT Basic Rate: 4.7 mW (Peak) BT 2-EDR: 3.4 mW (Peak) BT 3-EDR: 3.6 mW (Peak)
Antenna Connector	None
Number of Antennas	1
Diversity or Smart Antennas	No
Power Supply	Secondary Batteries (2x AAA NiMH cells)
Desktop Charger	PNLC1077 with AC adaptor PNLV233

Description of Test Item

The EUT is a DECT Handset with Bluetooth. The DECT part is covered by a separate report.

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

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	2.4 V DC

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 and Hopping, Basic Rate, 2-EDR and 3-EDR
Additional information	The following settings were used for all tests: Power Setting: Not selectable Bit Pattern: PSRB Frame Type: DH1, 2-DH1, 3-DH1

1.6 Comments

The EUT uses the Bluetooth protocol with Frequency Hopping.

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

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 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



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	N/A
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	Complies
Channel Separation and 20 dB BW	15.247(a)(1)	5.1 (4) (RSS-247)	7.8.2 (FHSS)	Complies
Number of Hopping Frequencies	15.31(m)	5.1 (6) (RSS-247)	7.8.3 (FHSS)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	N/A (FHSS)	Complies
Time of Occupancy (dwell time)	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	7.8.4 (FHSS)	Complies
Occupied Bandwidth	15.247(a)(1)	5.1 (7) (RSS-247)	6.9.2 FHSS)	N/A
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	Complies
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	Complies
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)	Complies
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)	Complies

Revision history

Revision	Date	Comment	Sign
00	2021-12-07	First edition	FS

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 μ H/50 ohms LISN.

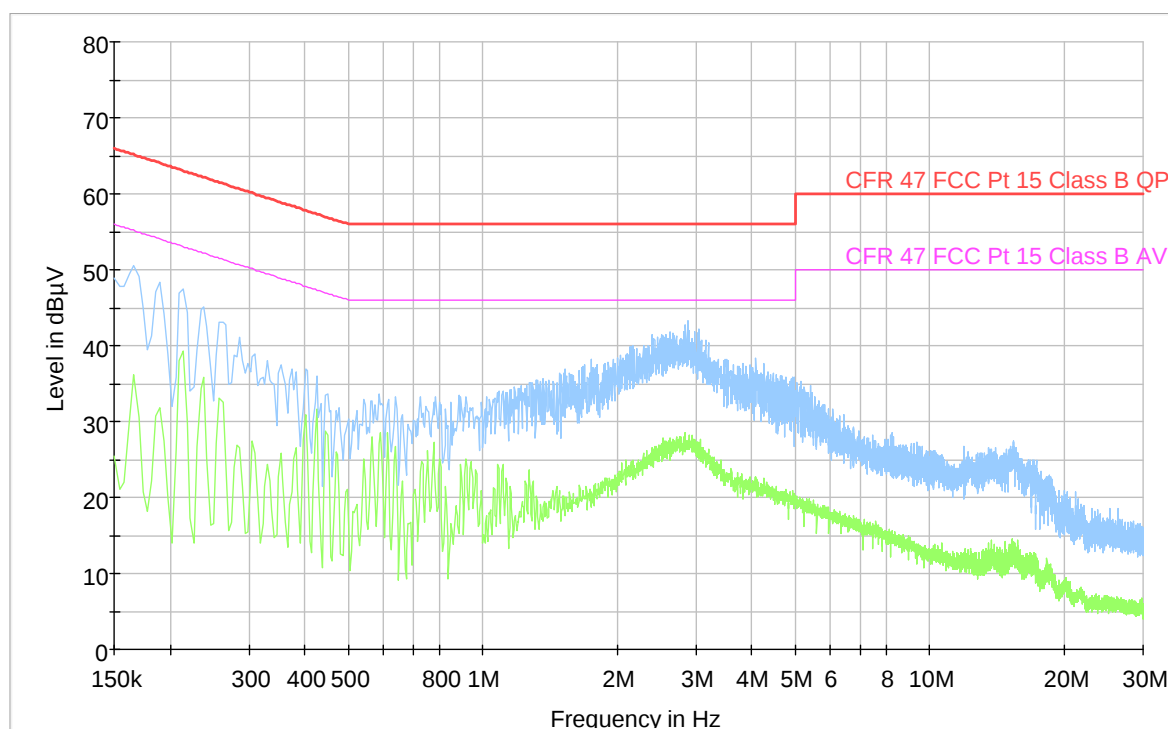
Test Results: Complies

Measurement Data: See attached plots.

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
---	---	---	---	---	---	---		

Full Spectrum



EUT in Charger, BT Active, 120V 60Hz

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		
	2402 MHz	2441 MHz	2480 MHz
Basic Rate (GFSK)	897 kHz	894 kHz	891 kHz
2-EDR ($\pi/4$ -DPSK)	1282 kHz	1282 kHz	1279 kHz
3-EDR (8-DPSK)	1295 kHz	1295 kHz	1298 kHz

RF channel has no influence on 20 dB bandwidth.

See attached plots

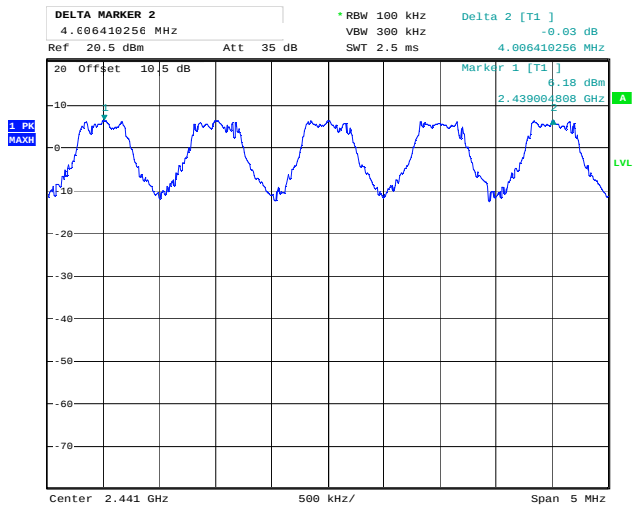
Requirement:

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

or:

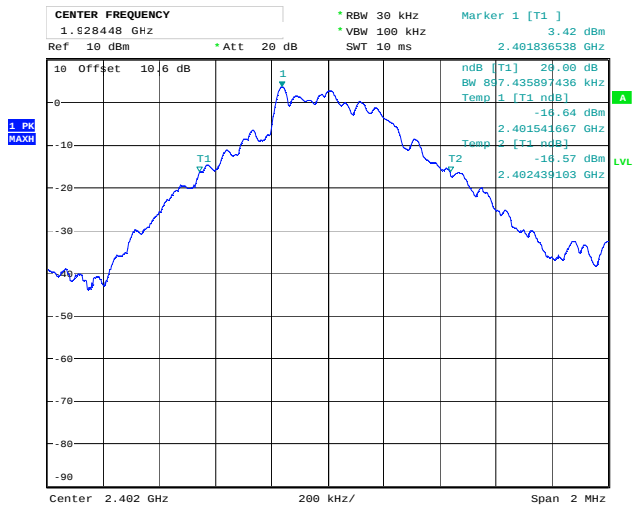
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125 mW.

No requirements for Digital Transmission Systems.



