

Nemko Test Report: 128858-1TRFWL

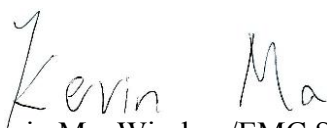
Applicant: BelAir Networks Inc.
603 March Road,
Ottawa, ON
K2K 2M5 Canada

Apparatus: ERM5

FCC ID: RAR20051001

In Accordance With: FCC Part 15 Subpart C, 15.247
FHSS System and Digitally Modulated Radiators
902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

Authorized By:


Kevin Ma, Wireless/EMC Specialist

Date: November 12, 2009

Total Number of Pages: 26

TABLE OF CONTENTS

Section 1 : Report Summary	3
Section 2 : Equipment Under Test.....	4
2.1 Identification of Equipment Under Test (EUT).....	4
2.2 Accessories	4
2.3 EUT Description.....	4
2.4 Technical Specifications of the EUT	5
2.5 EUT Setup diagram	5
2.6 Operation of the EUT during testing	6
2.7 Modifications incorporated in the EUT	6
Section 3 : Test Conditions.....	7
3.1 Specifications	7
3.2 Deviations From Laboratory Test Procedures	7
3.3 Test Environment	7
3.4 Measurement Uncertainty.....	7
3.5 Test Equipment.....	8
Section 4 : Results Summary	9
4.1 FCC Part 15 Subpart C : Test Results	9
Appendix A : Test Results.....	10
Clause 15.207(a) Powerline Conducted Emissions	10
Clause 15.209(a) Radiated Emissions within Restricted Bands	12
Clause 15.247(a)(2) 6 dB bandwidth for systems using digital modulation techniques	14
Clause 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.....	15
Clause 15.247(b)(4) Maximum peak output power	15
Clause 15.247(c)(1) Fixed point-to-point Operation with directional antenna gains greater than 6 dBi	15
Clause 15.247(d) Conducted Spurious Emissions	19
Clause 15.247(e) Power Spectral Density for Digitally Modulated Devices	22
Appendix B : Setup Photographs	25
Appendix C : Block Diagram of Test Setups.....	26

Section 1 : Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.

The assessment summary is as follows:

Apparatus Assessed:	ERM5
Specification:	FCC Part 15 Subpart C, 15.247
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release
Test Location:	Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2
Registration Number:	176392 (3 m Semi-Anechoic Chamber)
Tests Performed By:	Andrey Adelberg, Senior Wireless/EMC Specialist
Test Dates:	June–July 2009

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.

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Section 2 : Equipment Under Test

2.1 Identification of Equipment Under Test (EUT)

The following information identifies the EUT under test:

Type of Equipment:	Enhanced Radio Module
Brand Name:	BelAir
Model Name or Number:	ERM5
Serial Number:	K002360442
Nemko Sample Number:	1
FCC ID:	RAR20051001
Date of Receipt:	June 10, 2009

2.2 Accessories

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

Description:	Host Unit
Brand Name:	BelAir
Model Name or Number:	BelAir100T
Serial Number:	BELAF2398
Nemko Sample Number:	1
Connection Port:	PCI connection

Description:	Ethernet Hub
Brand Name:	Airlink
Model Name or Number:	ASW105/A4
Serial Number:	0526A4A20149
Nemko Sample Number:	2
Connection Port:	Ethernet

Description:	Laptop
Brand Name:	Toshiba
Model Name or Number:	Satellite A10 PSA10C-00REH
Serial Number:	63042093J
Nemko Sample Number:	3
Connection Port:	Ethernet connection through Ethernet Hub

2.3 EUT Description

The EUT is a WiFi module designed to operate in the 5.725–5.850 GHz band.

2.4 Technical Specifications of the EUT

Operating Band: 5725–5850 MHz

Operating Frequency: 5740–5835 MHz (for 20 MHz channel)
5750–5835 MHz (for 40 MHz channel)

Modulation: OFDM

Occupied Bandwidth: 20 and 40 MHz

Emission Designator: W7D

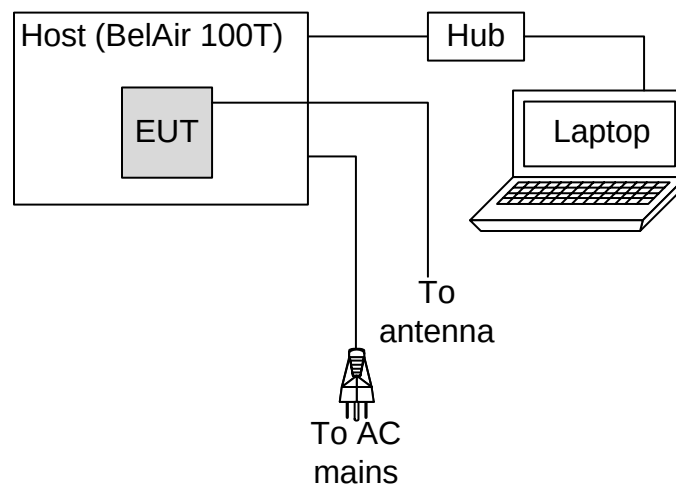
Antenna Data:

1. 10 dBi, Maxrad, MHO515010NM, N-Male
2. 10 dBi, MTI, MT-462008/N/A, SN 00004
3. 15 dBi, Maxrad, Panel Antenna, WISP4959018MBV
4. 19 dBi, MTI, MT-485001
5. 23 dBi, Huber&Suhner, SPA 5600/9/23/0/V, SN 04375
6. 15 dBi, BelAir, BAM Antenna BEL10008-A01
7. 10.5 dBi, BelAir, B1BB025AA-A01
8. 22.5 dBi, MTI, MT-485028/N
9. 29 dBi, Maxrad, Dish, MPRC2449

Antennas 1–3 are point-to-multipoint, the rest are point-to-point.

