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Test report

234511-4TRFWL

Date of issue: February 10, 2015

Applicant:

Technologies Humanware inc.

Product:

Prodigi

Model:

PGITAB

FCC ID:

XT5PGITAB

IC Registration number:

8670A-PGITAB

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:	Kevin Rose, Wireless/EMC Specialist
Reviewed by:	Andrey Adelberg, Senior Wireless/EMC Specialist
Date:	February 10, 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

DA 00-705 Released March 30, 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
ANSI C64.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C64.3 v 2003	American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

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(b)(4)	Maximum peak output power	Pass
§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
6.6	Occupied bandwidth	Pass
7.1.2	Receiver radiated emission limits	Not applicable
7.1.3	Receiver conducted emission limits	Not applicable
8.8	AC power lines conducted emission limits	Pass

Notes: [1] Section 5 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	Pass
A8.1 (b)	Minimum channel spacing for frequency hopping systems	Pass
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	July 15, 2013
Nemko sample ID number	1 and 2

3.2 EUT information

Product name	Prodigi
Model	PGITAB
Serial number	N/A

3.3 Technical information

Operating band	2.400 to 2.4835 GHz (79 channels)
Operating frequency	2402–2480 MHz
Modulation type	GFSK, π/4 DPSK (2Mbps), and 8 DPSK (3Mbps)
Occupied bandwidth (99 %)	878.2 kHz (GFSK), 1253.2 kHz (π/4 DPSK), 1246.8 (8 DPSK)
Emission designator	G1D
Power requirements	100–240 V_{AC} 50–60 Hz
Hardware version	PGI-100 PCBA-2.0.19
Software version	1.0.2.2170
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. Ethertronics M310210-1K, −1.3 dBi gain antenna is used

3.4 Product description and theory of operation

The EUT is an intelligent video magnifier. It features a handheld unit and a docking base station. It can be used as a mobile magnifier with a 5 inches touch screen LCD viewer running on battery.
It has lighting LEDS and a set of 2 cameras for close or far viewing.
It 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.
It is also used as for monitor support, battery charging, audio and USB connection.
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 BT module via USB cable. 1 radiated sample and 1 conducted sample have been provided

3.6 EUT sub assemblies

Table 3.6-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
Prodigi docking station	Prodigi	-	-
Power supply Brick	MEGA	ATS090-P190	-
Mouse	Comfort Mouse	4500/X821912-005	-
Ear buds	-	-	-

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

None

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.
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	May 30/14
Power source	California Instruments	3001i	FA001021	1 year	June 04/14
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Feb. 21/14
LISN	Rohde & Schwarz	ENV216	FA002023	1 year	Nov. 26/13
50 Ω coax cable	Huber + Suhner	None	FA002394	1 year	June 27/14
Spectrum analyzer	Rohde & Schwarz	FSP	FA001920	1 year	June 25/14
Horn antenna #2	EMCO	3115	FA000825	1 year	Feb. 21/14
1–18 GHz pre-amplifier	JCA	JCA118-503	FA002091	1 year	June 21/14
18–26 GHz pre-amplifier	Narda	BBS-1826N612	FA001550	—	VOU
Horn antenna 18–40 GHz	EMCO	3116	FA001847	1 year	Sept. 06/13
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/14
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/14
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR

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:	July 26, 2013	Temperature:	24 °C
Test engineer:	Kevin Rose	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	39 %

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.

Measurement Uncertainty = 1.7 dB

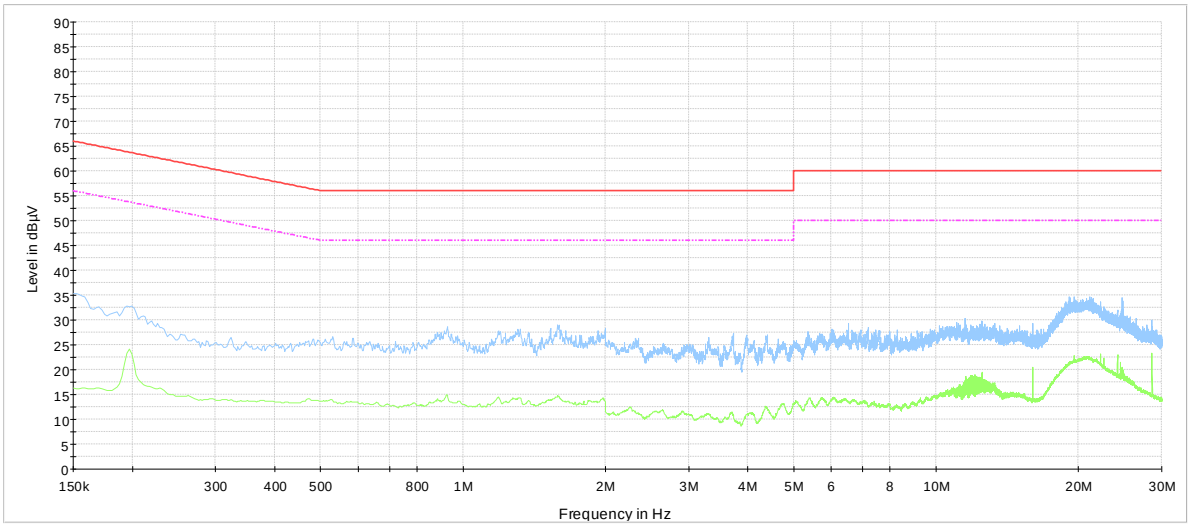
Receiver settings for preview measurements:

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

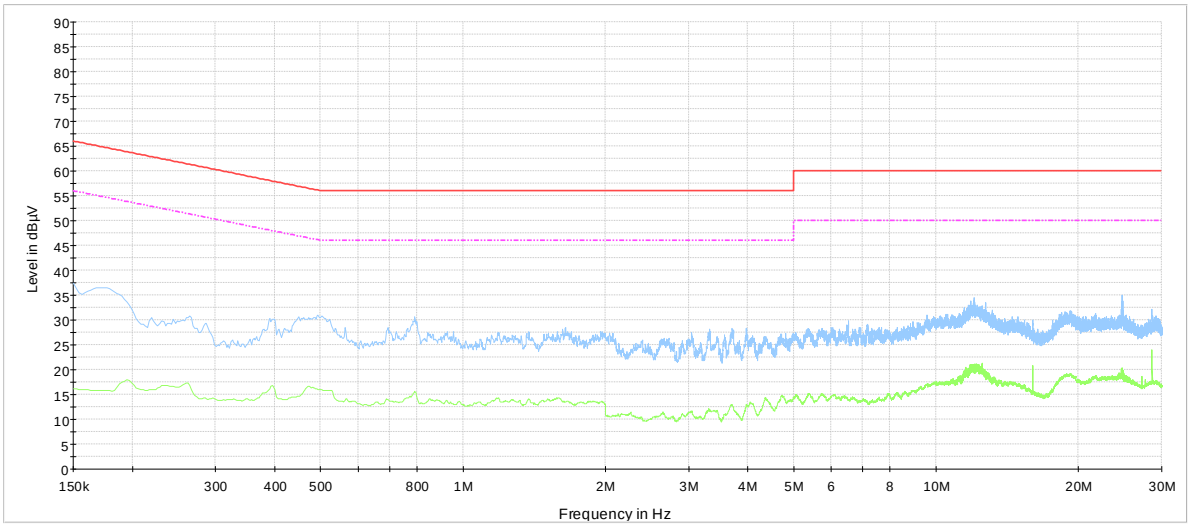
Receiver settings for final measurements:

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



Plot 8.1-2: Conducted emissions on neutral line

8.2 Clause 15.247(a)(1) IC A8.1 Frequency hopping requirements

8.2.1 Definitions and limits

FCC and IC:

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) 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. 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.

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:	July 25, 2013	Temperature:	24 °C
Test engineer:	Kevin Rose	Air pressure:	1003 mbar
Verdict:	Pass	Relative humidity:	39 %

8.2.3 Observations, settings and special notes

Spectrum analyser settings:

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

8.2.4 Test data

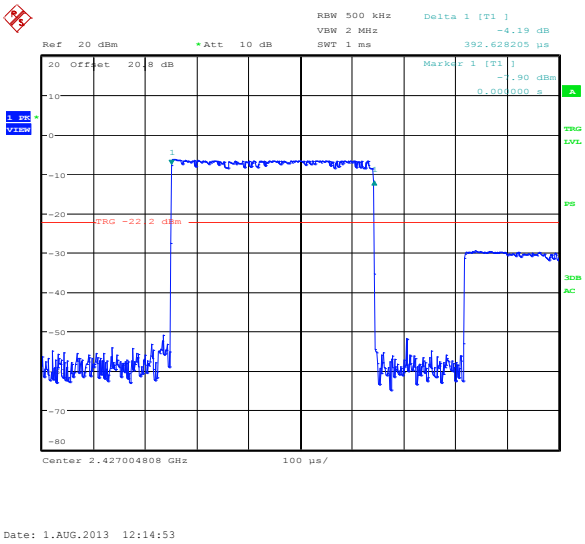


Figure 8.2-1: Pulse width

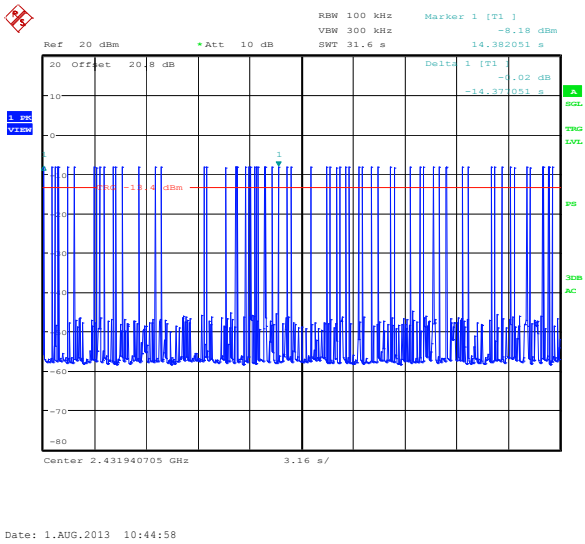


Figure 8.2-2: Number of pulses in 31.6 seconds (57 Pulses)

Dwell time (ms)	Number of appearances per channel	Average time of occupancy (ms)	Limit (ms)	Margin (ms)
0.3926	57	22.3782	400	377.6218

Note: Test time is 0.4 s × 79 = 31.6 s
Number of appearances = test time ÷ avg. rate of channel usage
Average time of occupancy = dwell time × number of appearances

8.2.4 Test data continued

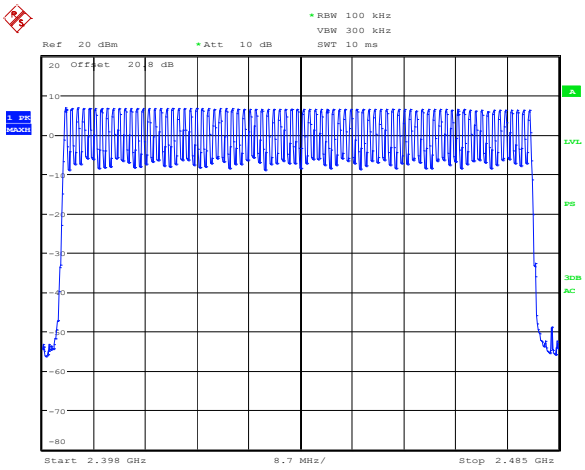


Figure 8.2-3: Number of channels (79)

