

Test Report

Product	Animal Collar for cattle
Name and address of the applicant	Nofence Evjevegen 8, 6631 Batnfjordsøra, Norway
Name and address of the manufacturer	Nofence Evjevegen 8, 6631 Batnfjordsøra, Norway
Model	C25
Rating	3.6VDC, rechargeable battery
Trademark	Nofence
Serial number	See page 3
Additional information	This test report covers Bluetooth Low Energy and intermodulation measurements. This device contains following FCC/ISED certified modules: - U-blox LTE-M FCC ID: XPYUBX20VA01, ISED ID:8595A-UBX20VA01
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 FCC KDB 996369 D04 Module Integration Guide V01, section 2e Modular transmitter integration guide-guidance for host product manufactures composite system operation (Co-Location)
Order number	PRJ0019249
Tested in period	2022-11-07 – 2022-11-12
Issue date	2023-06-05
Name and address of the testing laboratory	<div> Nemko Scandinavia AS Instituttveien 6, 2007 Kjeller, Norway </div> <div> CAB Number: FCC: NO0001 ISED: NO0470 TEL: +47 22 96 03 30 </div> <div>   </div>
An accredited technical test executed under the Norwegian accreditation scheme	
<div> <div>  </div> <div>  </div> </div> <div> Prepared by [G.Suhanthakumar] Approved by [Frode Sveinsen] </div>	
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Nemko Scandinavia AS, Instituttveien 6, P.O. Box 96 Kjeller, 2027 Kjeller, Norway
TEL +47 22 96 03 30 EMAIL info@nemko.com

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1 INFORMATION

1.1 Test Item

Name	Nofence collar
Model/version	C25
FCC ID	2A3V8C25
ISED ID	28021-C25
Serial number	Radiated sample: 290197 Conducted sample: 290217
Hardware identity and/or version	C2.5
Software identity and/or version	902
Frequency Range	2402–2480 MHz
Number of Channels	40
Operating Modes	TX/RX
Type of Modulation	GFSK
Conducted Output Power	3.50 mW (Peak)
Antenna Connector	None. integral antenna type-BLE: PCB integral antenna type-LTE M: Ethertronics P822601
Number of Antennas	1 for BLE and 1 for LTE-M
Diversity or Smart Antennas	No
Power Supply	Rechargeble Li-Ion polymer Battery (3.6Vdc)
Desktop Charger	Yes, Note 1

Note 1: Battery should be removed from the EUT and charged separately. The device can not be operated during charging.

Description of Test Item

The tested device is an animal collar for cattle. It contains BLE chip from Nordic semiconductor type nRF52840-QIAA-R.

In addition it contains certified LTE-M module from U-blox SARA-R4225 (FCC ID: XPYUBX20VA01, ISED ID:8595A-UBX20VA01) and GNSS module from U-blox MIA-M10Q.

1.2 Normal test condition

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

The values are the limit registered during the test period.

1.3 Test Engineer(s)

G.Suwanthakumar

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	Continuous TX with GFSK modulation
Additional information	The following settings were used for all tests: Power Setting: 4 dBm Data rate: 1Mbit/s
	BLE in simulatenious mode with 2g and LTE-M bands.

1.6 Comments

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

No intermodulation products were detected during BLE and 2g/LTE simulatenious transmissions. The output power level during simulatenious transmissions was set to maximum. The test results are given in page 24 to 28.

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

DTS 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 ¹
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies ²
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	N/A ¹
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	-
DTS Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	11.8 Option 1	Complies
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)	Complies
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

¹ The tested equipment only operates with battery

² Integral antenna.

-Only for information

Revision history

Revision	Date	Comment	Sign
A	2022-12-09	First edition	gns
B	2023-04-26	Model name changed	gns
C	2023-06-05	Max power level corrected in page 3	gns

3 TEST RESULTS

3.1 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:

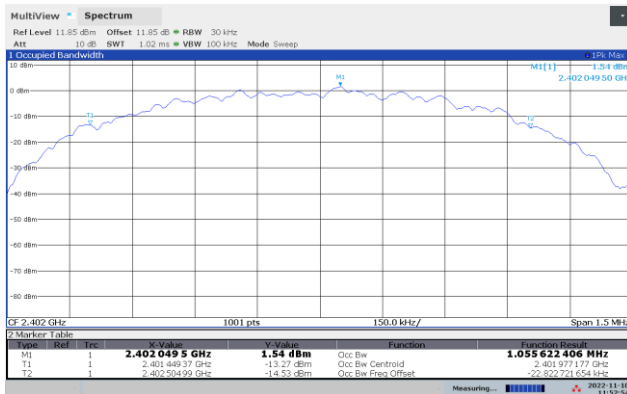
Carrier Frequency and Data Rate	Occupied Bandwidth (99% BW)
2402 MHz/1Mbit/s	1.06 MHz
2440 MHz/1Mbit/s	1.05 MHz
2480 MHz/1Mbit/s	1.06 MHz

Occupied Bandwidth is the same for all channels

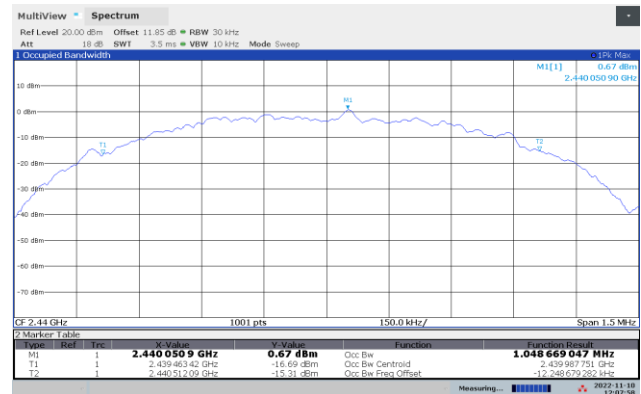
See attached plots.

Requirements:

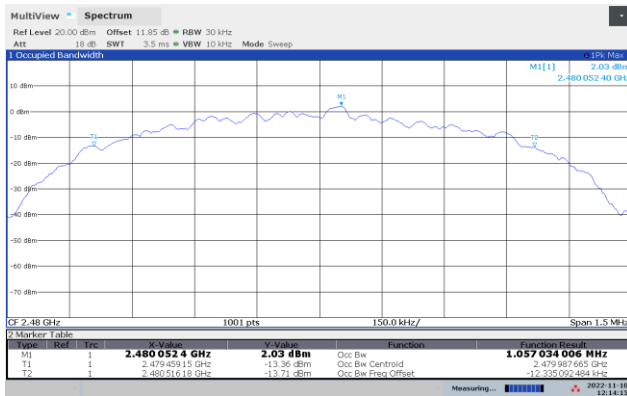
No requirement for 99% BW, reported for information only.