Power Supply Requirements: 120VAC, 60 Hz

2.5 EUT Setup diagram





Nemko Canada Inc.

SECTION 2 : EQUIPMENT UNDER TEST

Report Number: 128858-1TRFWL

Specification: FCC Part 15 Subpart C, 15.247

2.6 Operation of the EUT during testing

The EUT was controlled to transmit at desired frequency from laptop.

2.7 Modifications incorporated in the EUT

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

Section 3 : Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

FHSS System and Digitally Modulated Radiators

902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

3.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15–30 °C
Humidity range	:	20–75 %
Pressure range	:	86–106 kPa
Power supply range	:	±5 % of rated voltages

3.4 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.

3.5 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Cal. Date	Next Cal.
3 m EMI Test Chamber	TDK	SAC-3	FA002047	May 06/09	May 06/10
Bilog	Sunol	JB3	FA002108	Jan. 27/09	Jan. 27/10
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR	NCR
Controller	Sunol	SC104V	FA002060	NCR	NCR
Mast	Sunol	TLT2	FA002061	NCR	NCR
International Power Supply	California Inst.	3001i	FA001021	Jan. 13/09	Jan. 13/10
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 16/08	Dec. 16/09
Horn Antenna #2	EMCO	3115	FA000825	Jan. 21/09	Jan. 21/10
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 2/08	Oct 2/09
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 40	FA002071	Nov. 25/08	Nov. 25/09
Horn 18 – 26.5 GHz	Electro-Metrics	SH-50/60-1	FA000479	COU	COU
Horn 26.5 – 40 GHz	Electro-Metrics	SH-50/60-2	FA000485	COU	COU
18.0 – 26.0 GHz Amplifier	NARDA	BBS-1826N612	FA001550	COU	COU
26 – 40.0 GHz Amplifier	NARDA	DBL-2640N610	FA001556	COU	COU
Frequency Counter	HP	5352B	FA001915	Jan 08/09	Jan 08/10
Temperature Chamber	Thermotron	SM-16C	FA001030	NCR	NCR
Multimeter	Fluke	16	FA001831	Jan 13/09	Jan 13/10
Air probe	Fluke	None	FA001248	NCR	NCR
Attenuator	Narda	776B-20	FA001153	COU	COU

COU – Calibrate on Use

NCR – No Calibration Required

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C : 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)

4.1 FCC Part 15 Subpart C : Test Results

Part 15	Test Description	Required	Result
15.31(e)	Variation of power supply	Y	PASS
15.207(a)	Powerline Conducted Emissions	Y	PASS
15.209(a)	Radiated Emissions within Restricted Bands	Y	PASS
15.247(a)(1)	Frequency hopping systems	N	
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)	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	Y	PASS
15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	N	
15.247(d)	Conducted Spurious Emissions	Y	PASS
15.247(e)	Power Spectral Density for Digitally Modulated Devices	Y	PASS
15.247(f)	Time of Occupancy for Hybrid Systems	N	

Appendix A : Test Results

Clause 15.207(a) Powerline Conducted Emissions

Frequency of Conducted limit (dB μ V)

Emission (MHz)	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 Results: Pass

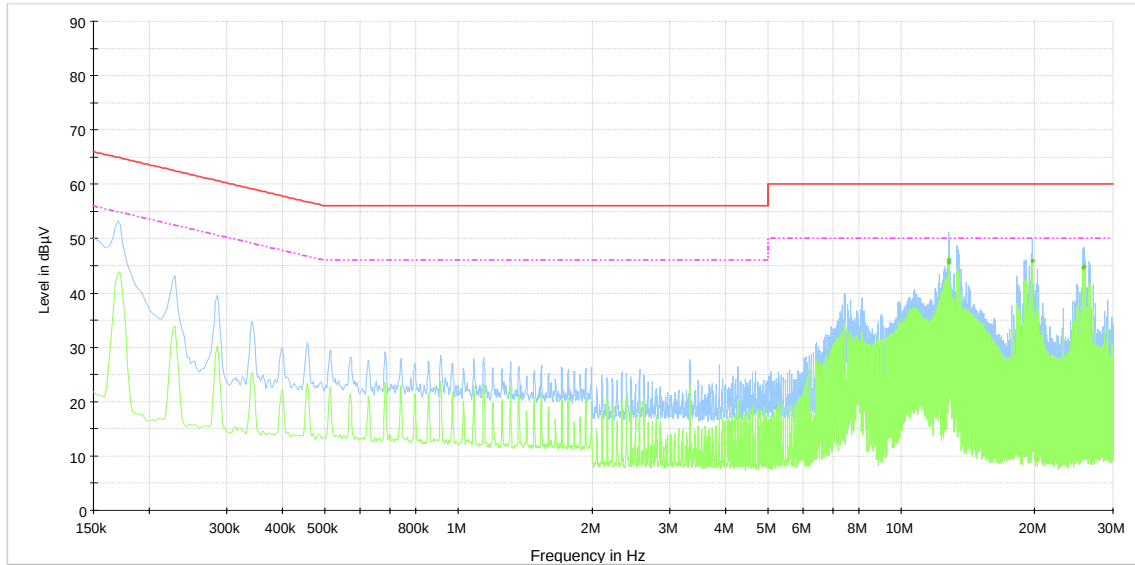
Additional Observations:

All plots were obtained using a sweeping receiver with an IF of 9 kHz using a Quasi-Peak and Average detector. The plots have been corrected with the cable loss and LISN loss to show compliance.