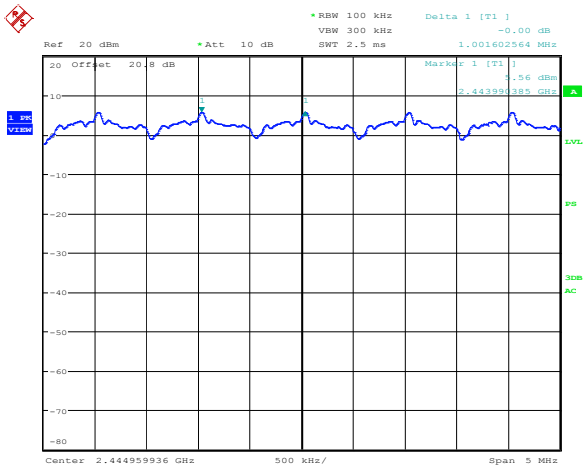


Figure 8.2-4: Channel spacing DH5

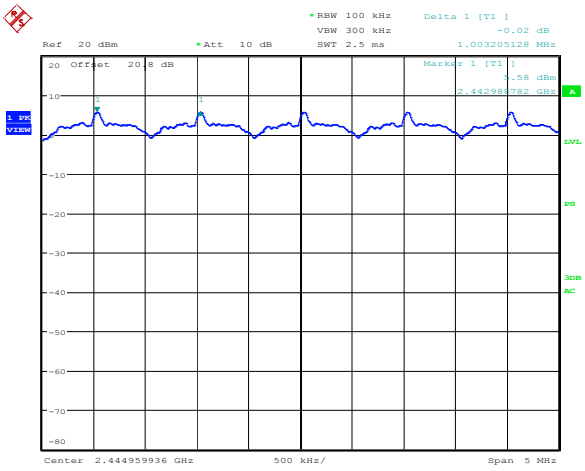


Figure 8.2-5: Channel spacing DH3

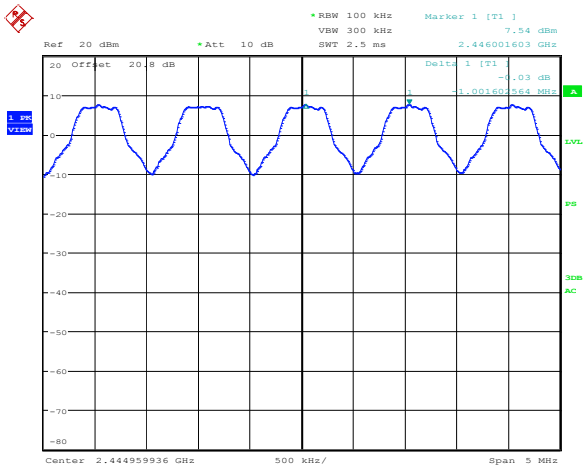


Figure 8.2-6: Channel spacing DH1

8.2.4 Test data continued

Table 8.2-1: 20 dB bandwidth results

Modulation	Frequency, MHz	20 dB bandwidth, kHz
GFSK	2402	814.1
GFSK	2444	814.1
GFSK	2480	817.3
π/4 DPSK	2402	1384.6
π/4 DPSK	2444	1394.2
π/4 DPSK	2480	1394.2
8 DPSK	2402	1387.8
8 DPSK	2444	1394.2
8 DPSK	2480	1384.6

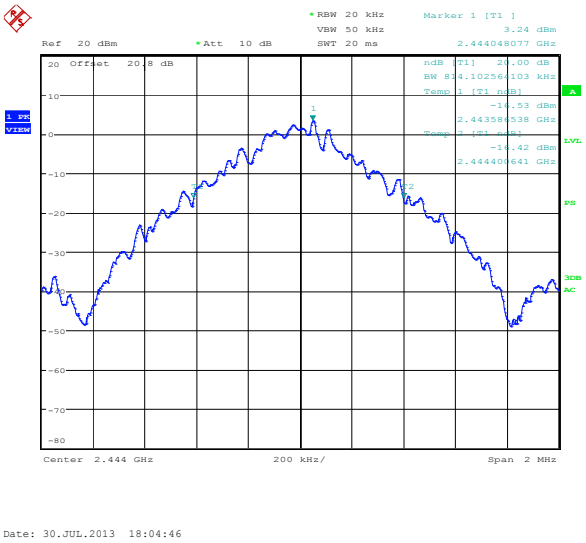


Figure 8.2-7: 20 dB bandwidth GFSK

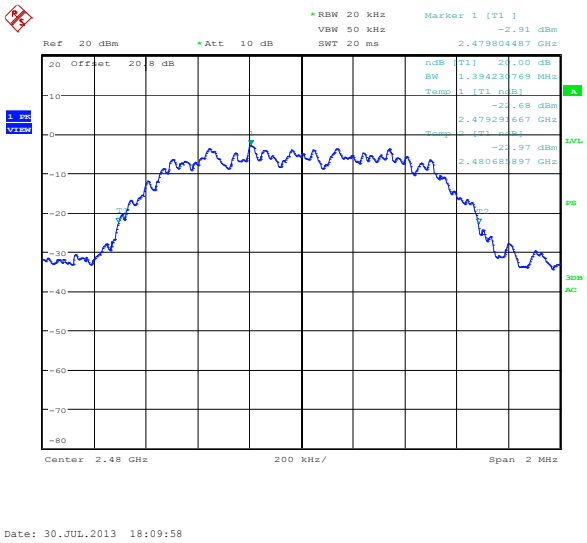


Figure 8.2-8: 20 dB bandwidth π/4 DPSK

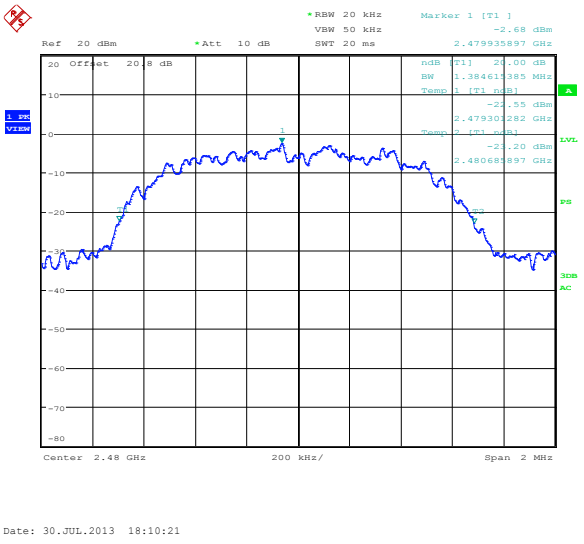


Figure 8.2-9: 20 dB bandwidth 8 DPSK

8.3 RSS-Gen 6.6 Occupied bandwidth

8.3.1 Definitions and limits

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 percent emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

