FLEXTRONICS

Test Report for the Libra MAX –LT/HD 5800
FCC Part 15 & Industry Canada RSS-210

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Approvals

Function	Name	Job title	Signature	Date
Document Release Approval	Steve Tippet	Lab Operations Manager		8th Dec 2009
Technical Reviewer	Jacques Rollin	EMC Advisor		Dec 8, 2009
Author	Denis Lalonde	Radio Compliance Discipline Leader	Ken Danforth on behalf of D. Lalonde	8 DEC 2009

Accreditations

The Design Validation Centre (DVC) test facilities are accredited by the Standards Council of Canada (SCC) to ISO/IEC 17025 in accordance with the scope of accreditation outlined at the web site http://palcan.scc.ca/specs/pdf/95_e.pdf [15]. The SCC is a signatory of the APLAC [1] and ILAC [11] Mutual Recognition Arrangements. The SCC's Laboratory Accreditation Program has been evaluated and has demonstrated its competence to operate according to the requirements of ISO/IEC 17011.

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1. Introduction

This document is written and distributed by Flextronics Canada Design Services Inc. Whenever Flextronics is mentioned in this document it shall be taken as referring to Flextronics Canada Design Services Inc.

1.1 Purpose and Scope

This document reports the test activities done by the DVC on the product called Libra MAX – LT/HD 5800 for EION Wireless through Design Validation Centre (DVC) project number K0001570. The objective of the test activities is to demonstrate compliance of the product to the applicable industry standards.

1.2 Executive Summary

This test report documents the measurements performed on the Libra MAX –LT/HD 5800 as part of an Original Equipment FCC and Industry Canada application.

The FCCID and Industry Canada certification numbers for this equipment are:

- FCCID: XEC -LMBS5800
- IC: 8367A- LMBS5800

On the basis of measurements performed in October 2009, the Libra MAX –LT/HD 5800 is verified to be compliant with FCC Part 15 and Industry Canada RSS-210 requirements. The test data included in this report apply to the product titled above manufactured by EION Wireless. A detailed summary of compliance results is found in Table 1: Compliance Results Summary on page 8.

1.3 Test Lab Information

Lab Name	Flextronics Design Validation Centre
Mailing / Shipping Address	21 Richardson Side Road, Kanata, Ontario, K2K 2C1, Canada
Primary Technical Contact	Steve Tippet
Title	Manager of Regulatory Design & Compliance
Phone	613-895-2050, extension 2820

1.4 Customer and Manufacturer Information

Company Name	EION Wireless
Mailing Address	320 March Road, Suite 500, Ottawa, Ontario, K2K 2E3
Primary Contact	Doug Reid

2. Compliance Summary

Table 1 summarizes all the measurements performed on the Libra MAX –LT/HD 5800 and its compliance to FCC Part 15 and Industry Canada RSS-210.

Table 1: Compliance Results Summary

Done	Description	Specification	Test Results		Notes
			Pass	Fail	
■	RF Power	FCC Part 15.247 b) 3) RSS-210 6.2.2 o) b)	■	☐	
■	6 dB Bandwidth	FCC Part 15.247 a) 2)	■	☐	
■	Peak Power Spectral Density	FCC Part 15.247 d) RSS-210 6.2.2 o) b)	■	☐	
■	Conducted Spurious Emissions	FCC Part 15.247 c) RSS-210 6.2.2 o) e1)	■	☐	
■	Field Strength of Spurious Emissions	FCC Part 15.247 c)	■	☐	
■	Receiver Spurious Emissions	RSS-210 7.3	■	☐	
☐	AC Mains Conducted Emissions	FCC 2.1047 RSS-210 6.6 & 7.4	☐	☐	The equipment does not connect to public AC Mains.

3. Equipment Under Test (EUT)

3.1 Product Overview

The product trade name of the unit tested was “Libra MAX –LT/HD 5800”.

The product is a fully-featured WiMAX Base Station - in a convenient all-outdoor enclosure for the cost-effective delivery of broadband wireless applications. Capable of broadband WiMAX speeds for last-mile communication in the unlicensed 5.8 GHz range. Libra MAX-5880-LT takes all of the popular features from EION’s Libra MAX-HD chassis based system and repackages them into an outdoor enclosure for the rapid deployment of point-to-point and point-to-multipoint WiMAX networks. Figure 1 shows the tested product.

Figure 1: View of the Product (front and back)

3.2 Transmitter Specifications

Table 2 lists the specifications of the transmitter under test.

Table 2: Transmitter specifications

Circuit Pack	Fundamental Frequencies (MHz)
Tx power	21.7 dBm
Tx frequency	5725 to 5850 MHz
Modulation	¾ 64QAM on OFDM as per IEEE 802.16d
Bit Rate	22 MB/s max supported
Antenna	External Antenna, see Support Equipment

3.3 System Components

The system tested consists of the unit shown in Table 3.

Table 3: EUT components

Component	Model	Serial Number
Libra MAX –LT/HD 5800	Libra MAX-SS 5X00e	S093488

3.4 EUT Interfaces and Cables

The system contained the interfaces shown in Table 4.

Table 4: System cables

Interface Type	EUT Connection	Description	Type	Length	Qty
Power and data	RJ45 connector	Category 5 with 4 twisted pairs	Shielded	15 m	1

3.5 Support Equipment

The support equipment used for operation and monitoring of the EUT is described in Table 5.

Table 5: Support equipment

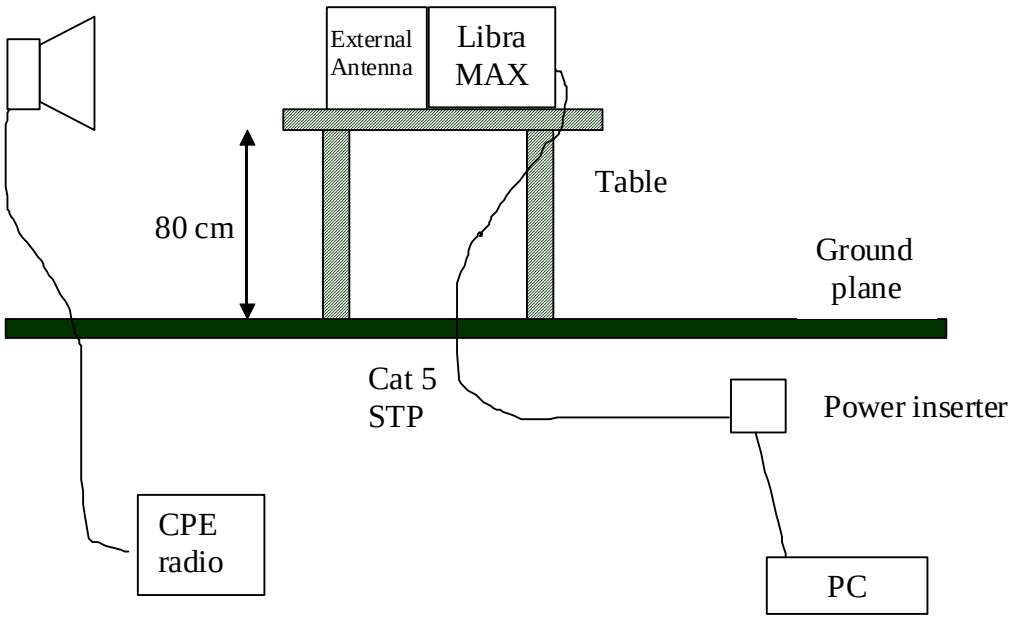
Description	Manufacturer	Model Number
CPE transceiver	EION Wireless	Libra MAX-SS 5X00e
Horn antenna	EMCO	3115
PC	Dell	XT
Power Inserter (POE)	CINCON Electronics Co.	TR60A-POE-L
External Panel Antenna	EION	TIL-TEK model TA-5206WL2: 23.0 dBi

3.6 System Setup and Test Configurations

The system configuration used for all test cases is presented in Figure 2.

The radio was set to transmit at maximum throughput for all tests (22 Mb/s). This was achieved by establishing a link between the EUT and a CPE transceiver.

Figure 2: Configuration of the EUT



A photograph of the test setup used in this test report is presented in Appendix A: Test Setup Photographs, on page 38.

3.7 System Modifications

A TDK ZCAT 3035-1330 ferrite was installed on the STP cable near the EUT (with 2 cable turns) to pass the idle mode radiated emissions requirements between 30 MHz and 1 GHz.

4. General Test Conditions

4.1 Test Facility

Radiated emissions testing is done in a 10-meter Ambient Free Chamber (AFC). The AFC consists of a shielded room lined with ferrite tiles and anechoic material.

All the above facilities are located at 21 Richardson Side Road, Kanata, Ontario, Canada.

These test facilities are approved and registered by Industry Canada and the FCC.

4.2 Measurement Instrumentation

The measurement instrumentation conforms to ANSI C63.2 [2] and CISPR 16 [4]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5. Detailed Test Results

5.1 RF Power

5.1.1 Test Specification

The system was tested to the requirements listed in Table 6.

Table 6: RF Power Requirements

Requirement	Part / Section
FCC	15.247 b) 3)
RSS-210	6.2.2 o) b)

5.1.1.1 Limits

The system was tested to the rated power of the EUT, as listed in Table 7. In the case where transmitting antennas of directional gain greater than 6 dBi were used, the peak output power from the intentional radiator was reduced below 1W by the amount in dB that the directional gain of the antenna exceeded 6 dBi.

Table 7: RF Power Limit

Antenna	Power Reduction Because of Antenna Directional Gain	Power Limit
External Panel Antenna (TA-5206WL2): 23.0 dBi	30 dBm – (10 – 6) dB	26 dBm

The value used for the RF power limit is 26 dBm.

5.1.2 Test Facility Information

Location:	DVC AFC Support Room #2
Date tested:	October 14, 2009
Tested by:	Denis Lalonde

5.1.3 Test Procedure

The radio unit was opened and the antenna disconnected. The output port of the radio transmitter was then connected to a spectrum analyzer with the channel power measurement feature.

The RF signal was set at both extremities and in the middle of the frequency band.

5.1.4 Test Results

Test results are shown in Table 8.

Table 8: RF Power Levels

Channel (MHz)	RF Power (dBm)	Reference
5730 (low channel)	18.6	Figure 10
5780 (middle channel)	19.3	Figure 11
5840 (high channel)	21.7	Figure 12

5.1.5 Test Conclusion

The test results met the requirement.

5.1.6 Test Equipment List

Table 9: Test Equipment used for RF Power

Category	Manufacture	Model Number	Serial Number	Cal. Due
Spectrum Analyzer	Rohde & Schwarz	ESU40	SSG013672	6 July 2010

The measurement instrumentation conforms to ANSI C63.2 [2] and CISPR 16 [4]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5.2 6 dB Bandwidth

5.2.1 Test Specification

The system occupied bandwidth was evaluated according to the specifications listed in Table 10.

Table 10: Occupied Bandwidth

Requirement	Part / Section
FCC	15.247 a) 2)

5.2.2 Test Facility Information

Location: DVC AFC Support Room #2

Date tested: October 28, 2004

Tested by: Denis Lalonde

5.2.3 Limits

The system was tested to the requirement listed in Table 11.

Table 11: 6 dB Occupied Bandwidth Limit

6 dB Occupied Bandwidth Limit
> 500 kHz

5.2.4 Test Procedure

Three occupied bandwidth measurements were performed at low, middle, and high channels.