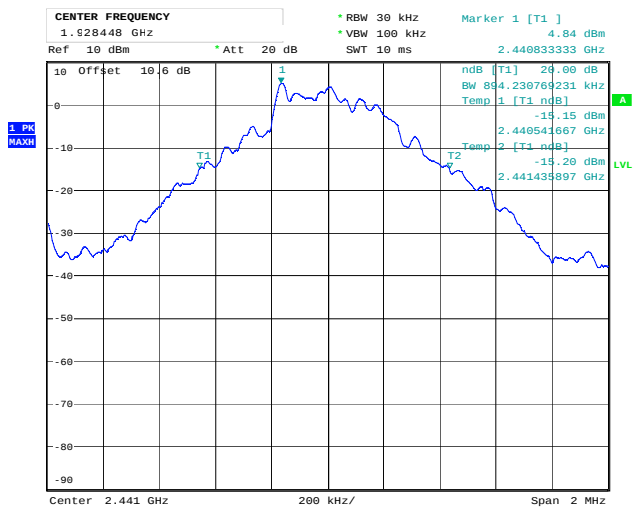
Date: 26.OCT.2021 14:06:26

Channel Separation



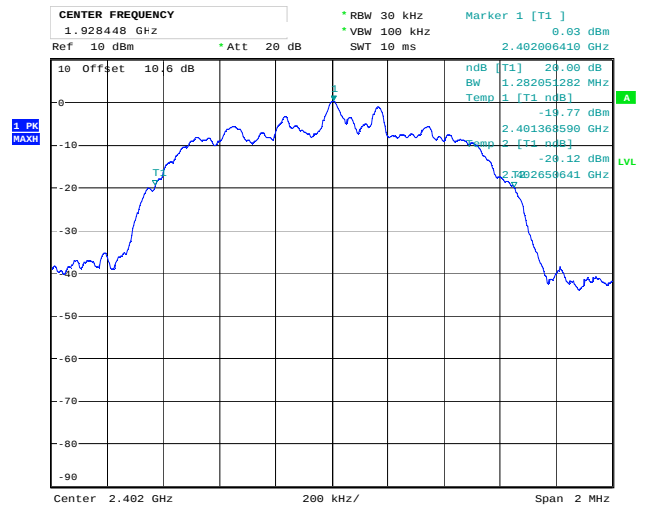
Date: 22.OCT.2021 13:53:00

20dB Bandwidth 2402 MHz, GFSK



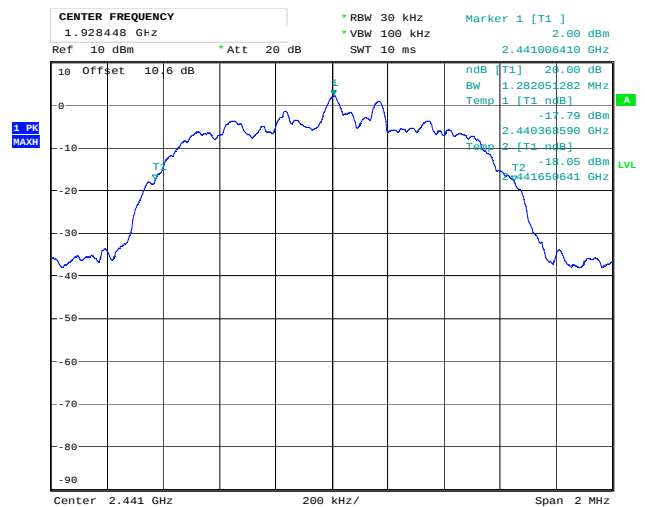
Date: 22.OCT.2021 14:03:59

20dB Bandwidth 2441 MHz, GFSK



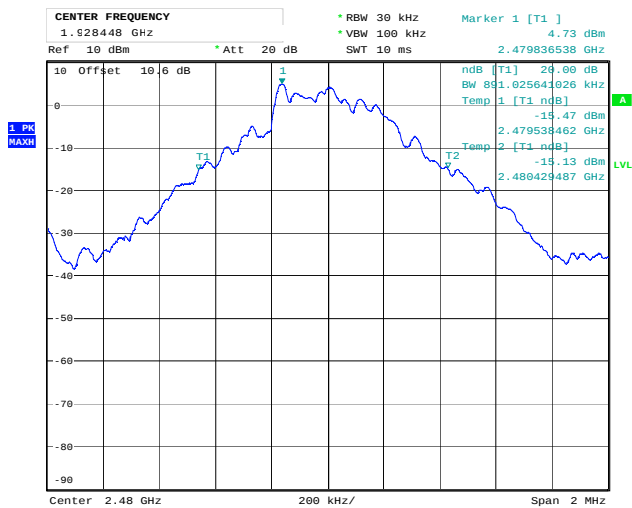
Date: 22.OCT.2021 14:48:06

20dB Bandwidth 2402 MHz, $\pi/4$ -DPSK



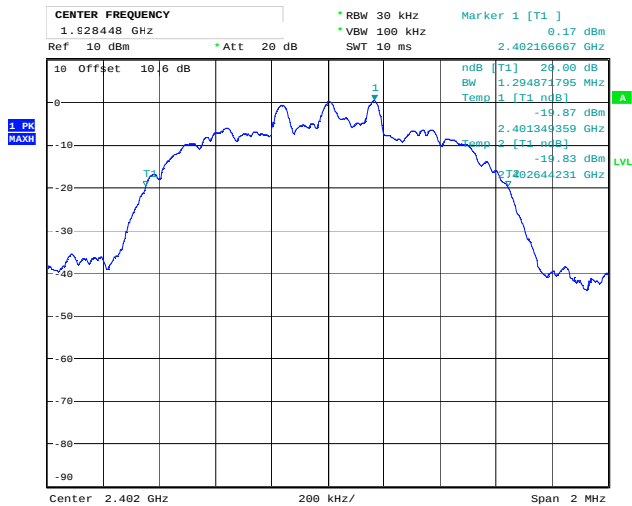
Date: 22.OCT.2021 14:45:03

20dB Bandwidth 2441 MHz, $\pi/4$ -DPSK



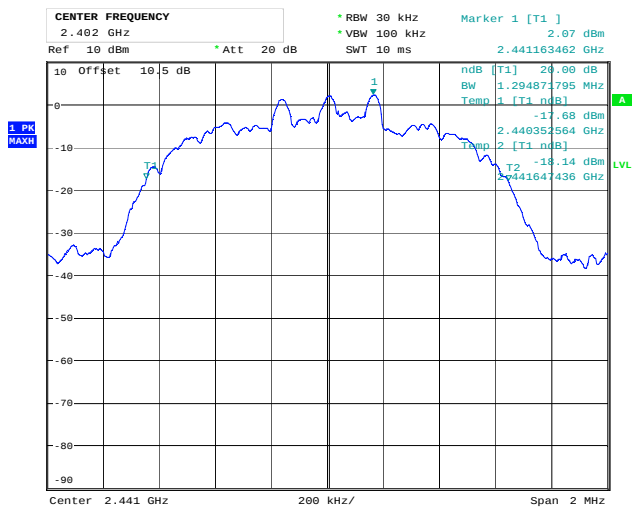
Date: 22.OCT.2021 14:21:12

20dB Bandwidth 2480 MHz, GFSK



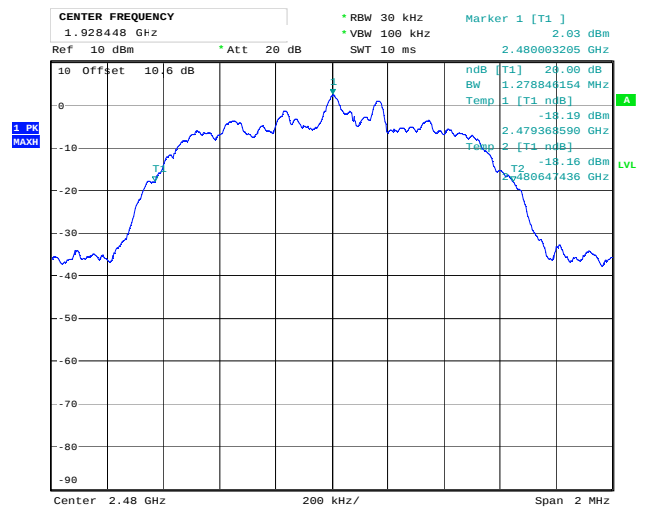
Date: 22.OCT.2021 14:50:44

20dB Bandwidth 2402 MHz, 8-DPSK

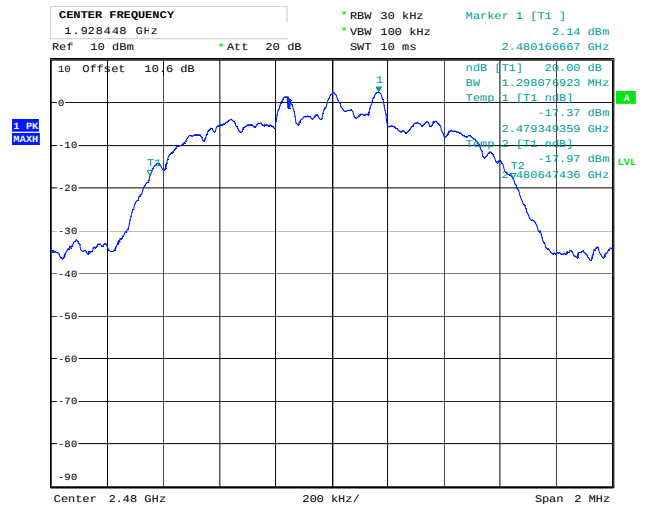


Date: 27.OCT.2021 16:29:28

20dB Bandwidth 2441 MHz, 8-DPSK



Date: 22.OCT.2021 14:35:59

20dB Bandwidth 2480 MHz, $\pi/4$ -DPSK

Date: 22.OCT.2021 14:39:45

20dB Bandwidth 2480 MHz, 8-DPSK

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: /

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.

Base Table Hopping Sequence

The hopping sequence is described in the document >.

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

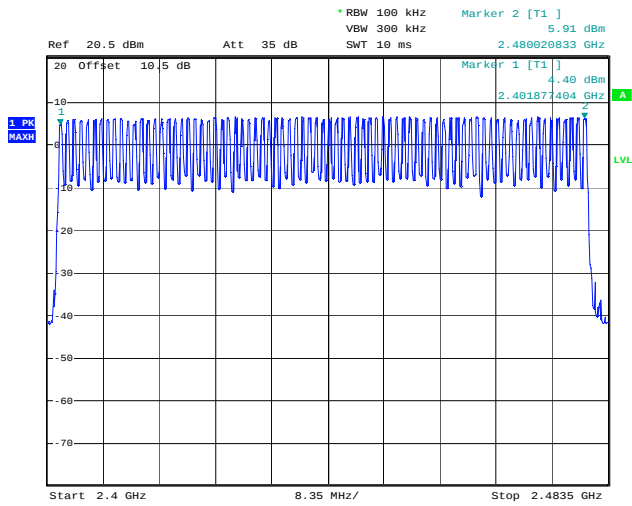
Measurement Data:

Number of RF Channels in use	20 to 79
Channel Centre Frequencies	2402 to 2480 MHz
Channel Separation	1 MHz

See attached plots.

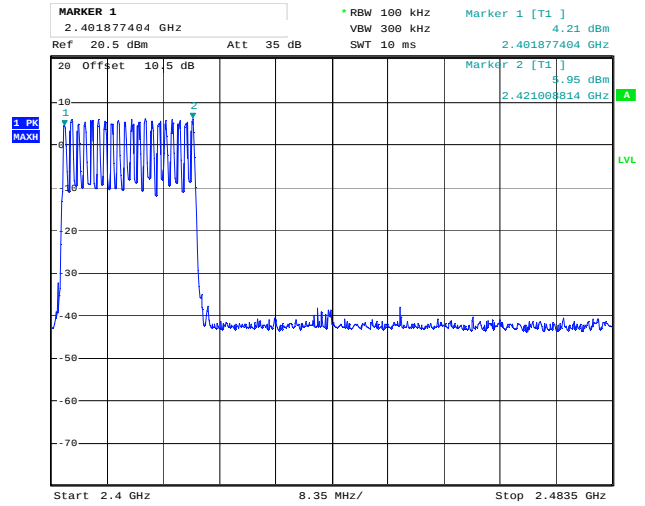
Requirements:

Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels. No requirements for bandwidth for this frequency band.



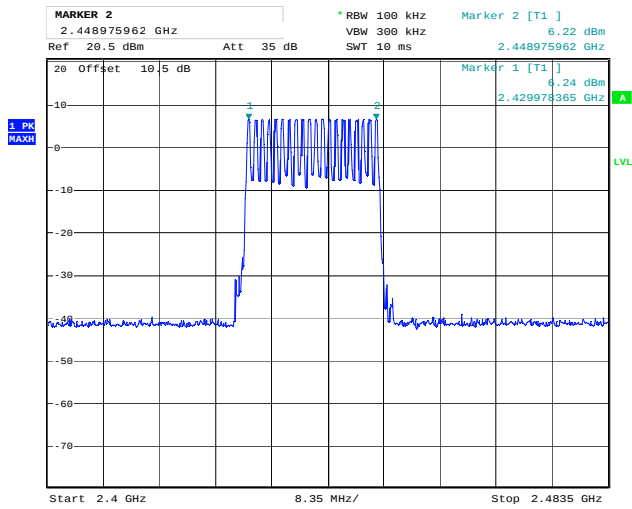
Date: 26.OCT.2021 13:44:01

RF Channels in Use, 79 Channels



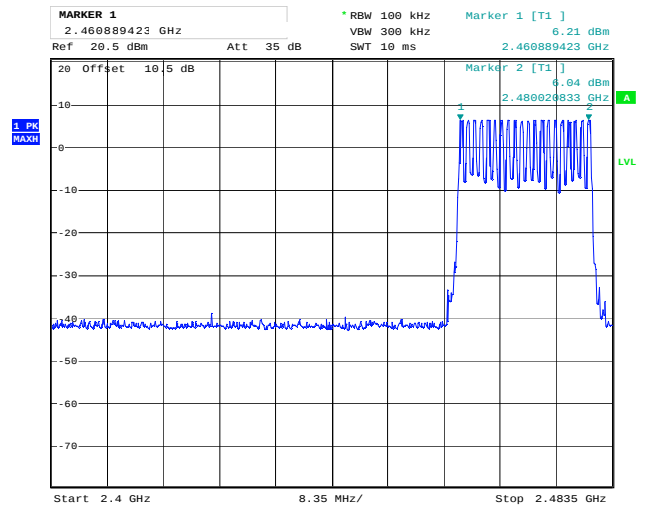
Date: 26.OCT.2021 13:46:50

RF Channels in Use, 20 Channels, Lower



Date: 26.OCT.2021 13:56:48

RF Channels in Use, 20 Channels, Middle



Date: 26.OCT.2021 14:00:22

RF Channels in Use, 20 Channels, Upper

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
DH1	0.394	1.25	126	Complies
DH3	1.65	2.51	263	Complies
DH5	2.91	3.77	309	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 * 400 ms) / Time Between Burst on Same Channel
= (Burst Length * 400 ms) / Frame Length

