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Test report

257447-2TRFWL

Date of issue: March 24, 2015

Applicant:

Technologies Humanware inc.

Product:

Desktop Video Magnifier

Model:

PGIDT

Model variant:

PGIDT20, PGIDT24

FCC ID:

XT5PGIDT

IC Registration number:

8670A-PGIDT

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.247

  Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

- RSS-210, Issue 8, December 2010, Annex 8

  Frequency Hopping and Digital Modulation Systems Operating in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz Bands

Test location

Company name:	Nemko Canada Inc.
Address:	303 River Road
City:	Ottawa
Province:	Ontario
Postal code:	K1V 1H2
Country:	Canada
Telephone:	+1 613 737 9680
Facsimile:	+1 613 737 9691
Toll free:	+1 800 563 6336
Website:	www.nemko.com
Site number:	FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by:	Andrey Adelberg, Senior Wireless/EMC Specialist
Reviewed by:	Kevin Rose, Wireless/EMC Specialist
Date:	March 24, 2015
Signature:	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Technologies Humanware inc.
Address	1800, rue Michaud
City	Drummondville
Province/State	Québec
Postal/Zip code	J2C 7G7
Country	Canada

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz
RSS-210, Issue 8 Annex 8	Frequency Hopping and Digital Modulation Systems Operating in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz Bands

1.3 Test methods

FCC Public Notice DA 00-705	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems|
ANSI C63.10, 2014	American National Standard for Testing Unlicensed Wireless Devices

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass[1]
§15.203	Antenna requirement	Pass[2]

Notes: [1] Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

[2] The Antennas are located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Pass
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Not applicable
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Pass
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Not applicable
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Not applicable
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

2.3 IC RSS-GEN, Issue 4, test results

Part	Test description	Verdict
7.1.2	Receiver radiated emission limits	Not applicable
7.1.3	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Pass

Notes: [1] According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

2.4 IC RSS-210, Issue 8, test results

Part	Test description	Verdict
A8.1	Frequency hopping systems	
A8.1 (a)	Bandwidth of a frequency hopping channel	Not applicable
A8.1 (b)	Minimum channel spacing for frequency hopping systems	Not applicable
A8.1 (c)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
A8.1 (d)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Pass
A8.1 (e)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
A8.2	Digital modulation systems	
A8.2 (a)	Minimum 6 dB bandwidth	Not applicable
A8.2 (b)	Maximum power spectral density	Not applicable
A8.3	Hybrid systems	
A8.3 (1)	Digital modulation turned off	Not applicable
A8.3 (2)	Frequency hopping turned off	Not applicable
A8.4	Transmitter output power and e.i.r.p. requirements	
A8.4 (1)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
A8.4 (2)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Pass
A8.4 (3)	Frequency hopping systems operating in the 5725–5850 MHz	Not applicable
A8.4 (4)	Systems employing digital modulation techniques	Not applicable
A8.4 (5)	Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable
A8.4 (6)	Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams	Not applicable
A8.5	Out-of-band emissions	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	January 17, 2014
Nemko sample ID number	1

3.2 EUT information

Product name	Desktop Video Magnifier
Model	PGIDT
Model variant	PGIDT20, PGIDT24
Serial number	219000000053

3.3 Technical information

Operating band	2400–2483.5 MHz
Operating frequency	2402–2480 MHz
Modulation type	GFSK (1M), π/4 DPSK (2M), 8 DPSK (3M)
Occupied bandwidth (99 %)	0.861 MHz (GFSK), 1.226 MHz(π/4 DPSK and 8 DPSK)
Emission designator	861KF1D (GFSK), 1M23F1D (π/4 DPSK and 8 DPSK)
Power requirements	120–240 V_{AC}, 47–63 Hz
Software version	1.0.4.2381
Hardware version	1.59
Antenna information	Ethertronics, Prestta WLAN embedded antenna, MN# 1000802, 3.5 dBi The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The EUT is an intelligent video magnifier. It features a 2.4 GHz Wi-Fi and Bluetooth capabilities. This test report covers Bluetooth option.
The EUT has text to speech capacity from any grabbed text source. A fixed docking station provides a stable illuminated surface of viewing with no mobile part. The base provides a touch surface and 3 control buttons for user interface.

3.5 EUT exercise details

A software application running on a laptop PC has been provided to control directly the Bluetooth module via USB cable. EUT was modified to connect directly to the antenna port in order to perform testing conducted.

3.6 EUT setup diagram

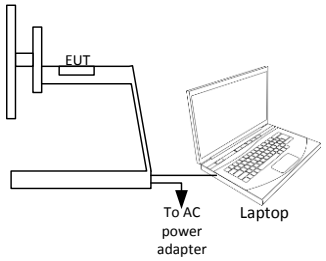


Figure 3.6-1: *Setup diagram*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
AC power adapter	MEGA	ATS090-P190	–

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

The EUT sample provided for testing was PGIDT20 – Prodigi Desktop with LCD monitor 20". Model variant is PGIDT24 – Prodigi Desktop with LCD monitor 24".

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 18/15
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Power source	California Instruments	3001i	FA001021	1 year	June 27/15
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/16
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Jan. 27/15
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Mar. 12/15
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Mar. 10/15
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	June 23/15
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	Jan. 09/16
LISN	Rohde & Schwarz	ENV216	FA002023	1 year	Jan. 09/16
50 Ω coax cable	C.C.A.	None	FA002556	1 year	June 23/15

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits

8.1.1 Definitions and limits

FCC:
Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

IC:
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 Ω/50 µH line impedance stabilization network (LISN).

Table 8.1-1: *Conducted emissions limit*

Frequency of emission, MHz	Conducted limit, dBµV	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - Decreases with the logarithm of the frequency.

8.1.2 Test summary

Test date:	June 5, 2014	Temperature:	22 °C
Test engineer:	Andrey Adelberg	Air pressure:	1006 mbar
Verdict:	Pass	Relative humidity:	31 %

8.1.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

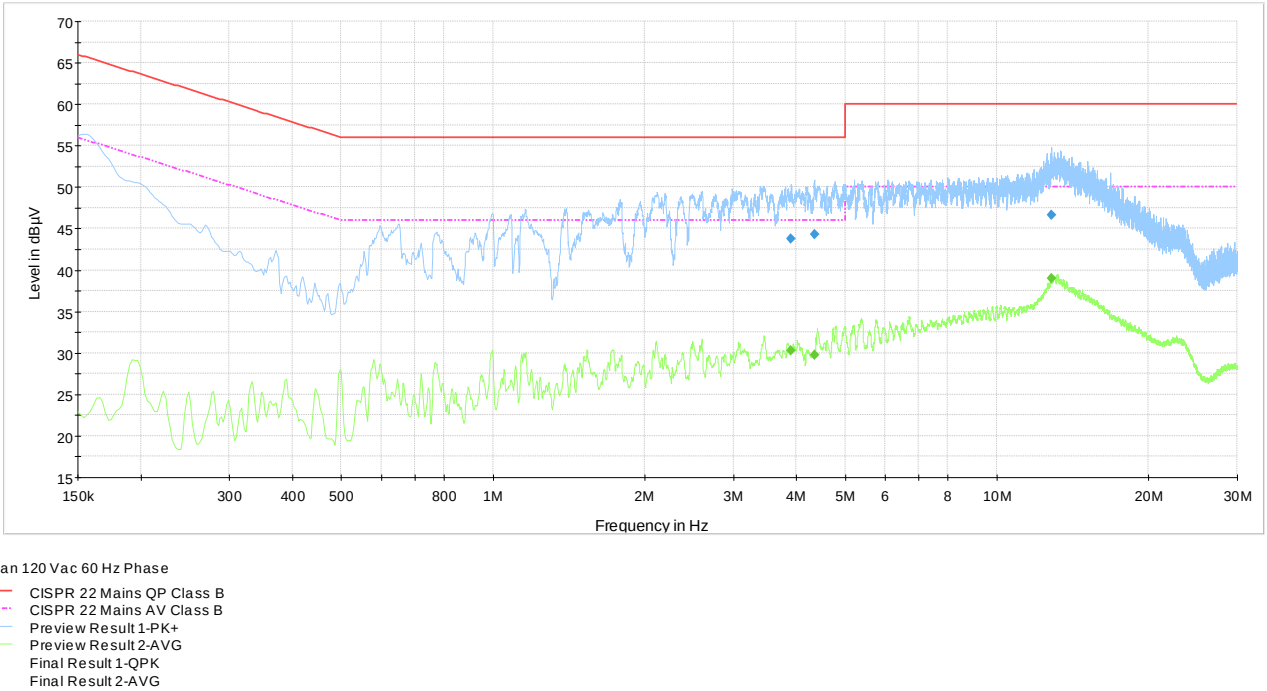
Receiver settings for preview measurements:

Resolution bandwidth:	9 kHz
Video bandwidth:	30 kHz
Detector mode:	Peak and Average
Trace mode:	Max Hold
Measurement time:	1000 ms

Receiver settings for final measurements:

Resolution bandwidth:	9 kHz
Video bandwidth:	30 kHz
Detector mode:	Quasi-Peak and Average
Trace mode:	Max Hold
Measurement time:	1000 ms

8.1.4 Test data



Plot 8.1-1: *Conducted emissions on phase line*

Table 8.1-2: *Quasi-Peak conducted emissions results on phase line*

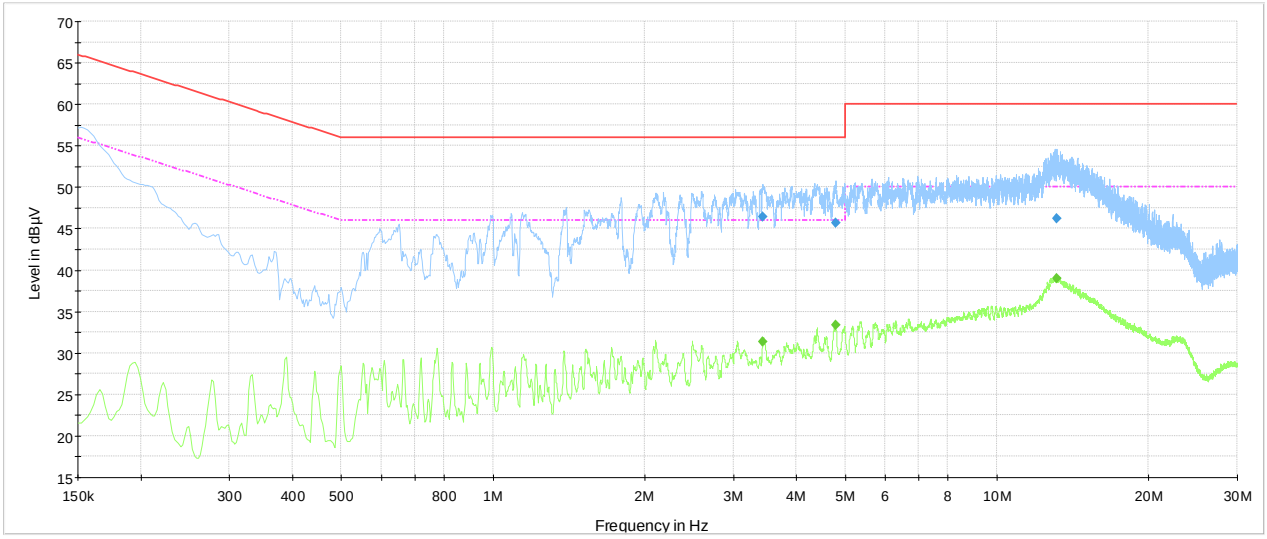
Frequency, MHz	Q-Peak result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
3.909750	43.7	1000.0	9	On	10.1	12.3	56.0
4.341750	44.3	1000.0	9	On	10.1	11.7	56.0
12.819250	46.7	1000.0	9	On	10.5	13.3	60.0

Note: 43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

Table 8.1-3: *Average conducted emissions results on phase line*

Frequency, MHz	Average result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
3.909750	30.3	1000.0	9	On	10.1	15.7	46.0
4.341750	29.8	1000.0	9	On	10.1	16.2	46.0
12.819250	39.0	1000.0	9	On	10.5	11.0	50.0

8.1.4 Test data, continued



CE Scan 120 Vac 60 Hz Neutral
CISPR 22 Mains QP Class B
CISPR 22 Mains AV Class B
Preview Result 1-PK+
Preview Result 2-AVG
Final Result 1-QPK
Final Result 2-AVG

Plot 8.1-2: *Conducted emissions on neutral line*

Table 8.1-4: *Quasi-Peak conducted emissions results on neutral line*

Frequency, MHz	Q-Peak result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
3.435000	46.4	1000.0	9	On	10.1	9.6	56.0
4.785000	45.6	1000.0	9	On	10.1	10.4	56.0
13.168000	46.2	1000.0	9	On	10.5	13.8	60.0

Note: 43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

Table 8.1-5: *Average conducted emissions results on neutral line*

Frequency, MHz	Average result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
3.435000	31.4	1000.0	9	On	10.1	14.6	46.0
13.168000	39.0	1000.0	9	On	10.5	11.0	50.0
13.168000	39.0	1000.0	9	On	10.5	11.0	50.0

8.2 FCC 15.247(a)(1)(iii) and RSS-210 A8.1 Frequency hopping requirements

8.2.1 Definitions and limits

FCC/IC:

(a/b) 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. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW (21 dBm). The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(iii/d) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

8.2.2 Test summary

Test date:	May 21, 2014	Temperature:	22 °C
Test engineer:	Andrey Adelberg	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	32 %

8.2.3 Observations, settings and special notes

Spectrum analyser settings for carrier frequency separation:

Resolution bandwidth:	100 kHz
Video bandwidth:	≥3 × RBW
Frequency span:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for number of hopping frequencies:

Resolution bandwidth:	100 kHz
Video bandwidth:	≥3 × RBW
Frequency span:	The frequency band of operation
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for time of occupancy:

Resolution bandwidth:	1 MHz
Video bandwidth:	≥3 × RBW
Frequency span:	Zero, centered on a hopping channel
Detector mode:	Peak
Trace mode:	Max Hold

8.2.4 Test data

Table 8.2-1: *20 dB bandwidth results*

Modulation	Frequency, MHz	20 dB bandwidth, MHz	2/3 of 20 dB BW, MHz
GFSK	2402	0.957	0.638
	2442	0.957	0.638
	2480	0.952	0.635
π/4 DPSK	2402	1.385	0.923
	2442	1.385	0.923
	2480	1.385	0.923
8 DPSK	2402	1.370	0.913
	2442	1.365	0.910
	2480	1.365	0.910

