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Nemko Canada Inc., 303 River Road, R.R. 5, Ottawa, Ontario, Canada, K1V 1H2

Report number: 136288-1TRFWL

Apparatus: Everest Braille Note

Applicant: Technologies Humanware Inc.
445, Rue du Parc-Industriel
Longueuil, Quebec,
Canada, J4H 3V7

FCC ID: XT5APBT320

Test specification:

Title 47 - Telecommunication
Chapter I - Federal Communications Commission
Subchapter A - General
Part 15 - Radio Frequency Devices
Subpart C - Intentional Radiators

- **§15.247 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz**

Reviewed by: Kevin Ma
Signature
Kevin Ma, Wireless/EMC Specialist

March 5, 2010
Date

Tested by: Andrey Adelberg, Senior Wireless/EMC Specialist

SCC Accredited LAB
LAB Accrédité CCN

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada.
The tests included in this report are within the scope of this accreditation.

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Section 1: Report summary

This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc.

Test specification:

FCC Part 15 Subpart C, 15.247
Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

Compliance status:	Complies
Exclusions:	None
Non-compliances:	None
Report release history:	Original release
Test location:	Nemko Canada Inc. 303 River Road, R.R. 5, Ottawa, Ontario, Canada, K1V 1H2
Registration number:	176392 (3 m Semi anechoic chamber)

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.

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Section 2: Equipment under test

2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

Type of equipment:	Braille notebook with WiFi and Bluetooth
Product marketing name:	Everest, BrailleNote
Model number:	APBT320
Model variant:	APQT320
Serial number:	None
Nemko sample number:	2
FCC ID:	XT5APBT320
Date of receipt:	October 14, 2009

2.2 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

Type of equipment:	LCD monitor	Keyboard	Mouse	Power supply	Memory stick
Brand name:	Samsung	Dell	Microsoft	Globtek	Verbatim
Model name or number:	2053BW	SK-8135	X802382-004	GTM21097-3005	None
Serial number:	AQ20H9NQ703443W	CN-0DJ346-71616-79I-0FC9	LZ8310D06RW	TR9CA6000EJ2YMED	Everest QA# 8
Nemko sample number:	1	4	6	10	12
Connection port:	VGA	USB	USB	DC jack	USB
Cable length and type:	1.5 m, VGA	1.5 m, USB	1.5 m, USB	1 m, DC wire	None

Type of equipment:	SD card	Microphone	Headphones
Brand name:	None	Labtec	None
Model name or number:	None	AM-252	None
Serial number:	None	None	None
Nemko sample number:	15	3	17
Connection port:	SD slot	Audio jack	Audio jack
Cable length and type:	None	1.5 m, Audio	1.5 m, Audio

Section 2: Equipment under test, continued

2.3 EUT description

The product is a notetaker device that includes in a single enclosure a microprocessor platform based on the Freescale iMX31 and the Microsoft Windows CE 6.0 operating system. The product provides all the functionality provided by a generic PDA but uses KeySoft software to make it accessible to blind people. The main applications provided by KeySoft are: email, internet browser, media player, word processor and daily planner.

The user enters data in the notetaker using a Perkins keyboard or a QWERTY keyboard. Feedback to the user is delivered in three different ways: Audio feedback using text to speech technology (TTS), the Braille displays cells and a connected VGA display. The notetaker provides synchronization capability with a personal computer. This allows the user to share contacts, appointments and email between the PC and the notetaker. The notetaker communicates with external devices using mainstream technologies such as USB, WiFi and Bluetooth.

The BrailleNote also needs to be compatible with the DeafBlind Communicator (DBC) application (KeySoft Add-On) using a modem for TTY communication and a remote QWERTY-Bluetooth device.

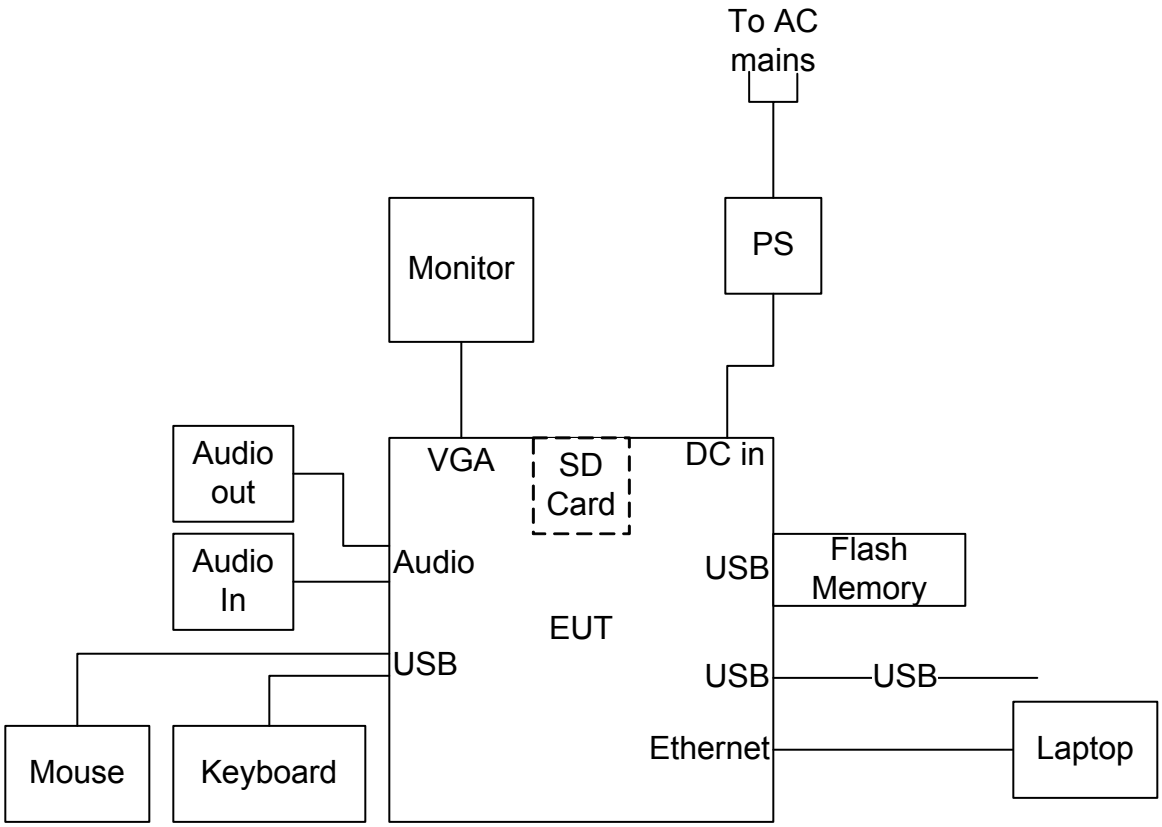
Between the two model variants, only the interface with the keyboard changes, everything else is the same. EUT with Perkins keyboard (APBT320) was chosen as a representative model for testing.