99% Occupied BW, GFSK, ch2402MHz



99% Occupied BW, GFSK, ch2440MHz



99% Occupied BW, GFSK, ch2480MHz

3.2 DTS Bandwidth

FCC Part 15.247 (a)(2)

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

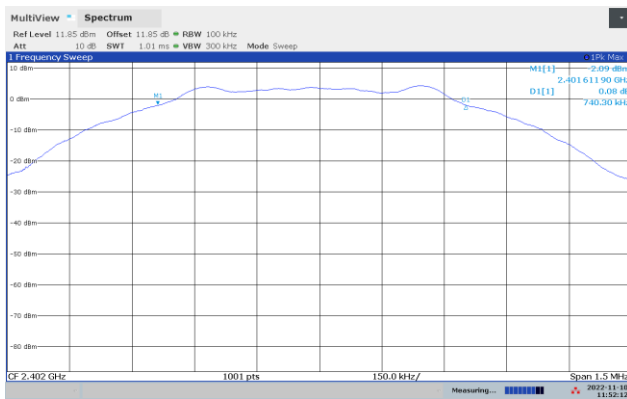
Measurement procedure: ANSI C63.10-2013 Clause 11.8

Test Results: Complies

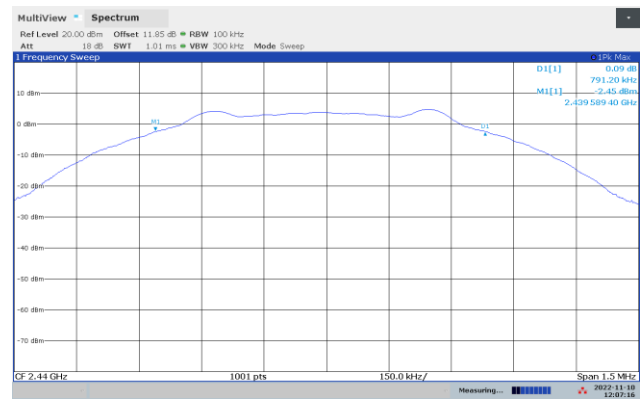
Measurement Data:

Operating Mode	DTS Bandwidth (6dB BW)		
	2402 MHz	2440 MHz	2480 MHz
GFSK, 1Mb/s	740.30 kHz	791.20 kHz	728.30 kHz

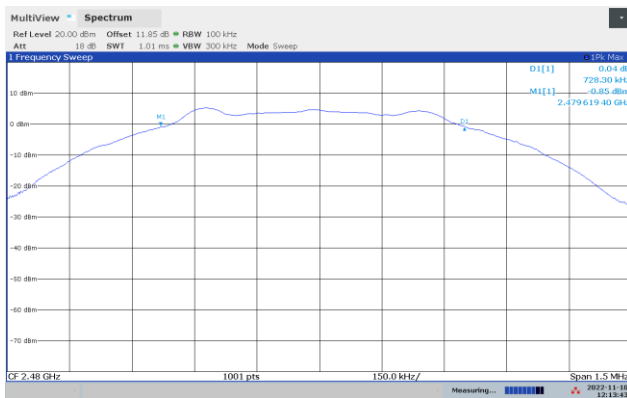
Frequency Band	Requirement for systems using Digital Modulation
902-928 MHz	The minimum 6 dB bandwidth shall be at least 500 kHz.
2400-2483.5 MHz	
5725-5850 MHz	



DTS BW, 2402 MHz, 1Mb



DTS BW, 2440 MHz, 1Mb



DTS BW, 2480 MHz, 1Mb

3.3 Peak Power Output

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Carrier Frequency (MHz)	Modulation Type	Conducted Power (dBm)	Conducted Power (mW)	Field Strength (dBμV/m)	EIRP (mW)	Antenna gain (dBi)
2402	GFSK	4.65	2.92	104.43	8.32	4.6
2440	GFSK	4.97	3.14	101.93	4.68	1.7
2480	GFSK	5.44	3.50	97.75	1.79	-2.9

The maximum radiated field strength is obtained in ZX plane and Vertical polarization.

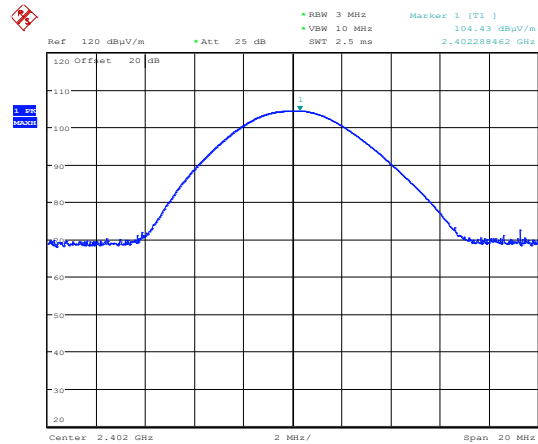
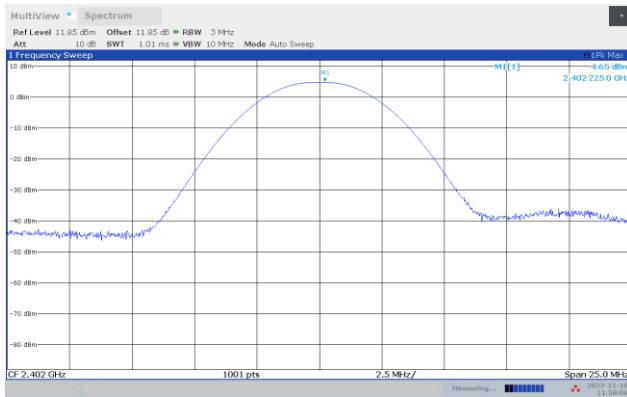
Output Power reported is Maximum Peak Power.

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

Antenna Gain is less than 6 dBi.

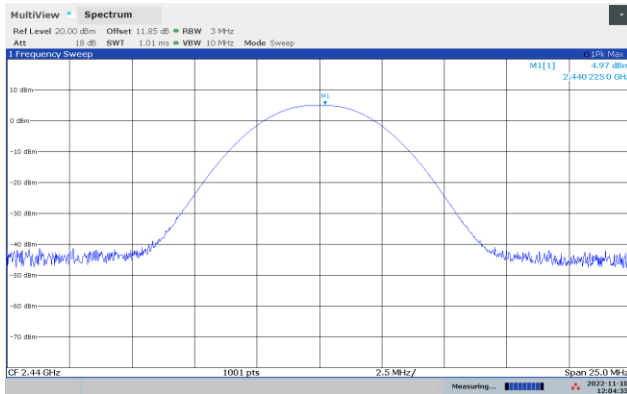
See attached plots.