For all of these measurements, the radio module output was connected to the spectrum analyzer through a RF cable.

5.2.5 Test Results

Table 12 lists the occupied bandwidth calculated and measured:

Table 12: Occupied Bandwidth Values

Channel (MHz)	Bandwidth (MHz)	Reference
5730	9.04	Figure 13
5780	9.04	Figure 14

Channel (MHz)	Bandwidth (MHz)	Reference
5840	9.13	Figure 15

5.2.6 Test Conclusion

The test results met the requirement.

5.2.7 Test Equipment List

Table 13: Test Equipment used for 6 dB Occupied Bandwidth

Category	Manufacture	Model Number	Serial Number	Cal. Due
Spectrum Analyzer	Rohde & Schwarz	ESU40	SSG013672	6 July 2010

The measurement instrumentation conforms to ANSI C63.2 [2]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5.3 Peak Power Spectral Density

5.3.1 Test Specification

The system was tested to the limits of the requirements listed in Table 14.

Table 14: Emission Mask Requirement

Requirement	Part / Section
FCC	15.247 a) 2)

5.3.1.1 Limits

The specification levels in Table 15 were used.

Table 15: Peak Power Spectral Density Limits

Peak Power Spectral Density Limits
8 dBm in any 3 kHz

5.3.2 Test Facility Information

Location: DVC AFC Support Room #2

Date tested: October 14, 2009

Tested by: Denis Lalonde

5.3.3 Test Procedure

Peak power spectral density measurements were performed on low, middle, and high channels.

For all of these measurements, the EUT RF output was connected to the spectrum analyzer through a calibrated RF cable.

5.3.4 Test Results

Table 16 lists the highest emissions measured.

Table 16: Peak Power Spectral Density Results

Channel (MHz)	PSD (dBm)	Reference
5730	-10.7	Figure 16
5780	-10.4	Figure 17
5840	-7.5	Figure 18

5.3.5 Test Conclusion

The test results met the requirement.

5.3.6 Test Equipment List

Table 17: Test Equipment used for Peak Power Spectral Density

Category	Manufacture	Model Number	Serial Number	Cal. Due
Spectrum Analyzer	Rohde & Schwarz	ESU40	SSG013672	6 July 2010

The measurement instrumentation conforms to ANSI C63.2 [2]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5.4 Conducted Spurious Emissions

5.4.1 Test Specification

The system was tested to the limits of the requirements listed in Table 18.

Table 18: Conducted Spurious Emissions Requirement

Requirement	Part / Section
FCC 15	15.247 c)
RSS-210	6.2.2 o) e1)

5.4.1.1 Limits

The specification levels applicable to this test are in Table 19.

Table 19: Conducted Spurious Emission Limit

Frequency Range (MHz)	Limit (dBc)
0 to 40000	-20 dBc in any 100 kHz

5.4.2 Test Facility Information

Location:	DVC AFC Support Room #2
Date tested:	October 14, 2009
Tested by:	Denis Lalonde

5.4.3 Test Procedure

Conducted spurious emissions were measured at low, middle, and high channels.

The EUT output was connected to the spectrum analyzer through a calibrated RF cable.

5.4.4 Test Results

The test results are shown in Table 20.

Table 20: Conducted Spurious Emissions

Channel (MHz)	Results	Reference
5730	> 35 dBc	Figure 19
5780	> 35 dBc	Figure 20

Channel (MHz)	Results	Reference
5840	> 40 dBc	Figure 21

5.4.5 Test Conclusion

The test results met the requirement.

5.4.6 Test Equipment List

Table 21: Test Equipment used for Conducted Spurious Emissions

Category	Manufacture	Model number	Serial number	Calibr. due
Spectrum Analyzer	Rohde & Schwarz	ESU40	SSG013672	6 July 2010

The measurement instrumentation conforms to ANSI C63.2 [2] and CISPR 16 [4]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5.5 Field Strength of Spurious Emissions

5.5.1 Test Specification

The system was tested to the limits of the requirements listed in Table 22.

Table 22: Radiated Emissions Requirement

Requirement	Part / Section
FCC Part 15	15.247 c)

5.5.1.1 Limits

The following specification levels are worst-case limits taken from all test specifications.

Table 23: Field Strength of Spurious Emissions Limit

Restricted Bands as per FCC Part 15.205	Radiated Emissions Limit at 3 m, AVG detection (dBuV/m)	Radiated Emissions Limit at 3 m, Peak detection (dBuV/m)
37.5–38.25 MHz	40	60
73–74.6 MHz	40	60
74.8–75.2 MHz	40	60
108–121.94 MHz	43.5	63.5
123–138 MHz	43.5	63.5
149.9–150.05 MHz	43.5	63.5
156.7–156.9 MHz	43.5	63.5
156.52475–156.52525 MHz	43.5	63.5
162.0125–167.17 MHz	43.5	63.5
167.72–173.2 MHz	43.5	63.5
240–285 MHz	46	66
322–335.4 MHz	46	66
399.9–410 MHz	46	66
608–614 MHz	46	66
960–1240 MHz	54	74
1300–1427 MHz	54	74
1435–1626.5 MHz	54	74
1645.5–1646.5 MHz	54	74
1660–1710 MHz	54	74

Restricted Bands as per FCC Part 15.205	Radiated Emissions Limit at 3 m, AVG detection (dBuV/m)	Radiated Emissions Limit at 3 m, Peak detection (dBuV/m)
-- table continued on next page --		
1718.8–1722.2 MHz	54	74
2200–2300 MHz	54	74
2310–2390 MHz	54	74
2483.5–2500 MHz	54	74
2655–2900 MHz	54	74
3260–3267 MHz	54	74
3332–3339 MHz	54	74
3345.8–3358 MHz	54	74
3600–4400 MHz	54	74
4.5–5.15 GHz	54	74
5.35–5.46 GHz	54	74
7.25–7.75 GHz	54	74
8.025–8.5 GHz	54	74
9.0–9.2 GHz	54	74
9.3–9.5 GHz	54	74
10.6–12.7 GHz	54	74
13.25–13.4 GHz	54	74
14.47–14.5 GHz	54	74
15.35–16.2 GHz	54	74
17.7–21.4 GHz	54	74
22.01–23.12 GHz	54	74
23.6–24.0 GHz	54	74

5.5.2 Test Facility Information

Location: DVC 10-meter AFC

Date tested: October 5 to 14, 2009

Tested by: D. Lalonde, M. Lee, S. Turner, and K. Sivaratnam

5.5.3 Test Procedure

The test was performed as per the relevant Test procedures: ANSI C63.4-2003 [3].

The system was tested in the following manner:

- The EUT was placed on a 80 cm high wooden table which was set on a turntable inside the AFC and it was configured as in normal operation. The cable was routed outside of the AFC where the EUTs support equipment was installed. The system was grounded in accordance with its normal installation specifications. No additional grounding connections are allowed.
- For tests between:
  - 30 MHz and 1 GHz, a broadband bilog antenna was placed at a 10 m distance;
  - 1 GHz and 10 GHz, a horn antenna and a LNA were placed at a 3 m distance.
  - 10 GHz and 12 GHz, a horn antenna, LNA (with a 8 to 12 GHz bandpass filter in front of it) were placed at a 3 m distance.
  - 12 GHz and 18 GHz, a horn antenna and a LNA were placed at a 3 m distance.
  - 18 GHz and 40 GHz, a horn antenna and a LNA were placed at a 1 m distance.
- Between 30 MHz and 26 GHz, a pre-scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 meters, in steps of 1 meter, and for horizontal and vertical polarizations of the receiving antenna.
- Between 26 GHz 40 GHz, a pre-scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan was performed by manually sweeping the test antenna around a 1 meter sphere that surrounds the EUT. This procedure was repeated for horizontal and vertical polarizations of the receiving antenna.
- Prescan optimization was performed based on the pre-scan data. All frequencies, having emission levels within 10 dB of the specification(s) limits, were optimized. For each such frequency, the EUT was rotated in azimuth over 360 degrees and the direction of maximum emission was noted. Antenna height was then varied from 1 to 4 meters at this azimuth to obtain maximum emissions. Then the maximum level measured was recorded.
- The frequency range investigated was 30 MHz to 40 GHz.
- Between 30 MHz and 1 GHz, a resolution bandwidth of 120 kHz was used.
- Above 1 GHz, a 1 MHz resolution bandwidth and 100 kHz video bandwidth were used for the prescans. The video bandwidth was reduced to 3 Hz for average optimization measurements and 1 MHz for peak measurements.

The external panel antenna (23 dBi gain) was used to maximize the level of radiated emissions. All tests were repeated for operation on low, middle, and high channels.

Plots of the 30 MHz to 40 GHz prescan measurements are shown below.

5.5.4 Test Results

The following table and figures list the highest emissions measured.

Table 24: E-field Radiated Emissions Test Results (30 MHz to 1 GHz)

Parameter	Unit	Emission 1	Emission 2	Emission 4	Emission 3	Emission 7	Emission 5
Frequency	(MHz)	50.410	55.011	59.277	60.813	453.552	533.289
Azimuth	(deg)	328	20	67	76	235	197
Height	(cm)	100	106	278	387	140	270
Polarization		Vert	Vert	Vert	Vert	Horz	Vert
Meter Reading	(dBμV)	38.85	43.90	42.59	43.24	41.84	35.07
Detector	(Pk, QP, Av)	qp	qp	qp	qp	qp	qp
Gain / Loss Factor	(dB)	-26.2	-26.2	-26.1	-26.1	-24.7	-24.4
Transducer Factor	(dB)	12.9	11.0	9.8	9.8	15.6	17.9
Level	(dBμV/m)	25.6	28.7	26.3	26.9	32.7	28.6
Margin to FCC Part 15	(dB)	4.0	0.8	3.2	2.6	2.9	7.0