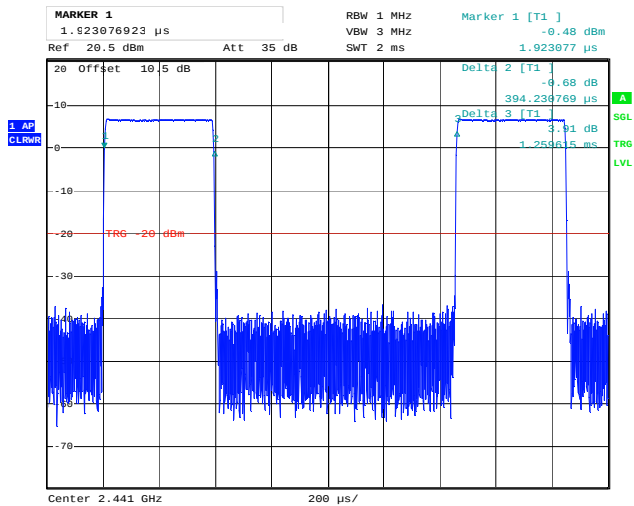
Number of RF channels is minimum 20 and maximum 78

See attached plots

Requirements:

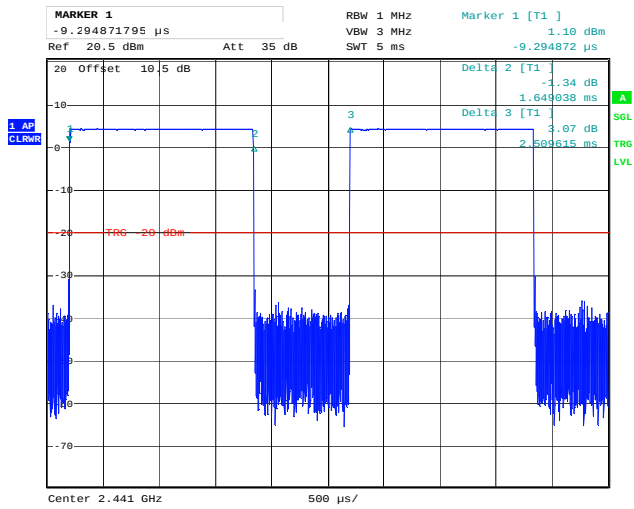
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

No requirements for Digital Transmission Systems.



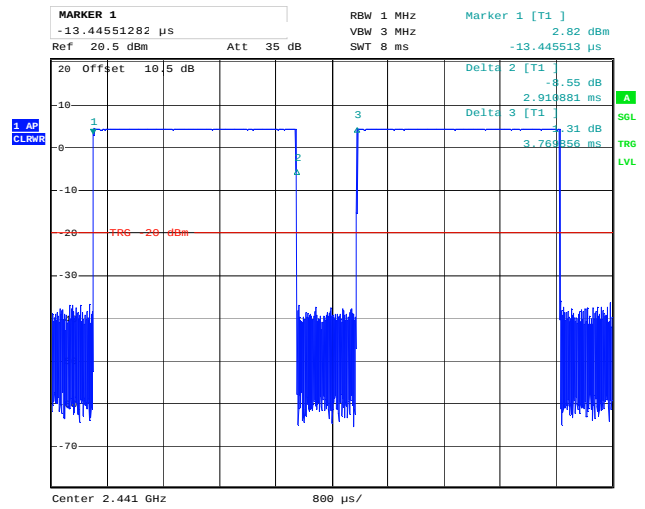
Date: 26.OCT.2021 13:29:06

RF Burst, DH1



Date: 26.OCT.2021 13:32:36

RF Burst, DH3



Date: 26.OCT.2021 13:35:09

RF Burst DH5

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)
2441 MHz Basic Rate	853 kHz
2441 MHz 2-EDR	1176 kHz
2441 MHz 3-EDR	1173 kHz

Occupied Bandwidth is the same for all channels

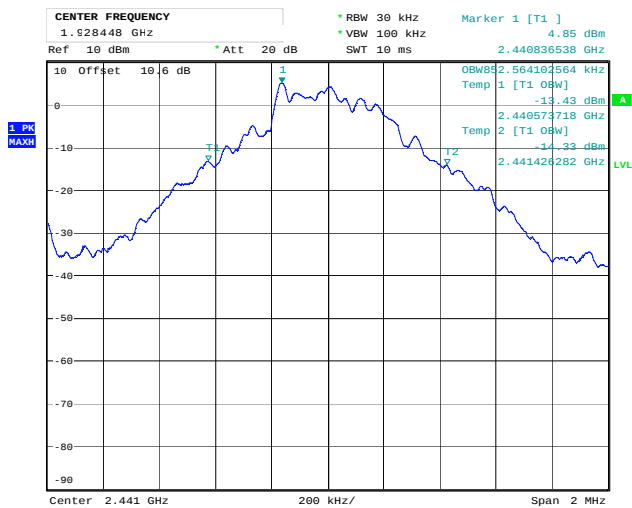
See attached plots.

Requirements:

Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels. No requirements for bandwidth for this frequency band.

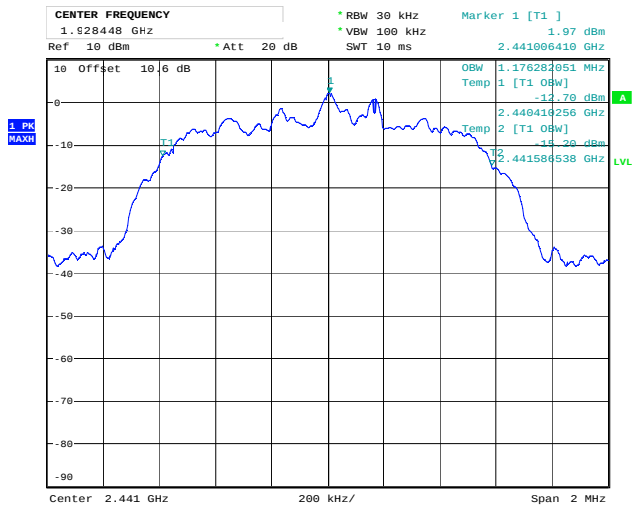
No requirements for Digital Transmission Systems.

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



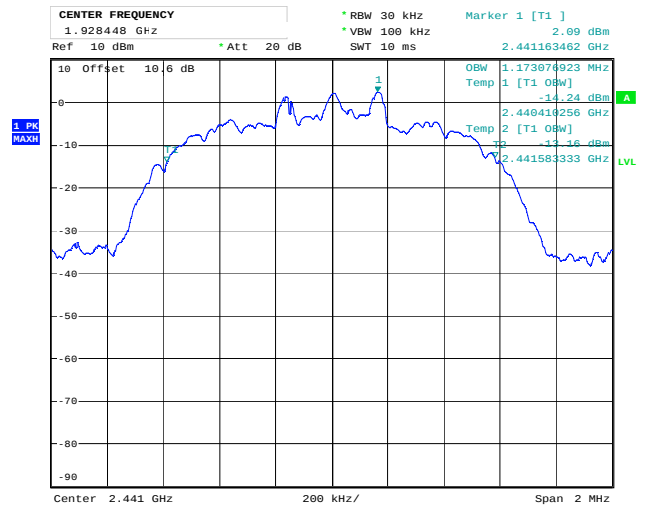
Date: 22.OCT.2021 13:58:53

99% Occupied BW, GFSK



Date: 22.OCT.2021 14:44:18

99% Occupied BW, $\pi/4$ -DPSK



Date: 22.OCT.2021 14:41:57

99% Occupied BW, 8-DPSK

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)
2402	GFSK	5.31	3.40
	$\pi/4$ -DPSK	3.47	2.22
	8-DPSK	3.91	2.46
2441	GFSK	6.72	4.70
	$\pi/4$ -DPSK	5.26	3.36
	8-DPSK	5.51	3.56
2480	GFSK	6.53	4.50
	$\pi/4$ -DPSK	5.21	3.32
	8-DPSK	5.61	3.64

Output Power reported is Maximum Peak Power.

Manufacturers Declared Antenna Gain is less than 6 dBi.

See attached plots.

Requirements:

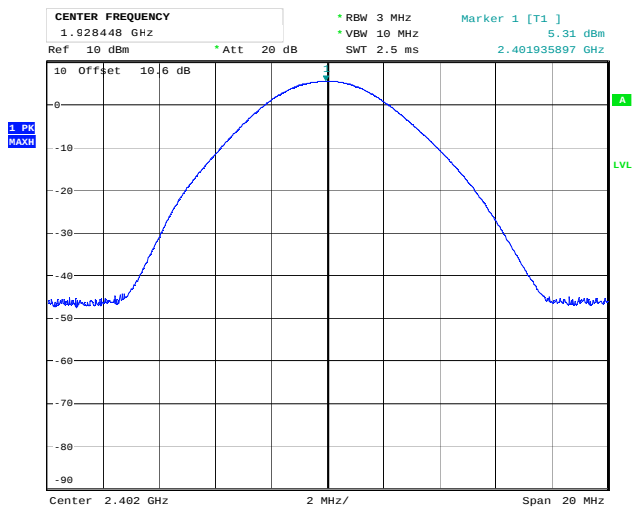
The maximum peak output power shall not exceed the following limits:

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

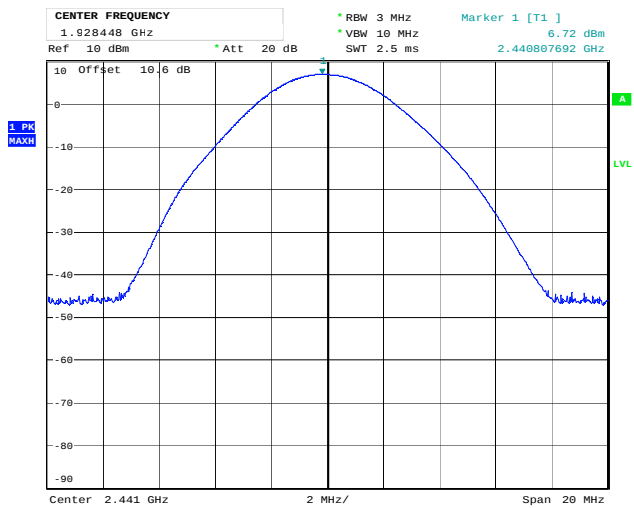
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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.