Frequency MHz	Average dB μ V	Meas. Time ms	Bandwidth kHz	Filter	Line	Corr. dB	Margin dB	Limit dB μ V
12.747250	45.6	100.0	9.000	On	Phase	10.5	4.4	50.0
12.808000	46.2	100.0	9.000	On	Phase	10.5	3.8	50.0
19.708750	45.9	100.0	9.000	On	Phase	10.7	4.1	50.0
25.693750	44.7	100.0	9.000	On	Phase	10.9	5.3	50.0
25.876000	44.8	100.0	9.000	On	Phase	10.9	5.2	50.0

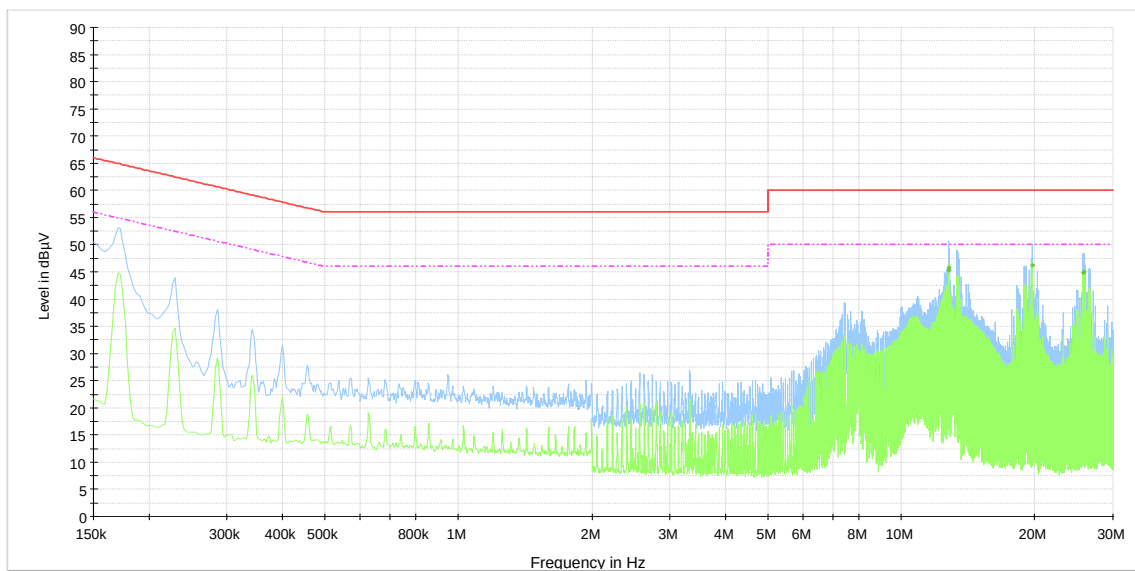
Frequency MHz	Average dB μ V	Meas. Time ms	Bandwidth kHz	Filter	Line	Corr. dB	Margin dB	Limit dB μ V
12.747250	45.3	100.0	9.000	On	Neutral	10.5	4.7	50.0
12.808000	45.8	100.0	9.000	On	Neutral	10.5	4.2	50.0
19.708750	46.2	100.0	9.000	On	Neutral	10.8	3.8	50.0
25.693750	44.8	100.0	9.000	On	Neutral	11.1	5.2	50.0
25.876000	45.0	100.0	9.000	On	Neutral	11.1	5.0	50.0

Phase:



Conducted Emissions on Phase Line
 — CISPR 22 Mains QP Class B.LimitLine
 - - - CISPR 22 Mains AV Class B.LimitLine
 — Preview Peak Result
 — Preview Average Result
 ♦ Final Average Result

Neutral:



Conducted Emissions on Neutral
 — CISPR 22 Mains QP Class B.LimitLine
 - - - CISPR 22 Mains AV Class B.LimitLine
 — Preview Peak Result
 — Preview Average Result
 ♦ Final Average Result

Clause 15.209(a) Radiated Emissions within Restricted Bands

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength		Measurement Distance (meters)
	(μ V/m)	(dB μ V/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

Note: F = fundamental frequency in kHz

Test Results: Pass

Additional Observations:

The Spectrum was searched from 30 MHz to the 40 GHz.

These results apply to emissions found in the Restricted bands defined in FCC Part 15 Subpart C, 15.205.

Peak Detector with 100 kHz/300 kHz RBW/VBW was used for measurements below 1 GHz and 1 MHz/3 MHz RBW/VBW for frequencies above 1 GHz. Since EUT has 100 % duty cycle average measurements were performed at the frequencies above 1 GHz with 1 MHz/10 Hz RBW/VBW spectrum analyzer settings.

The EUT was scanned with scanned with all modulation bandwidths. The highest gain antenna of each type was chosen for the test. Only the worst case of data is provided.

The EUT can have one of the following antennae:

Antenna Type	Antenna Gain, dBi	Antenna #	Antenna Info
Omni directional Rod	10	1	Maxrad, MHO515010NM
		2	MTI, MT-462008/N/A
90 degrees Sectional	15	3	Maxrad, Panel Antenna, WISP4959018MBV
Flat	23	4	Huber&Suhner, SPA 5600/9/23/0/V
	22.5	5	MTI, MT-485028/N
	19	6	MTI, MT-485001
Patch	10.5	7	BelAir, B1BB025AA-A01
	15	8	BelAir, BAM Antenna BEL10008-A0
Dish parabolic	29	9	Maxrad, Dish, MPRC2449

The highest gain antenna of each type was chosen for the test.