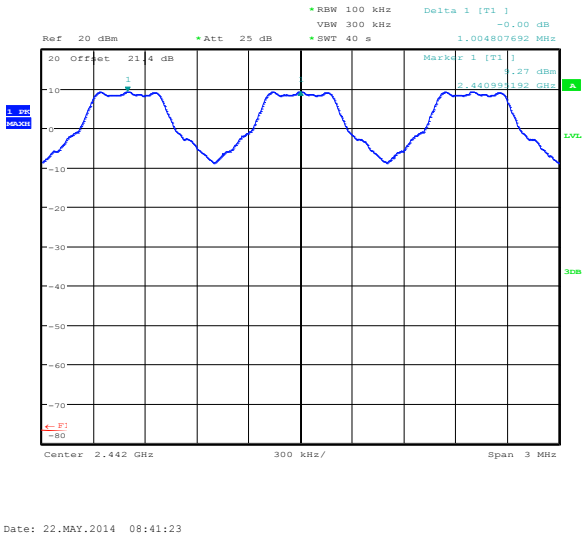


Figure 8.2-1: *Carrier frequency separation*

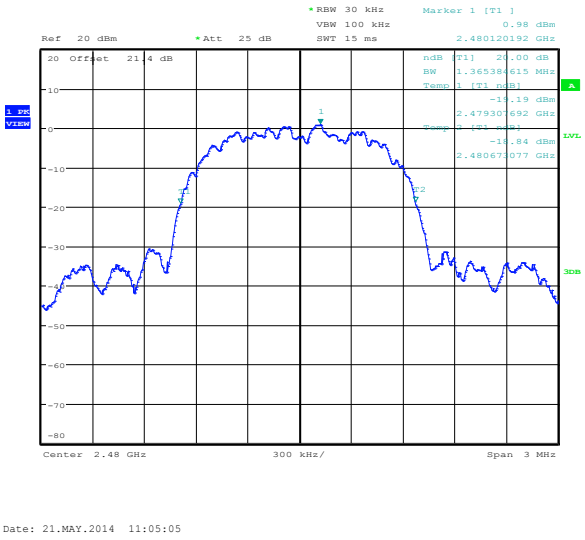


Figure 8.2-2: *20 dB bandwidth, sample plot*

Carrier frequency separation is 1.005 MHz. Minimum requirement is 2/3 of 20 dB BW (for systems with an output power less than 21 dBm) which is 0.923 MHz.

8.2.4 Test data, continued

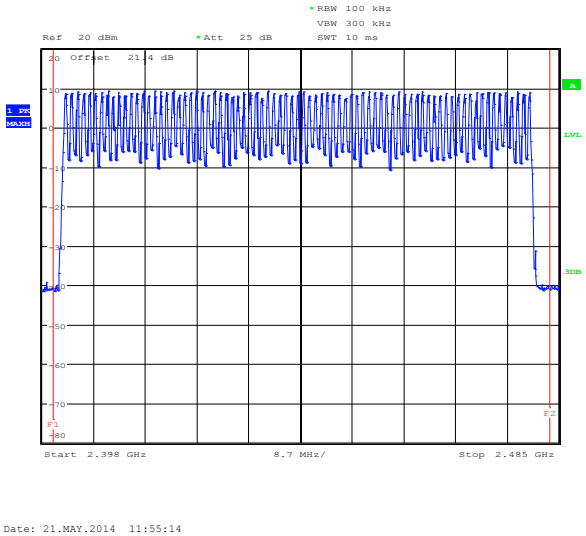


Figure 8.2-3: *Number of hopping channels (79)*

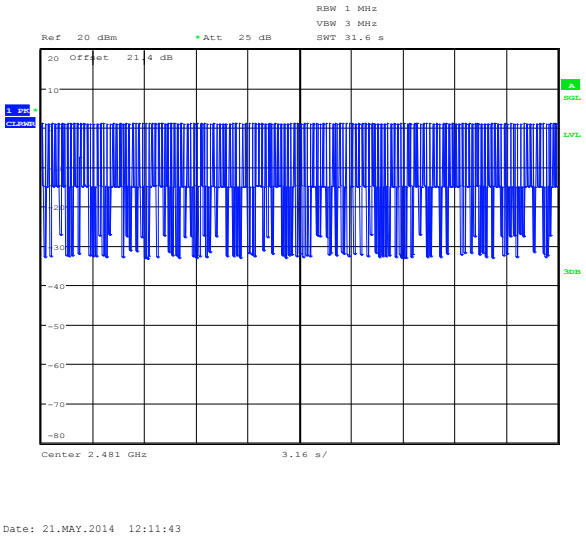


Figure 8.2-4: *Number of hop per single channel, DH1 (297)*

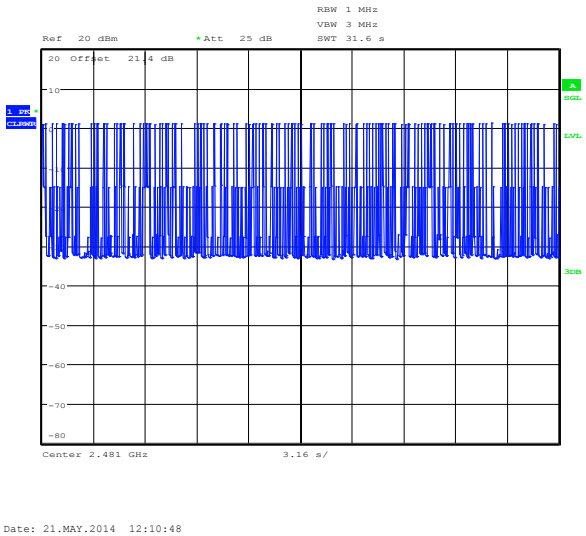


Figure 8.2-5: *Number of hop per single channel, DH3 (122)*

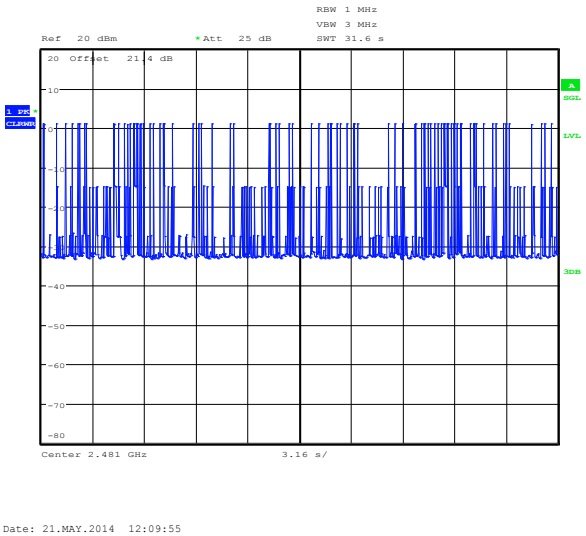


Figure 8.2-6: *Number of hop per single channel, DH5 (72)*

Pulse width is 387.8 µs.
Dwell time calculation.

For DH1: T_{DWELL} = 387.8 µs × 297 = 115.2 ms
For DH3: T_{DWELL} = 387.8 µs × 122 = 47.3 ms
For DH5: T_{DWELL} = 387.8 µs × 72 = 27.9 ms

Dwell time limit is 400 ms.

Number of hopping channels is 79. Minimum required number is 15.