Figure 3: Field Strength, 30 MHz to 1 GHz

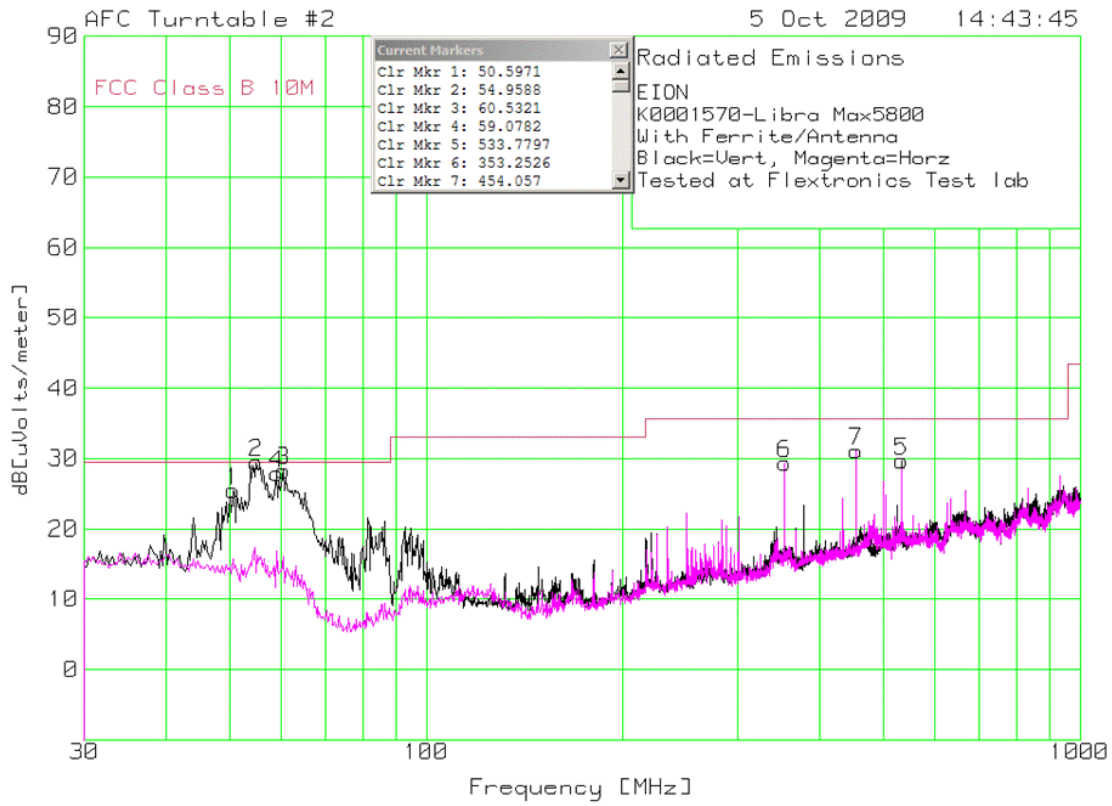


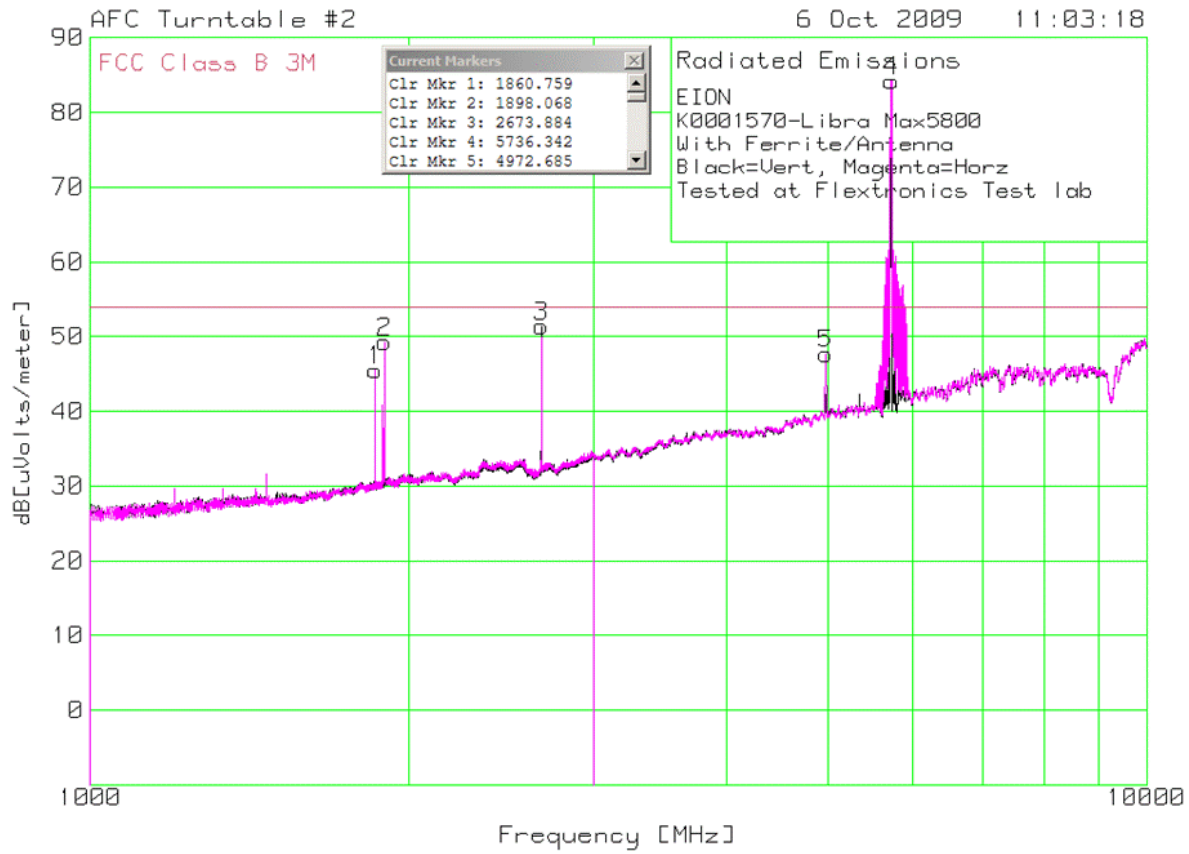
Table 25: E-field Radiated Emissions Test Results (1 GHz to 10 GHz)

Parameter	Unit	Em. 3 (low channel)	Em. 3 (low channel)	Em. 3 (middle channel)	Em. 3 (middle channel)	Em. 3 (high channel)	Em. 3 (high channel)
Frequency	(MHz)	2672.464	2672.464	2730.031	2730.031	2734.978	2734.978
Azimuth	(deg)	194.0	194.0	193.0	193.0	155.0	155.0
Height	(cm)	107	107	143	143	120	120
Polarization		Vert	Vert	Vert	Vert	Vert	Vert
Meter Reading	(dBμV)	59.64	57.35	49.36	52.65	48.13	52.03
Detector	(Pk, QP, Av)	pk	av	av	pk	av	pk
Gain / Loss Factor	(dB)	-33.8	-33.8	-34.7	-34.7	-34.7	-34.7
Transducer Factor	(dB)	28.8	28.8	29.0	29.0	29.0	29.0
Level	(dBμV/m)	54.6	52.4	43.7	47.0	42.4	46.3
Margin to FCC Part 15 54 dBuV/m for avg 74 dBuV/m for pk	(dB)	19.4	1.7	10.3	27.1	11.6	27.7

Table 26: E-field Radiated Emissions Test Results (1 GHz to 10 GHz)

Parameter	Unit	Emission 5	Emission 5
Frequency	(MHz)	4966.100	4966.100
Azimuth	(deg)	2.0	2.0
Height	(cm)	100	100
Polarization		Horz	Horz
Meter Reading	(dBμV)	55.00	36.49
Detector	(Pk, QP, Av)	pk	av
Gain / Loss Factor	(dB)	-30.0	-30.0
Transducer Factor	(dB)	33.1	33.1
Level	(dBμV/m)	58.1	39.6
Margin to FCC Part 15 54 dBuV/m for avg 74 dBuV/m for pk	(dB)	15.9	14.4

Figure 4: Field Strength, 1 GHz to 10 GHz

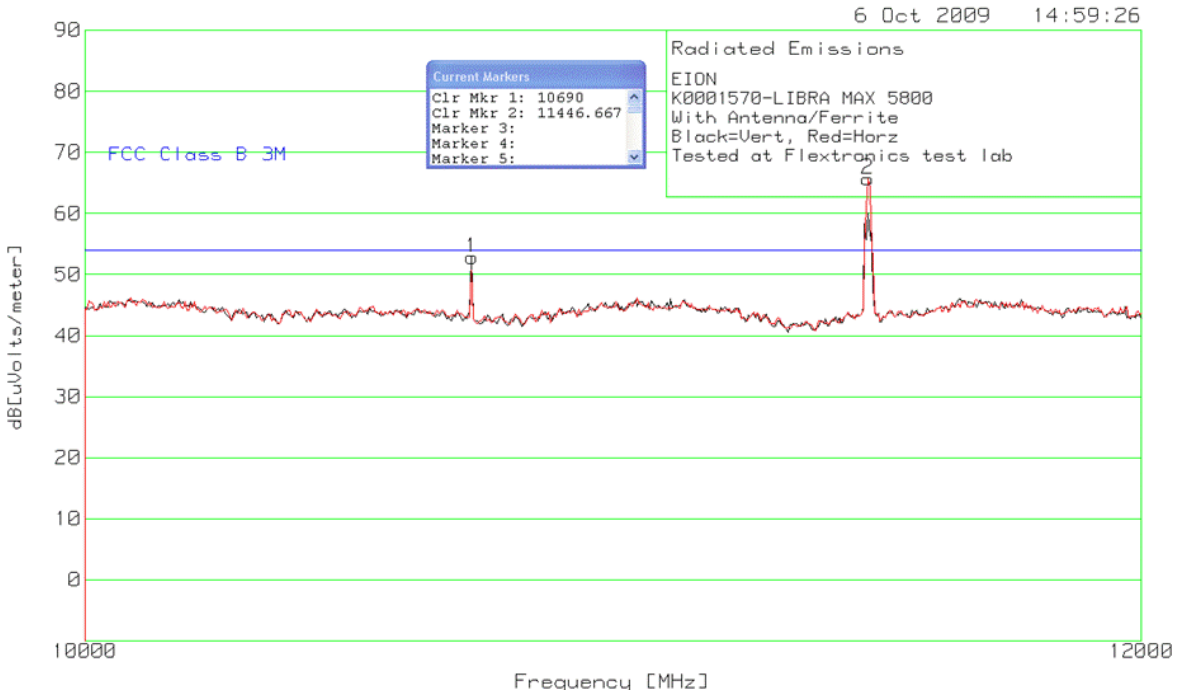


Note: the signals at 1860 and 1898 MHz are ambients from PCS1900 mobile telephones that were in the proximity of the radio lab. This signal disappeared when attempts were made to measure it with lower frequency spans.

Table 27: E-field Radiated Emissions Test Results, (10 to 12 GHz)

Parameter	Unit	Emission 2 (low ch.)	Emission 2 (low ch.)	Emission 2 (mid ch.)	Emission 2 (mid ch.)	Emission 2 (high ch.)	Emission 2 (high ch.)
Frequency	(MHz)	11452.0	11452.0	11682.17	11682.17	11702.50	11702.50
Azimuth	(deg)	190.0	190.0	233.0	233.0	136.0	136.0
Height	(cm)	99	99	111	111	99	99
Polarization		Vert	Vert	Vert	Vert	Vert	Vert
Meter Reading	(dBμV)	52.33	31.00	63.33	31.00	59.33	31.50
Detector	(Pk, QP, Av)	pk	av	pk	av	pk	av
Gain / Loss Factor	(dB)	-31.5	-31.5	-31.5	-31.5	-31.5	-31.5
Transducer Factor	(dB)	38.9	38.9	38.9	38.9	39.0	39.0
Level	(dBμV/m)	62.7	38.4	70.7	38.4	66.8	39.0
Margin to FCC Part 15 54 dBuV/m for avg 74 dBuV/m for pk	(dB)	11.3	15.6	3.3	15.6	7.2	15.0