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

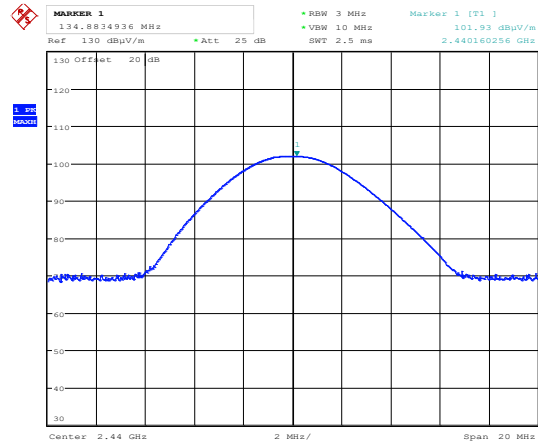


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Peak Power, 2402 MHz, GFSK

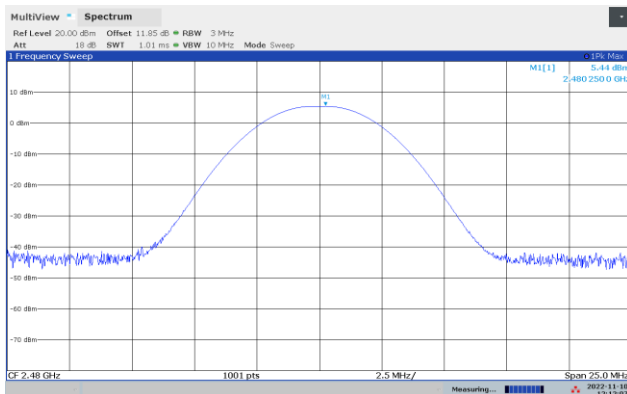


Maximum Field Strength, 2402 MHz, GFSK

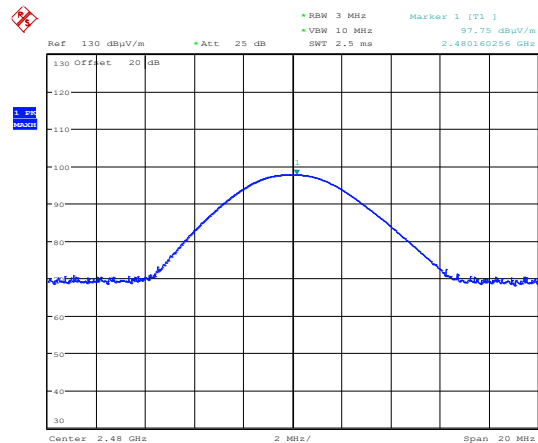


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Peak Power, 2440 MHz, GFSK



Maximum Field Strength, 2440 MHz, GFSK



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Peak Power, 2480 MHz, GFSK

Maximum Field Strength, 2480 MHz, GFSK

3.4 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

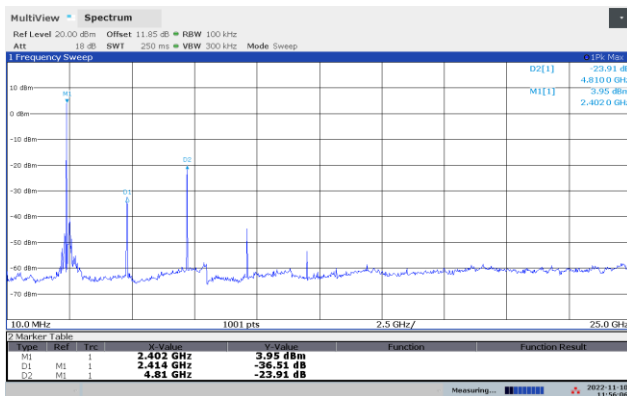
Measurement Data:

Carrier Frequency	Highest Value (dBc)	Margin (dB)	Verdict
2402 MHz	23.91	> 20	Pass
2440 MHz	23.16	> 20	Pass
2480 MHz	26.50	> 20	Pass

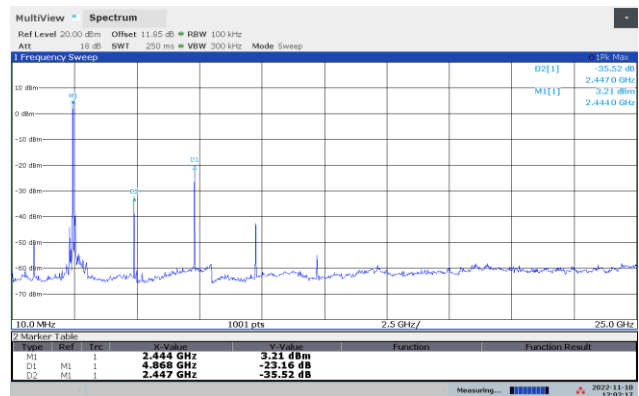
Measured with Peak Detector

RF conducted power to 25 GHz: see attached plots.

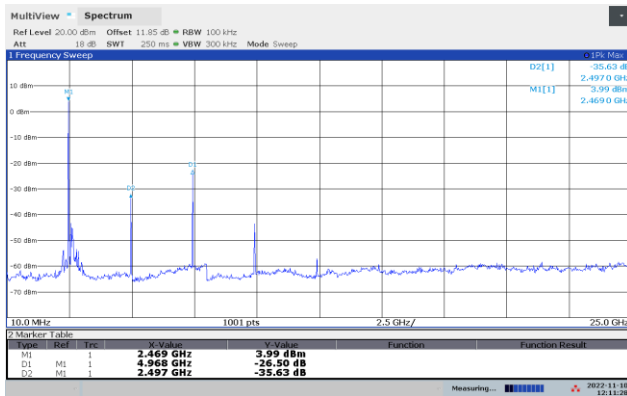
Requirements for all systems	
Peak measurement	RMS averaging (alternative measurement)
20 dB or more below carrier measured in 100 kHz bandwidth	30 dB or more below carrier measured in 100 kHz bandwidth
<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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.</p> <p>Attenuation below the general limits specified in § 15.209(a) is not required.</p>	



Conducted Emissions 10-25000 MHz, 2402 MHz, GFSK



Conducted Emissions 10 - 25000 MHz, 2440 MHz, GFSK



Conducted Emissions 10-25000 MHz, 2440 MHz, GFSK

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 Canada (MHz)	FCC (GHz)	ISED Canada (GHz)
0.090-0.110		0.96-1.24 1.3-1.427	0.96-1.427
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		2.69-2.9	2.655-2.9
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		3.6-4.4	3.5-4.4
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 123-138	108-138	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.6 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:

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	64.54	44.54	74	54	9.46	9.46
2480 MHz GFSK	2483.5 MHz	63.70	43.70			10.3	10.3

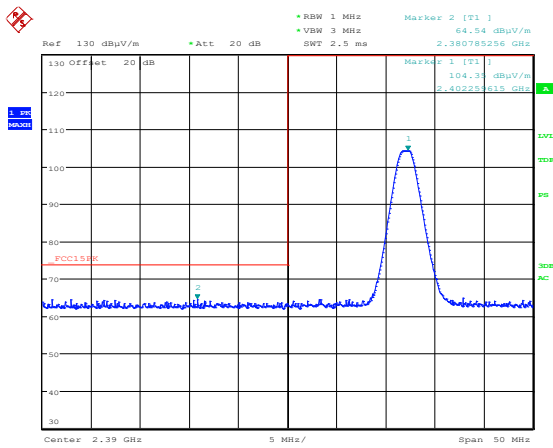
Average Detector values are measured with Peak Detector and corrected for Duty Cycle.

See attached plots.

Duty Cycle Correction Factor Calculation: According to the manufacturer document is 1.152%

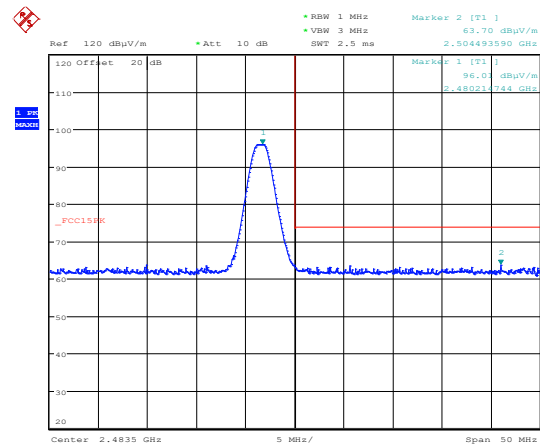
Duty Cycle Correction factor = $-20 \times \log(0.001152) = -38.77$ dB

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



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Lower Band Edge 2402 MHz, GFSK, Peak



Date: 7.NOV.2022 20:10:21

Upper Band Edge 2480 MHz, GFSK, Peak

3.8 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

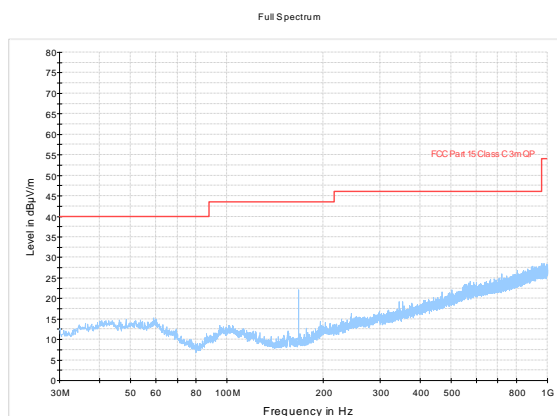
Measurement Data:

Detector: Peak (found frequencies were measured with Quasi-Peak Detector)

Measuring distance 3 m

Tested in active mode.

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
---	---	---	---	---	---	---	---	---



Radiated Emissions 30 - 1000 MHz, GFSK

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		

3.9 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.