8.2.4 Test data, continued

Table 8.2-2: *99 % bandwidth results*

Modulation	Frequency, MHz	99 % occupied bandwidth, MHz
GFSK	2402	0.861
	2442	0.861
	2480	0.861
π/4 DPSK	2402	1.226
	2442	1.226
	2480	1.226
8 DPSK	2402	1.226
	2442	1.226
	2480	1.226

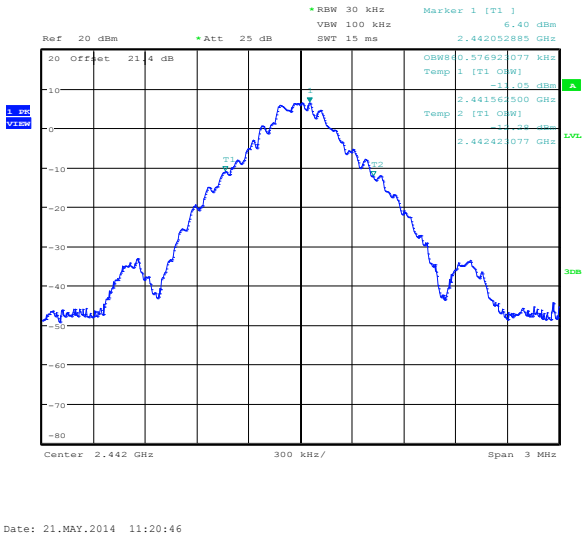


Figure 8.2-7: *99 % bandwidth on GFSK, sample plot*

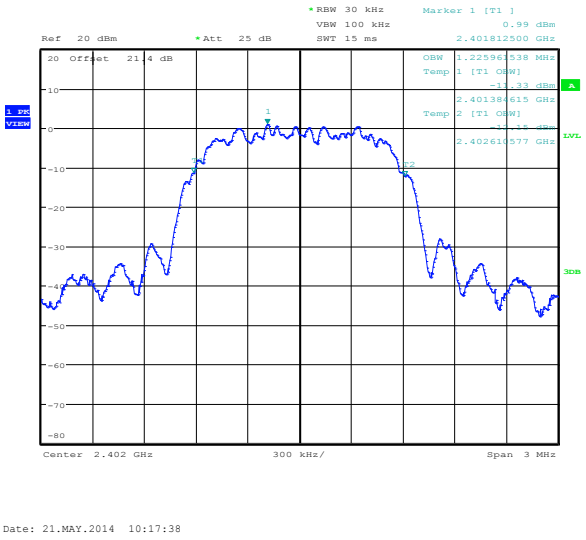


Figure 8.2-8: *99 % bandwidth on π/4 DPSK, sample plot*

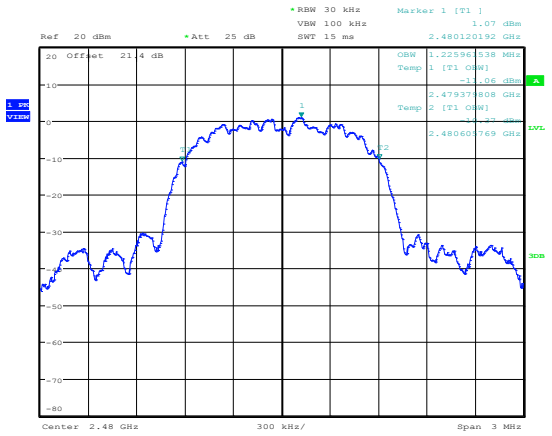


Figure 8.2-9: *99 % bandwidth on 8 DPSK, sample plot*

8.3 FCC 15.247(b)(1) and RSS-210 A8.4 (2) Transmitter output power and e.i.r.p. requirements

8.3.1 Definitions and limits

FCC:
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(1) For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 W (30 dBm). For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 W (21 dBm).
IC:
A8.4 (2) Transmitter Output Power and e.i.r.p. Requirements for frequency hopping systems operating in the band 2400–2483.5 MHz
For frequency hopping systems operating in the band 2400–2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

8.3.2 Test summary

Test date:	May 21, 2014	Temperature:	22 °C
Test engineer:	Andrey Adelberg	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	32 %

8.3.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	2 MHz
Video bandwidth:	5 MHz
Frequency span:	10 MHz
Detector mode:	Peak
Trace mode:	Max hold

8.3.4 Test data

Table 8.3-1: *Output power and EIRP measurements results*

Modulation	Frequency, MHz	Conducted output power, dBm		Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
		Measured	Limit					
GFSK	2402	8.41	30.00	21.59	3.50	11.91	36.00	24.09
	2442	9.41	30.00	30.00	3.50	12.91	36.00	23.09
	2480	9.11	30.00	30.00	3.50	12.61	36.00	23.39
π/4 DPSK	2402	8.35	30.00	30.00	3.50	11.85	36.00	24.15
	2442	9.37	30.00	30.00	3.50	12.87	36.00	23.13
	2480	9.07	30.00	30.00	3.50	12.57	36.00	23.43
8 DPSK	2402	8.69	30.00	30.00	3.50	12.19	36.00	23.81
	2442	9.93	30.00	30.00	3.50	13.43	36.00	22.57
	2480	9.62	30.00	30.00	3.50	13.12	36.00	22.88

Note: EIRP = Conducted output power + Antenna gain

8.3.4 Test data, continued

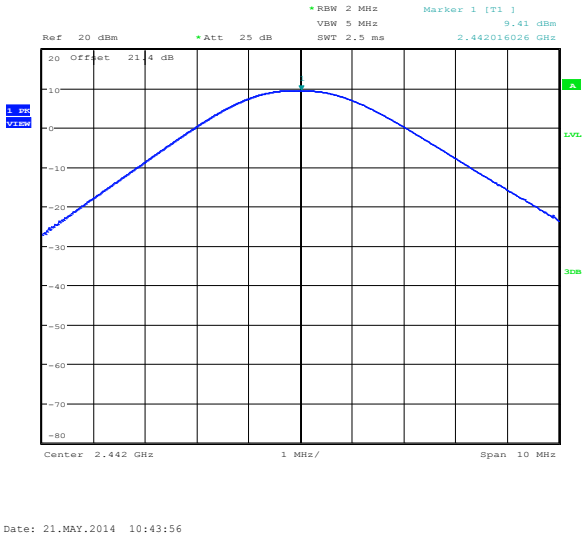


Figure 8.3-1: *Output power on GFSK, sample plot*

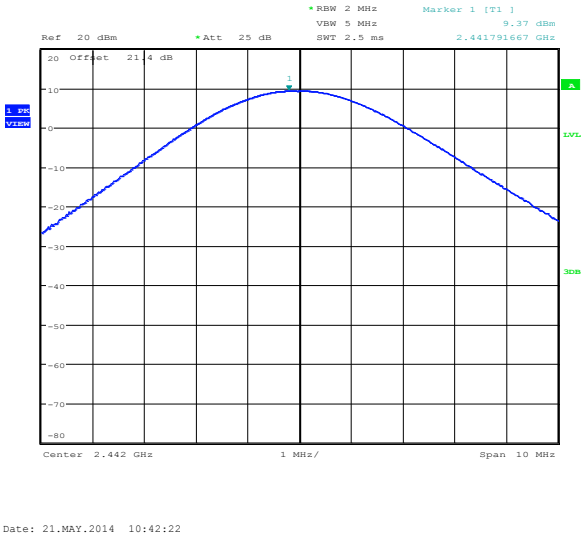


Figure 8.3-2: *Output power on π/4 DPSK, sample plot*

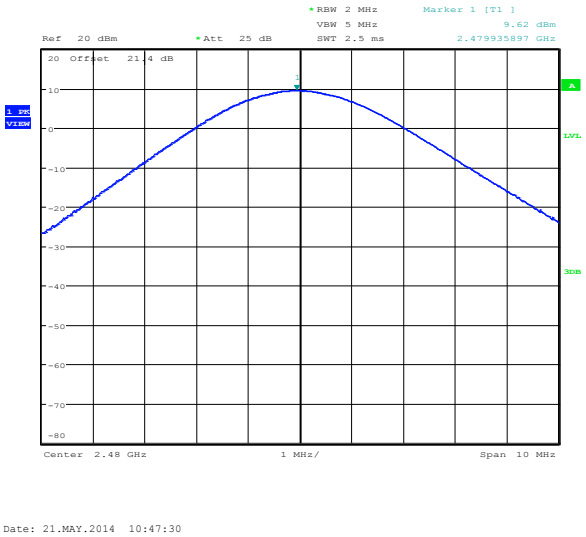


Figure 8.3-3: *Output power on 8 DPSK, sample plot*

8.4 FCC 15.247(d) and RSS-210 A8.5 Spurious (out-of-band) emissions

8.4.1 Definitions and limits

FCC:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

IC:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

Table 8.4-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.4-2: *IC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677-5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