Figure 5: Field Strength, 10 GHz to 12 GHz

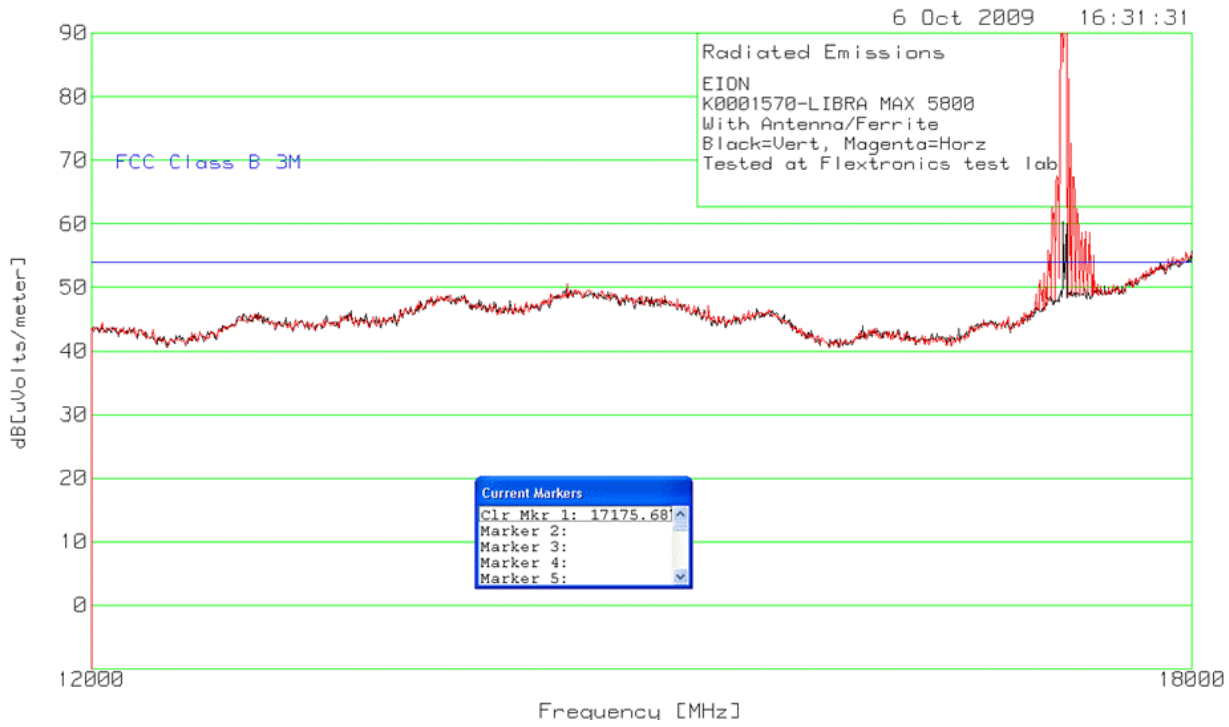


Note: The emission at 10690 MHz was an intermittent signal. This signal disappeared when attempts were made to measure it with lower frequency spans.

Table 28: E-field Radiated Emissions Test Results (12 GHz to 18 GHz)

Parameter	Unit	Emission 1 (low ch)	Emission 1 (mid ch)	Emission 1 (high ch)
Frequency	(MHz)	17175.0	17520.0	17550.0
Azimuth	(deg)	340.0	327.0	11.0
Height	(cm)	284	100	104
Polarization		Horz	Horz	Vert
Meter Reading	(dBµV)	24.77	35.91	35.06
Detector	(Pk, QP, Av)	100 kHz RBW / pk	100 kHz RBW / pk	100 kHz RBW / pk
Gain / Loss Factor	(dB)	5.8	5.9	5.9
Transducer Factor	(dB)	41.8	43.7	44.0
Level	(dBµV/m)	72.4	76.1	75.6
Margin to FCC Part 15 ➢ 20 dBc limit (Tx = 115.8 dBuV/m in 100 kHz)	(dBc)	23.4	19.7	20.2

Figure 6: Field Strength, 12 GHz to 18 GHz



Note: the signal at 17175 MHz is outside the restricted bands (this applies for low, middle, and high channel selections).

Figure 7: Field Strength, 18 GHz to 26.5 GHz

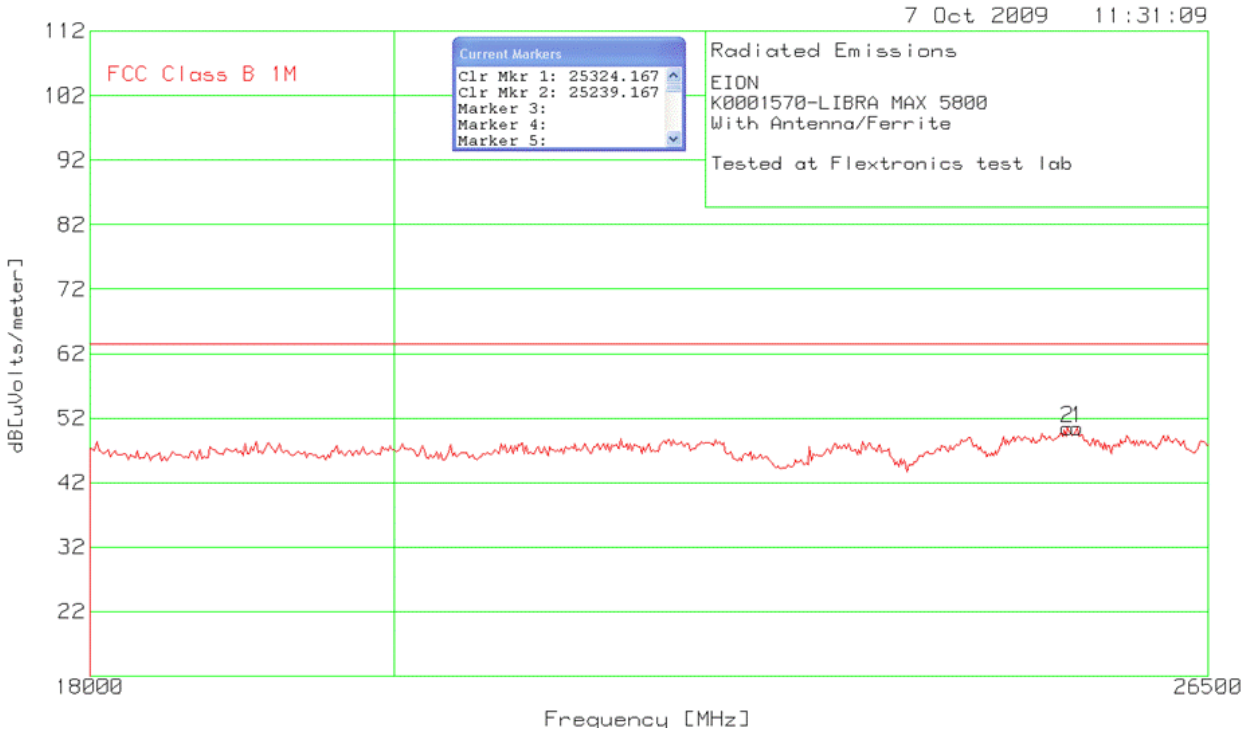
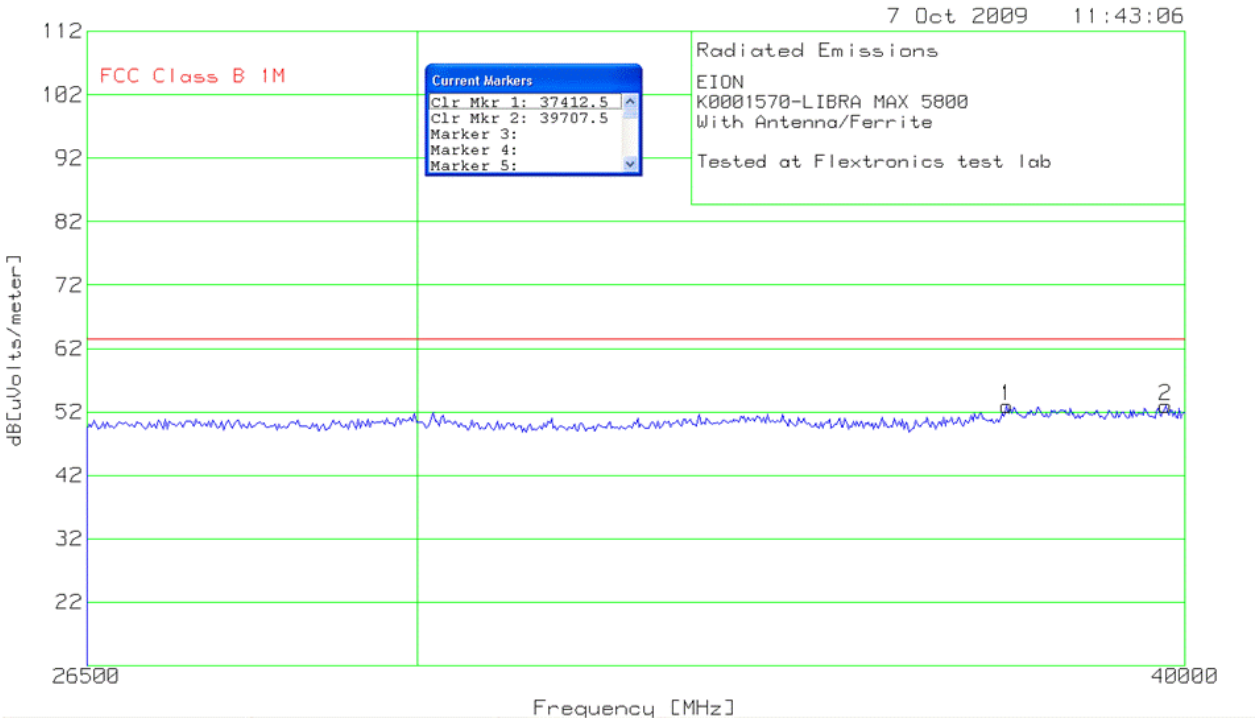


Figure 8: Field Strength, 26.5 GHz to 40 GHz



5.5.5 Calculation of the Compliance Margin

The following illustrates the manner in which the compliance margin is calculated in the "E-field Radiated Emissions Test Results" table(s) from section Test Results on page 24.

The rows in these tables are defined as follows:

Meter Reading (dBµV) =	Voltage measured using the spectrum analyzer with quasi-peak adapter
Gain/Loss Factor (dB) =	Cumulative gain or loss of pre-amplifier and cables used in the measurement path (a negative value indicates gain)
Transducer Factor (dB) =	Antenna factor
Level (dBµV/m) =	Corrected value or field strength, i.e., the parameter of interest that is compared to the limit
Margin (dB) =	Level with respect to the appropriate limit (a positive **Margin** indicates that the **Level** is below the limit and that the measurement is a PASS)

The values in the **Level** row are calculated as follows:

Level = Meter Reading + Gain/Loss Factor + Transducer Factor

The values in the **Margin** row are calculated as follows:

Margin = Limit – Level

5.5.6 Test Conclusion

The test results met the requirement.

5.5.7 Test Equipment List

Table 29: Test Equipment used for Field Strength of Spurious Emissions

Description	Make	Model number	Asset ID	Calibr. due
Bilog Antenna	Antenna Research Associates	LPB 2520A	SSG012299	12/24/2009
Coaxial Cable # 6	Huber & Suhner	106A, Sucoflex	SSG012456	2/9/2010
Spectrum Analyzer	Hewlett Packard	8566B	SSG012521	2/20/2010
Spec. A, RF PreSelector	Hewlett Packard	85685A	SSG012010	2/20/2010
Attenuator	Hewlett Packard	8496B	SSG012363	1/22/2010
Double Ridged Horn	Emco	3115	SSG012298	2/5/2010
Pre-Amplifier	BNR	LNA	SSG012360	2/22/2010
Coaxial Cable # 8	Huber & Suhner	104PEA, Sucoflex	SSG012131	10/31/2009
Coaxial Cable # 14	Huber & Suhner	104PEA, Sucoflex	SSG012041	10/31/2009
Coaxial Cable # 2	Huber & Suhner	106A, Sucoflex	SSG012453	2/9/2010
Spectrum Analyzer Display	Hewlett Packard	85662A	SSG012433	2/20/2010
Coaxial Cable # 27	Huber & Suhner	ST18/Nm/Nm/36, Sucotest	SSG012786	1/23/2010
Quasi-Peak Adapter	Hewlett Packard	85650A	SSG013142	12/12/2009
Horn Antenna (18 - 26.5 GHz)	Emco	3160-09	SSG012292	12/29/2009
Horn Antenna (26.5 - 40 GHz)	Emco	3160-10	SSG012294	12/29/2009
Spectrum Analyzer- portable	HP	8564E	SSG012069	04/13/2010

The measurement instrumentation conforms to ANSI C63.2 [2] and CISPR 16 [4]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5.6 Receiver Spurious Emissions

5.6.1 Test Specification

The system was tested to the limits of the requirements identified in Table 30.