2.4 Technical specifications of the EUT

Operating band:	2400–2483.5 MHz
Operating frequency:	2412–2462 MHz
Modulation type:	802.11 b/g (OFDM and CCK)
Occupied bandwidth:	16.5 MHz (OFDM); 11.1 MHz (CCK)
Channel spacing:	20 MHz
Emission designator:	16M5W7D (OFDM); 11M1G1D (CCK)
Antenna data:	1.9 dBi
Antenna type:	Integral Permanent fixed antenna, which may be built-in, (Equipment does not have an external 50 Ω RF connector)
Power source	120 VAC, 60 Hz external

Section 2: Equipment under test, continued

2.5 EUT setup diagram



2.6 Operation of the EUT during testing

The EUT was controlled by *"pdaunitest"* software for constant transmission on low, mid and high channels.

2.7 Modifications incorporated in the EUT

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

Section 3: Test conditions

3.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

3.2 Test conditions, power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa 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.
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 3: Test conditions, continued

3.3 Measurement uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.

3.4 Test equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
3 m EMI Test Chamber	TDK	SAC-3	FA002047	May 06/10
International Power Supply	California Inst.	3001i	FA001021	Jan. 13/10
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 16/09
Spectrum Analyzer	Rohde & Schwarz	FSP	FA001920	Apr. 24/10
Bilog	Sunol	JB3	FA002108	Jan. 27/10
Horn Antenna #2	EMCO	3115	FA000825	Jan. 21/10
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 07/10
Horn 18 – 26.5 GHz	Electro-Metrics	SH-50/60-1	FA000479	COU
26 – 40.0 GHz Amplifier	NARDA	DBL-2640N610	FA001556	COU
LISN	Rohde & Schwarz	ENV216	FA002023	Sept. 08/10
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR
Controller	Sunol	SC104V	FA002060	NCR
Mast	Sunol	TLT2	FA002061	NCR

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use

Section 4: Result summary

4.1 FCC Part 15 Subpart C, 15.247: Test results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N	No : not applicable / not relevant.
Y	Yes : Mandatory i.e. the apparatus shall conform to these tests.
N/T	Not Tested, mandatory but not assessed. (See report summary)

Part	Test description	Required	Result
General requirements for FCC Part 15			
§15.31(e)	Variation of power source	Y	Pass
§15.31(m)	Number of operating frequencies	Y	Noted
§15.203	Antenna requirement	Y	Pass
§15.207(a)	Conducted limits	Y	Pass
Specific requirements for FCC Part 15 Subpart C, 15.247			
§15.247(a)(1)	Frequency hopping systems	---	---
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	N	
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	N	
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	N	
§15.247(a)(2)	Minimum 6 dB BW for systems using digital modulation techniques	Y	Pass
§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	N	
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	N	
§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	Y	Pass
§15.247(b)(4)	Maximum peak output power	Y	Pass
§15.247(c)(1)	Fixed point-to-point Operation with directional antenna gains greater than 6 dBi	N	

Notes: None

Appendix A: Test results

Clause 15.31(e) Variation of the power source

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Test date: October 17, 2009

Test results: Pass

Test data

- Transmit output power was measured while supply voltage was varied from 102 VAC to 138 VAC (85 % to 115 % of the nominal rated supply voltage). No change in transmit output power was observed.

Clause 15.31(m) Number of operating frequencies

Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz and less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Test data

The frequency band is 83.5 MHz therefore number of operating frequencies is 3.

Low frequency / channel	2412 MHz
Mid frequency / channel	2437 MHz
High frequency / channel	2462 MHz

Clause 15.203 Antenna requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Test date: October 20, 2009

Test results: Pass

Test data

– The EUT uses an on-board antenna.

Detailed photo of the antenna

Clause 15.207(a) Conducted limits

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.

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
*-Decreases with the logarithm of the frequency.		

Test date: October 16, 2009

Test results: Pass

Special notes

Port under test: AC input of the power supply

Preview measurements:
0.15 MHz to 30 MHz
Receiver settings:
– Peak and average detector
– 9 kHz RBW

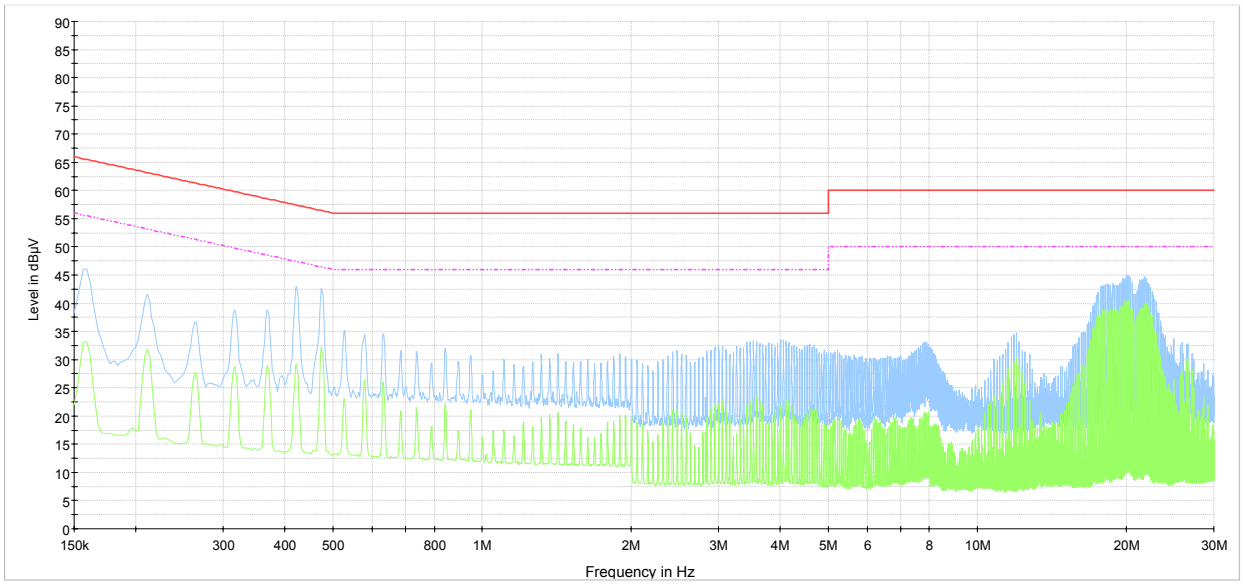
Final measurement:
0.15 MHz to 30 MHz
Receiver settings:
– Q-Peak and average detector
– 9 kHz RBW