Note: Certain frequency bands listed in Table 8.4-2 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

8.4.1 Definitions and limits, continued

Table 8.4-3: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.4.2 Test summary

Test date:	May 21, 2014	Temperature:	22 °C
Test engineer:	Andrey Adelberg	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	32 %

8.4.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
EUT was set to transmit with 100 % duty cycle.
Radiated measurements were performed at a distance of 3 m.
Since fundamental power was tested using average method, the spurious emissions outside restricted bands limit is −30 dBc/100 kHz

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	120 kHz
Video bandwidth:	300 kHz
Detector mode:	Quasi-Peak
Trace mode:	Max Hold

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

8.4.3 Observations, settings and special notes, continued

Spectrum analyser settings for conducted spurious emissions measurements:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.4.4 Test data

Table 8.4-4: *Radiated field strength measurement results*

Frequency, MHz	Quasi-Peak Field strength, dBµV/m	Limit, dBµV/m	Margin, dB
101.670	35.5	40.5	5.0
106.050	38.3	40.5	2.2
297.000	44.2	47.5	3.3

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

All other radiated spurious emissions were more than 15 dB below the limit.

8.4.4 Test data, continued

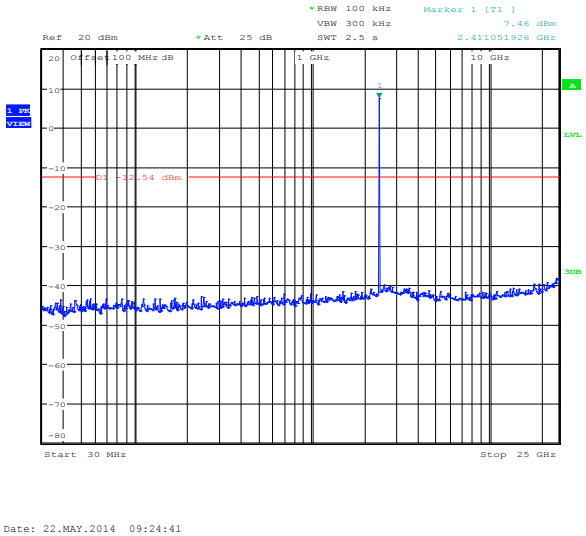


Figure 8.4-1: *Conducted spurious emissions for GFSK, low channel*

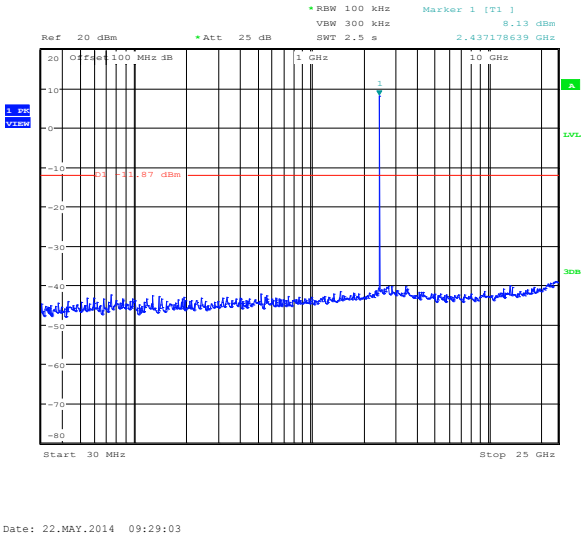


Figure 8.4-2: *Conducted spurious emissions for GFSK, mid channel*

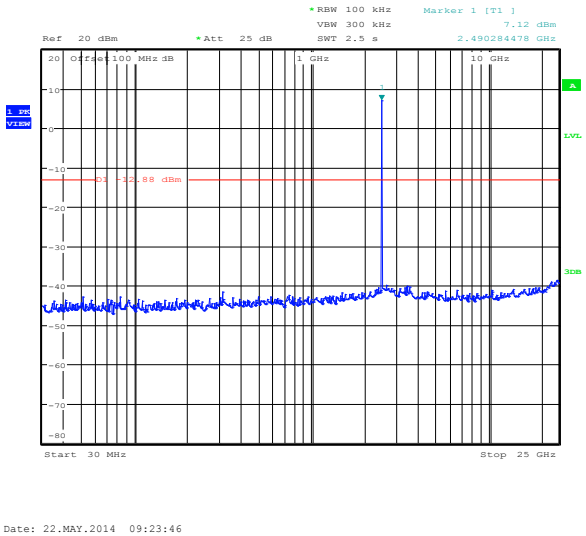


Figure 8.4-3: *Conducted spurious emissions for GFSK, high channel*

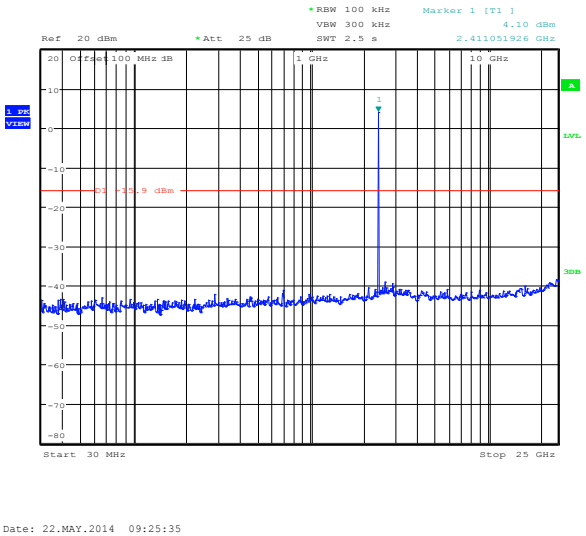


Figure 8.4-4: *Conducted spurious emissions for π/4 DPSK, low channel*

8.4.4 Test data, continued

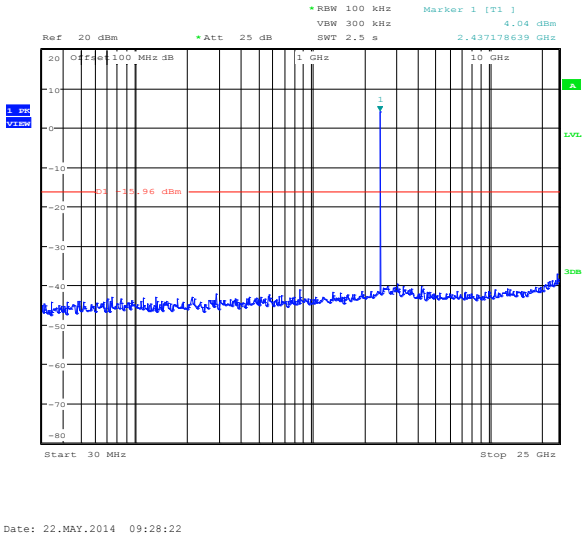


Figure 8.4-5: *Conducted spurious emissions for π/4 DPSK, mid channel*

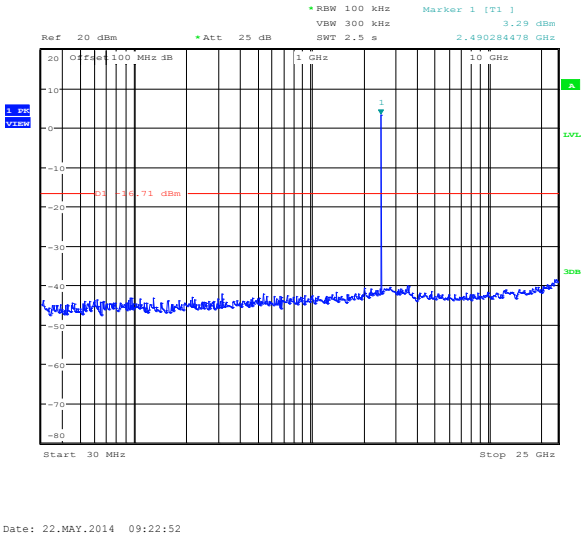


Figure 8.4-6: *Conducted spurious emissions for π/4 DPSK, high channel*

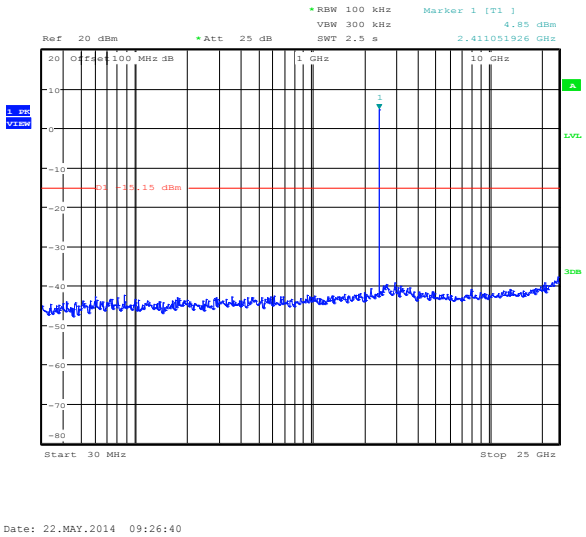


Figure 8.4-7: *Conducted spurious emissions for 8 DPSK, low channel*

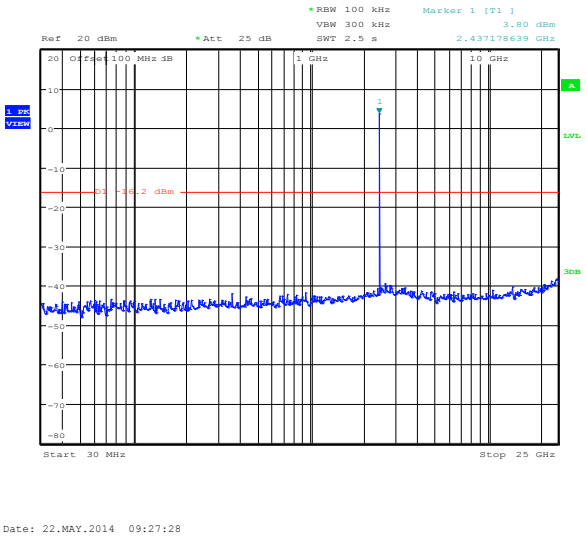


Figure 8.4-8: *Conducted spurious emissions for 8 DPSK, mid channel*

8.4.4 Test data, continued

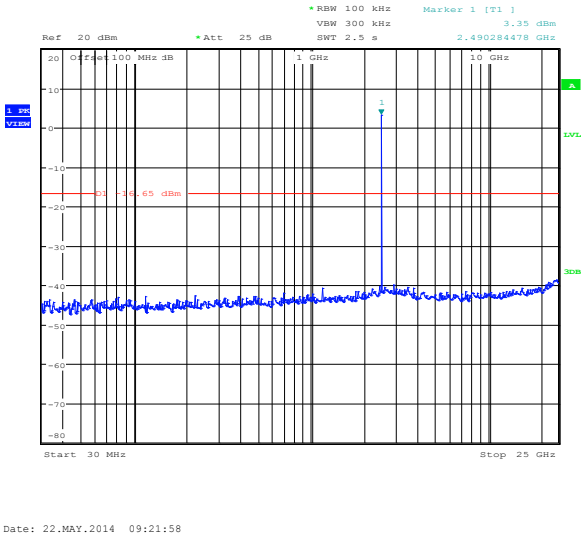


Figure 8.4-9: *Conducted spurious emissions for 8 DPSK, high channel*

8.4.4 Test data, continued

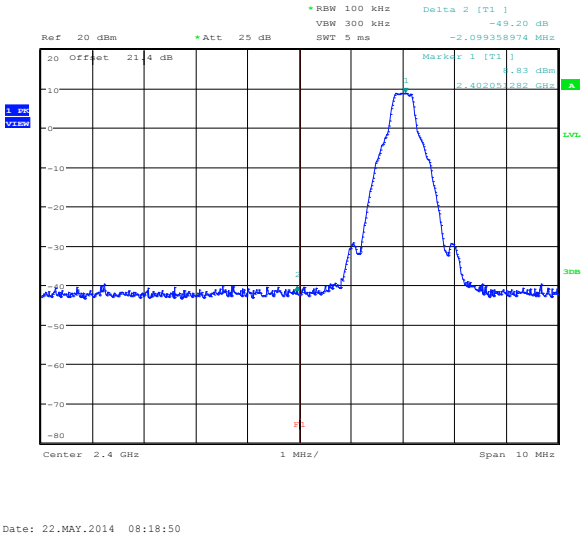


Figure 8.4-10: *Conducted band edge emission at 2400 MHz for GFSK, hopping sequence is off*

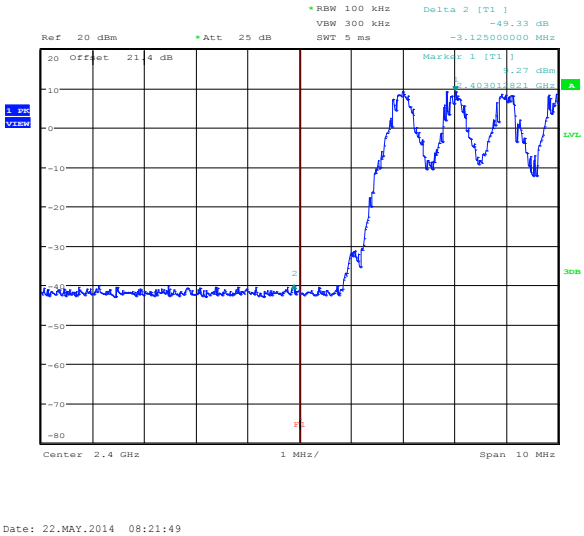


Figure 8.4-11: *Conducted band edge emission at 2400 MHz for GFSK, hopping sequence is on*