Peak Detector, RBW=1 MHz

Carrier freq. (MHz)	Measured Frequency (GHz)	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2402	/	GFSK	/	74	/
2440	7.32	GFSK	53.97	74	20.03
2480	/	GFSK	/	74	/

Average Detector, RBW=1 MHz

Carrier freq. (MHz)	Measured Frequency (GHz)	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2402	/	GFSK	/	54	/
2440	7.32	GFSK	/	54	/
2480	/	GFSK	/	54	/

Duty Cycle Correction Factor Calculation: According to the manufacturer document is 1.12%

Duty Cycle Correction factor = $-20 \times \log(0.00112) = -59.01 \text{ dB}$

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

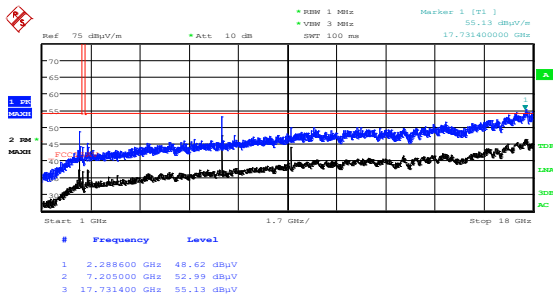
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

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

See plots

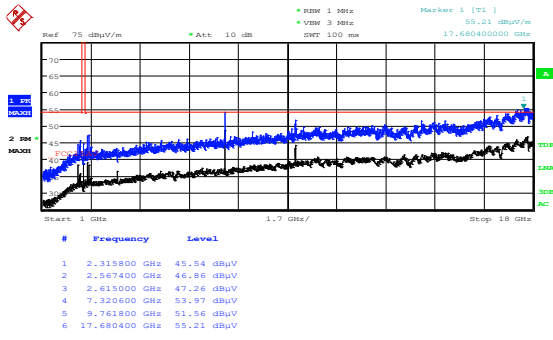
Requirements/Limit

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



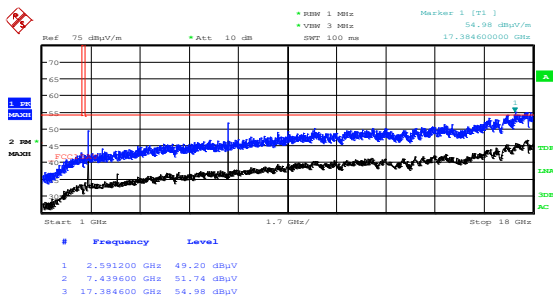
Date: 7.NOV.2022 19:12:31

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



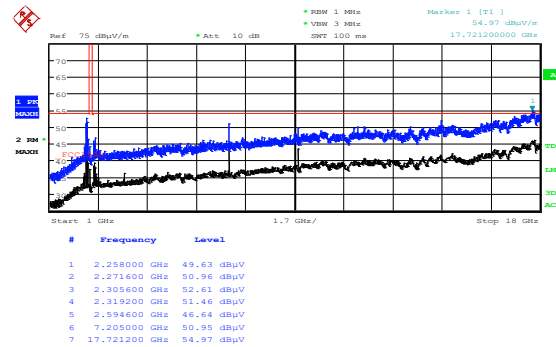
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Radiated Emissions 1 - 18 GHz, 2440 MHz, GFSK, HP



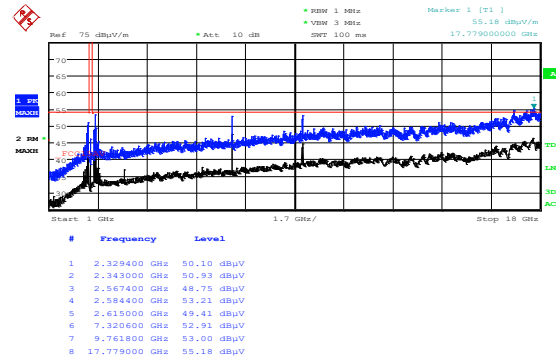
Date: 7.NOV.2022 20:01:27

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



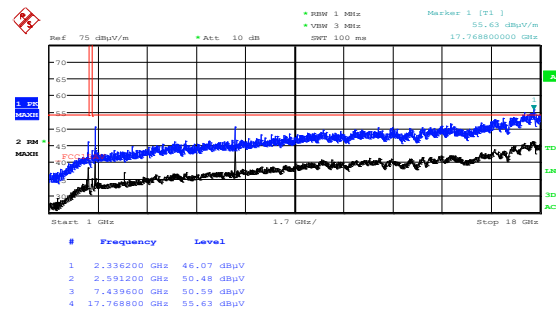
Date: 7.NOV.2022 19:10:36

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



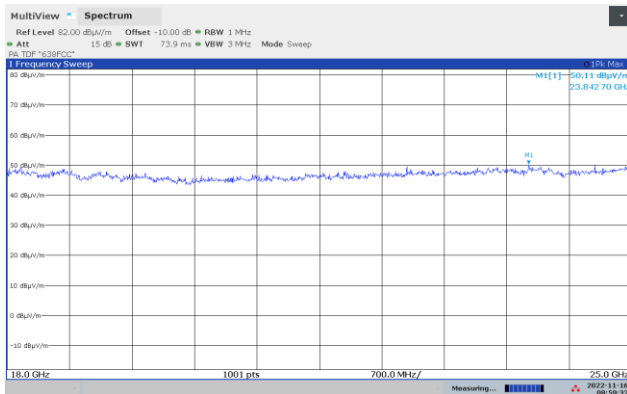
Date: 7.NOV.2022 19:49:23

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

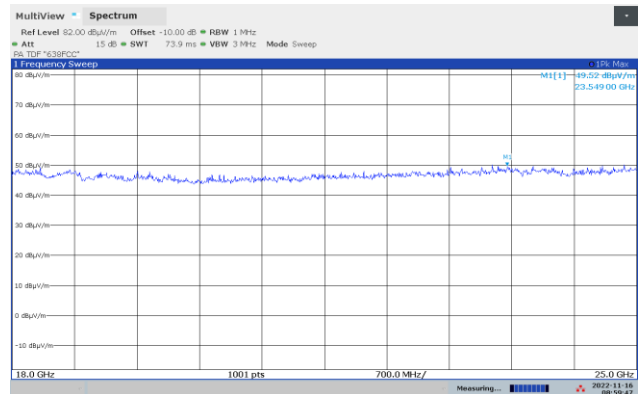


Date: 7.NOV.2022 19:59:32

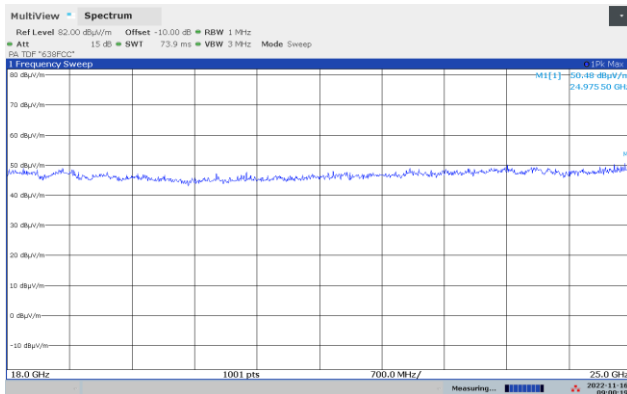
Radiated Emissions 1 - 18 GHz, 2480 MHz, GFSK, VP



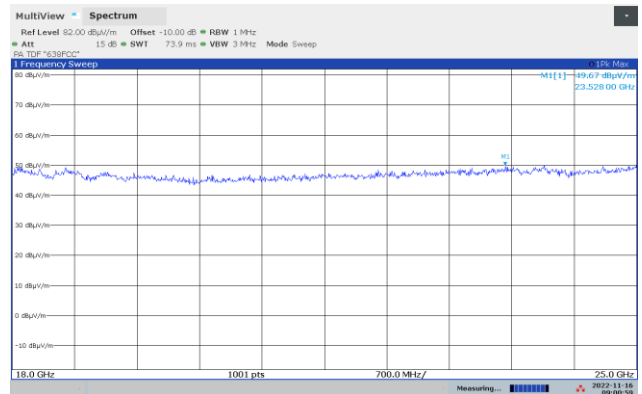
Radiated Emissions 18 - 26 GHz, 2402 MHz, GFSK, HP, pk scan @1m