8.3.2 Test summary

Test date:	July 26, 2013	Temperature:	24 °C
Test engineer:	Kevin Rose	Air pressure:	1003 mbar
Verdict:	Pass	Relative humidity:	39 %

8.3.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	≥1 % of span
Video bandwidth:	≥3 × RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.3.4 Test data

Table 8.3-1: 99 % bandwidth results

Modulation	Frequency, MHz	99 % bandwidth, kHz
GFSK	2402	858.9
GFSK	2444	871.8
GFSK	2480	878.2
π/4 DPSK	2402	1221.1
π/4 DPSK	2444	1250.0
π/4 DPSK	2480	1253.2
8 DPSK	2402	1224.3
8 DPSK	2444	1246.8
8 DPSK	2480	1246.8

8.3.5 Test data, continued

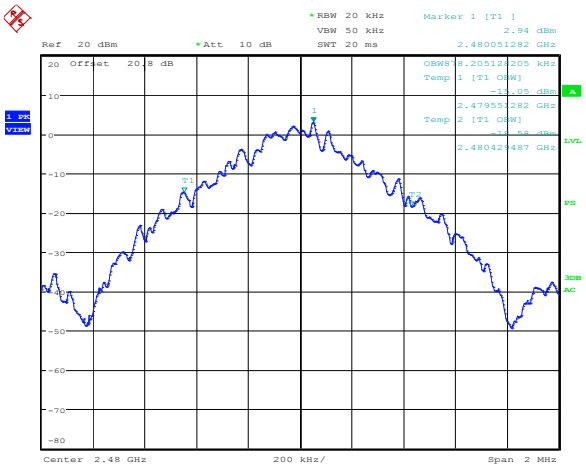


Figure 8.3-1: 99 % bandwidth GFSK

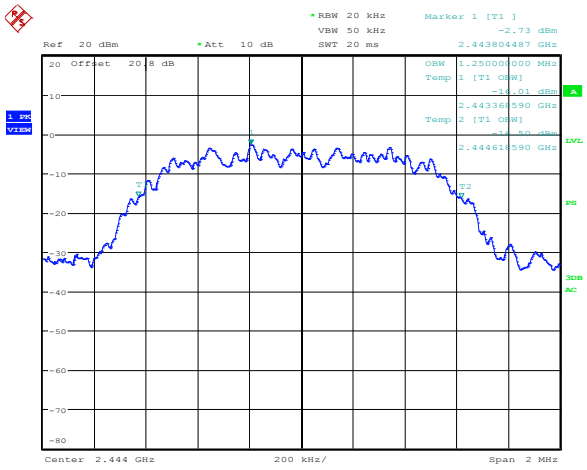


Figure 8.3-2: 99 % bandwidth π/4 DPSK

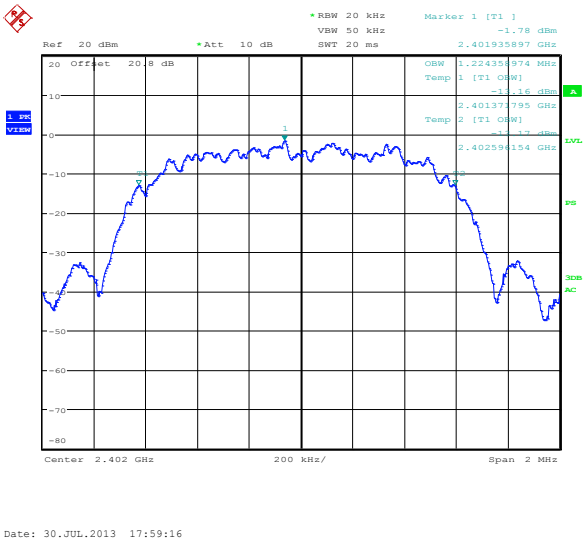


Figure 8.3-3: 99 % bandwidth 8 DPSK

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

8.4.1 Definitions and limits

FCC:
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

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).

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Fixed, point-to-point operation, as used in paragraph (b)(4)(i) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

IC:
A8.4 (2) Transmitter Output Power and e.i.r.p. Requirements for Frequency hopping systems operating in the 2400–2483.5 MHz band
For frequency hopping systems operating in the band 2400–2483.5 MHz 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 (21 dBm). Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W (36 dBm).

8.4.2 Test summary

Test date:	July 26, 2013	Temperature:	24 °C
Test engineer:	Kevin Rose	Air pressure:	1003 mbar
Verdict:	Pass	Relative humidity:	39 %

8.4.3 Observations, settings and special notes

Resolution bandwidth	3 MHz
Video bandwidth	10 MHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Auto

8.4.4 Test data

Table 8.4-1: Conducted output power results

Modulation	Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Margin (dB)
GFSK	2402	8.21	30.0	21.79
GFSK	2444	6.82	30.0	23.18
GFSK	2480	6.59	30.0	23.41
π/4 DPSK	2402	8.22	30.0	21.78
π/4 DPSK	2444	6.82	30.0	23.18
π/4 DPSK	2480	6.57	30.0	23.43
8 DPSK	2402	8.77	30.0	21.23
8 DPSK	2444	7.17	30.0	22.83
8 DPSK	2480	6.94	30.0	21.79

Table 8.4-2: EIRP calculation results

Modulation	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)
GFSK	2402	6.91	36.0	29.09
GFSK	2444	5.52	36.0	30.48
GFSK	2480	5.29	36.0	30.71
π/4 DPSK	2402	6.92	36.0	29.08
π/4 DPSK	2444	5.52	36.0	30.48
π/4 DPSK	2480	5.27	36.0	30.73
8 DPSK	2402	7.47	36.0	28.53
8 DPSK	2444	5.87	36.0	30.13
8 DPSK	2480	5.64	36.0	30.36