Table 30: Emission Mask Requirement

Requirement	Part / Section
RSS-210	7.3

5.6.1.1 Limits

The following specification levels are worst-case limits taken from all test specifications.

Table 31: Field Strength of Receiver Spurious Emissions Limit

Frequency (MHz)	RSS 210 Table 3 requirement (dBuV/m)
30 – 88	40
88 – 216	43.5
216 – 960	46
960 – 1610	54.0
1610 – 12310	60.0

5.6.2 Test Facility Information

Location: DVC 10-meter AFC

Date tested: October 5 to 14, 2009

Tested by: D. Lalonde, M. Lee, S. Turner, and K. Sivaratnam

5.6.3 Test Procedure

The test was performed as per the relevant Test procedures: ANSI C63.4-2003 [3].

The system was tested in the following manner:

- The EUT was placed on a 80 cm high wooden table which was set on a turntable inside the AFC and it was configured as in normal operation. The cable routed up to a 2 m high wooden rack and then routed down to the basement of the AFC where the EUTs support equipment was installed. The system was grounded in accordance with its normal installation specifications. No additional grounding connections were installed.

- For tests between:
  - 30 MHz and 1 GHz, a broadband bilog antenna was placed at a 3 m distance;
  - 1 GHz and 12.5 GHz, a horn antenna and a LNA were placed at a 3 m distance.
- A pre-scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan (using a peak detector) was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 meters, in steps of 1 meter, and for horizontal and vertical polarizations of the receiving antenna.
- Prescan optimization was performed based on the pre-scan data. All frequencies, having emission levels within 10 dB of the specification(s) limits, were optimized. For each such frequency, the EUT was rotated in azimuth over 360 degrees and the direction of maximum emission was noted. Antenna height was then varied from 1 to 4 meters at this azimuth to obtain maximum emissions. The procedure was repeated for both horizontal and vertical polarizations of the search antenna. Then the maximum level measured was recorded.
- The frequency range investigated was 30 MHz to 40 GHz.
- Between 30 MHz and 1 GHz, a resolution bandwidth of 120 kHz was used.
- Above 1 GHz, a 1 MHz resolution bandwidth and 1 MHz video bandwidth were used.

The measurements were performed while the radio was setup in transmit/receive mode. The panel antenna (23 dBi gain) was used because it is the antenna with the highest gain.

Plots of the 30 MHz to 40 GHz prescan measurements are shown in previous section Field Strength of Spurious Emissions on page 21.

5.6.4 Test Results

See Figure 3 to Figure 8 and Table 24 to Table 28.

All emissions except transmitter related signal meet the receiver spurious emissions limit.

5.6.5 Calculation of the Compliance Margin

The following illustrates the manner in which the compliance margin is calculated in the “E-field Radiated Emissions Test Results” table(s) from section Test Results on page 35.

The rows in these tables are defined as follows:

Meter Reading (dBµV) =	Voltage measured using the spectrum analyzer with quasi-peak adapter
Gain/Loss Factor (dB) =	Cumulative gain or loss of pre-amplifier and cables used in the measurement path (a negative value indicates gain)
Transducer Factor (dB) =	Antenna factor

Level (dBμV/m) =	Corrected value or field strength, i.e., the parameter of interest that is compared to the limit
Margin (dB) =	Level with respect to the appropriate limit (a positive **Margin** indicates that the **Level** is below the limit and that the measurement is a PASS)

The values in the **Level** row are calculated as follows:

Level = Meter Reading + Gain/Loss Factor + Transducer Factor

The values in the **Margin** row are calculated as follows:

Margin = Limit – Level

5.6.6 Test Conclusion

The test results met the requirement.

5.6.7 Test Equipment List

Table 32: Test Equipment used for Field Strength of Spurious Emissions

Description	Make	Model number	Asset ID	Calibr. due
Bilog Antenna	Antenna Research Associates	LPB 2520A	SSG012299	12/24/2009
Coaxial Cable # 6	Huber & Suhner	106A, Sucoflex	SSG012456	2/9/2010
Spectrum Analyzer	Hewlett Packard	8566B	SSG012521	2/20/2010
Spec. A, RF PreSelector	Hewlett Packard	85685A	SSG012010	2/20/2010
Attenuator	Hewlett Packard	8496B	SSG012363	1/22/2010
Double Ridged Horn	Emco	3115	SSG012298	2/5/2010
Pre-Amplifier	BNR	LNA	SSG012360	2/22/2010
Coaxial Cable # 8	Huber & Suhner	104PEA, Sucoflex	SSG012131	10/31/2009
Coaxial Cable # 14	Huber & Suhner	104PEA, Sucoflex	SSG012041	10/31/2009
Coaxial Cable # 2	Huber & Suhner	106A, Sucoflex	SSG012453	2/9/2010
Spectrum Analyzer Display	Hewlett Packard	85662A	SSG012433	2/20/2010
Coaxial Cable # 27	Huber & Suhner	ST18/Nm/Nm/36, Sucotest	SSG012786	1/23/2010
Quasi-Peak Adapter	Hewlett Packard	85650A	SSG013142	12/12/2009

The measurement instrumentation conforms to ANSI C63.2 [2] and CISPR 16 [4]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

6. References

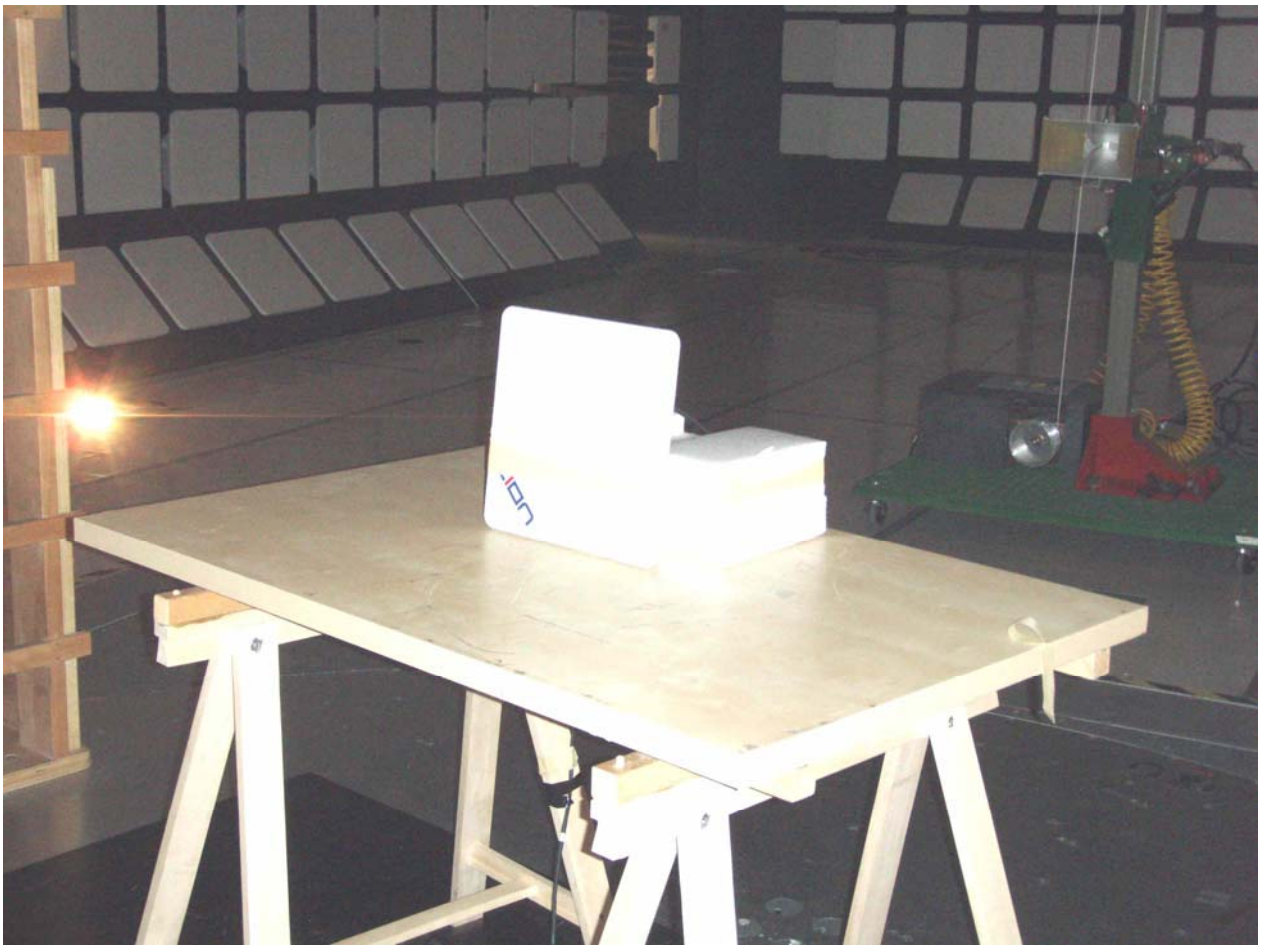
The documents, regulations, and standards that are referenced throughout this document are listed alphabetically as follows.

1. APLAC, Asia Pacific Laboratory Accreditation Cooperation, Website (February 10th, 2004): http://www.aplac.org.
2. ANSI C63.2-1996, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz – Specifications.
3. ANSI C63.4-2003, Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, January 2004.
4. CISPR 16-1-1, Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1: Radio Disturbance and Immunity Measuring Apparatus, Edition 2.2, 2007.
5. DVC Quality Manual, K0000608-QD-QM-01-10, Oct 5, 2007.
6. DVC Lab Operations Manual KG000347-QD-LAB-01-10, April 17, 2008.
7. DVC EMC General Lab Test Procedure, KP000270-LP-EMC-01-14, October 2009.
8. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations), Part 1, U.S. Federal Communications Commission.
9. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations), Part 2, U.S. Federal Communications Commission.
10. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations), Part 15, U.S. Federal Communications Commission.
11. ILAC, International Laboratory Accreditation Cooperation, Website (February 10th, 2004): http://www.ilac.org/
12. Industry Canada, RSS 212, Test Facilities and Test Methods for Radio Equipment, Issue 1 (Provisional), February 27, 1999.
13. NAMAS Publication NIS 81: “The Treatment of Uncertainty in EMC Measurements”, Edition 1, May 1994.
14. RSS-210, Issue 7, “Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)”, June 2007.
15. Standards Council of Canada Scope of Accreditation Letter SCC 1003-15/163 dated 2002-12-16 (Scope of accreditation is effective until 2005-10-05 and includes FCC Part 15 and ICES-003). This scope of accreditation is outlined at the following web site http://palcan.scc.ca/specs/pdf/95_e.pdf

7. Appendices

7.1 Appendix A: Test Setup Photographs

Figure 9: Setup for Radiated Emissions



7.2 Appendix B: Plots of Tx Power

This appendix presents all transmitter plots for the test cases measured.