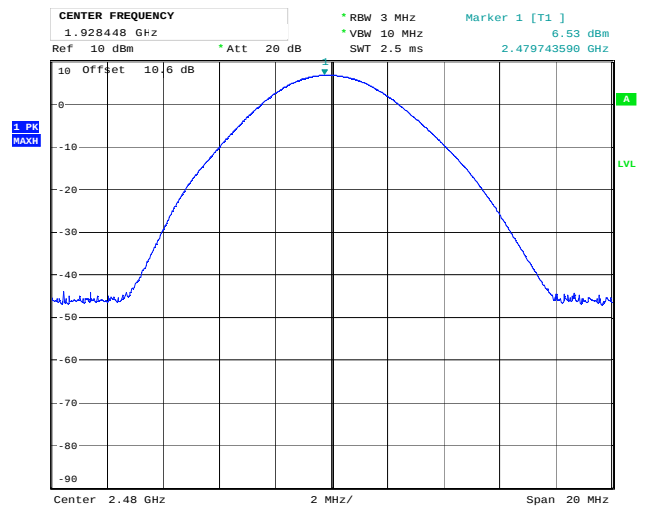
Date: 22.OCT.2021 13:51:11

Peak Power, 2402 MHz, GFSK



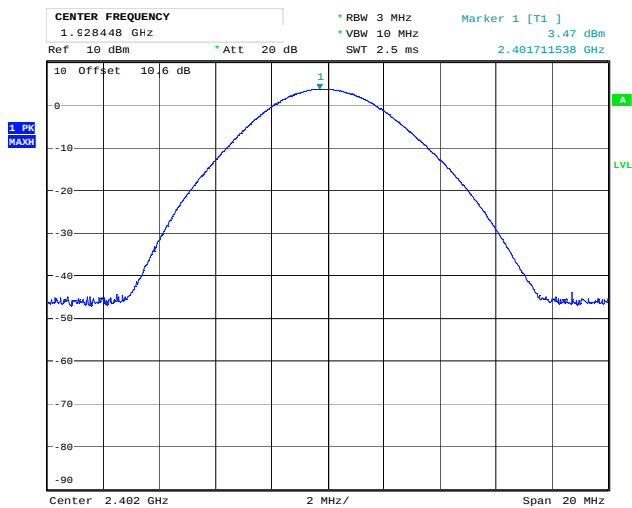
Date: 22.OCT.2021 13:54:28

Peak Power, 2441 MHz, GFSK



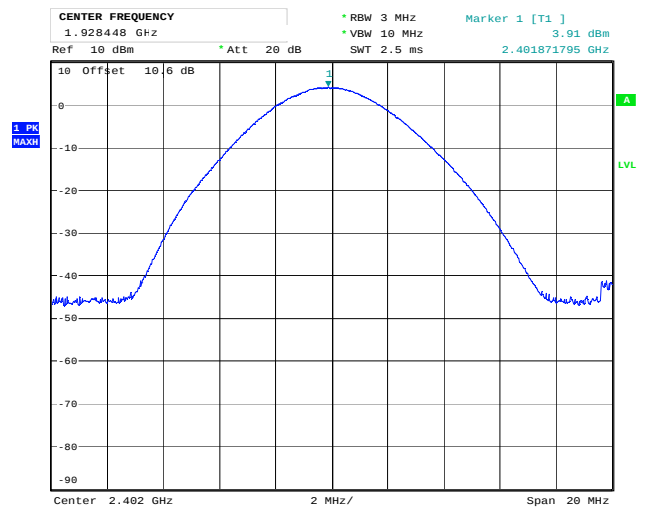
Date: 22.OCT.2021 14:04:59

Peak Power, 2480 MHz, GFSK



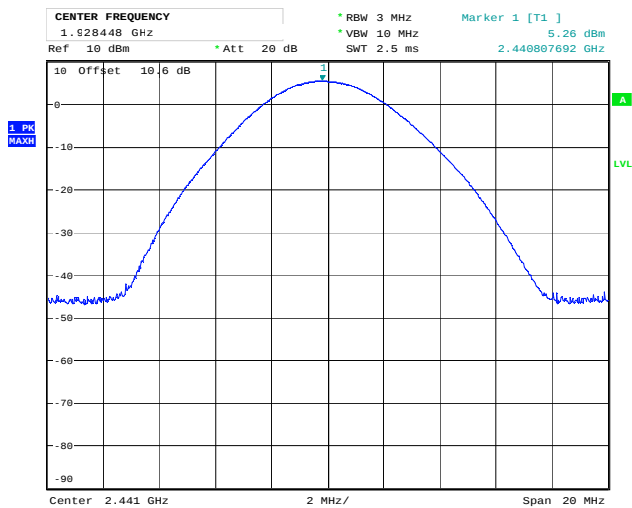
Date: 22.OCT.2021 14:55:31

Peak Power, 2402 MHz, $\pi/4$ -DPSK



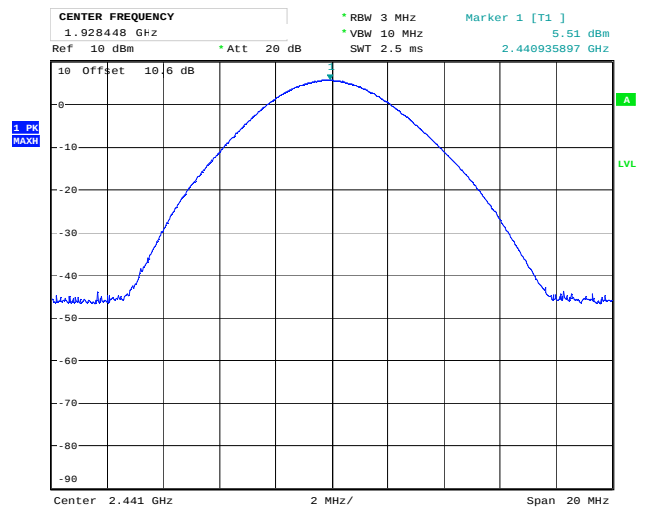
Date: 22.OCT.2021 14:56:33

Peak Power, 2402 MHz, 8-DPSK



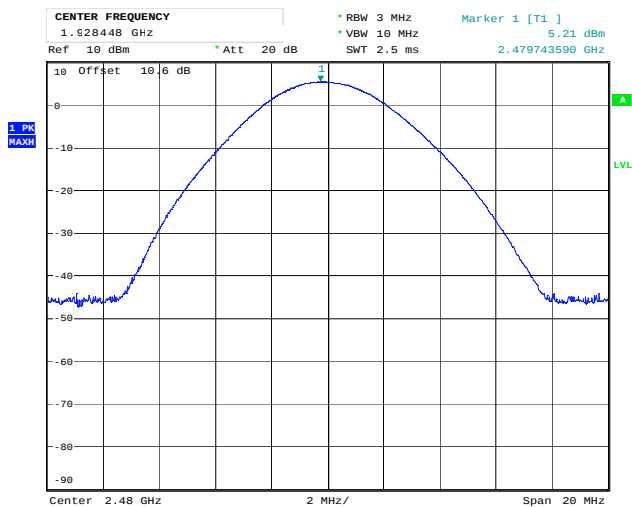
Date: 22.OCT.2021 14:58:48

Peak Power, 2441 MHz, $\pi/4$ -DPSK



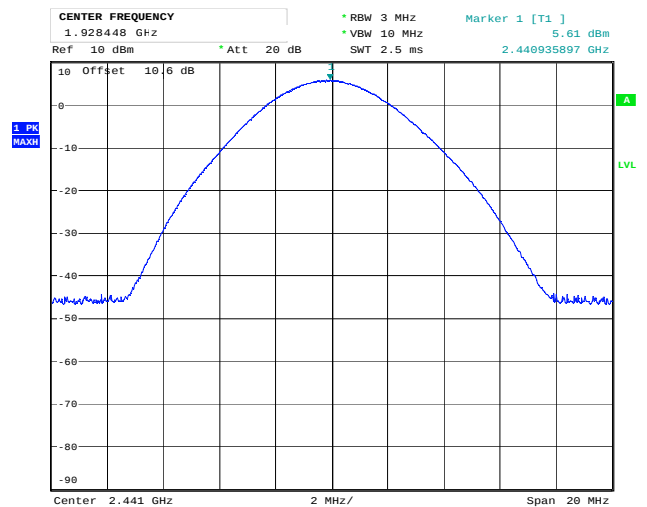
Date: 22.OCT.2021 14:41:07

Peak Power, 2441 MHz, 8-DPSK



Date: 22.OCT.2021 15:01:59

Peak Power, 2480 MHz, $\pi/4$ -DPSK



Date: 22.OCT.2021 14:57:46

Peak Power, 2480 MHz, 8-DPSK

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
2402 MHz	>50	>30	Pass
2441 MHz	>50	>30	Pass
2480 MHz	>50	>30	Pass

Measured with Peak Detector

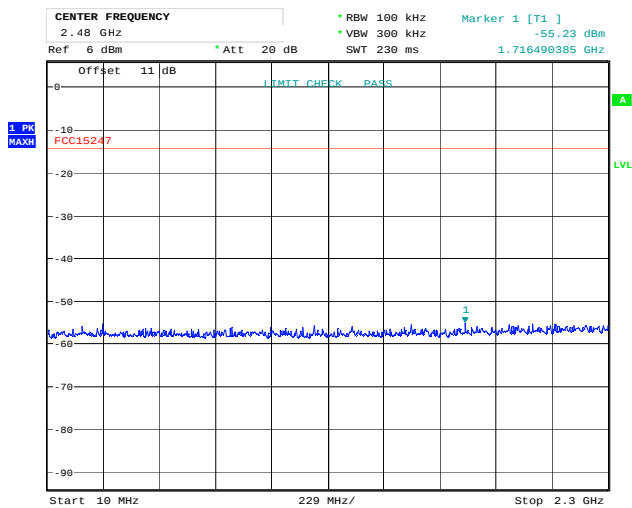
RF conducted power to 25 GHz: see attached plots.

Limit

Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

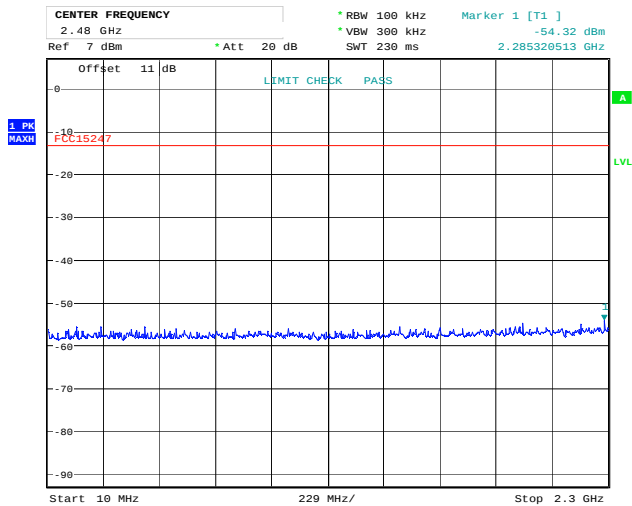
Detector type shall be the same as used for measuring Output Power.

Attenuation below the general limits specified in part 15.209(a) is not required.