- Spectral plots have been corrected for transducer factors; cable loss, LISN, and attenuators.
- Emissions detected within 6 dB of limit were re-measured with a quasi peak or average detector for a final measurement.

Clause 15.207(a) Conducted limits, continued

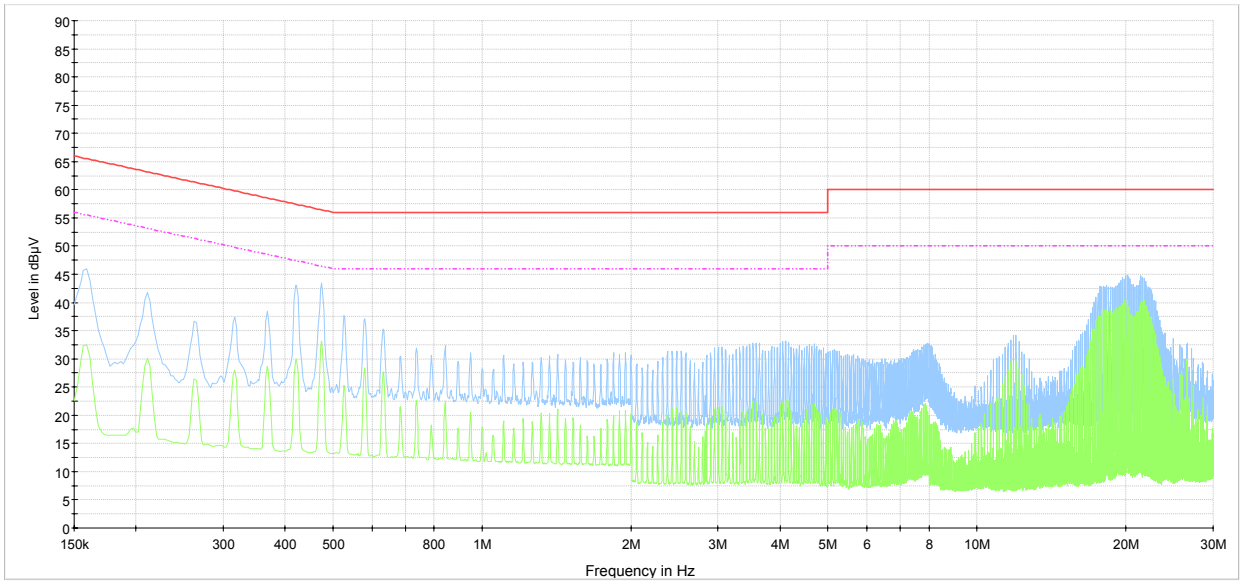
Test data

Phase line:



Conducted emissions at phase line 120 VAC, 60 Hz
CISPR 22 Mains QP Class B.LimitLine
CISPR 22 Mains AV Class B.LimitLine
Preview Result 1
Preview Result 2

Neutral line:



Conducted emissions at neutral line 120 VAC, 60 Hz
CISPR 22 Mains QP Class B.LimitLine
CISPR 22 Mains AV Class B.LimitLine
Preview Result 1
Preview Result 2

Clause 15.207(a) Conducted limits, continued

Set up photo

Clause 15.247(a)(2) Minimum 6 dB bandwidth for digital modulation systems

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test date: October 18, 2009

Test results: Pass

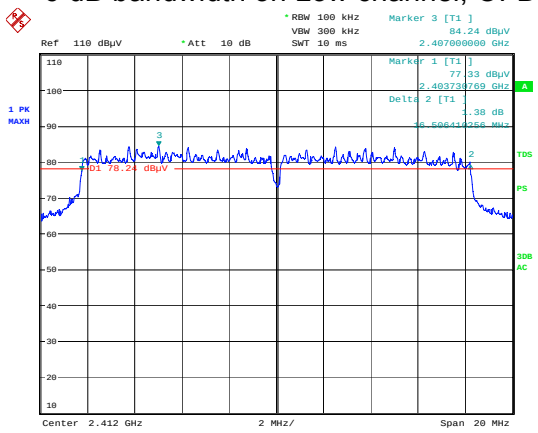
Special notes

- The peak detector was used with 100 kHz/300 kHz RBW/VBW
- The span was wider than RBW.

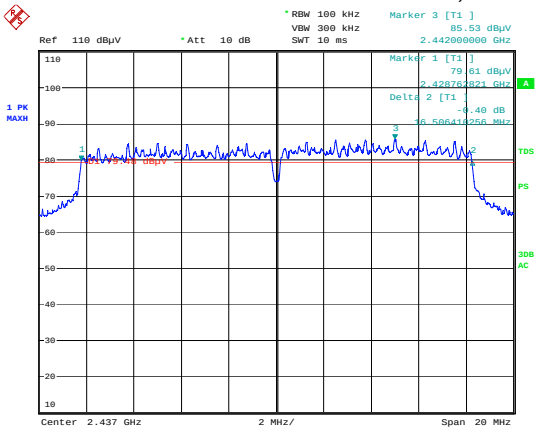
Clause 15.247(a)(2) Minimum 6 dB bandwidth for digital modulation systems, continued