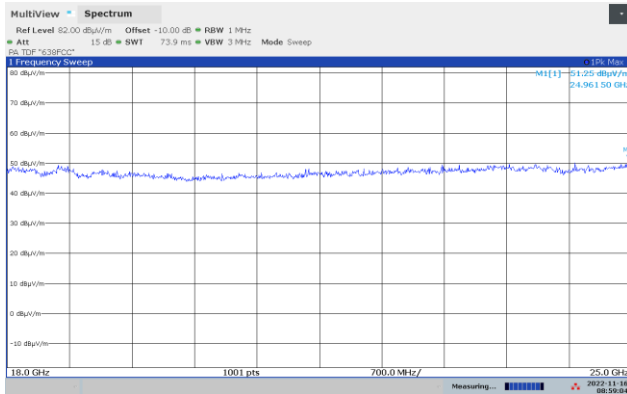
Radiated Emissions 18 - 26 GHz, 2402 MHz, GFSK, VP, pk scan @1m



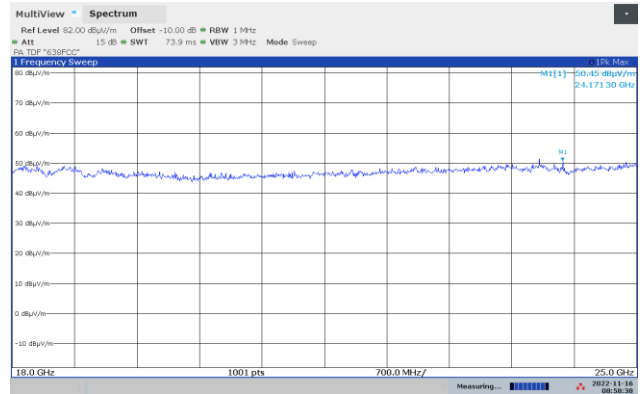
Radiated Emissions 18 - 26 GHz, 2440 MHz, GFSK, HP, pk scan @1m



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



Radiated Emissions 18 - 26 GHz, 2480 MHz, GFSK, HP, pk scan @1m

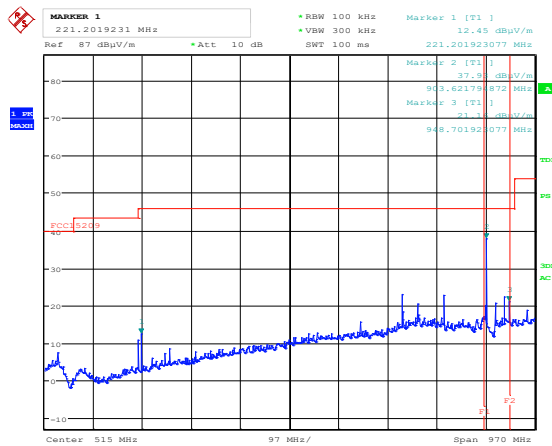


Radiated Emissions 18 - 26 GHz, 2480 MHz, GFSK, VP, pk scan @1m

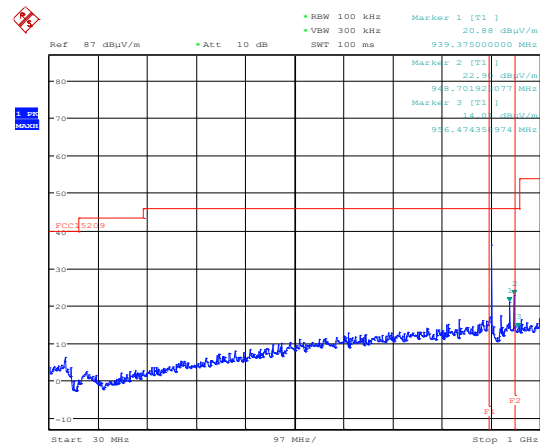
Intermodulation radiated spurious emissions BLE with 2G/LTE cat-M:

(BLE was in broadcast mode)

Used LTE cat M Band number	Frequency (MHz)	Intermodulation products
2	1909.21	None detected
3 and 4	1710.67	None detected
20	832.8	None detected
Used 2 g bands	-	-
900MHz	902	None detected
1800MHz	1748	None detected

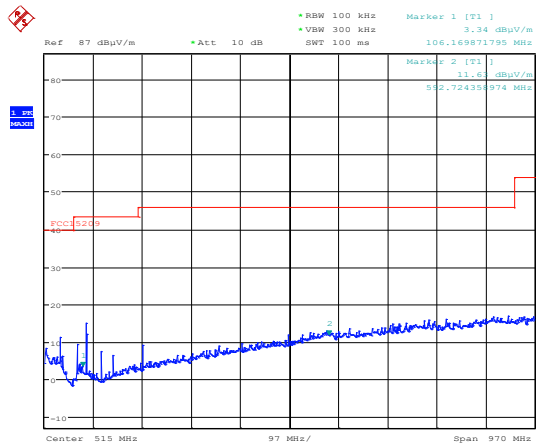


Date: 24.NOV.2022 14:53:18



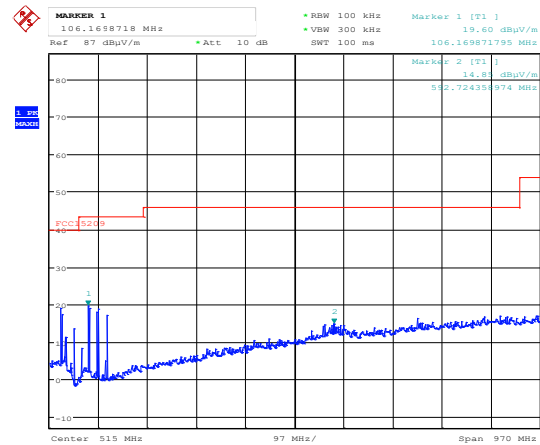
Date: 24.NOV.2022 14:51:54

Radiated Emissions 30 - 1000 MHz, 2g band 900/BLE, HP, pk scan



Date: 24.NOV.2022 15:18:14

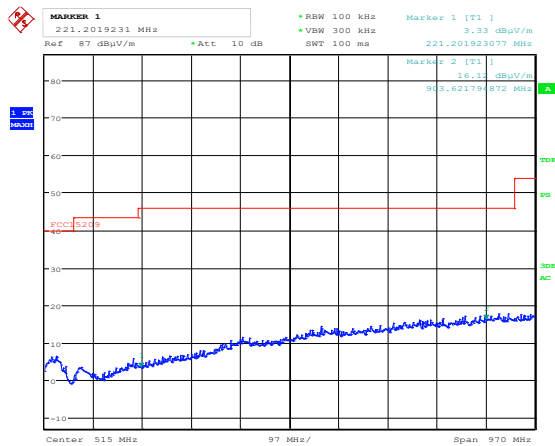
Radiated Emissions 30 - 1000 MHz, 2g band 900/BLE, VP, pk scan



Date: 24.NOV.2022 15:17:24

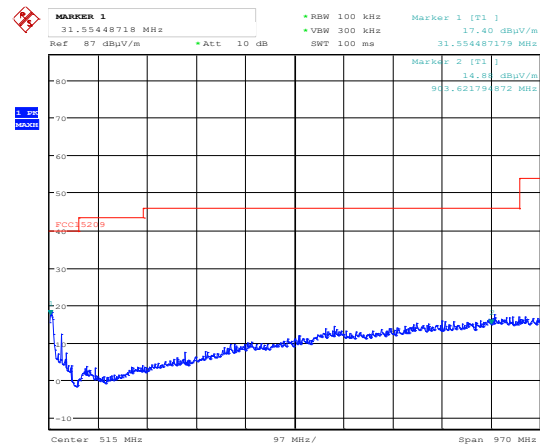
Radiated Emissions 30 - 1000 MHz, LTE band 2BLE, HP, pk scan