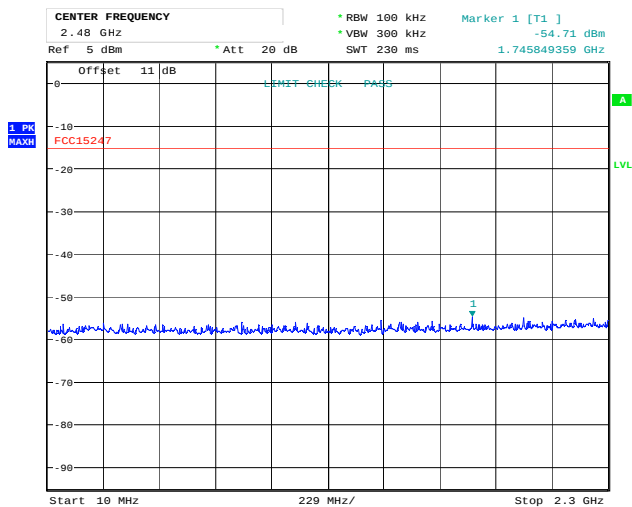
Date: 22.OCT.2021 15:15:37

Conducted Emissions 10-2300 MHz, 2402 MHz, GFSK



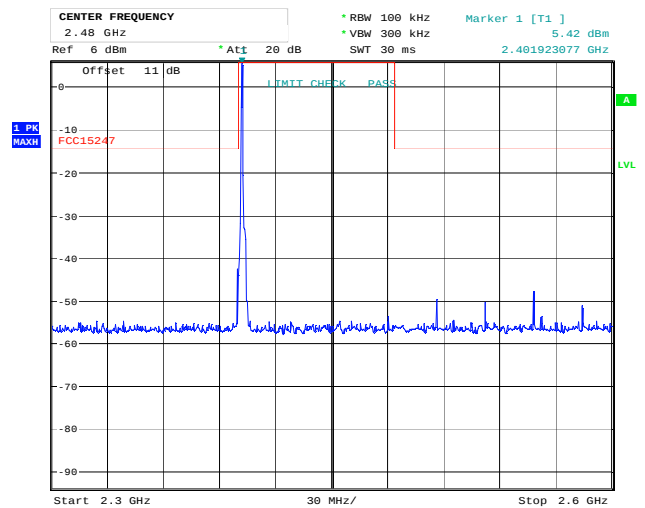
Date: 22.OCT.2021 15:10:52

Conducted Emissions 10-2300 MHz, 2441 MHz, GFSK



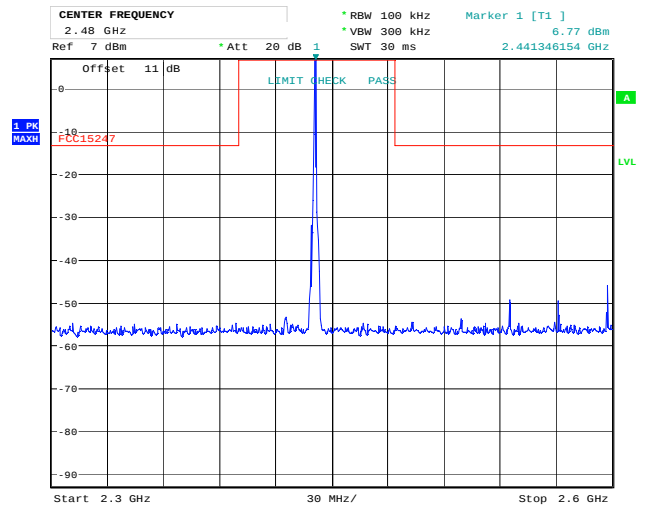
Date: 22.OCT.2021 15:06:45

Conducted Emissions 10-2300 MHz, 2480 MHz, GFSK



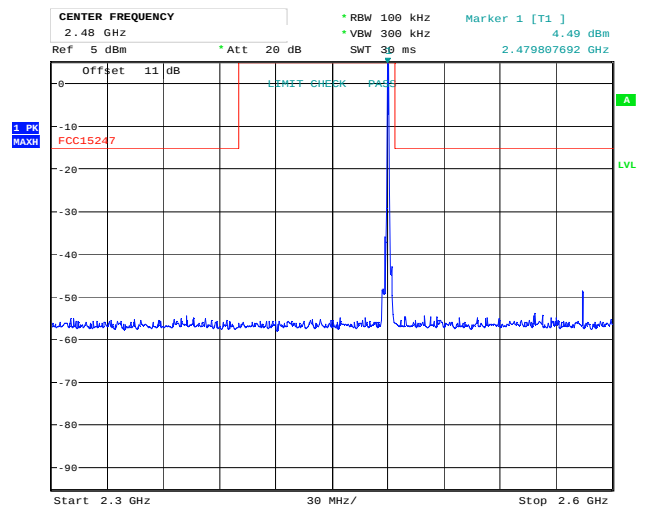
Date: 22.OCT.2021 15:14:49

Conducted Emissions 2300-2600 MHz, 2402 MHz, GFSK



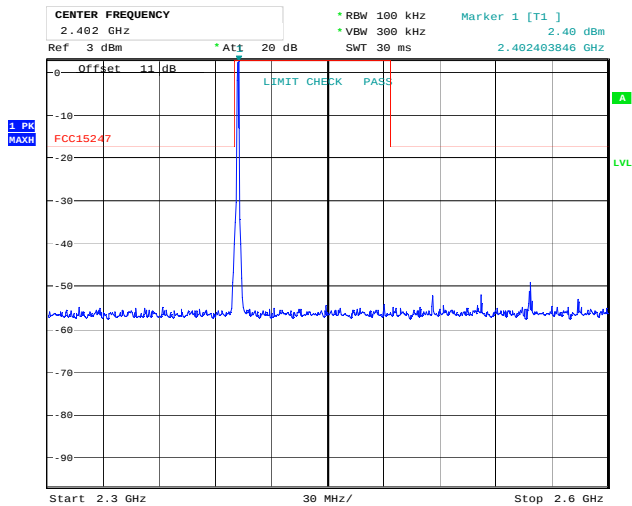
Date: 22.OCT.2021 15:10:05

Conducted Emissions 2300-2600 MHz, 2441 MHz, GFSK



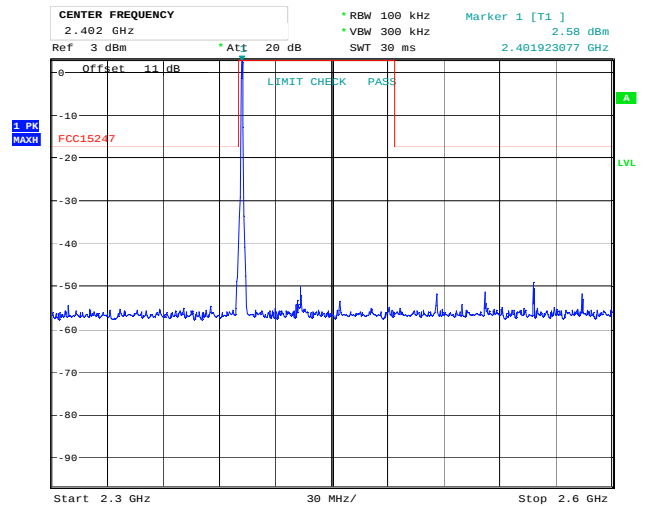
Date: 22.OCT.2021 15:05:57

Conducted Emissions 2300-2600 MHz, 2480 MHz, GFSK



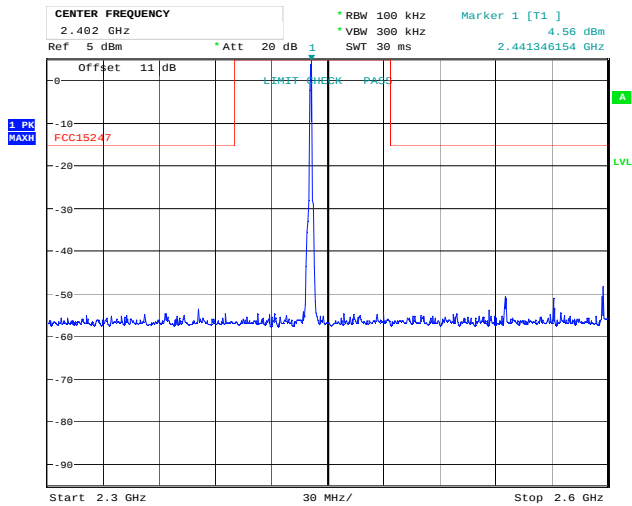
Date: 27.OCT.2021 16:20:48

Conducted Emissions 2300-2600 MHz, 2402 MHz, $\pi/4$ -DPSK



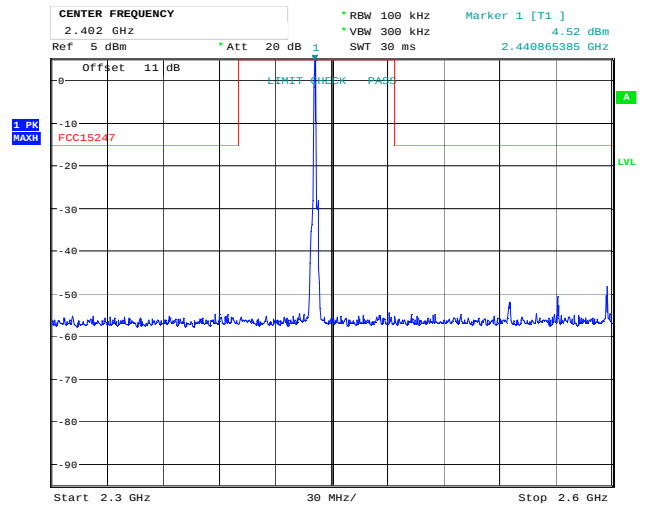
Date: 27.OCT.2021 16:27:42

Conducted Emissions 2300-2600 MHz, 2402 MHz, 8-DPSK



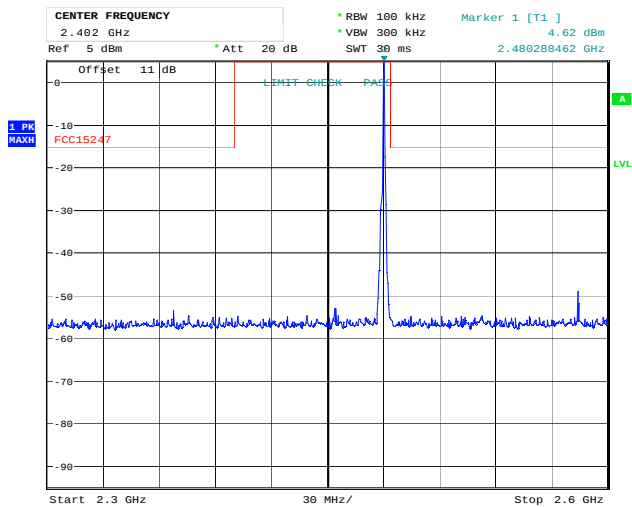
Date: 27.OCT.2021 16:22:16

Conducted Emissions 2300-2600 MHz, 2441 MHz, $\pi/4$ -DPSK



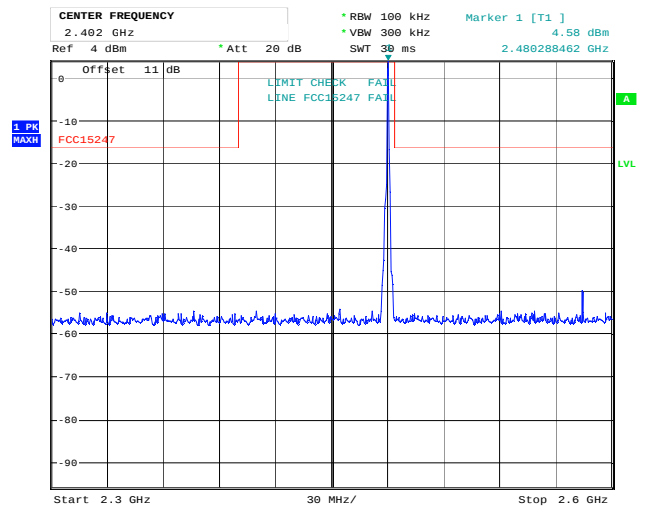
Date: 27.OCT.2021 16:26:42

Conducted Emissions 2300-2600 MHz, 2441 MHz, 8-DPSK



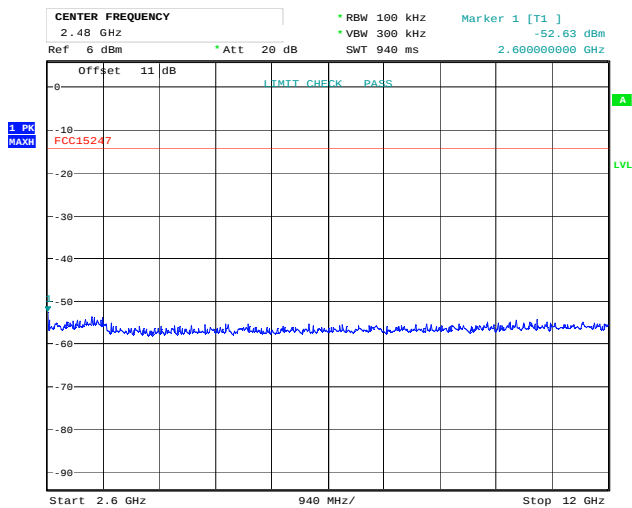
Date: 27.OCT.2021 16:23:27