Test data

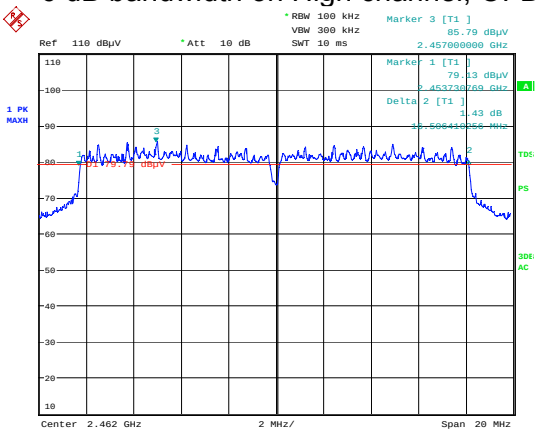
6 dB bandwidth on Low channel, OFDM:



6 dB bandwidth on Mid channel, OFDM:



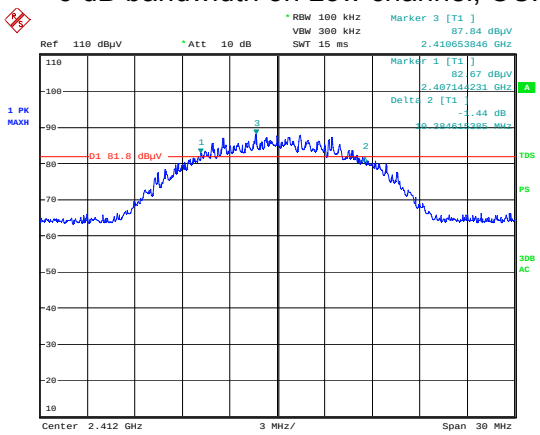
6 dB bandwidth on High channel, OFDM:



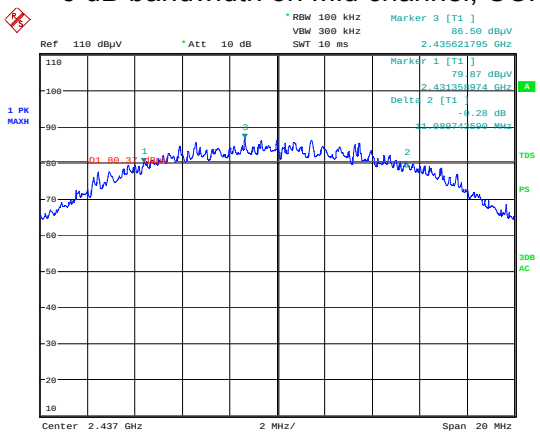
Clause 15.247(a)(2) Minimum 6 dB bandwidth for digital modulation systems, continued

Test data, continued

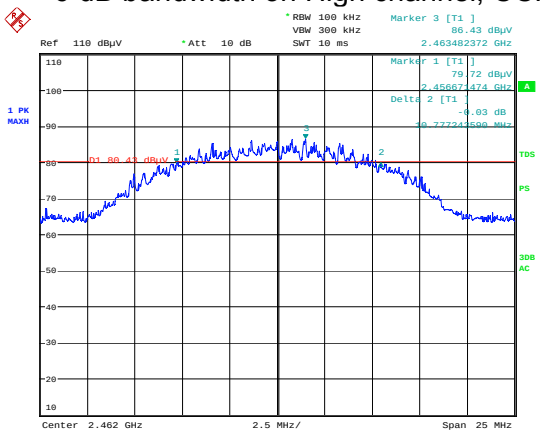
6 dB bandwidth on Low channel, CCK:



6 dB bandwidth on Mid channel, CCK:



6 dB bandwidth on High channel, CCK:



Clause 15.247(a)(2) Minimum 6 dB bandwidth for digital modulation systems, continued

Test data, continued

Frequency, MHz	6 dB bandwidth, MHz	Limit, MHz	Margin, MHz
OFDM			
2412	16.506	0.5	16.006
2437	16.506	0.5	16.006
2462	16.506	0.5	16.006
CCK			
2412	10.384	0.5	9.884
2437	11.089	0.5	10.589
2462	10.777	0.5	10.277

Clause 15.247(b)(3) Maximum peak conducted output power for systems using digital modulation

The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands: 1 W. As an alternative to a peak power measurement, compliance with the 1 W 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 *maximum conducted output power* is the highest total transmit power occurring in any mode.
(4) 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 by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(i) 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.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) 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.

Test date: October 18, 2009

Test results: Pass

Clause 15.247(b)(3) Maximum peak conducted output power for systems using digital modulation, continued

Test data

Radiated measurements were performed:

- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
  - using a peak detector with RBW wider than emission bandwidth
- Only the worst data presented in the test report.

Frequency, MHz	Polarization	Field strength, dBµV/m	Output power, dBm	Limit, dBm	Margin, dBm
OFDM					
2412	V	104.17	7.04	30.00	22.96
2412	H	100.11	2.98	30.00	27.02
2437	V	104.21	7.08	30.00	22.92
2437	H	102.38	5.25	30.00	24.75
2462	V	104.74	7.61	30.00	22.39
2462	H	101.28	4.15	30.00	25.85
CCK					
2412	V	105.01	7.88	30.00	22.12
2412	H	103.30	6.17	30.00	23.83
2437	V	106.12	8.99	30.00	21.01
2437	H	103.11	5.98	30.00	24.02
2462	V	106.18	9.05	30.00	20.95
2462	H	103.47	6.34	30.00	23.66

Theoretical conversion from Field Strength measured at 3 m to power conducted from the intentional radiator to the antenna:

$$P\ (W) = \frac{E^2 R^2}{30G}$$

E = Measured field strength value (V/m)
R = Measurement distance (m)
G = Antenna Gain (numeric)

Therefore dBW = dBV/m + 20Log(3) − 10Log(30) − 10Log(G)

From which we obtain

dBmW = dBµV/m − 120 + 20Log(3) − 10Log(30) − 10Log(G) + 30
= dBµV/m − 95.23 − 10Log(G)

Output power [dBm] = Field Strength [dBµV/m] − 95.23 [dB] − Antenna gain [dBi]
Antenna gain is 1.9 dBi

Clause 15.247(b)(3) Maximum peak conducted output power for systems using digital modulation, continued