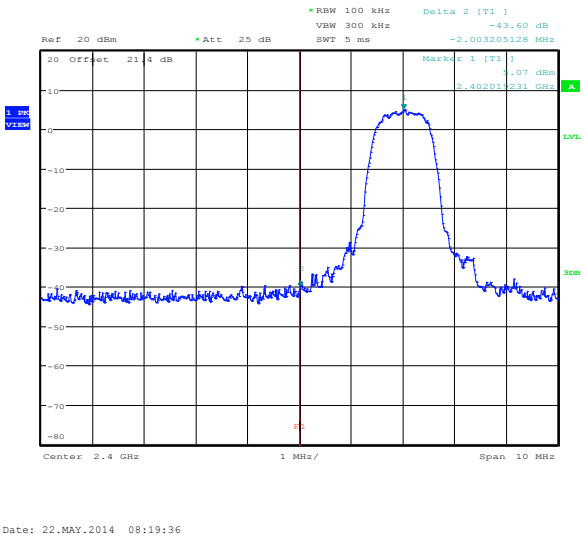


Figure 8.4-12: *Conducted band edge emission at 2400 MHz for π/4 DPSK, hopping sequence is off*

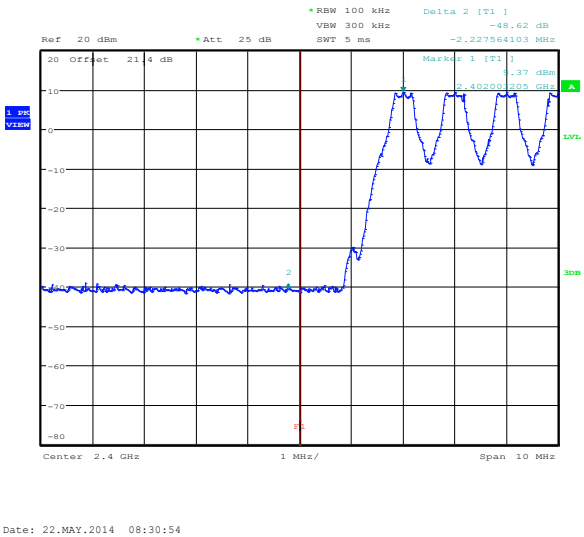


Figure 8.4-13: *Conducted band edge emission at 2400 MHz for π/4 DPSK, hopping sequence is on*

8.4.4 Test data, continued

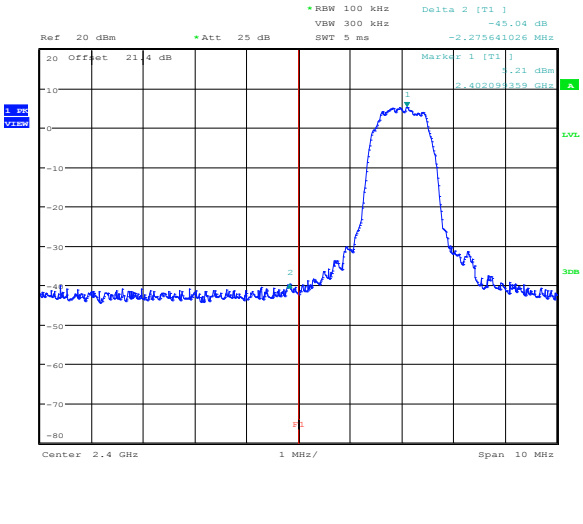


Figure 8.4-14: *Conducted band edge emission at 2400 MHz for 8 DPSK, hopping sequence is off*

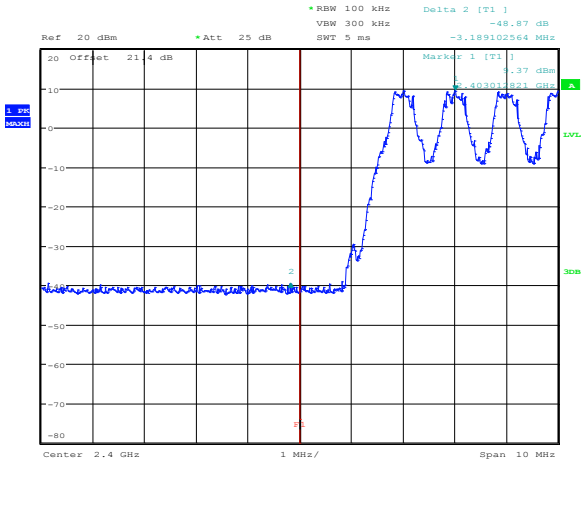


Figure 8.4-15: *Conducted band edge emission at 2400 MHz for 8 DPSK, hopping sequence is on*

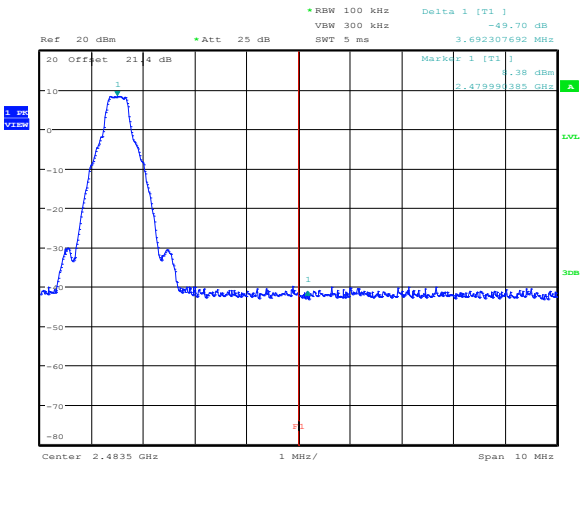


Figure 8.4-16: *Conducted band edge emission at 2483.5 MHz for GFSK, hopping sequence is off*

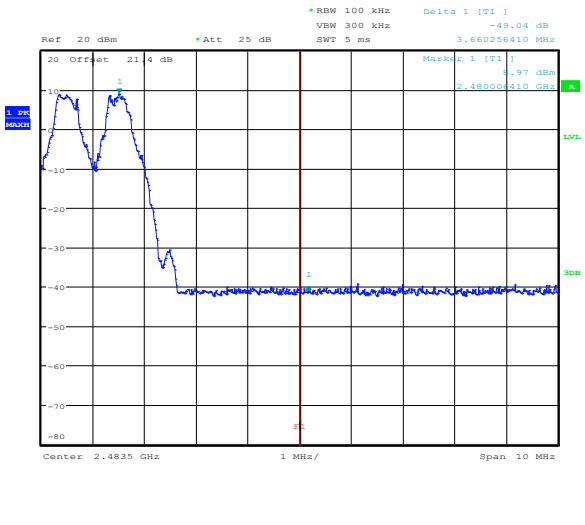


Figure 8.4-17: *Conducted band edge emission at 2483.5 MHz for GFSK, hopping sequence is on*

8.4.4 Test data, continued

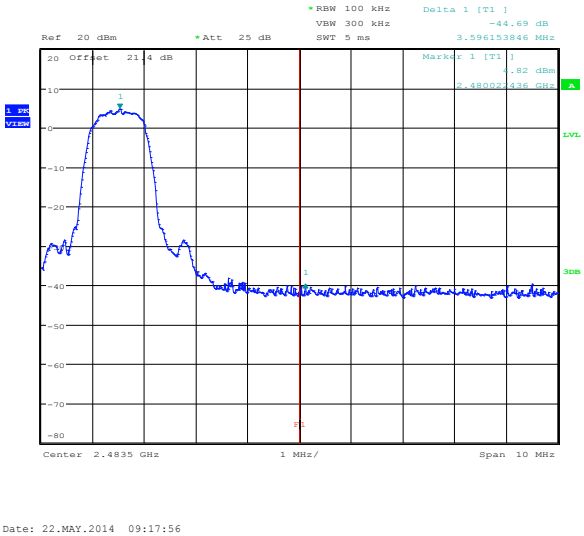


Figure 8.4-18: *Conducted band edge emission at 2483.5 MHz for π/4 DPSK, hopping sequence is off*