Conducted Emissions 2300-2600 MHz, 2480 MHz, $\pi/4$ -DPSK



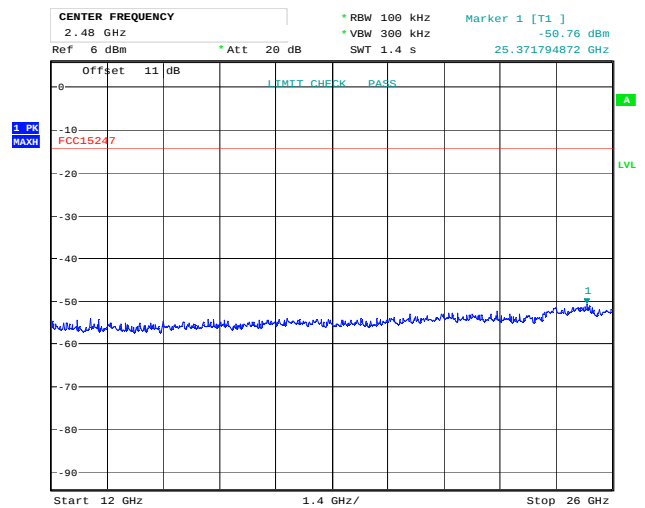
Date: 27.OCT.2021 16:24:23

Conducted Emissions 2300-2600 MHz, 2480 MHz, 8-DPSK



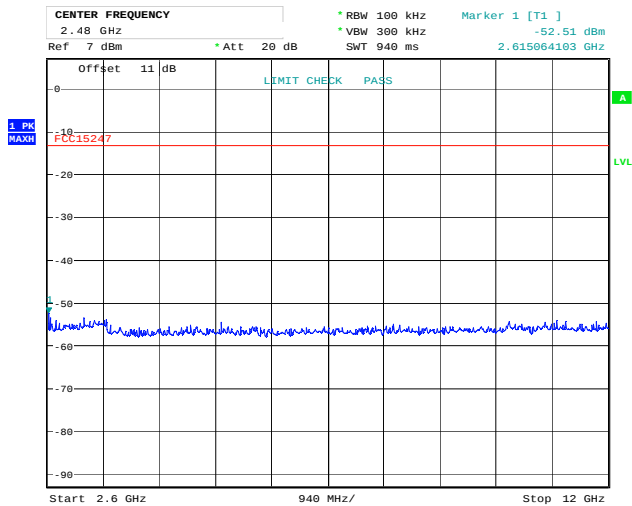
Date: 22.OCT.2021 15:16:29

Conducted Emissions 2600-12000 MHz, 2402 MHz, GFSK



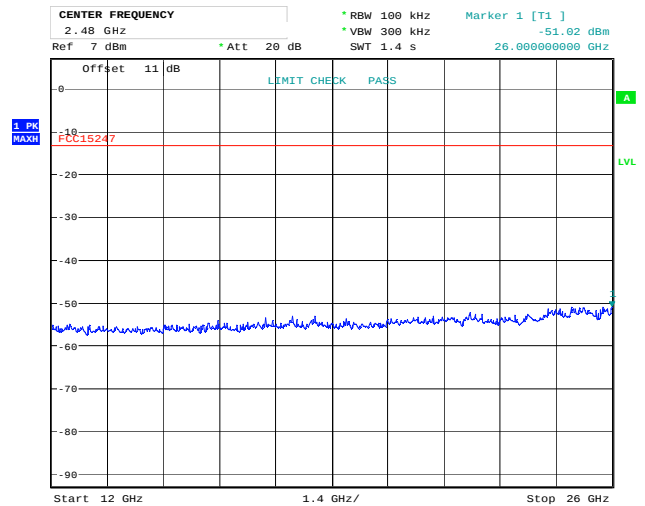
Date: 22.OCT.2021 15:17:17

Conducted Emissions 12000-26000 MHz, 2402 MHz, GFSK



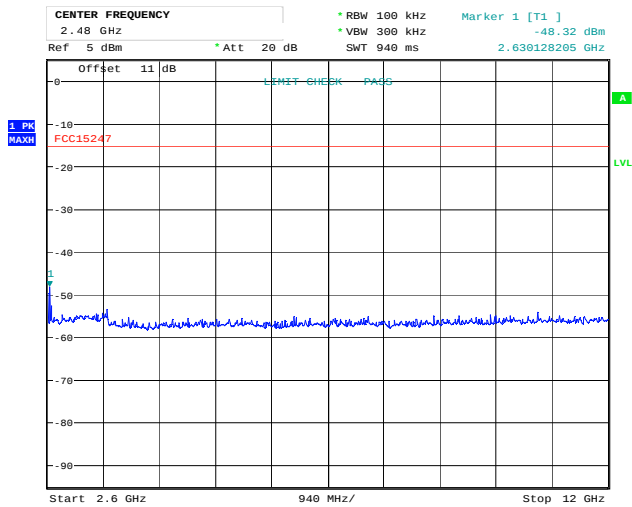
Date: 22.OCT.2021 15:11:50

Conducted Emissions 2600-12000 MHz, 2441 MHz, GFSK



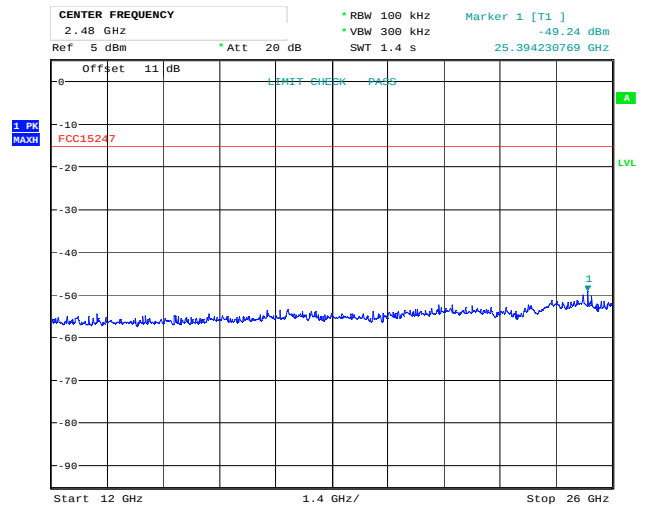
Date: 22.OCT.2021 15:12:38

Conducted Emissions 12000-26000 MHz, 2441 MHz, GFSK



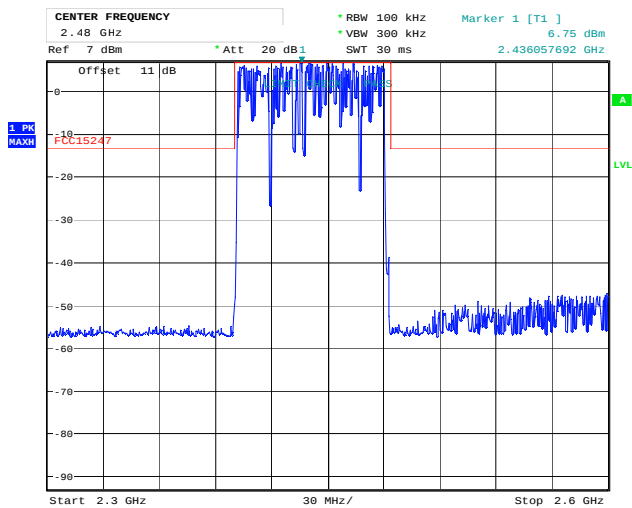
Date: 22.OCT.2021 15:07:42

Conducted Emissions 2600-12000 MHz, 2480 MHz, GFSK



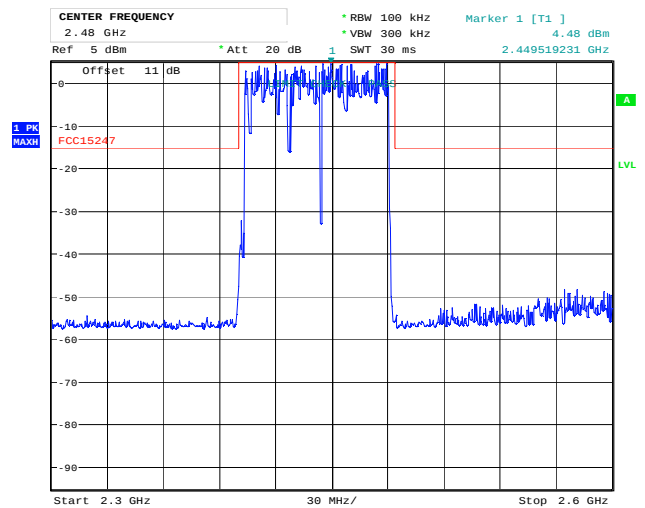
Date: 22.OCT.2021 15:08:29

Conducted Emissions 12000-26000 MHz, 2480 MHz, GFSK



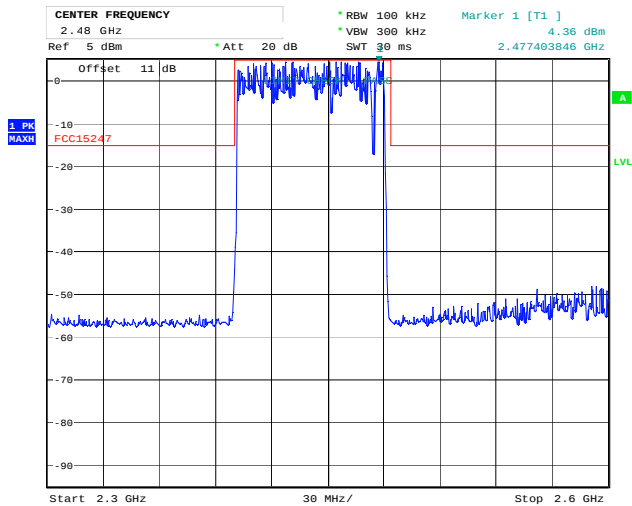
Date: 22.OCT.2021 15:18:42

Conducted Emissions 2300-2600 MHz, Hopping, GFSK



Date: 22.OCT.2021 15:20:27

Conducted Emissions 2300-2600 MHz, Hopping, $\pi/4$ -DPSK



Date: 22.OCT.2021 15:21:58

Conducted Emissions 2300-2600 MHz, Hopping, 8-DPSK

3.9 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)	ISSED Canada (MHz)	FCC (GHz)	ISSED 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.