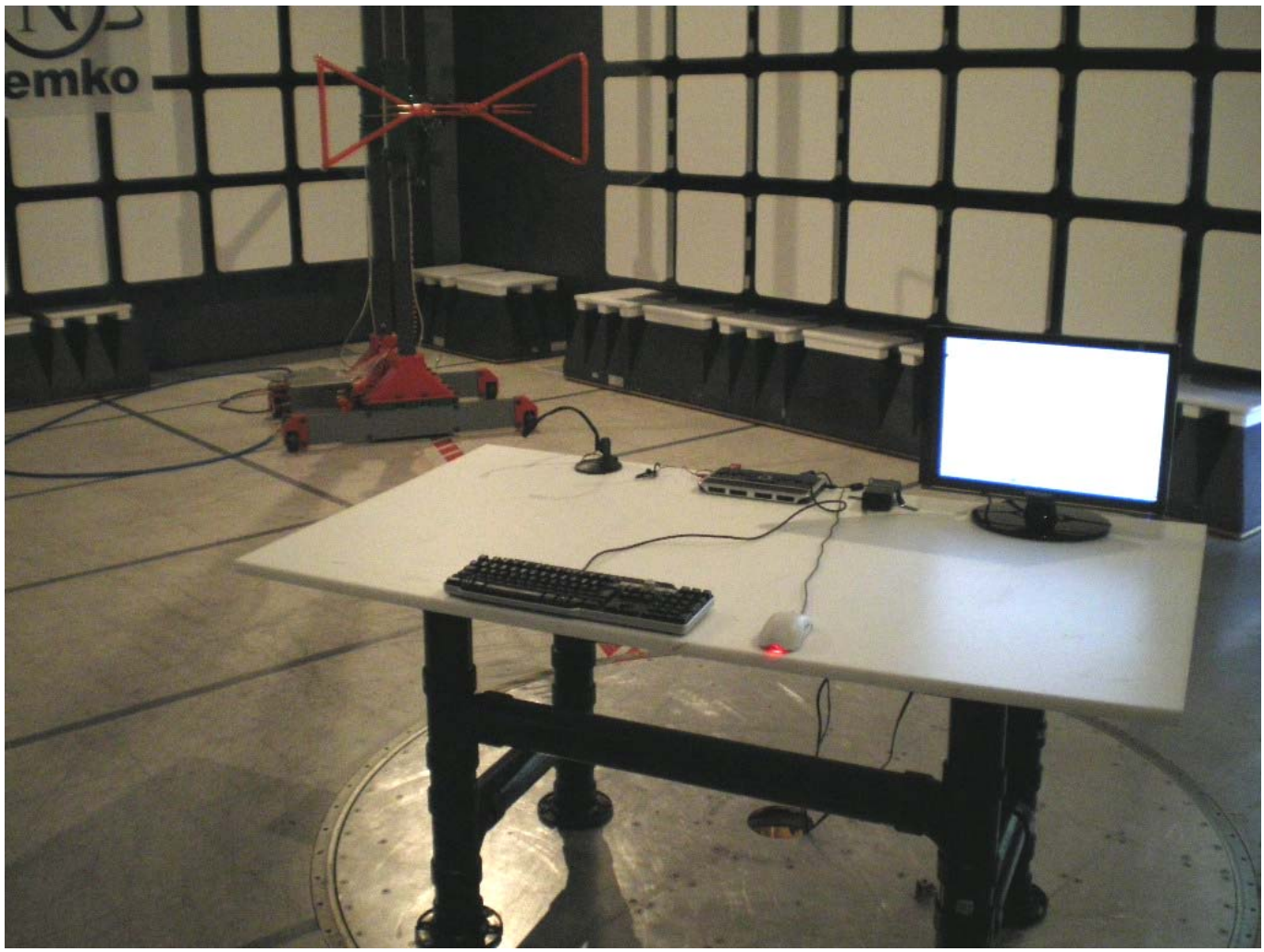
Test data, continued

Frequency, MHz	Polarization	EIRP, dBm	EIRP limit, dBm	Margin, dBm
OFDM				
2412	V	8.94	36.00	27.06
2412	H	4.88	36.00	31.12
2437	V	8.98	36.00	27.02
2437	H	7.15	36.00	28.85
2462	V	9.51	36.00	26.49
2462	H	6.05	36.00	29.95
CCK				
2412	V	9.78	36.00	26.22
2412	H	8.07	36.00	27.93
2437	V	10.89	36.00	25.11
2437	H	7.88	36.00	28.12
2462	V	10.95	36.00	25.05
2462	H	8.24	36.00	27.76

EIRP [dBm] = Output power [dBm] + Antenna gain [dBi]
Antenna gain is 1.9 dBi

Clause 15.247(b)(3) Maximum peak conducted output power for systems using digital modulation, continued

Set up photo



Clause 15.247(d) Spurious emissions

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)):

Frequency (MHz)	Field strength		Measurement distance (m)
	(µV/m)	(dBµV/m)	
0.009–0.490	2400/F	67.6−20log(F)	300
0.490–1.705	24000/F	87.6−20log(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:
- F = fundamental frequency in kHz
- 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.

Test date: October 17, 2009

Test results: Pass

Clause 15.247(d) Spurious emissions, continued

Special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
  - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
  - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
    - and using peak detector with 100 kHz/300 kHz RBW/VBW for average results.
- During the test duty cycle was 100 %.
- Only the worst data presented in the test report.
- No spurious emissions were detected within 20 dB below the limit

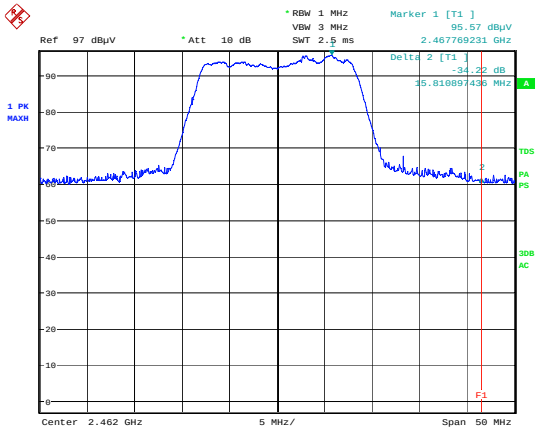
§ 15.205 Restricted bands of operation.