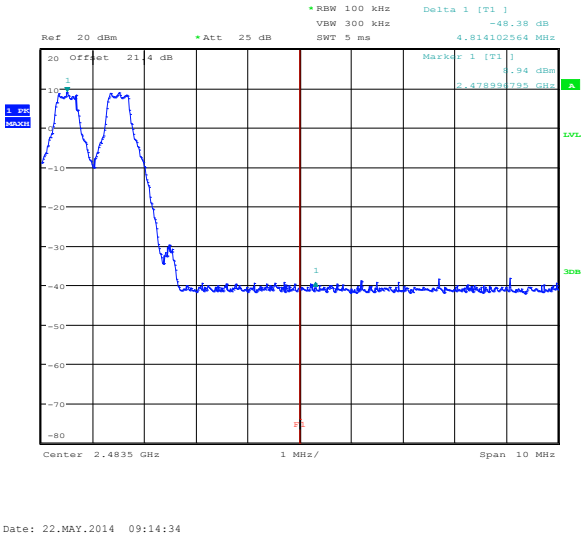


Figure 8.4-19: *Conducted band edge emission at 2483.5 MHz for π/4 DPSK, hopping sequence is on*

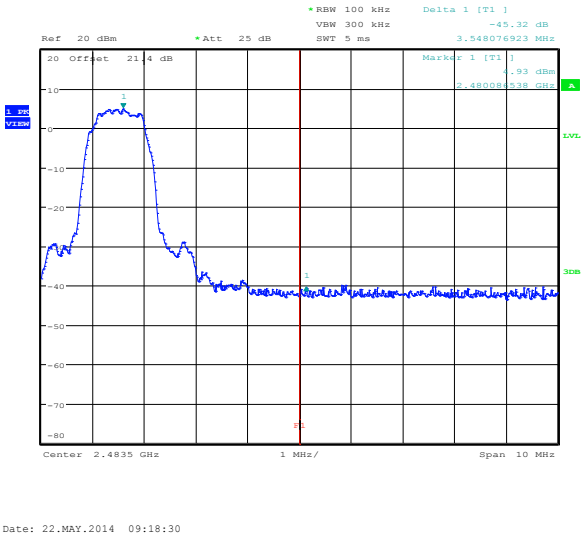


Figure 8.4-20: *Conducted band edge emission at 2483.5 MHz for 8 DPSK, hopping sequence is off*

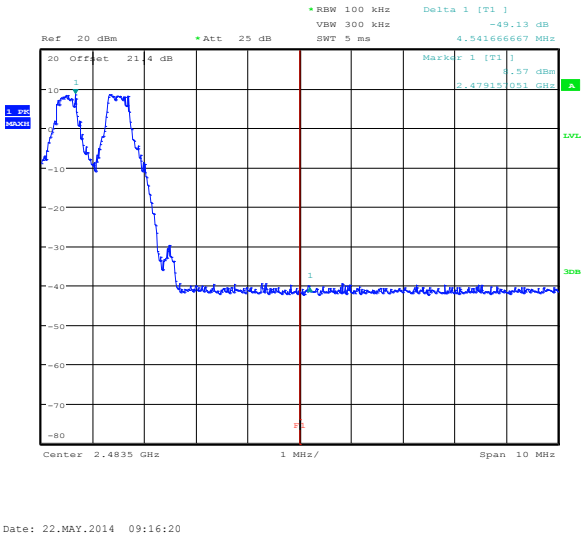
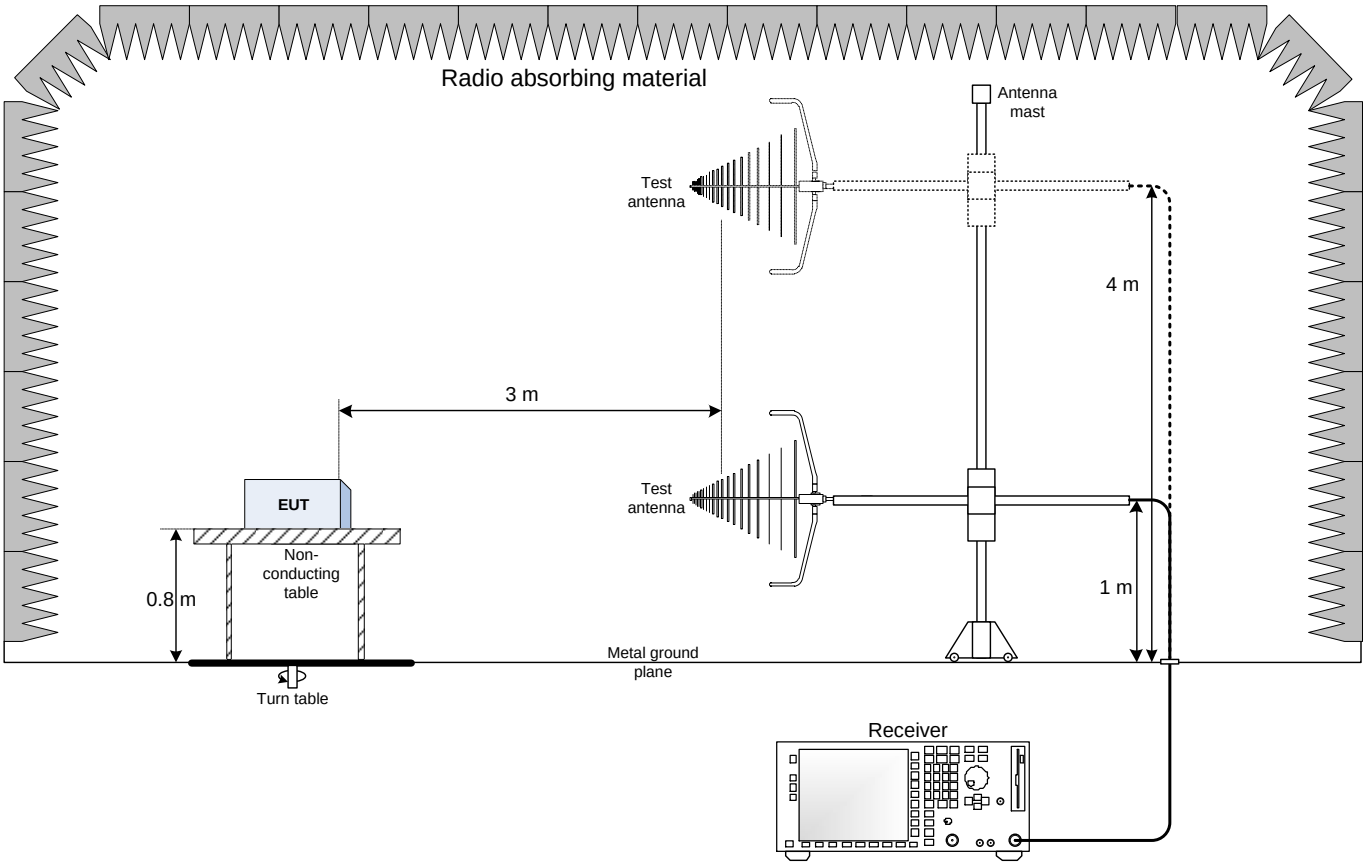


Figure 8.4-21: *Conducted band edge emission at 2483.5 MHz for 8 DPSK, hopping sequence is on*

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up