Antenna	Frequency, MHz	FS Peak, dB μ V/m	FS Peak Limit, dB μ V/m	Margin, dB	FS Avg, dB μ V/m	FS Avg Limit, dB μ V/m	Margin, dB
Flat 23 dBi (4)	11480	65.87	74.00	8.13	50.87	54.00	3.13
	11580	62.88	74.00	11.12	49.73	54.00	4.27
	11670	64.69	74.00	9.31	50.13	54.00	3.87
Omni 10 dBi (1)	11480	64.91	74.00	9.09	51.40	54.00	2.60
	11580	63.39	74.00	10.61	48.56	54.00	5.44
	11670	62.44	74.00	11.56	48.29	54.00	5.71
90 deg Sector 15 dBi (3)	11480	63.46	74.00	10.54	49.73	54.00	4.27
	11580	63.25	74.00	10.75	48.61	54.00	5.39
	11670	61.59	74.00	12.41	47.60	54.00	6.40
Patch 15 dBi (8)	11480	64.80	74.00	9.20	49.56	54.00	4.44
	11580	62.65	74.00	11.35	48.69	54.00	5.31
	11670	60.11	74.00	13.89	45.81	54.00	8.19
Dish 29 dBi (9)	11480	69.87	74.00	4.13	53.10	54.00	0.90
	11580	70.14	74.00	3.86	53.44	54.00	0.56
	11670	67.77	74.00	6.23	52.34	54.00	1.66

Note: Field Strength (FS) result includes antenna factor, cable losses and amplifier gain where applicable.
Number in parentheses indicates the antenna number from the table above.

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

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 Results: Pass

6 dB Bandwidth:

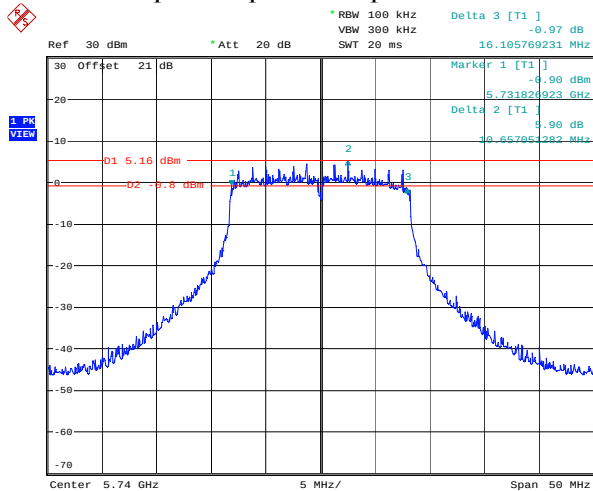
For 20 MHz channel

Frequency, MHz	6 dB BW, MHz	Limit, MHz	Margin, MHz
5740	16.11	0.5	15.61
5790	15.71	0.5	15.21
5835	16.11	0.5	15.61

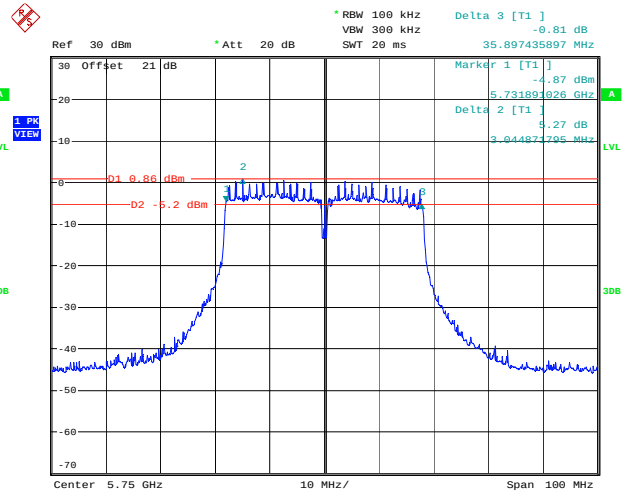
For 40 MHz channel

Frequency, MHz	6 dB BW, MHz	Limit, MHz	Margin, MHz
5750	35.89	0.5	35.39
5790	36.12	0.5	35.62
5825	36.22	0.5	35.72

6 dB BW Spectral plots samples:



Date: 3.JUL.2009 15:05:38



Date: 3.JUL.2009 15:58:31

Clause 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

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 signalling 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.

Clause 15.247(b)(4) Maximum peak output power

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.

Clause 15.247(c)(1) Fixed point-to-point Operation with directional antenna gains greater than 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 conducted 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 conducted output power.
- (iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(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 or digitally modulated 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 Results: Pass

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.

The output RF power was measured on the antenna port by means of a spectrum analyzer and following the 'Power Output Option 2, Method 3' procedure from the FCC guidelines for Measurement of Digital Transmission Systems operating under Section 15.247 (since the maximum resolution bandwidth of a spectrum analyser is less than 40 MHz channel).

Output power for 20 MHz channel:

Omni-directional antennas.

Freq. (MHz)	G _{ANT} (dBi)	Antenna number	Cable loss (dB)	G _{ANT+CABLE} (dBi)	SW power setting	PTX Cond. (mW)	PTX Cond. (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
5740	10	1, 2	1	9	36	123.911	20.93	27.00	6.07	29.93	36.00	6.07
5790	10	1, 2	1	9	40	148.257	21.71	27.00	5.29	30.71	36.00	5.29
5835	10	1, 2	1	9	40	166.119	22.20	27.00	4.80	31.20	36.00	4.80
5740	15	3	1	14	38	148.063	21.70	22.00	0.30	35.70	36.00	0.30
5790	15	3	1	14	40	148.257	21.71	22.00	0.29	35.71	36.00	0.29
5835	15	3	1	14	39	145.922	21.64	22.00	0.36	35.64	36.00	0.36

Peak Output power limit = 30 dBm – (antenna gain – 6 dBi) [for antennas greater than 6 dBi]

Note: antenna gain considered as a combination of the actual antenna gain with the cable.

Output power for 20 MHz channel:

Directional antennas.