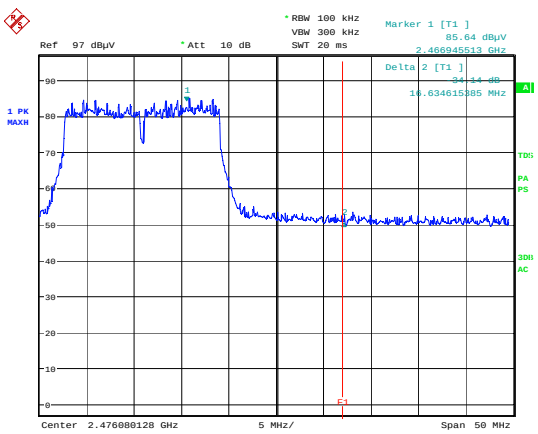
MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	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			

Clause 15.247(d) Spurious emissions, continued

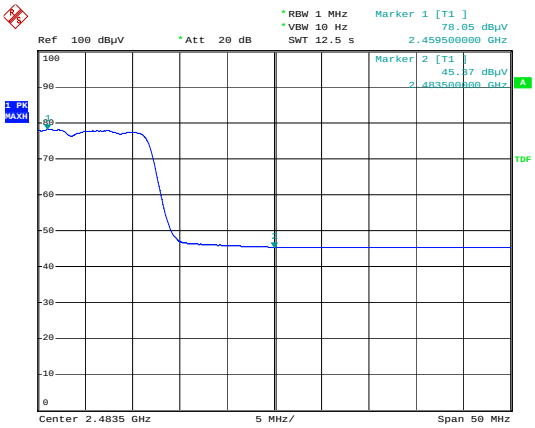
Test data, continued

Delta marker measurement for 2.4835 GHz Band Edge, OFDM
Measured field strength for high channel in 1 MHz/3 MHz RBW/VBW = 95.57 dBµV/m





Average measurement with 1 MHz RBW and 10 Hz VBW:

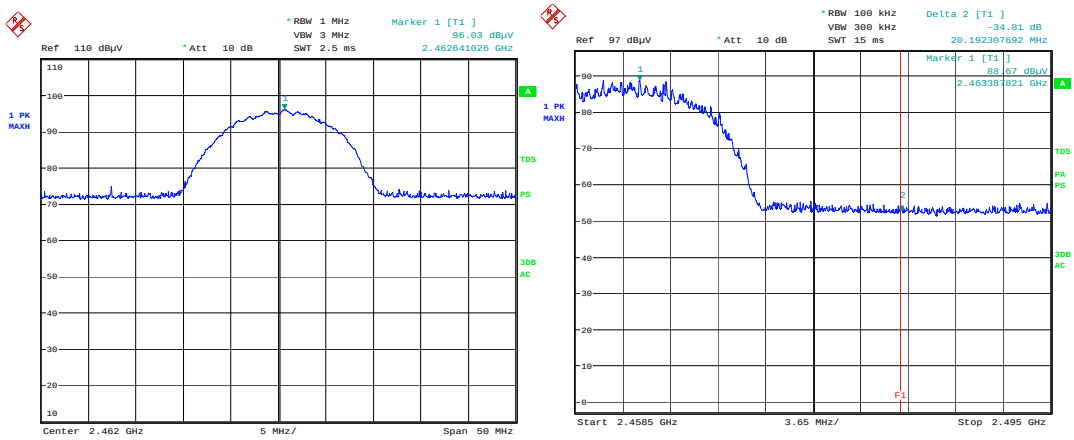


Delta marker = 34.14 dB
Therefore, Peak Field Strength = 95.57 dBµV/m − 34.14 dB (Delta marker) = 61.43 dBµV/m
Limit = 74 dBµV/m
Average Field Strength = 45.37 dBµV/m
Limit = 54 dBµV/m

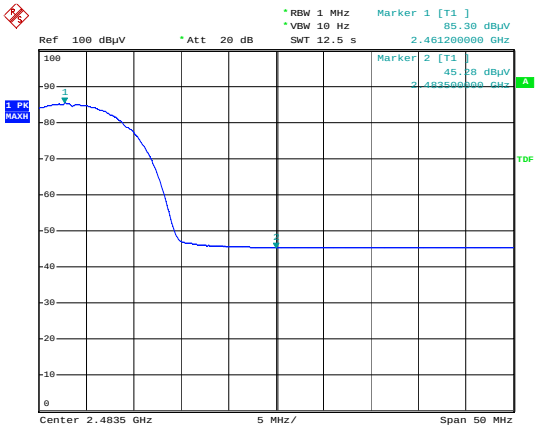
Clause 15.247(d) Spurious emissions, continued

Test data, continued

Delta marker measurement for 2.4835 GHz Band Edge, CCK
Measured field strength for high channel in 1 MHz/3 MHz RBW/VBW = 96.03 dBµV/m



Average measurement with 1 MHz RBW and 10 Hz VBW:

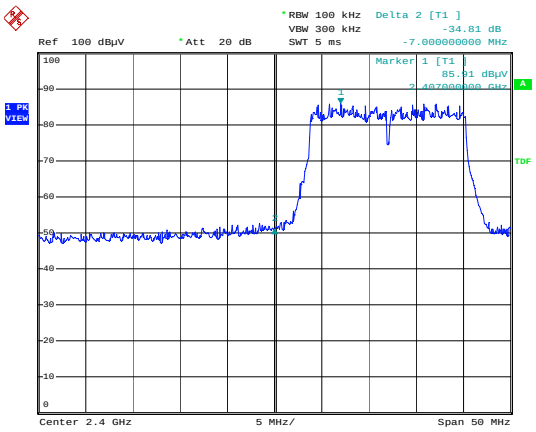


Delta marker = 34.81 dB
Therefore, Peak Field Strength = 96.03 dBµV/m − 34.81 dB (Delta marker) = 61.22 dBµV/m
Limit = 74 dBµV/m
Average Field Strength = 45.28 dBµV/m
Limit = 54 dBµV/m