3.10 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 Data Rate	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
2402 MHz GFSK	2390 MHz	53.1	/	74	54	20.9	/
2480 MHz GFSK	2483.5 MHz	60.7	40.7			13.3	13.3
2402 MHz 2-EDR	2390 MHz	53.5	/			20.5	/
2480 MHz 2-EDR	2483.5 MHz	63.1	43.1			10.9	10.9
2402 MHz 3-EDR	2390 MHz	53.2	/			20.8	/
2480 MHz 3-EDR	2483.5 MHz	63.1	43.1			10.9	10.9

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

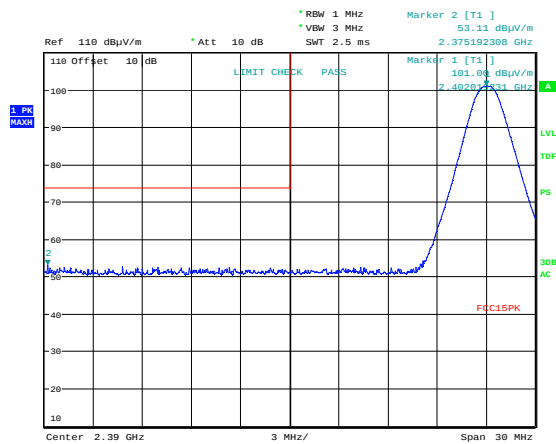
See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = slot length / frame length

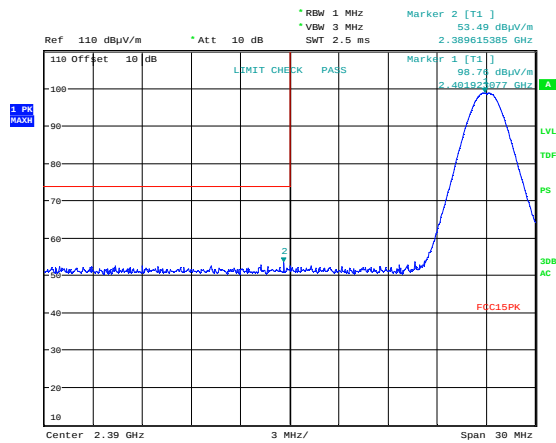
Duty Cycle Correction factor = $-20 \times \log(\text{Duty Cycle}) = 27.5 \text{ dB}$

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



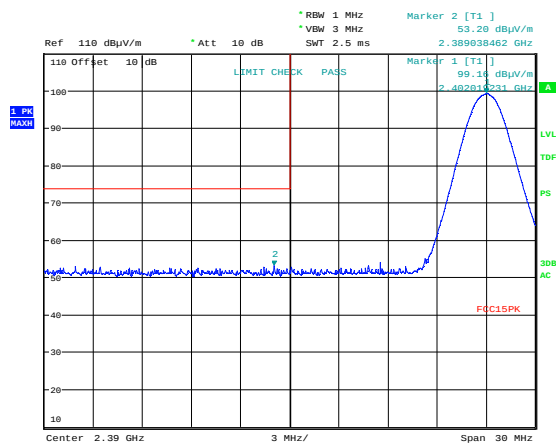
Date: 25.OCT.2021 13:30:23

Lower Band Edge 2402 MHz, GFSK, Peak



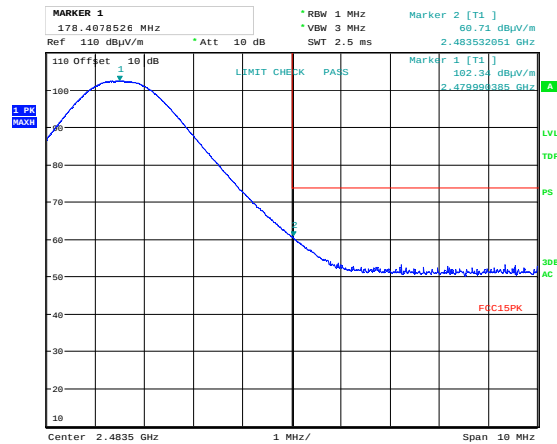
Date: 25.OCT.2021 13:21:01

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



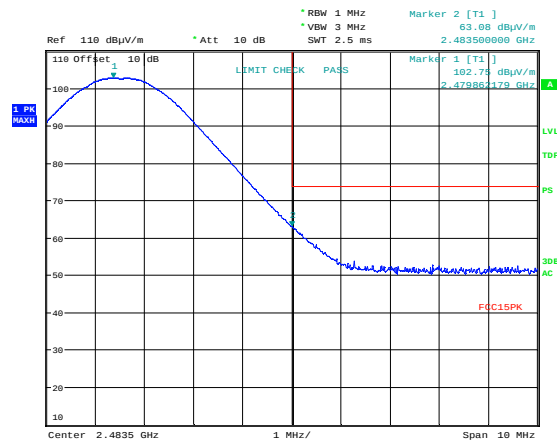
Date: 25.OCT.2021 13:24:10

Lower Band Edge 2402 MHz, 8-DPSK, Peak



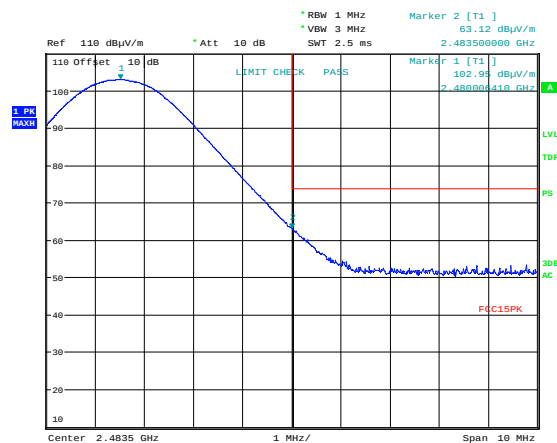
Date: 25.OCT.2021 13:08:58

Upper Band Edge 2480 MHz, GFSK, Peak



Date: 25.OCT.2021 12:51:43

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



Date: 25.OCT.2021 12:55:18

Upper Band Edge 2480 MHz, 8-DPSK, Peak

3.11 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 were measured with Quasi-Peak Detector)

Measuring distance 3 m

Tested in BT hopping mode

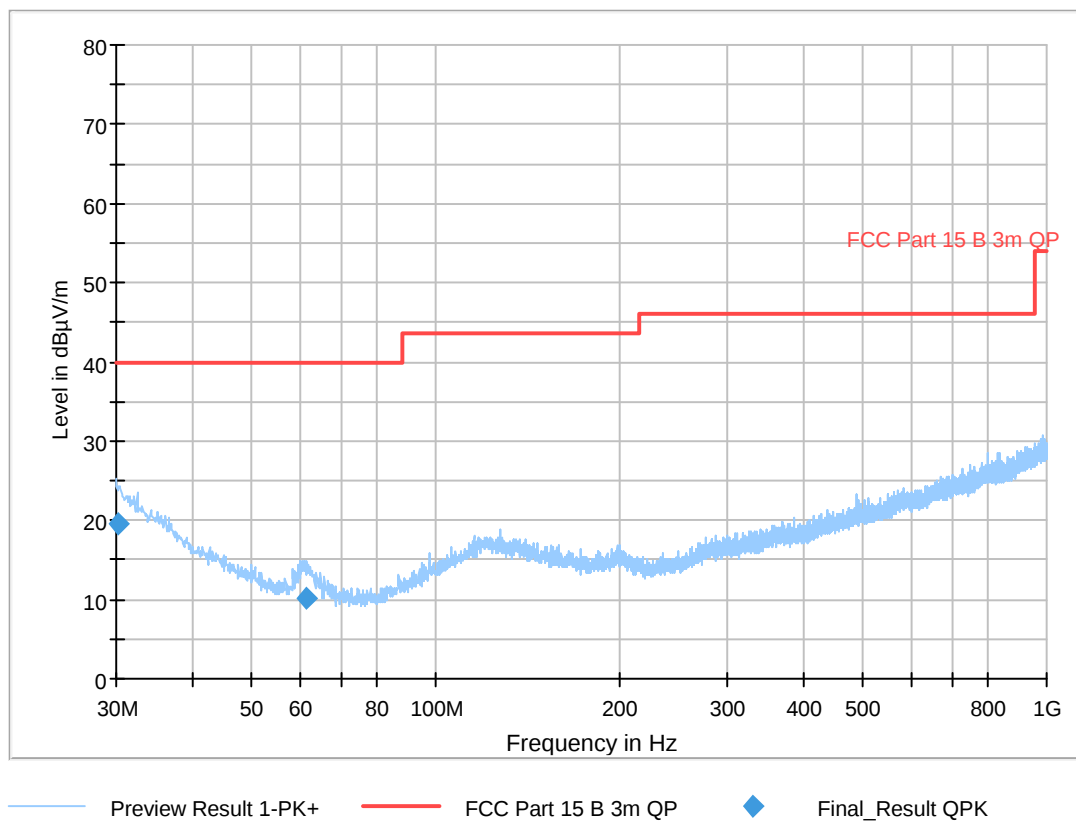
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.236800	19.51	40.00	20.49	1000.0	120.000	211.0	V	173.0
61.287400	10.19	40.00	29.81	1000.0	120.000	106.0	V	30.0

See attached plot.

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	

Full Spectrum



Radiated Emissions 30 - 1000 MHz, GFSK

3.12 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.

No Spurious emissions were detected.

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

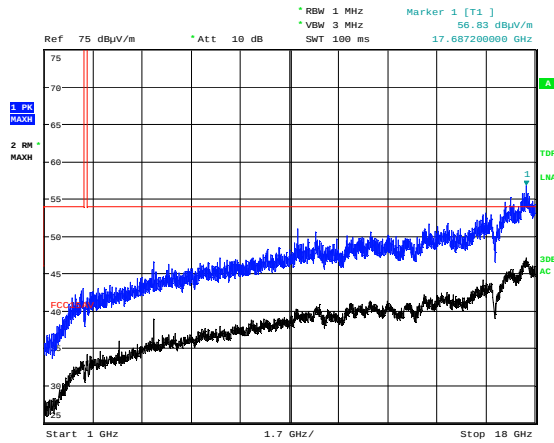
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