EIRP = Conducted output power [dBm] + antenna gain [dBi]

Antenna gain = −1.3 dBi

8.4.4 Test data continued

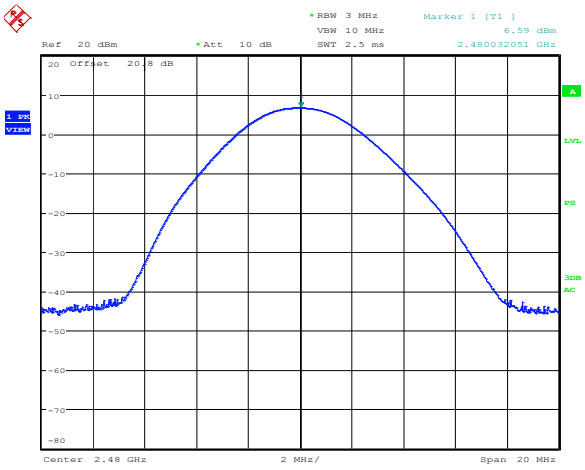


Figure 8.4-1: GFSK conducted power sample

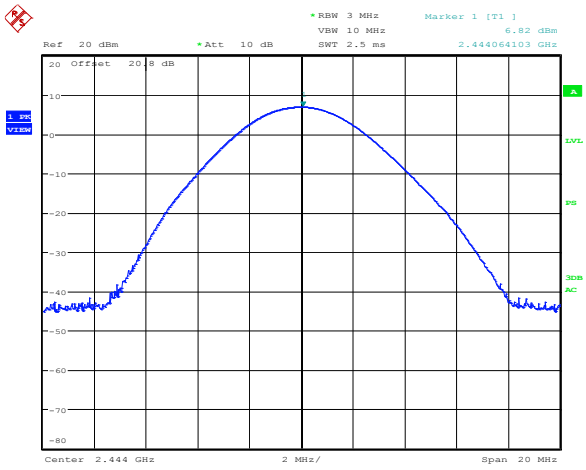


Figure 8.4-2: π/4 DPSK conducted power sample

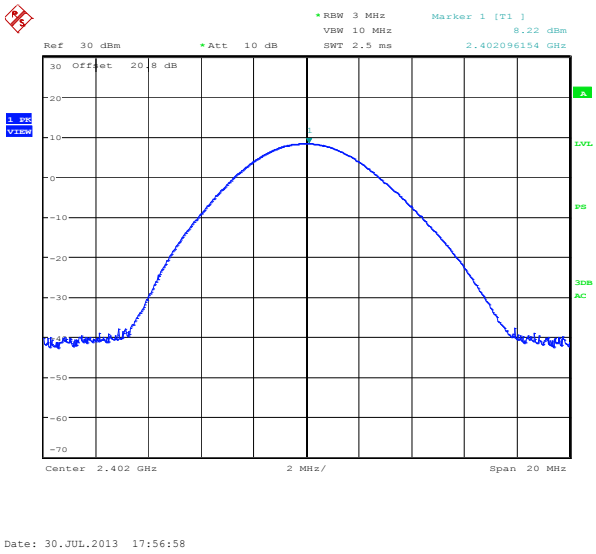


Figure 8.4-3: 8 DPSK conducted power sample

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

8.5.1 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 8.5-1: 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 8.5-2: 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 8.5-2 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

8.5.1 Definitions and limits, continued

Table 8.5-3: 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			

8.5.2 Test summary

Test date:	July 25, 2013	Temperature:	24 °C
Test engineer:	Kevin Rose	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	39 %

8.5.3 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.
No Radiated emissions within 30 dB were found.

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

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

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

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz (for Peak); 10 Hz (for Average)
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for conducted spurious emissions measurements:

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

8.5.4 Test data

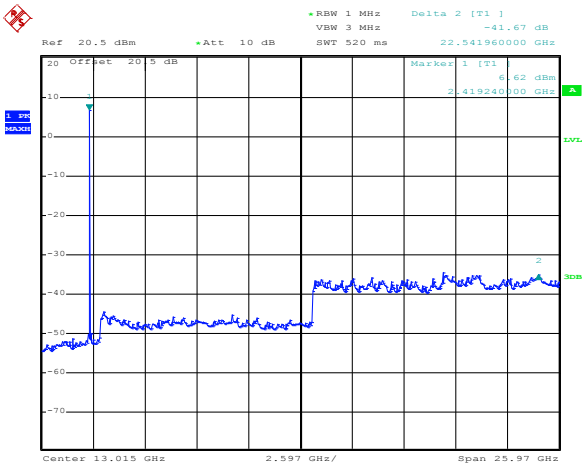


Figure 8.5-1: Conducted spurious emissions Low Channel

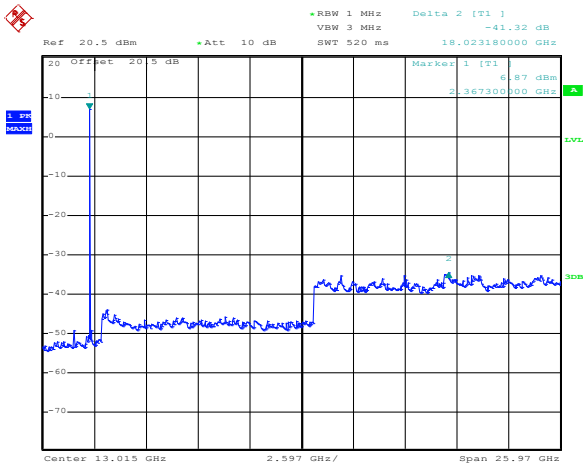


Figure 8.5-2: Conducted spurious emissions Mid Channel

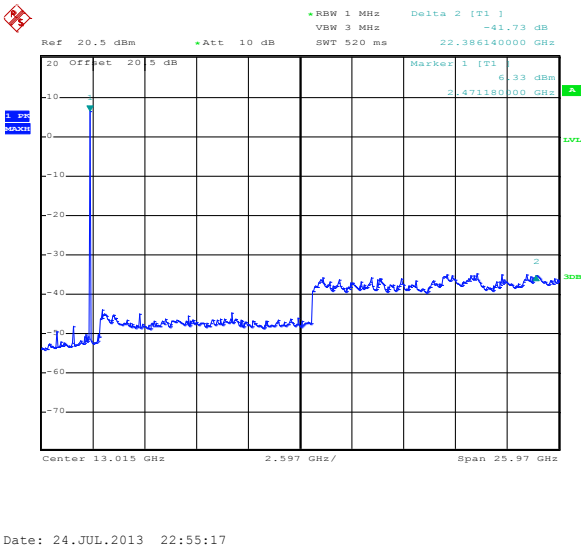


Figure 8.5-3: Conducted spurious emissions High Channel

8.5.4 Test data Continued

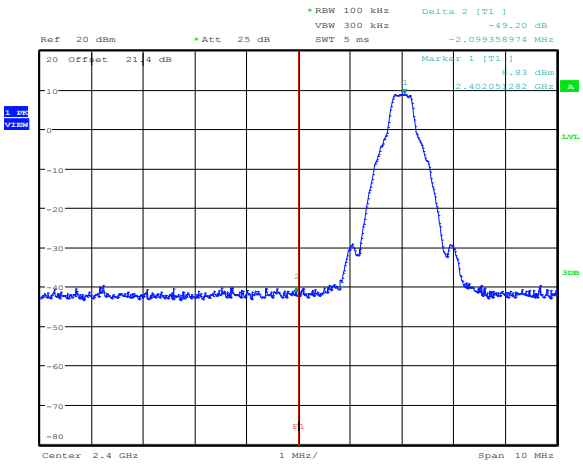


Figure 8.5-4: *Conducted band edge emission at 2400 MHz for GFSK, hopping sequence is off*

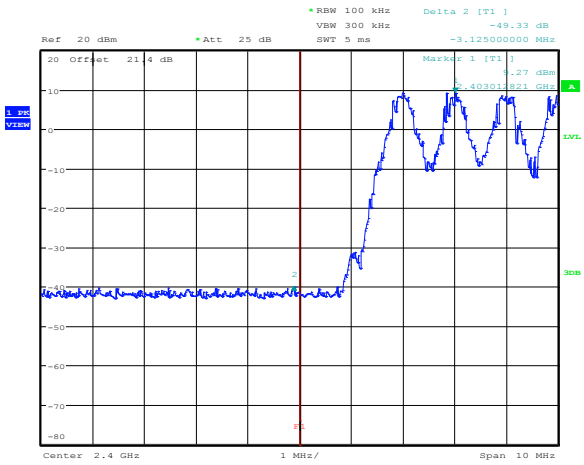


Figure 8.5-5: *Conducted band edge emission at 2400 MHz for GFSK, hopping sequence is on*

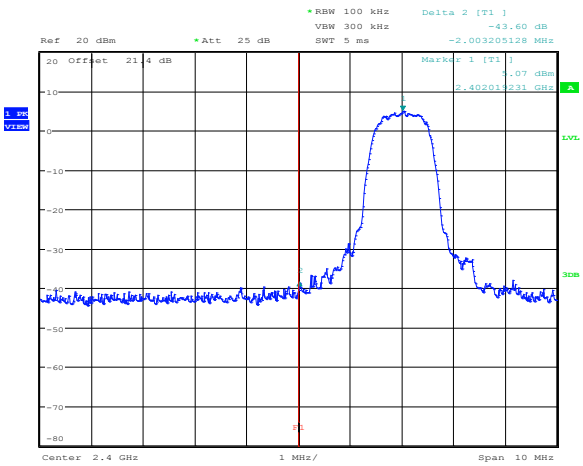


Figure 8.5-6: *Conducted band edge emission at 2400 MHz for π/4 DPSK, hopping sequence is off*

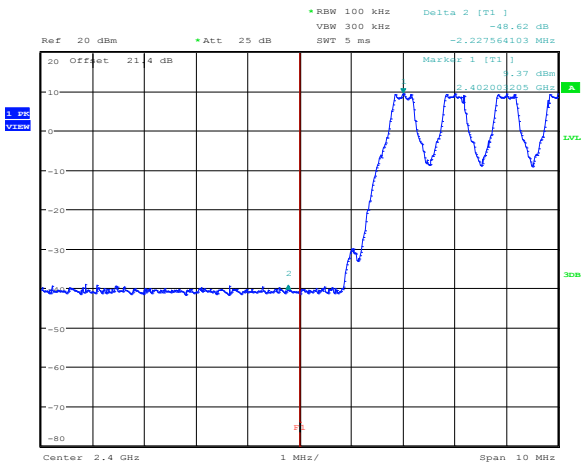


Figure 8.5-7: *Conducted band edge emission at 2400 MHz for π/4 DPSK, hopping sequence is on*

8.5.1 Test data, continued

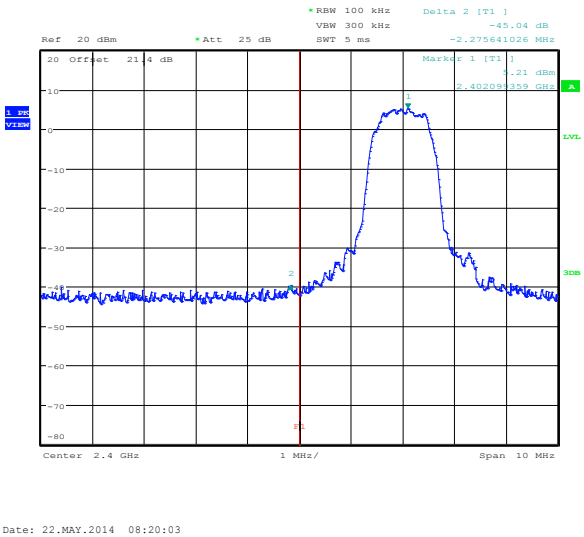


Figure 8.5-8: *Conducted band edge emission at 2400 MHz for 8 DPSK, hopping sequence is off*