Figure 10: Tx Power, low channel

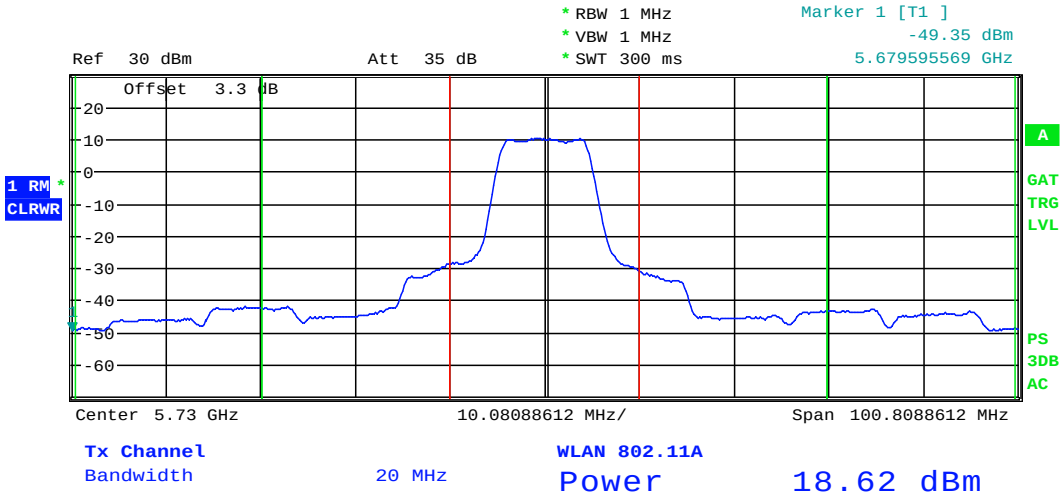


Figure 11: Tx Power, middle channel

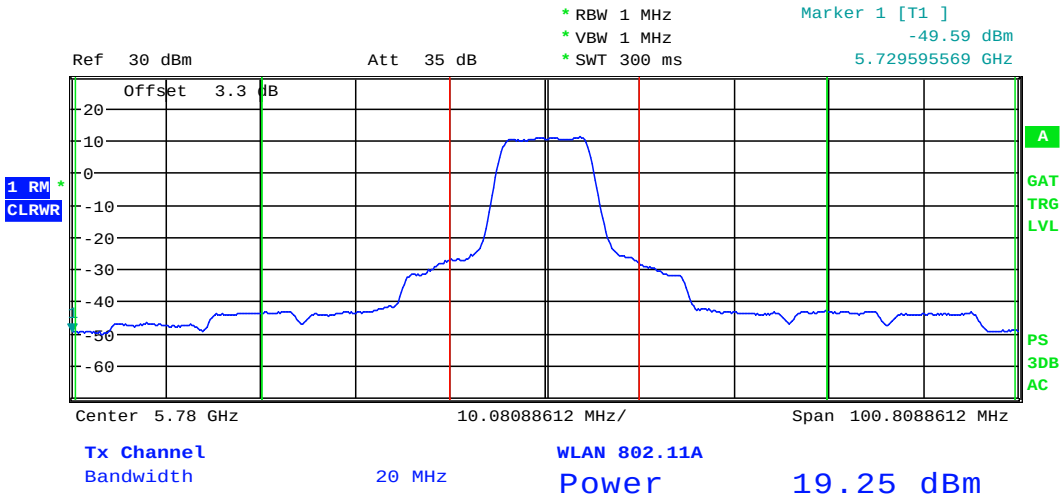
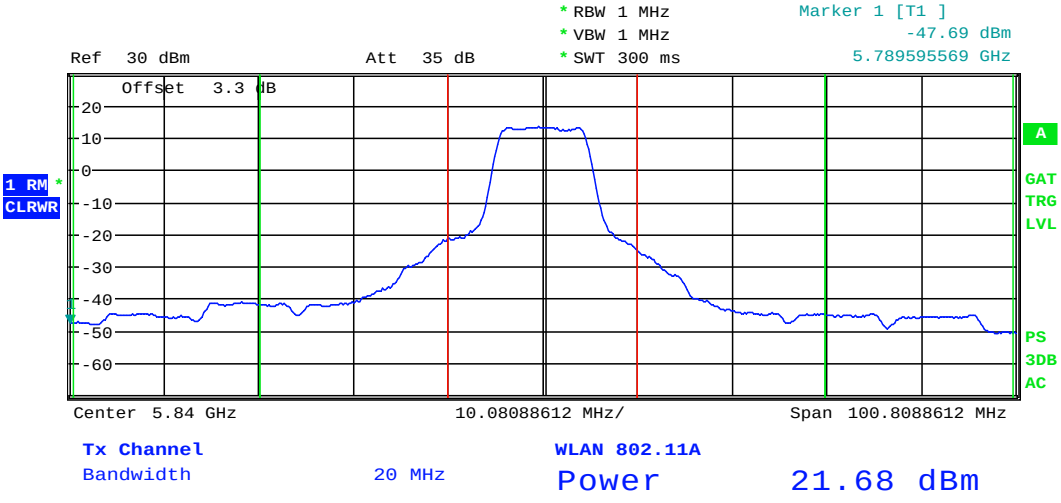


Figure 12: Tx Power, high channel



7.3 Appendix C: Plots of 6 dB Bandwidth

This appendix presents all occupied bandwidth plots for the test cases measured.

Figure 13: 6 dB Occupied Bandwidth, low channel

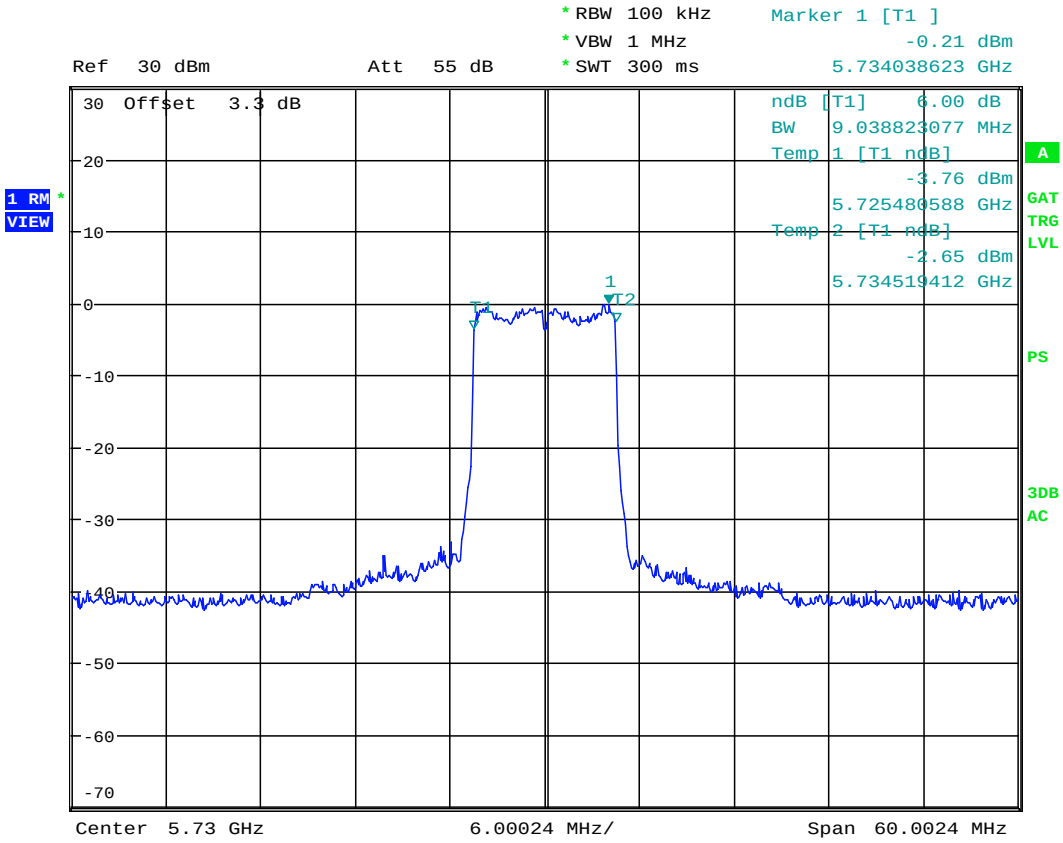
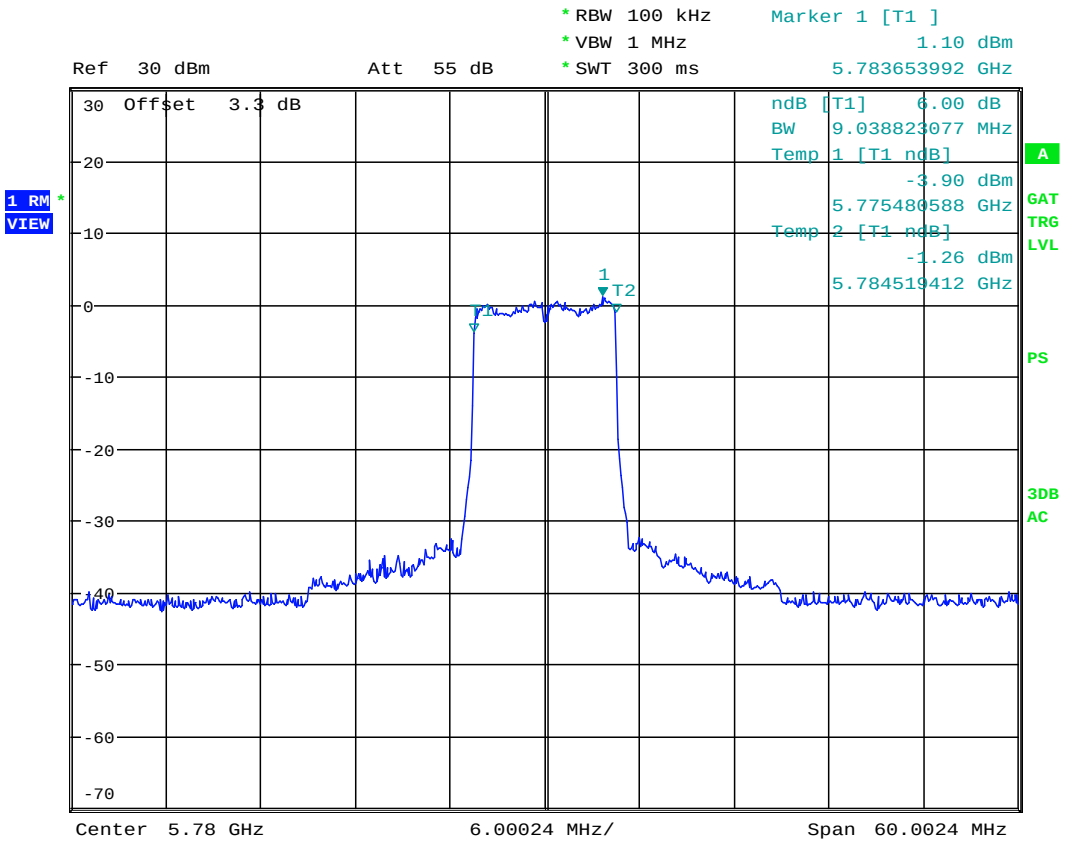
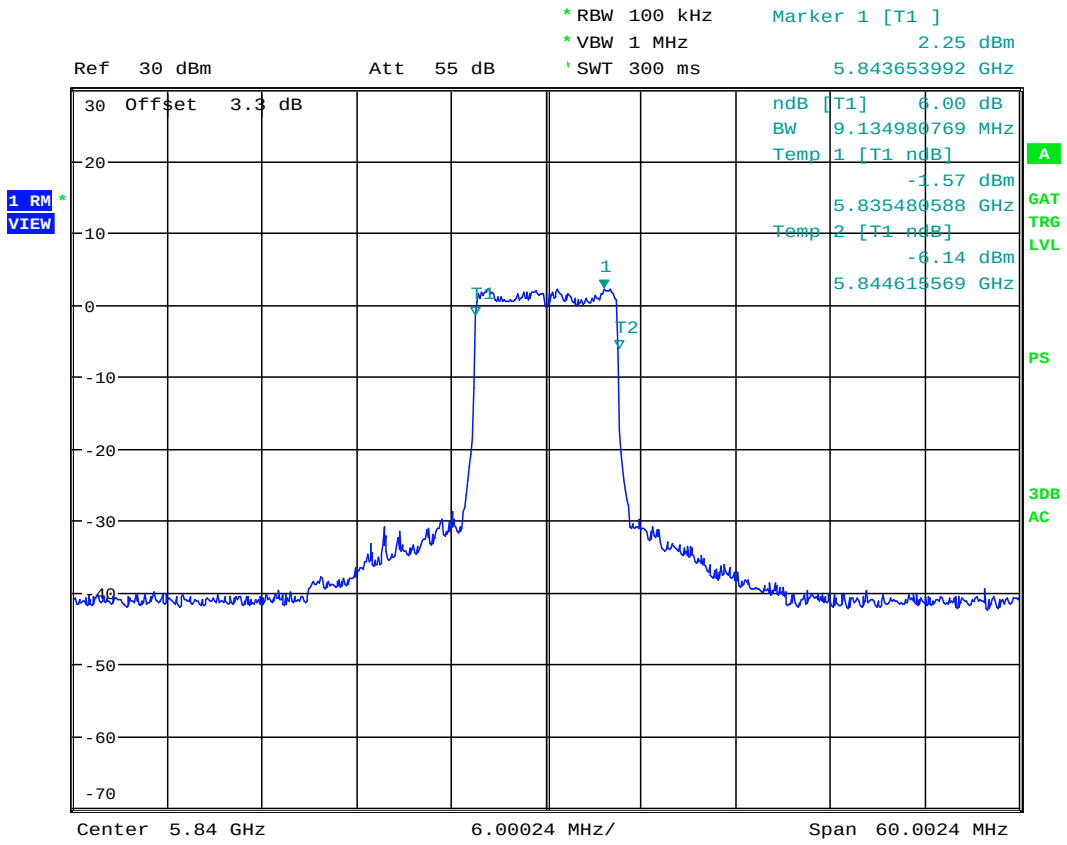