Freq. (MHz)	G _{ANT} (dBi)	Antenna number	Cable loss (dB)	G _{ANT+CABLE} (dBi)	SW power setting	PTX Cond. (mW)	PTX Cond. (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
5740	19	6	1	18	40	185.264	22.68	30.00	7.32	40.68	p-t-p	N/A
5790	19	6	1	18	40	148.257	21.71	30.00	8.29	39.71	p-t-p	N/A
5835	19	6	1	18	40	166.119	22.20	30.00	7.80	40.20	p-t-p	N/A
5740	22.5	5	1	21.5	40	185.264	22.68	30.00	7.32	44.18	p-t-p	N/A
5790	22.5	5	1	21.5	40	148.257	21.71	30.00	8.29	43.21	p-t-p	N/A
5835	22.5	5	1	21.5	40	166.119	22.20	30.00	7.80	43.70	p-t-p	N/A
5740	23	4	1	22	40	185.264	22.68	30.00	7.32	44.68	p-t-p	N/A
5790	23	4	1	22	40	148.257	21.71	30.00	8.29	43.71	p-t-p	N/A
5835	23	4	1	22	40	166.119	22.20	30.00	7.80	44.20	p-t-p	N/A
5740	10.5	7	1	9.5	40	185.264	22.68	30.00	7.32	32.18	p-t-p	N/A
5790	10.5	7	1	9.5	40	148.257	21.71	30.00	8.29	31.21	p-t-p	N/A
5835	10.5	7	1	9.5	40	166.119	22.20	30.00	7.80	31.70	p-t-p	N/A
5740	15	8	1	14	40	185.264	22.68	30.00	7.32	36.68	p-t-p	N/A
5790	15	8	1	14	40	148.257	21.71	30.00	8.29	35.71	p-t-p	N/A
5835	15	8	1	14	40	166.119	22.20	30.00	7.80	36.20	p-t-p	N/A
5740	29	9	1	28	33	82.523	19.17	30.00	10.83	47.17	p-t-p	N/A
5790	29	9	1	28	34	84.574	19.27	30.00	10.73	47.27	p-t-p	N/A
5835	29	9	1	28	40	166.119	22.20	30.00	7.80	50.20	p-t-p	N/A

Note: antenna gain considered as a combination of the actual antenna gain with the cable.

Antenna Type	Antenna Gain, dBi	Antenna number	Antenna Info
Omni directional Rod	10	1	Maxrad, MHO515010NM
		2	MTI, MT-462008/N/A
90 degrees Sectional	15	3	Maxrad, Panel Antenna, WISP4959018MBV
Flat	23	4	Huber&Suhner, SPA 5600/9/23/0/V
	22.5	5	MTI, MT-485028/N
	19	6	MTI, MT-485001
Patch	10.5	7	BelAir, B1BB025AA-A01
	15	8	BelAir, BAM Antenna BEL10008-A0
Dish parabolic	29	9	Maxrad, Dish, MPRC2449

Only Omni-Directional Rod and 90 degrees Sectional antennas (1, 2 and 3) are point-to-multipoint antennas. The rest of antennas are directional or point-to point antennas.

Output power for 40 MHz channel:

Omni-directional antennas.

Freq. (MHz)	G _{ANT} (dBi)	Antenna number	Cable loss (dB)	G _{ANT+CABLE} (dBi)	SW power setting	PTX Cond. (mW)	PTX Cond. (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
5750	10	1, 2	1	9	37	90.620	19.57	27.00	7.43	28.57	36.00	7.43
5790	10	1, 2	1	9	40	100.393	20.02	27.00	6.98	29.02	36.00	6.98
5825	10	1, 2	1	9	40	115.523	20.63	27.00	6.37	29.63	36.00	6.37
5750	15	3	1	14	40	121.330	20.84	22.00	1.16	34.84	36.00	1.16
5790	15	3	1	14	40	100.393	20.02	22.00	1.98	34.02	36.00	1.98
5825	15	3	1	14	40	115.523	20.63	22.00	1.37	34.63	36.00	1.37

Peak Output power limit = 30 dBm – (antenna gain – 6 dBi) [for antennas greater than 6 dBi]

Note: antenna gain considered as a combination of the actual antenna gain with the cable.

Output power for 40 MHz channel:

Directional antennas.

Freq. (MHz)	G _{ANT} (dBi)	Antenna number	Cable loss (dB)	G _{ANT+CABLE} (dBi)	SW power setting	PTX Cond. (mW)	PTX Cond. (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
5750	19	6	1	18	40	121.330	20.84	30.00	9.16	38.84	p-t-p	N/A
5790	19	6	1	18	40	100.393	20.02	30.00	9.98	38.02	p-t-p	N/A
5825	19	6	1	18	40	115.523	20.63	30.00	9.37	38.63	p-t-p	N/A
5750	22.5	5	1	21.5	40	121.330	20.84	30.00	9.16	42.34	p-t-p	N/A
5790	22.5	5	1	21.5	40	100.393	20.02	30.00	9.98	41.52	p-t-p	N/A
5825	22.5	5	1	21.5	40	115.523	20.63	30.00	9.37	42.13	p-t-p	N/A
5750	23	4	1	22	40	121.330	20.84	30.00	9.16	42.84	p-t-p	N/A
5790	23	4	1	22	40	100.393	20.02	30.00	9.98	42.02	p-t-p	N/A
5825	23	4	1	22	40	115.523	20.63	30.00	9.37	42.63	p-t-p	N/A
5750	10.5	7	1	9.5	40	121.330	20.84	30.00	9.16	30.34	p-t-p	N/A
5790	10.5	7	1	9.5	40	100.393	20.02	30.00	9.98	29.52	p-t-p	N/A
5825	10.5	7	1	9.5	40	115.523	20.63	30.00	9.37	30.13	p-t-p	N/A
5750	15	8	1	14	40	121.330	20.84	30.00	9.16	34.84	p-t-p	N/A
5790	15	8	1	14	40	100.393	20.02	30.00	9.98	34.02	p-t-p	N/A
5825	15	8	1	14	40	115.523	20.63	30.00	9.37	34.63	p-t-p	N/A
5750	29	9	1	28	40	121.330	20.84	30.00	9.16	48.84	p-t-p	N/A
5790	29	9	1	28	40	100.393	20.02	30.00	9.98	48.02	p-t-p	N/A
5825	29	9	1	28	40	115.523	20.63	30.00	9.37	48.63	p-t-p	N/A