Radiated Emissions 30 - 1000 MHz, LTE band 2 and BLE, VP, pk scan



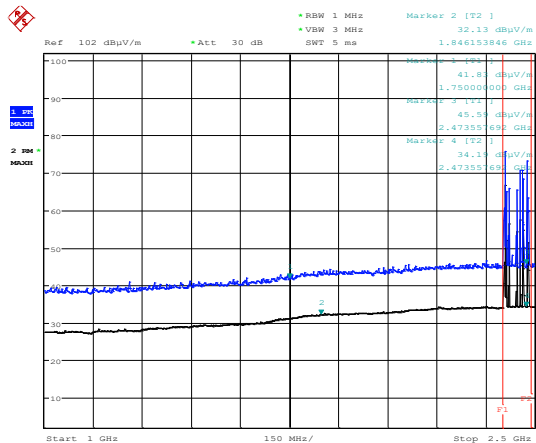
Date: 24.NOV.2022 14:59:39

Radiated Emissions 30 - 1000 MHz, 2g, 1800, BLE, HP, pk scan



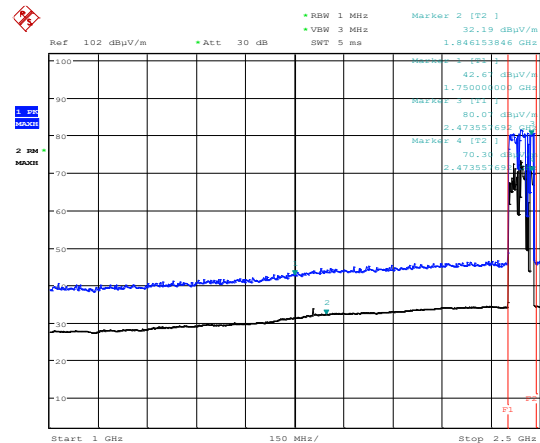
Date: 24.NOV.2022 15:00:12

Radiated Emissions 30 - 1000 MHz, 2g, 1800, BLE, V, pk scan



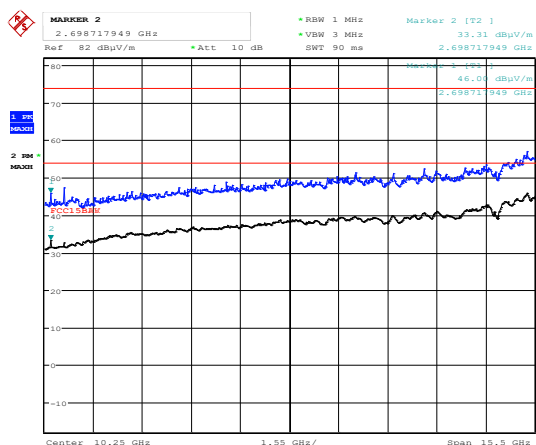
Date: 25.NOV.2022 09:19:14

Radiated Emissions 1 - 2.5GHz, 2G band 900/BLE, HP, pk scan



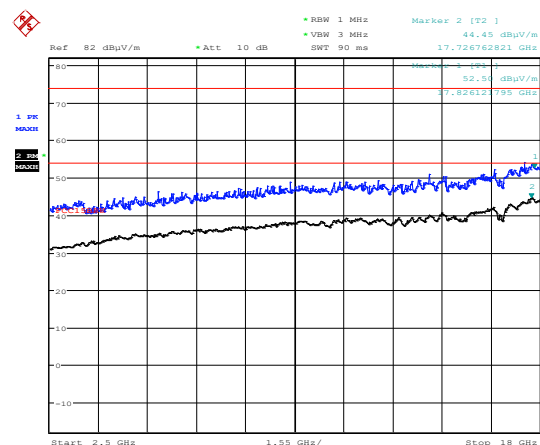
Date: 25.NOV.2022 09:17:00

Radiated Emissions 1 - 2.5GHz, 2G band 900/BLE, VP, pk scan



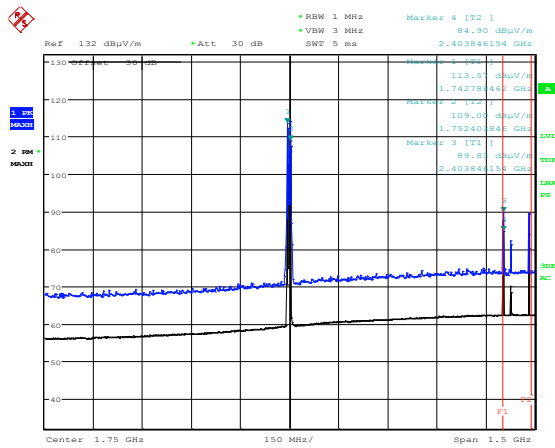
Date: 25.NOV.2022 06:32:39

Radiated Emissions 2.5 - 18GHz, 2g, 900/BLE, HP, pk scan



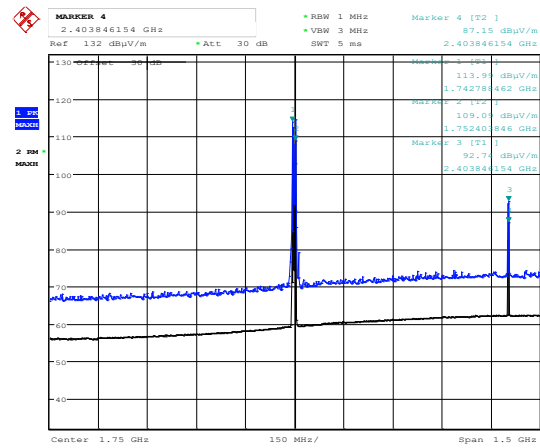
Date: 25.NOV.2022 06:31:21

Radiated Emissions 2.5 - 18GHz, 2g, 900/BLE, VP, pk scan



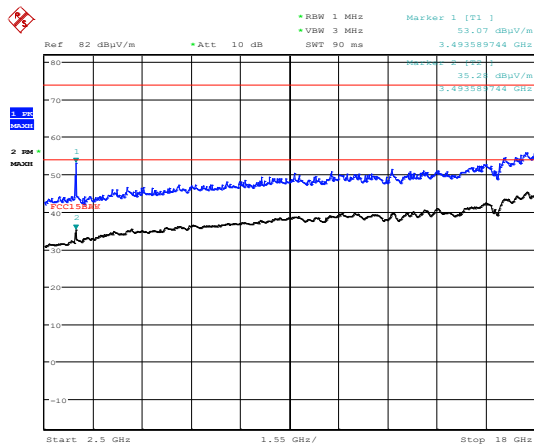
Date: 25.NOV.2022 07:37:52

Radiated Emissions 1 - 2.5GHz, LTE band 3/BLU, HP, pk scan (only wanted signals are detected above)



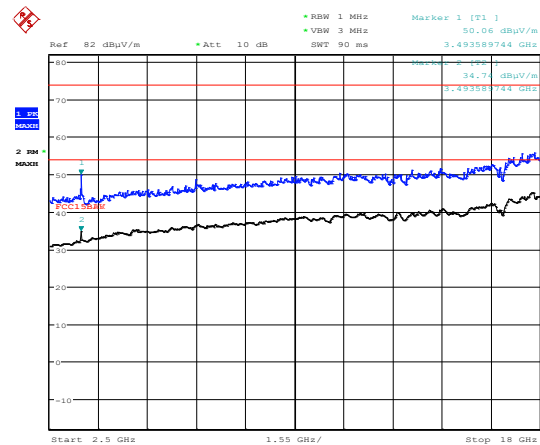
Date: 25.NOV.2022 07:25:56

Radiated Emissions 1 - 2.5GHz, LTE band 3/BLU, VP, pk scan (only wanted signals are detected above)