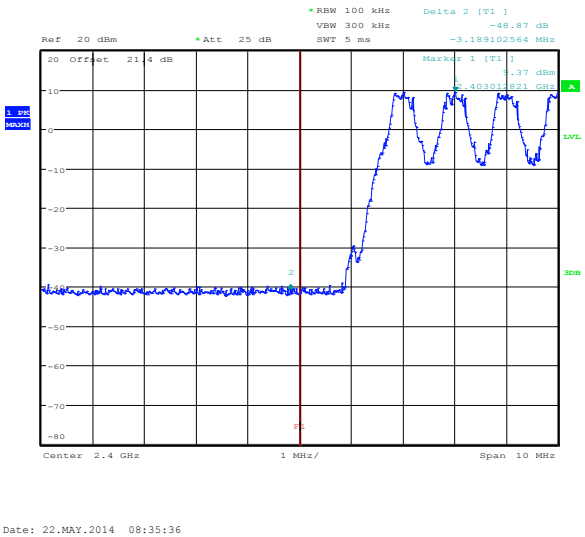


Figure 8.5-9: *Conducted band edge emission at 2400 MHz for 8 DPSK, hopping sequence is on*

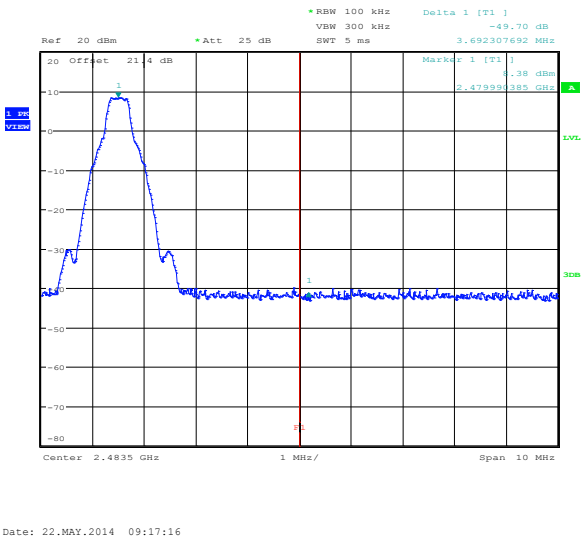


Figure 8.5-10: *Conducted band edge emission at 2483.5 MHz for GFSK, hopping sequence is off*

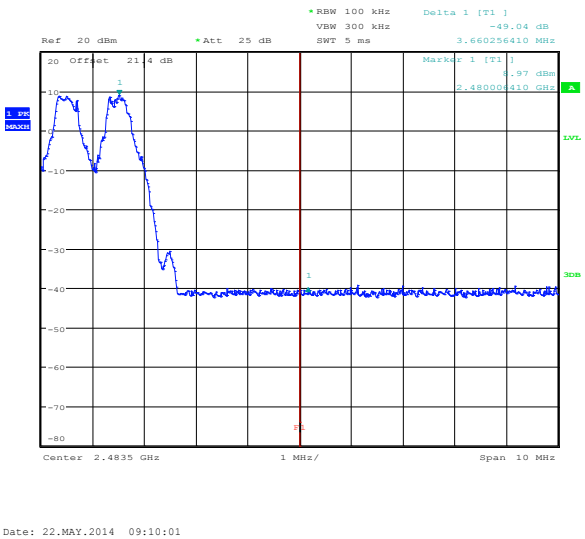


Figure 8.5-11: *Conducted band edge emission at 2483.5 MHz for GFSK, hopping sequence is on*

8.5.2 Test data, continued

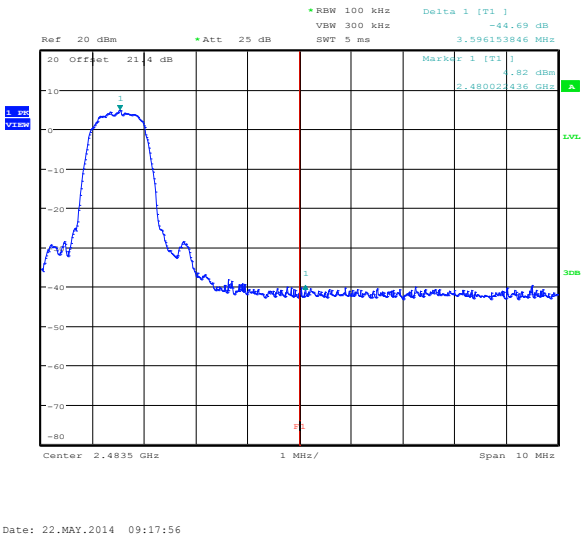


Figure 8.5-12: *Conducted band edge emission at 2483.5 MHz for π/4 DPSK, hopping sequence is off*

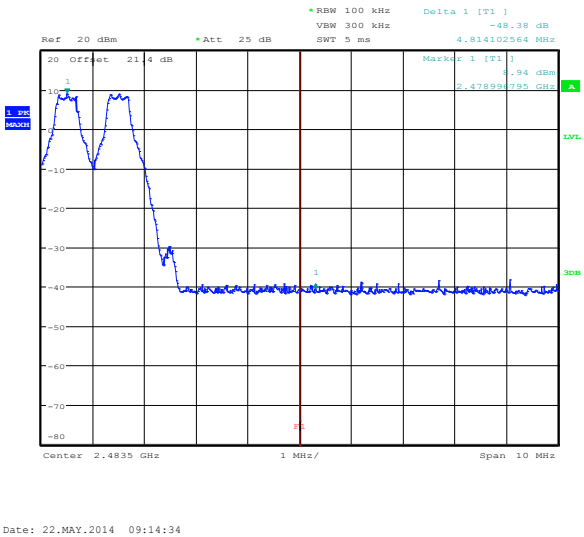


Figure 8.5-13: *Conducted band edge emission at 2483.5 MHz for π/4 DPSK, hopping sequence is on*