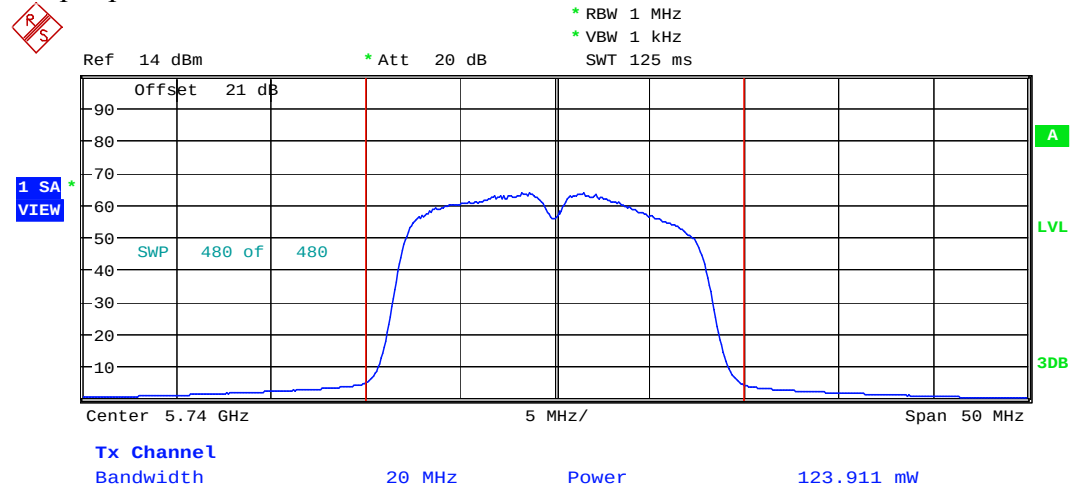
Note: antenna gain considered as a combination of the actual antenna gain with the cable.

Antenna Type	Antenna Gain, dBi	Antenna number	Antenna Info
Omni directional Rod	10	1	Maxrad, MHO515010NM
		2	MTI, MT-462008/N/A
90 degrees Sectional	15	3	Maxrad, Panel Antenna, WISP4959018MBV
Flat	23	4	Huber&Suhner, SPA 5600/9/23/0/V
	22.5	5	MTI, MT-485028/N
	19	6	MTI, MT-485001
Patch	10.5	7	BelAir, B1BB025AA-A01
	15	8	BelAir, BAM Antenna BEL10008-A0
Dish parabolic	29	9	Maxrad, Dish, MPRC2449

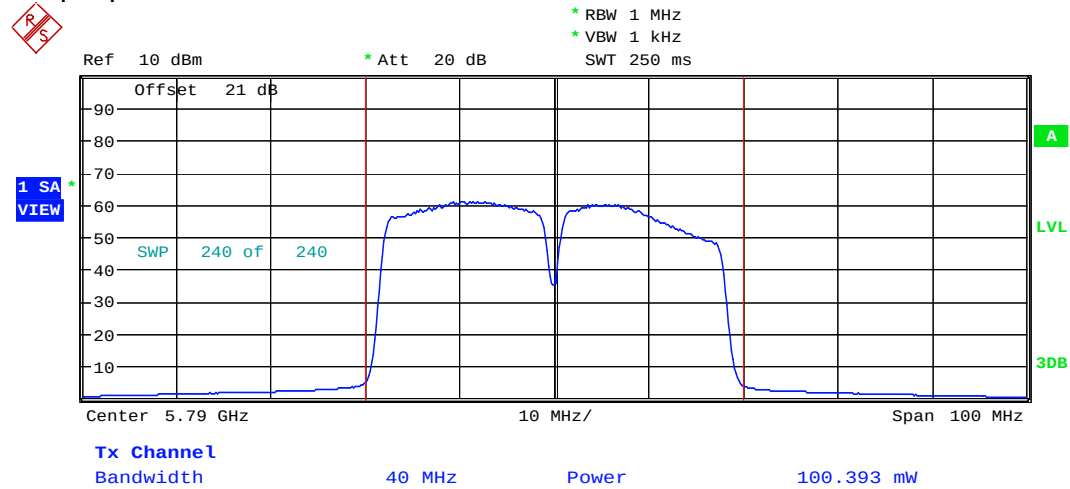
Only *Omni-Directional Rod* and *90 degrees Sectional* antennas (1, 2 and 3) are point-to-multipoint antennas. The rest of antennas are directional or point-to point antennas.

Output power sample spectral plots:

Output power for 20 MHz channel:



Output power for 40 MHz channel:



Clause 15.247(d) Conducted 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)).