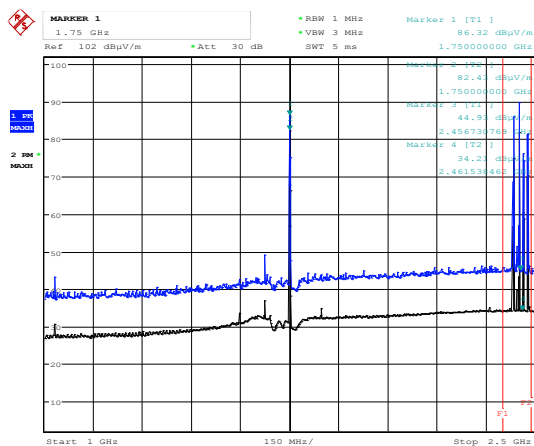
Date: 25.NOV.2022 07:03:35

Radiated Emissions 2.5 - 18GHz, LTE band 3/BLU, HP, pk scan (only 2nd harmonic is of B2 detected above)



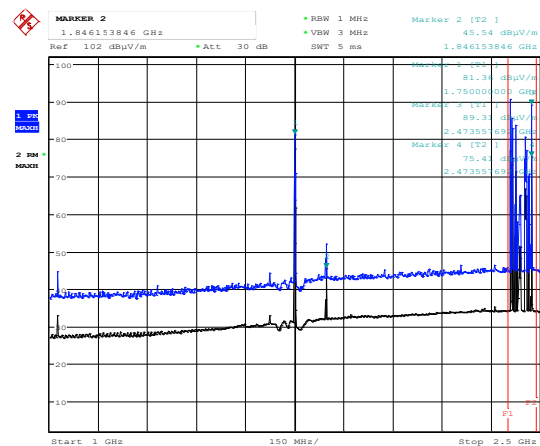
Date: 25.NOV.2022 07:02:13

Radiated Emissions 2.5 - 18GHz, LTE band 3/BLU, VP, pk scan (only 2nd harmonic is of B2 detected above)



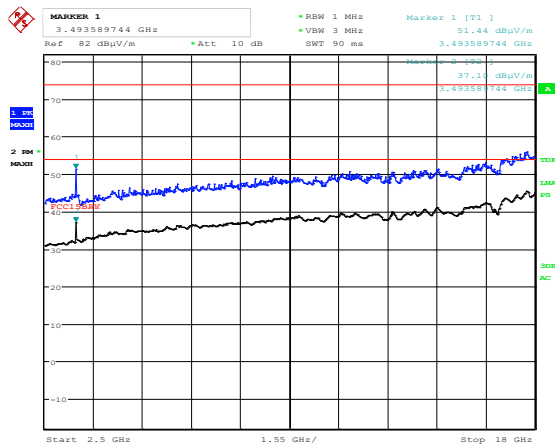
Date: 25.NOV.2022 08:58:40

Radiated Emissions 1 - 2.5GHz, 2g, 1800/BLU, HP, pk scan (only wanted signals are detected above)



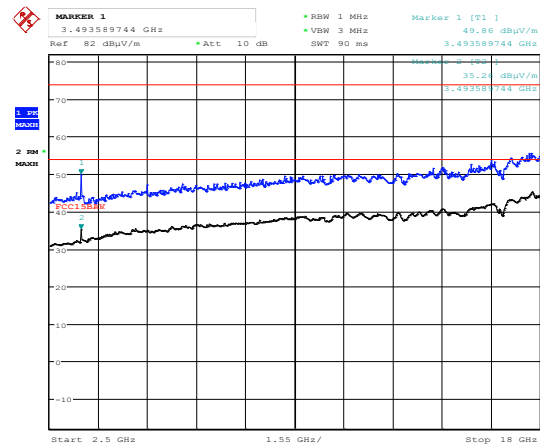
Date: 25.NOV.2022 09:00:06

Radiated Emissions 1 - 2.5GHz, 2g, 1800/BLU, VP, pk scan (only wanted signals are detected above)



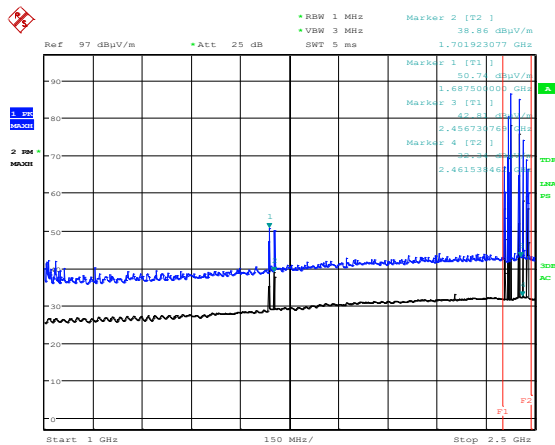
Date: 25.NOV.2022 06:50:30

Radiated Emissions 2.5 - 18GHz,2g, 1800/BLE, HP ,pk scan (only 2nd harmonics are detected above)



Date: 25.NOV.2022 06:52:20

Radiated Emissions 2.5 - 18GHz,2g, 1800/BLE, HP ,pk (only 2nd harmonics are detected above)



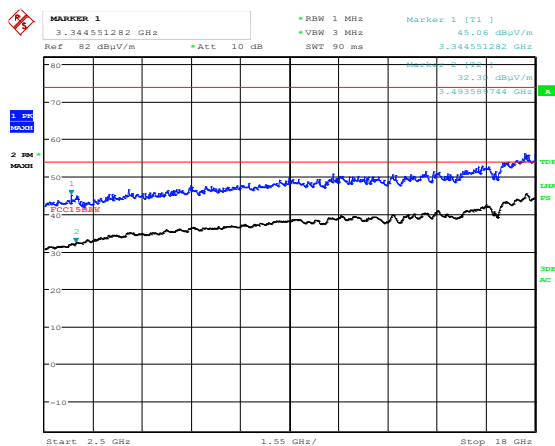
Date: 25.NOV.2022 08:46:35

Radiated Emissions 1 - 2.5GHz,LTE band 20/BLE, HP ,pk scan (only harmonics of B20MHz and BLE are detected above)



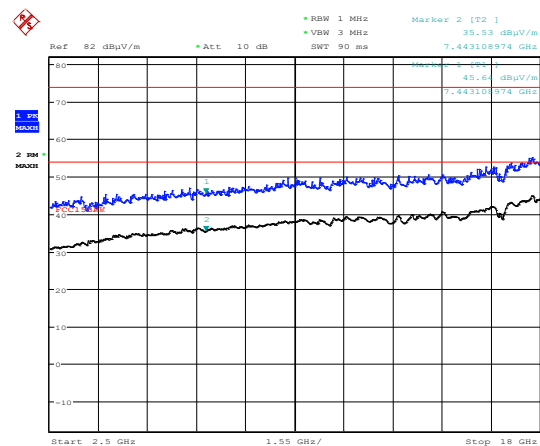
Date: 25.NOV.2022 07:16:35

Radiated Emissions 2.5 - 18GHz,LTE band 20/BLE, VP ,pk scan



Date: 25.NOV.2022 07:14:32

Radiated Emissions 2.5 - 18GHz,LTE band 20/BLE, HP ,pk scan



Date: 25.NOV.2022 07:16:35

Radiated Emissions 2.5 - 18GHz,LTE band 20/BLE, VP ,pk scan

3.10 Power Spectral Density (PSD)

FCC part 15.247(d)

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

Measurement procedure: ANSI C63.10-2013 Clause 11.10

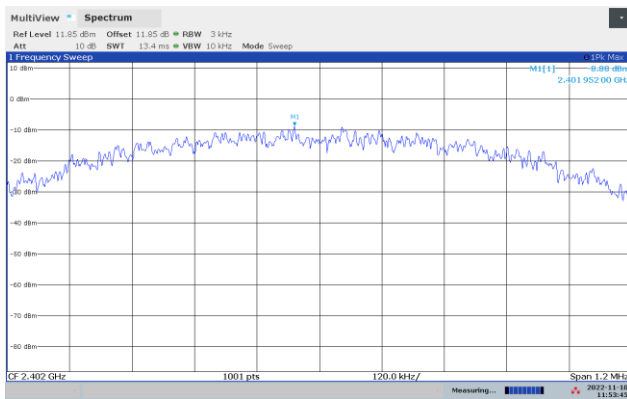
Test Results: Complies

Measurement Data:

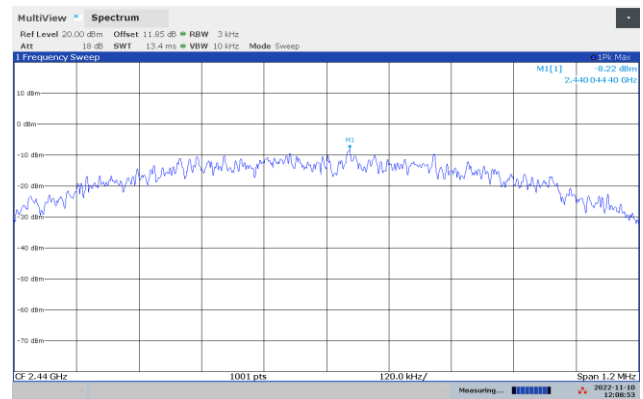
The measurement procedure PKPSD described in ANSI C63.10-2013 was used.