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

See plots

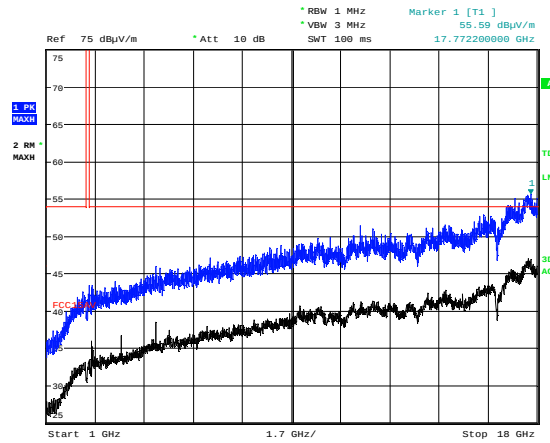
Requirements/Limit

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



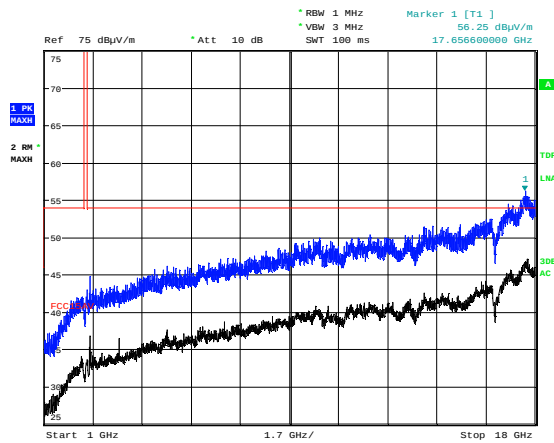
Date: 21.OCT.2021 16:37:16

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



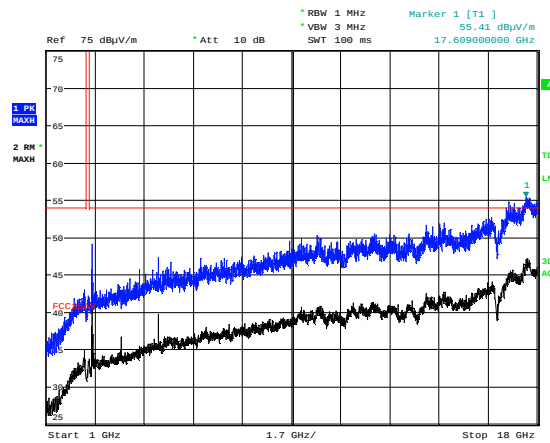
Date: 21.OCT.2021 16:35:26

Radiated Emissions 1 - 18 GHz, 2402 MHz, GFSK, VP



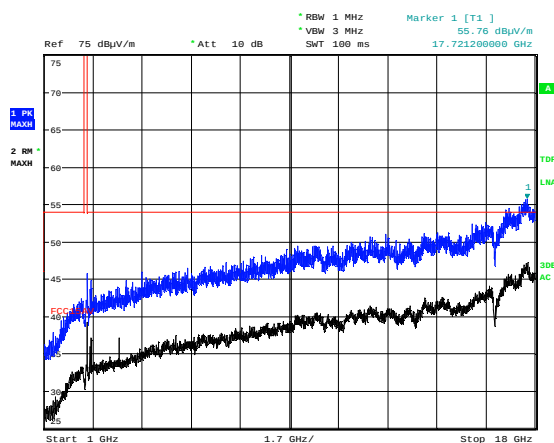
Date: 21.OCT.2021 15:56:00

Radiated Emissions 1 - 18 GHz, 2441 MHz, GFSK, HP



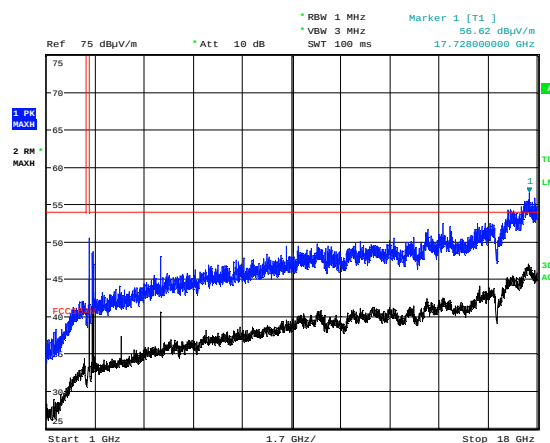
Date: 21.OCT.2021 15:59:39

Radiated Emissions 1 - 18 GHz, 2441 MHz, GFSK, VP



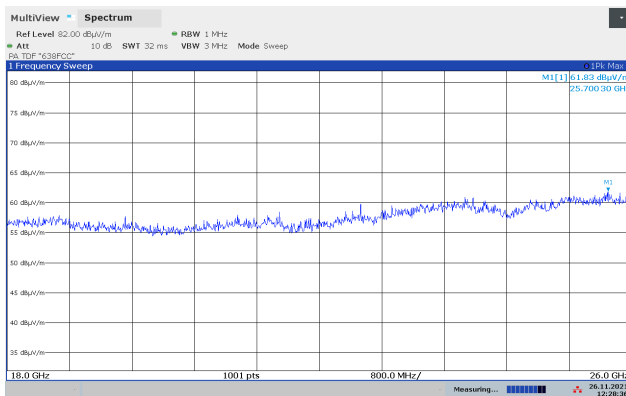
Date: 21.OCT.2021 16:11:28

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

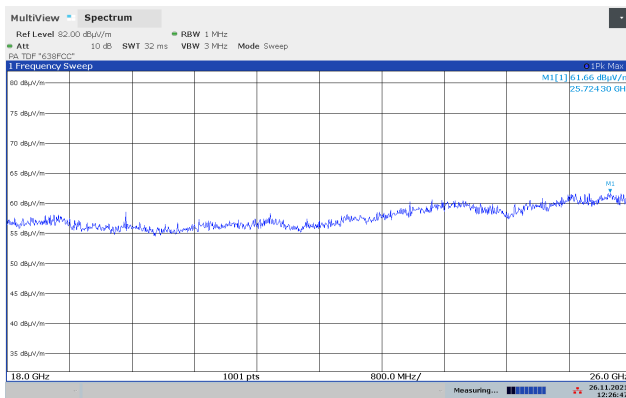


Date: 21.OCT.2021 16:09:38

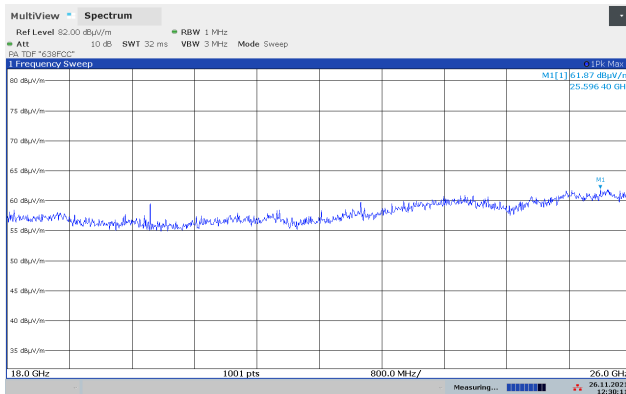
Radiated Emissions 1 - 18 GHz, 2480 MHz, GFSK, VP



Pre-scan 18 - 26 GHz, 2402 MHz, GFSK @approx 10cm



Pre-scan 18 - 26 GHz, 2441 MHz, GFSK @approx 10cm



Pre-scan 18 - 26 GHz, 2480 MHz, GFSK @approx 10cm

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.

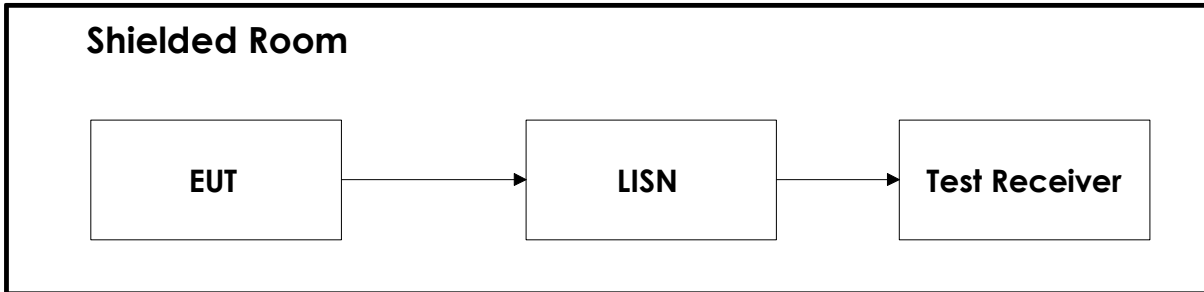
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSU26	Spectrum Analyzer	Rohde & Schwarz	LR 1504	2020-01	2022-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2021-02	2022-02
3	6810.17B	Attenuator	Suhner	LR 1669	2021-08	2022-08
4	NO324415	Band Reject Filter	Microwave Circuits	LR 1760	COU	
5	JB3	BiLog Antenna	Sunol	N-4525	2020-03	2023-03
6	310	Preamplifier	Sonoma Inst.	LR 1686	2021-08	2022-08
7	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2021-08	2022-08
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2021-08	2022-08
9	638	Antenna Horn	Narda	LR 1480	N/A	
10	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2020-10	2022-10
11	ESCI3	Measuring Receiver	Rohde & Schwarz	N-4259	2021.10	2023.10
12	ESH2-Z5	Two Line V-Network	Rohde & Schwarz	N-4097	2020-04	2022-04
13	ESH3-Z2	Pulse Limiter	Rohde & Schwarz	LR 1074	COU	
14	6812B	AC Power Source	Agilent	LR 1515	2020-04	2022-04
15	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

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

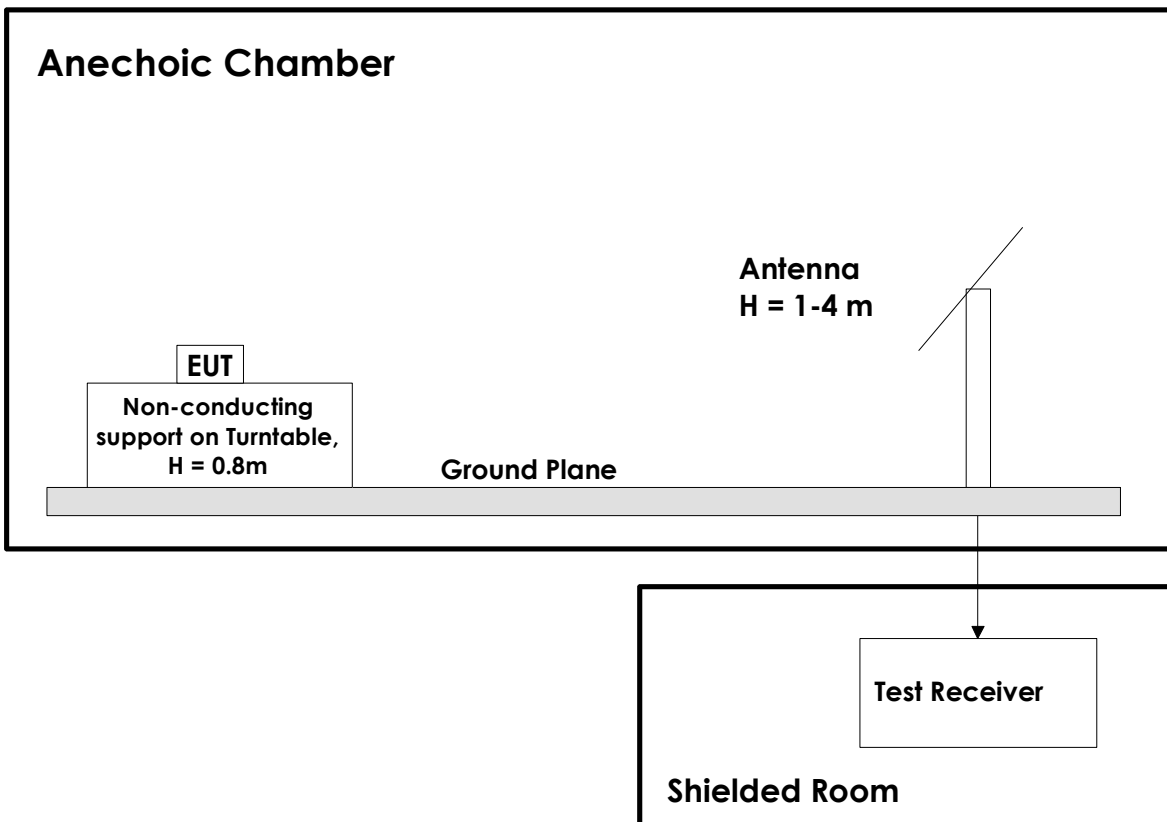
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.30.10	Power Line Conducted test software
2	Rohde & Schwarz	EMC32	10.30.10	Radiated Emission test software
3	Nemko AS	RSPlot	1.0.8.0	Screen capture from R&S Spectrum Analyzers

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.