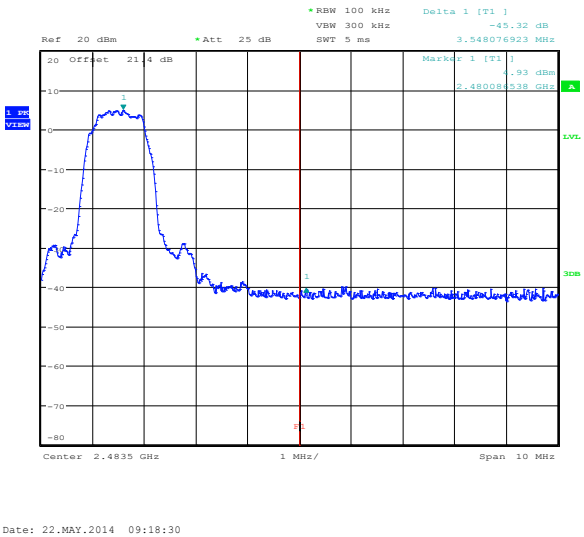


Figure 8.5-14: *Conducted band edge emission at 2483.5 MHz for 8 DPSK, hopping sequence is off*

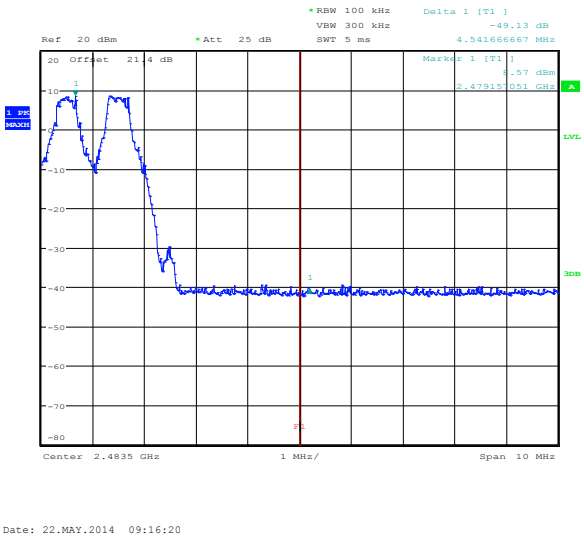
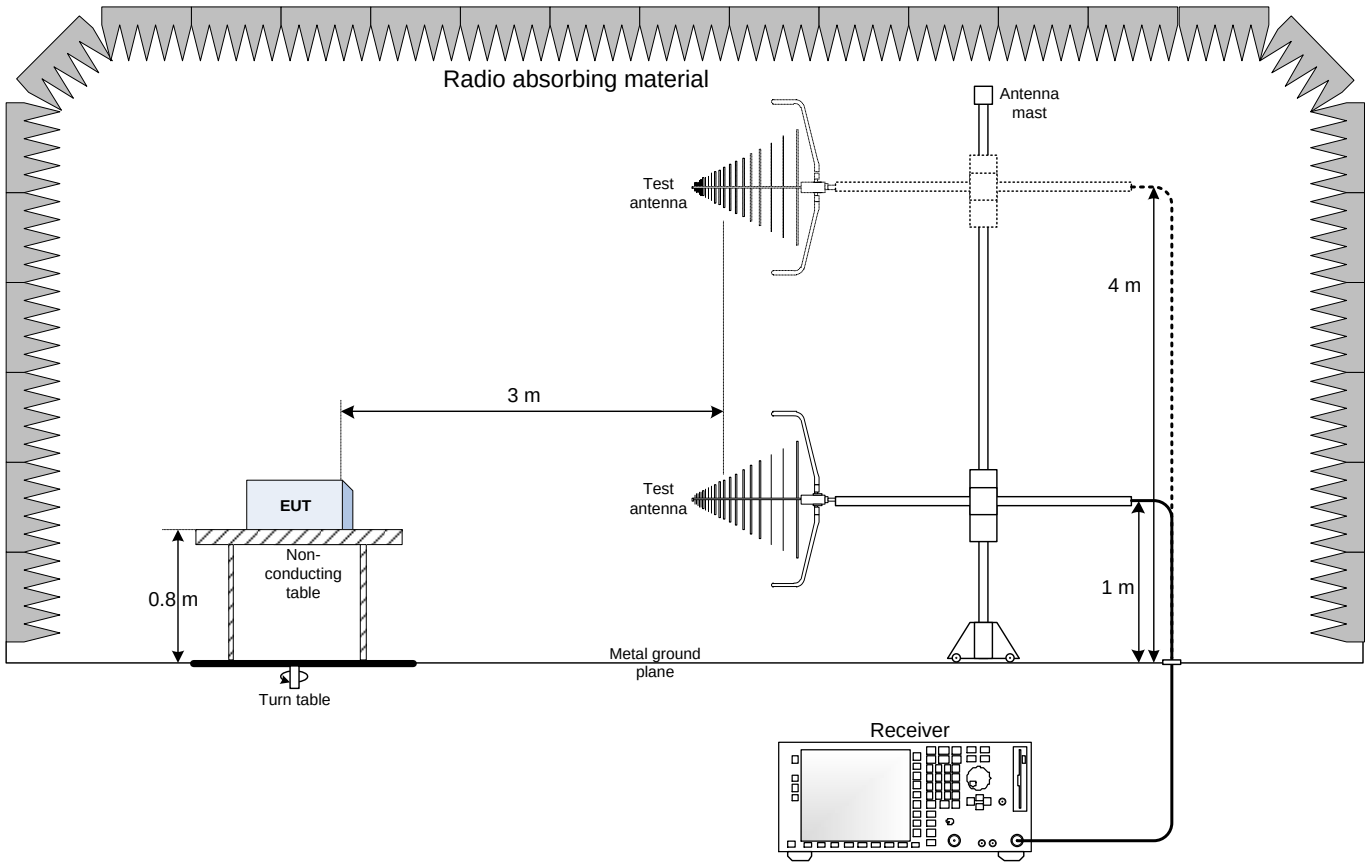


Figure 8.5-15: *Conducted band edge emission at 2483.5 MHz for 8 DPSK, hopping sequence is on*

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up