Modulation Type	Measured Power Spectral Density (dBm/3kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK	-8.88	-8.22	-6.91

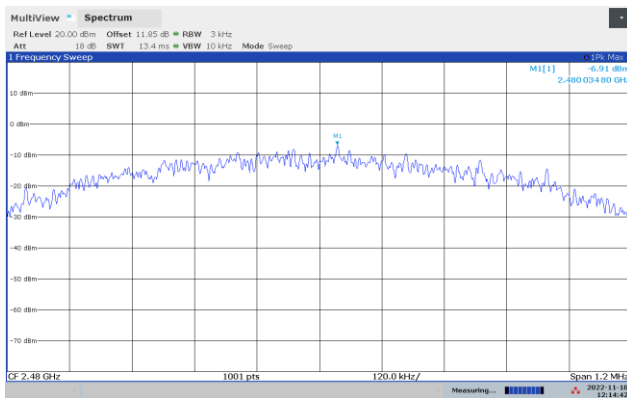
Requirement for systems using Digital Modulation
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
No requirements for Frequency Hopping Systems.



PSD, 2402 MHz, GFSK



PSD, 2440 MHz, GFSK



PSD, 2480 MHz, GFSK

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.

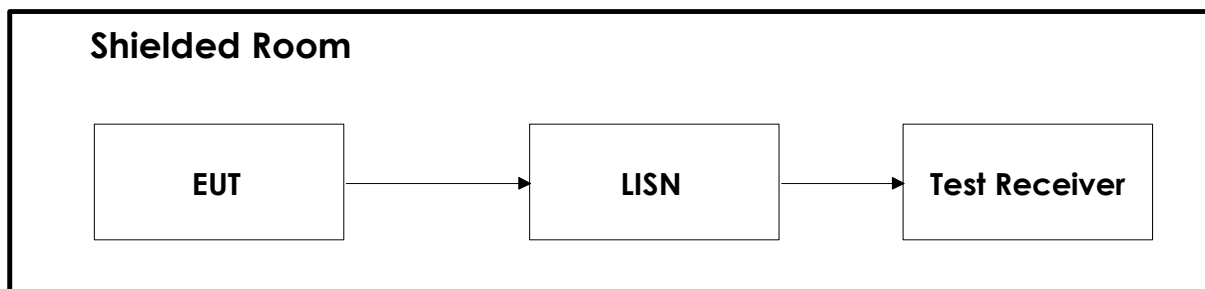
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1.	ESU 40	EMI Receiver	Rohde & Schwarz	LR 1639	2022-01	2023-01
2.	FSU26	Spectrum Analyzer	Rohde & Schwarz	LR 1504	2022-01	2023-01
3.	6810.17B	Attenuator	Suhner	LR 1668	COU	
4.	NO324415	Band Reject Filter	Microwave Circuits	LR 1760	COU	
5.	VULB9163	Bilog	Schwarzbeck	LR 1616	2020-05	2023-05
6.	316	Preamplifier	Sonoma Inst.	LR 1686	2022-08	2023-08
7.	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2017-08	2023-08
8.	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2022-08	2023-08
9.	3115	Double Ridged, Horn antenna	EMCO	LR 1226	N/A	
10.	638	Antenna Horn	Narda	LR 1480	N/A	
11.	4768-10	Attenuator	Narda	LR 1670	COU	
12.	Model 87V	Multimeter	Fluke	LR 1599	2021-01	2023-01
13.	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

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

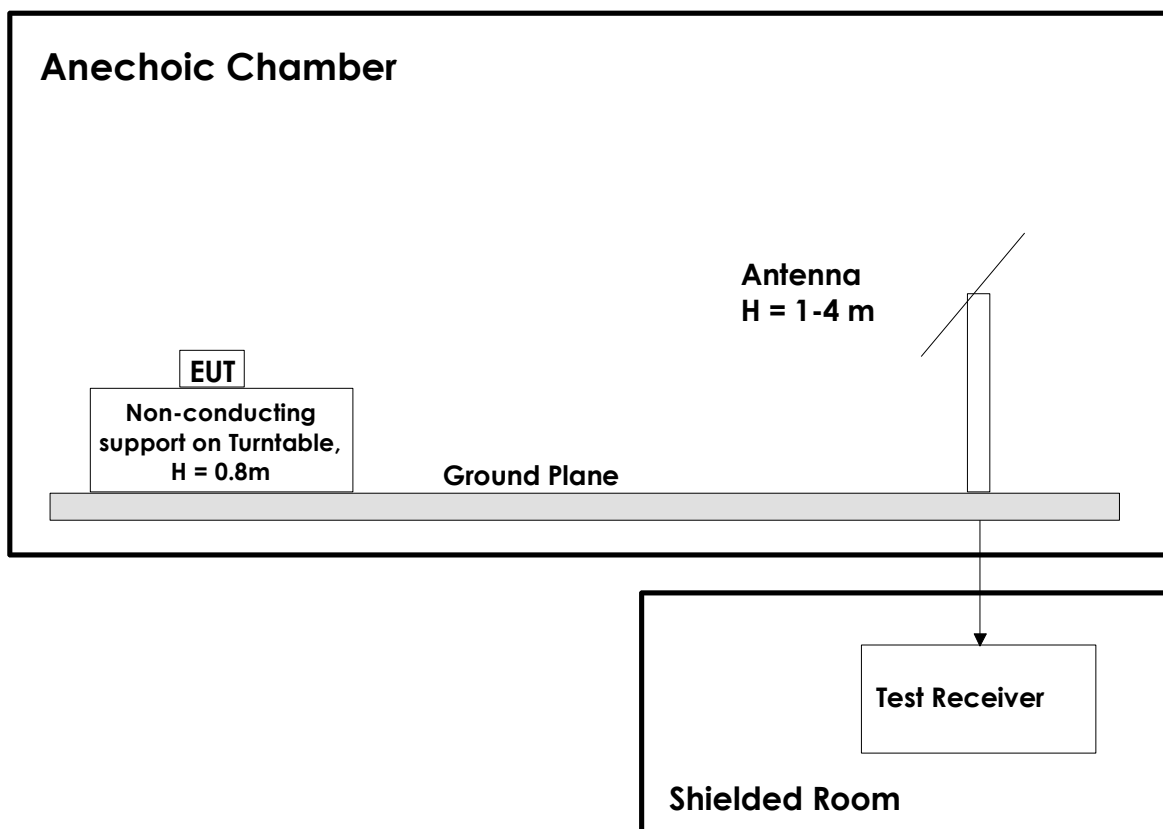
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.30.10	Power Line Conducted test software
2	Rohde & Schwarz	EMC32	10.30.10	Radiated Emission test software
3	Nemko AS	RSPlot	1.0.8.0	Screen capture from R&S Spectrum Analyzers

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.