Clause 15.247(d) Spurious emissions, continued

Test data, continued

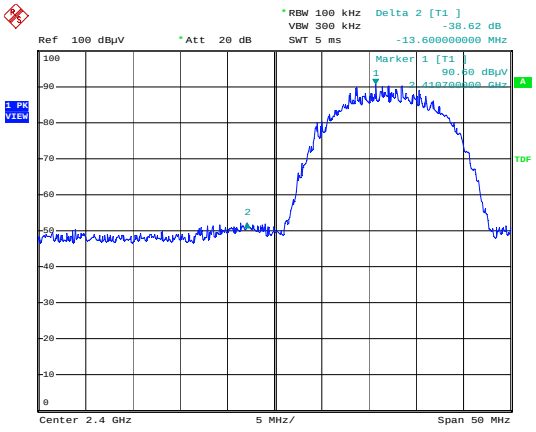
Band Edge measurement for 2.4 GHz, OFDM
Measured field strength for high channel in 100 kHz/300 kHz RBW/VBW



Date: 18.NOV.2009 12:57:17

The band edge emission is –34.81 dBc/100 kHz. The limit is –30 dBc/100 kHz

Band Edge measurement for 2.4 GHz, CCK
Measured field strength for high channel in 100 kHz/300 kHz RBW/VBW



Date: 18.NOV.2009 12:58:14

The band edge emission is –38.62 dBc/100 kHz. The limit is –30 dBc/100 kHz

Clause 15.247(e) Power spectral density

For digitally modulated systems, 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test date: October 18, 2009

Test results: Pass

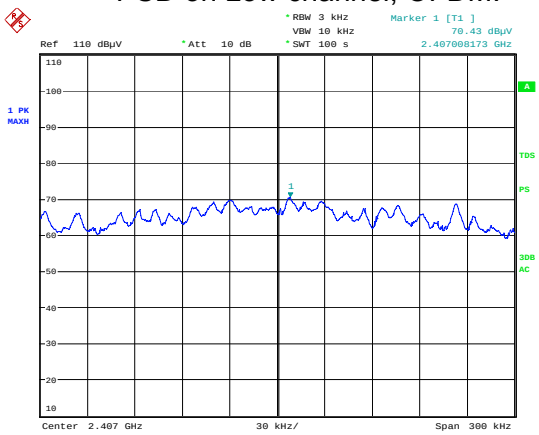
Special notes

- Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set > RBW. Sweep time was set to Span/3 kHz. Peak level was measured.

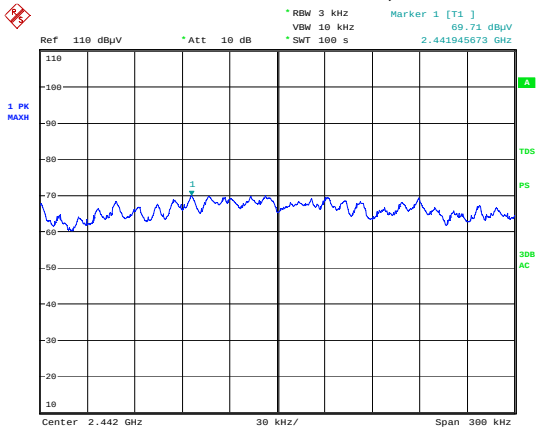
Clause 15.247(c) Power spectral density, continued

Test data

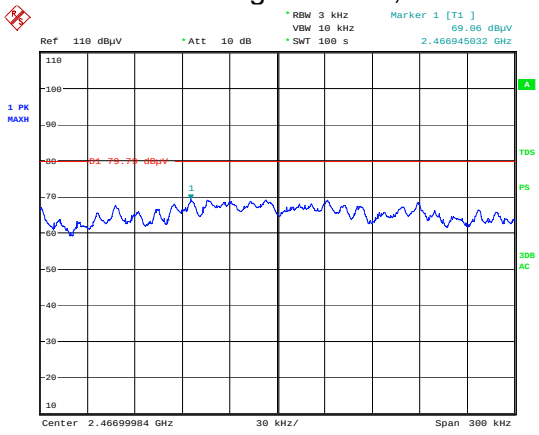
PSD on Low channel, OFDM:



PSD on Mid channel, OFDM:



PSD on High channel, OFDM:



Clause 15.247(c) Power spectral density, continued

Test data, continued

Frequency, MHz	Field strength, dBµV/m/3 kHz	PSD, dBm/3 kHz	Limit, dBm/3 kHz	Margin, dBm
2412	70.43	-26.70	8.00	34.70
2437	69.71	-27.42	8.00	35.42
2462	69.06	-28.07	8.00	36.07

Theoretical conversion from Field Strength measured at 3 m to power conducted from the intentional radiator to the antenna:

$$P\ (W) = \frac{E^2 R^2}{30G}$$

E = Measured field strength value (V/m/3 kHz)
R = Measurement distance (m)
G = Antenna Gain (numeric)

Therefore dBW = dBV/m + 20Log(3) − 10Log(30) − 10Log(G)

From which we obtain

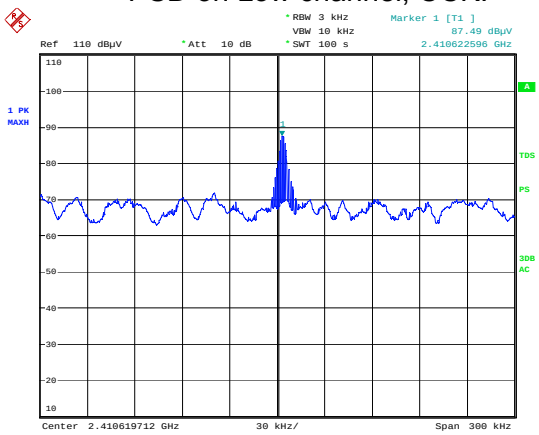
dBmW = dBµV/m − 120 + 20Log(3) − 10Log(30) − 10Log(G) + 30
= dBµV/m − 95.23 − 10Log(G)

PSD [dBm/3 kHz] = Field Strength [dBµV/m/3 kHz] − 95.23 [dB] − Antenna gain [dBi]
Antenna gain is 1.9 dBi