Figure 14: 6 dB Occupied Bandwidth, middle channel



Date: 14.OCT.2009 16:16:58

Figure 15: 6 dB Occupied Bandwidth, high channel

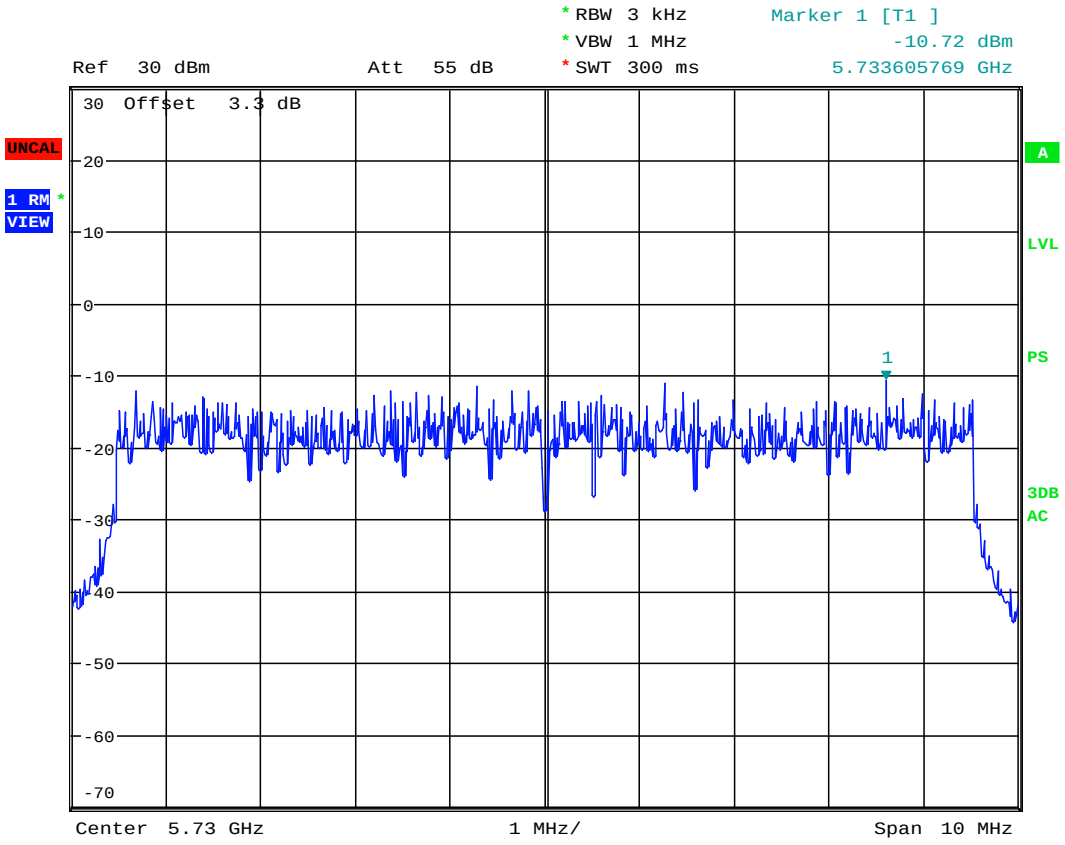


Date: 14.OCT.2009 15:40:44

7.4 Appendix D: Plots of Peak Power Spectral Density

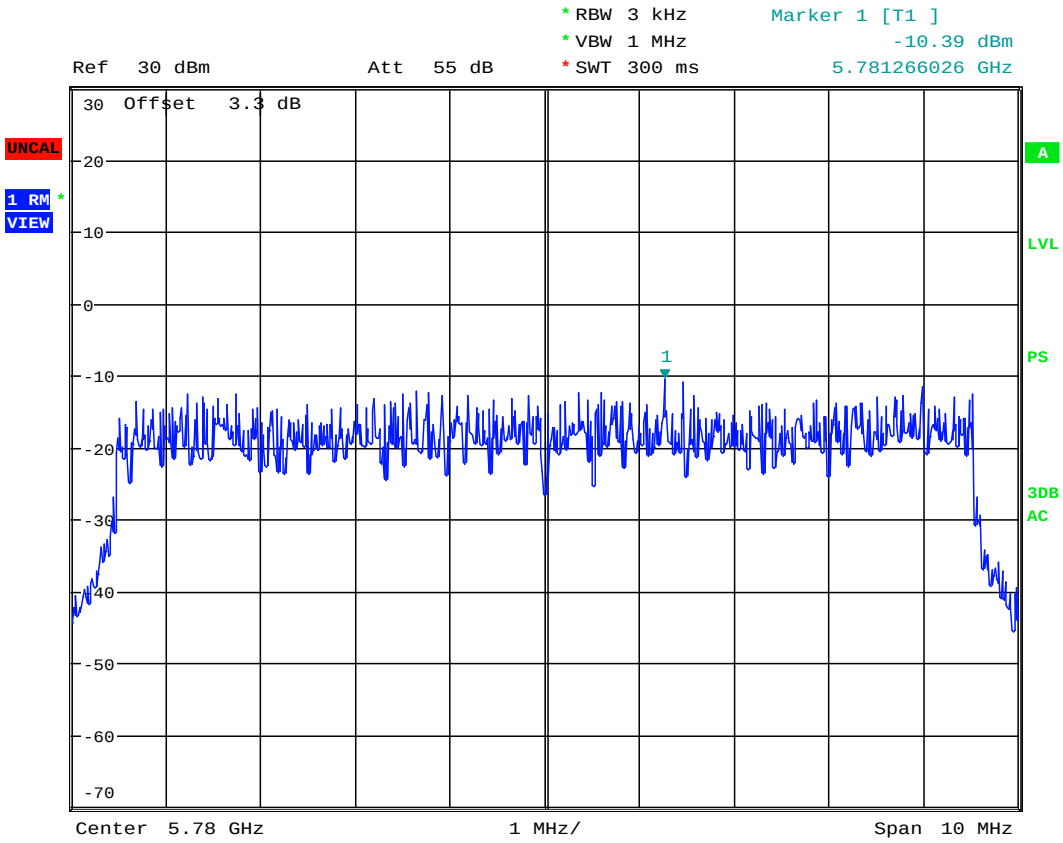
This appendix presents all peak power spectral density plots for the test cases measured.