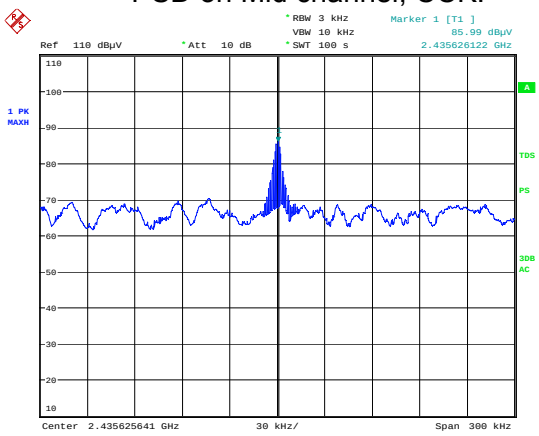
Clause 15.247(c) Power spectral density, continued

Test data, continued

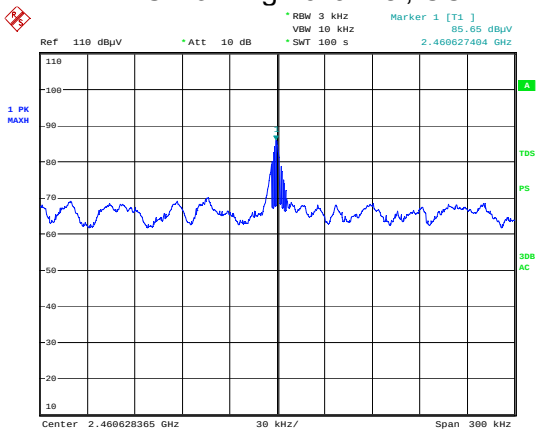
PSD on Low channel, CCK:



PSD on Mid channel, CCK:



PSD on High channel, CCK:



Clause 15.247(c) Power spectral density, continued

Test data, continued

Frequency, MHz	Field strength, dBµV/m/3 kHz	PSD, dBm/3 kHz	Limit, dBm/3 kHz	Margin, dBm
2412	87.49	-9.64	8.00	17.64
2437	85.99	-11.14	8.00	19.14
2462	85.65	-11.48	8.00	19.48

Theoretical conversion from Field Strength measured at 3 m to power conducted from the intentional radiator to the antenna:

$$P\ (W) = \frac{E^2 R^2}{30G}$$

E = Measured field strength value (V/m/3 kHz)
R = Measurement distance (m)
G = Antenna Gain (numeric)

Therefore dBW = dBV/m + 20Log(3) − 10Log(30) − 10Log(G)

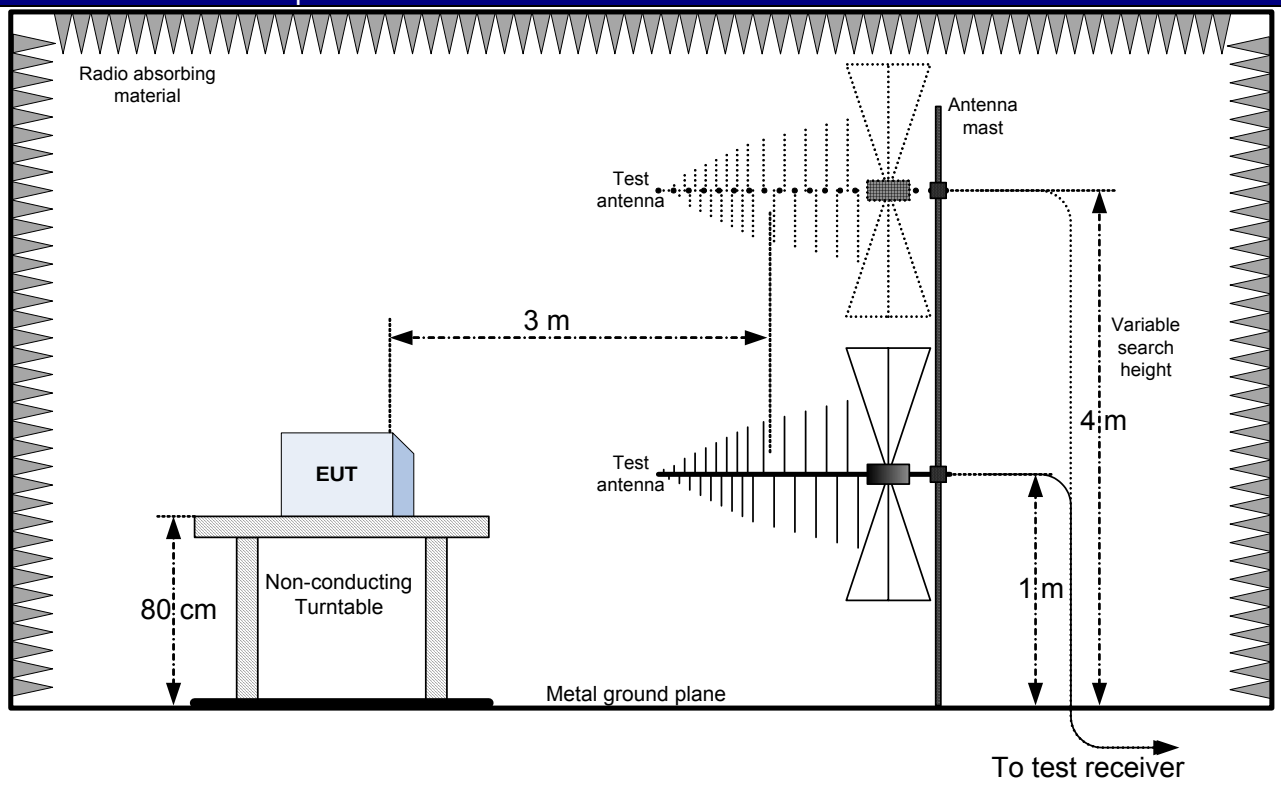
From which we obtain

dBmW = dBµV/m − 120 + 20Log(3) − 10Log(30) − 10Log(G) + 30
= dBµV/m − 95.23 − 10Log(G)

PSD [dBm/3 kHz] = Field Strength [dBµV/m/3 kHz] − 95.23 [dB] − Antenna gain [dBi]
Antenna gain is 1.9 dBi

Appendix B: Block diagrams of test set-ups

Radiated emissions set-up



Conducted emissions set-up