Figure 16: PSD, low channel



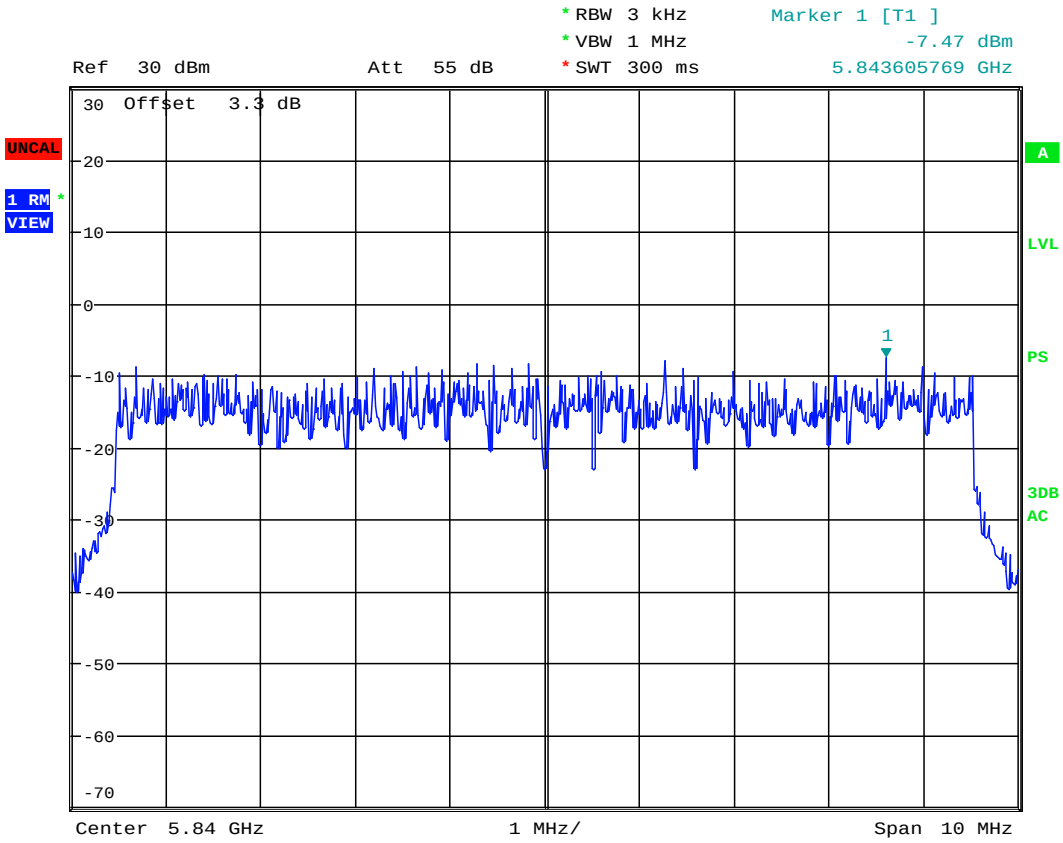
Date: 14.OCT.2009 16:03:22

Figure 17: PSD, middle channel



Date: 14.OCT.2009 16:18:10

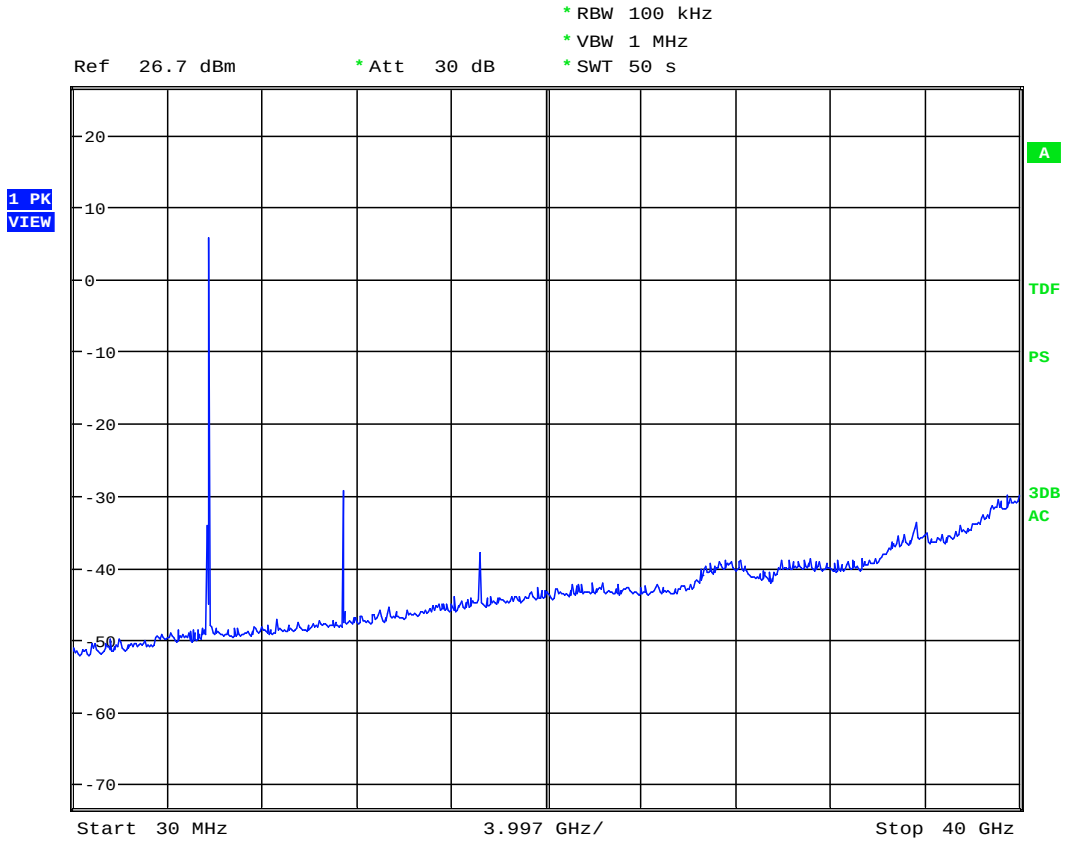
Figure 18: PSD, high channel



Date: 14.OCT.2009 15:50:45

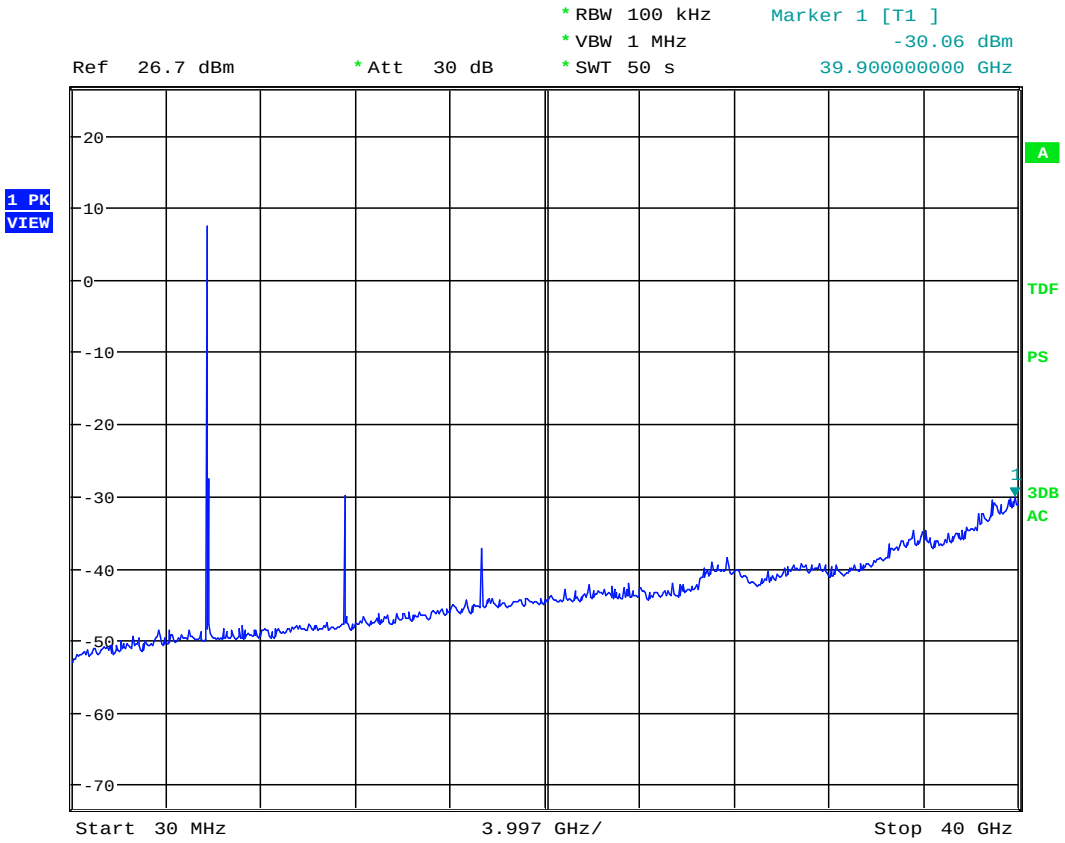
7.5 Appendix E: Plots of Conducted Spurious Emissions

Figure 19: Conducted Spurious Emissions Between 30 MHz and 40 GHz, low channel



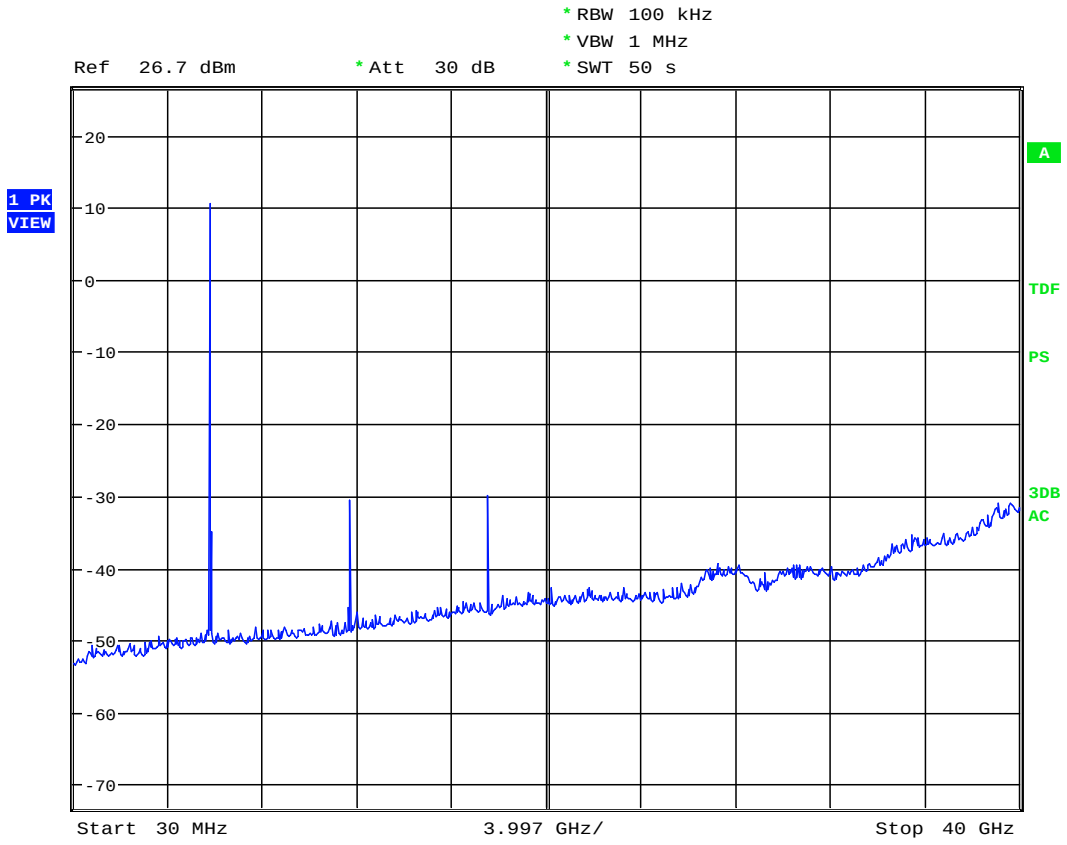
Date: 14.OCT.2009 16:52:12

Figure 20: Conducted Spurious Emissions at Between 30 MHz and 40 GHz, middle channel



Date: 14.OCT.2009 16:40:56

Figure 21: Conducted Spurious Emissions Between 30 MHz and 40 GHz, high channel



Date: 14.OCT.2009 16:59:35

7.6 Appendix F: Abbreviations

Included below are abbreviations of terms used in this document.

Term	Definition
AC	Alternating Current
AFC	Ambient Free Chamber
AM	Amplitude modulation
ANSI	American National Standards Institute
AVG	Average detector
CISPR	Comité International Spécial Perturbation Radioélectrique (International Special Committee on Radio Interference)
Class A	Class A Limits for typical commercial establishments
Class B	Class B Limits for typical domestic and residential establishments
dB	Decibel
DVC	Design Validation Centre
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Normative
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
GND	Ground
IC	Industry Canada
PA	Broadband Power Amplifier
RBW	Resolution Bandwidth
RF	Radio-Frequency
RFI	Radio-Frequency Interference
SCC	Standards Council of Canada

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