Test Results:

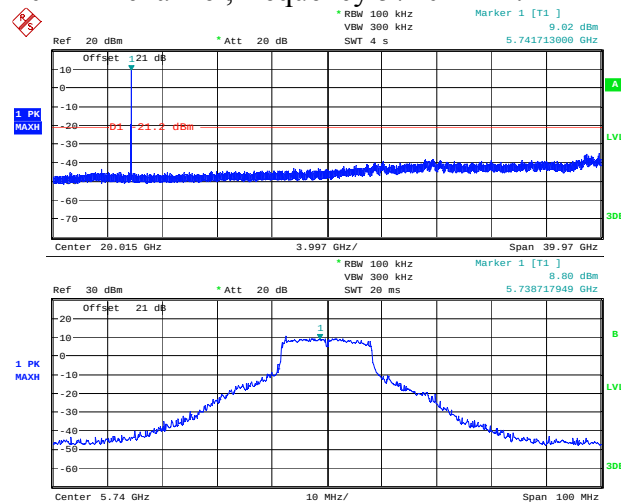
Pass

The Spectrum was searched from 30 MHz to 40 GHz.

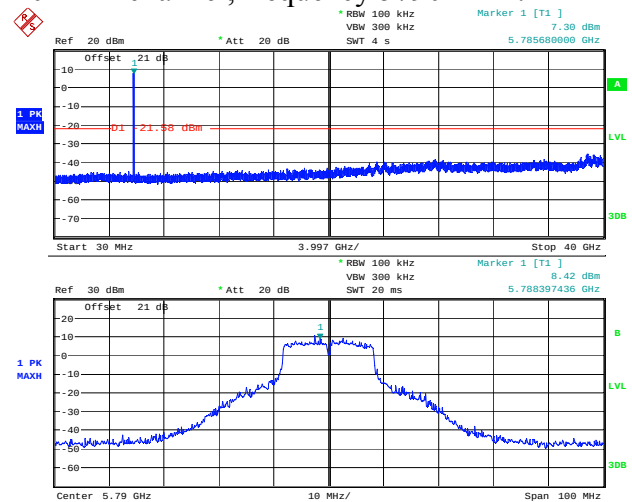
All measurements for spurious emissions were performed conducted using a Spectrum analyzer with Peak Detector with 100 kHz/300 kHz RBW/VBW.

'Power Output Option 2, Method 3' procedure from the FCC guidelines for Measurement of Digital Transmission Systems operating under Section 15.247 was used for power measurements, therefore the attenuation of 30 dB down from the highest emission level within the authorized band was used instead of 20 dB.

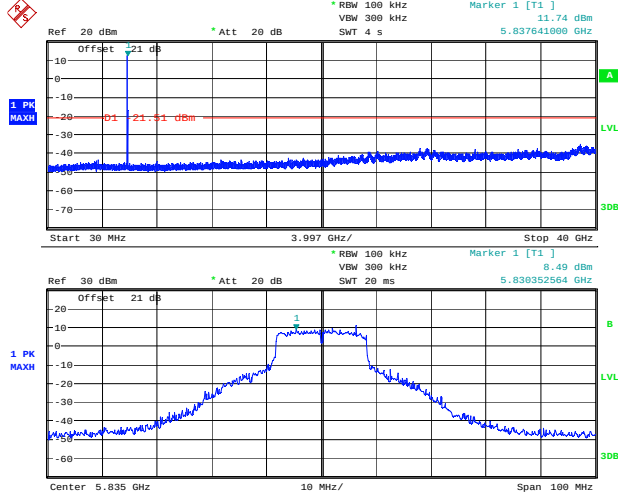
20 MHz channel, frequency 5740 MHz:



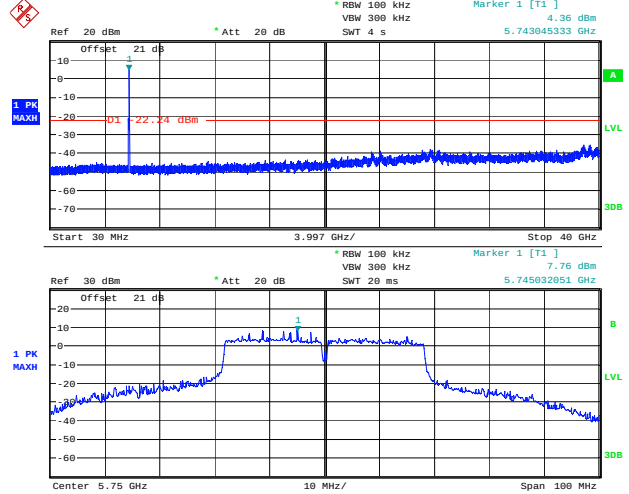
20 MHz channel, frequency 5790 MHz:



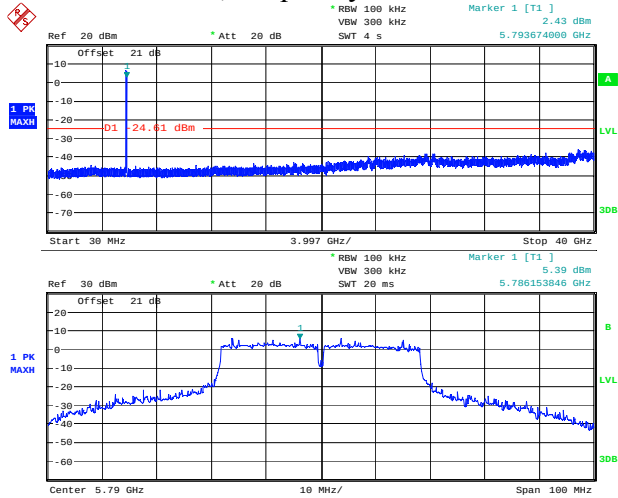
20 MHz channel, frequency 5835MHz:



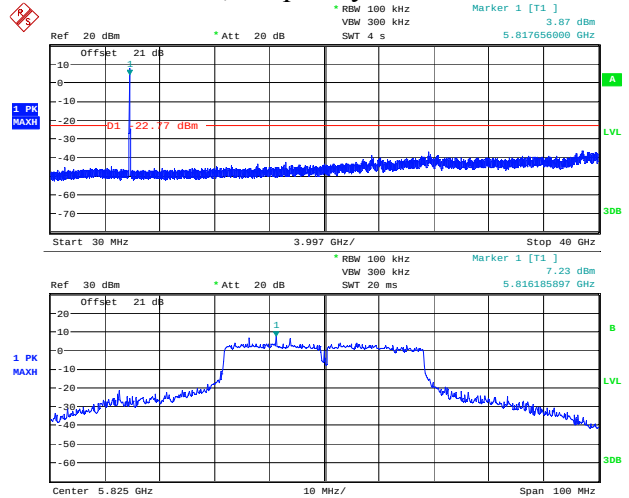
40 MHz channel, frequency 5750 MHz:



40 MHz channel, frequency 5790 MHz:



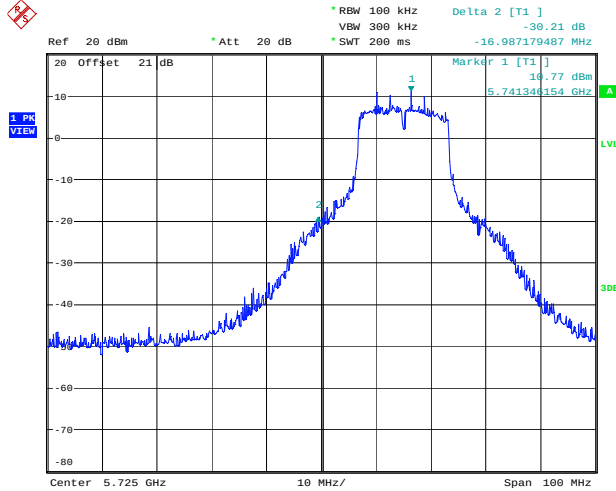
40 MHz channel, frequency 5825 MHz:



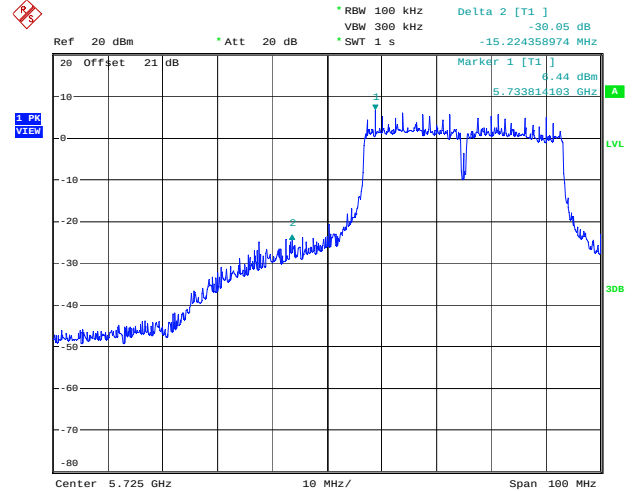
Band edges measurements:

Lower band edge

Frequency 5740 MHz, 20 MHz channel

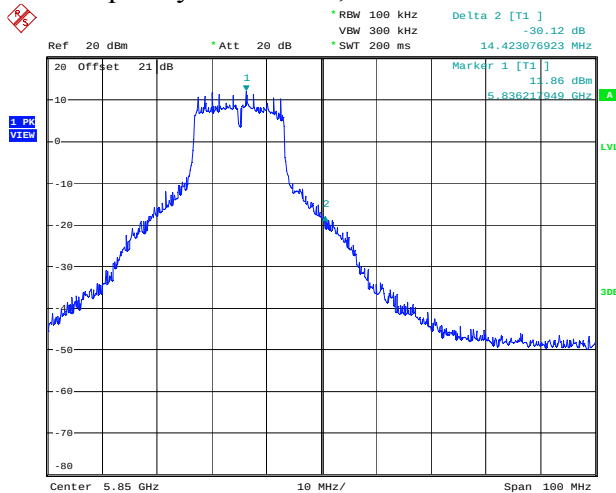


Frequency 5750 MHz, 40 MHz channel

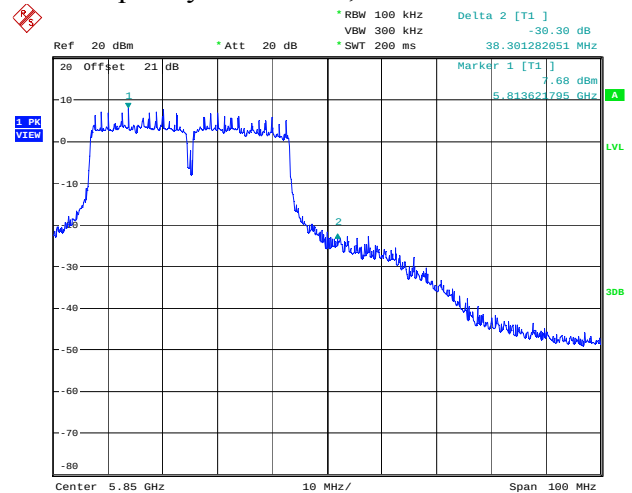


Upper band edge

Frequency 5835 MHz, 20 MHz channel



Frequency 5825 MHz, 40 MHz channel



Band edge results:

20 MHz channel at lower band edge:

Minimum attenuation below the fundamental is 30.21 dB

20 MHz channel at upper band edge:

Minimum attenuation below the fundamental is 30.12 dB

40 MHz channel at lower band edge:

Minimum attenuation below the fundamental is 30.05 dB

40 MHz channel at upper band edge:

Minimum attenuation below the fundamental is 30.30 dB

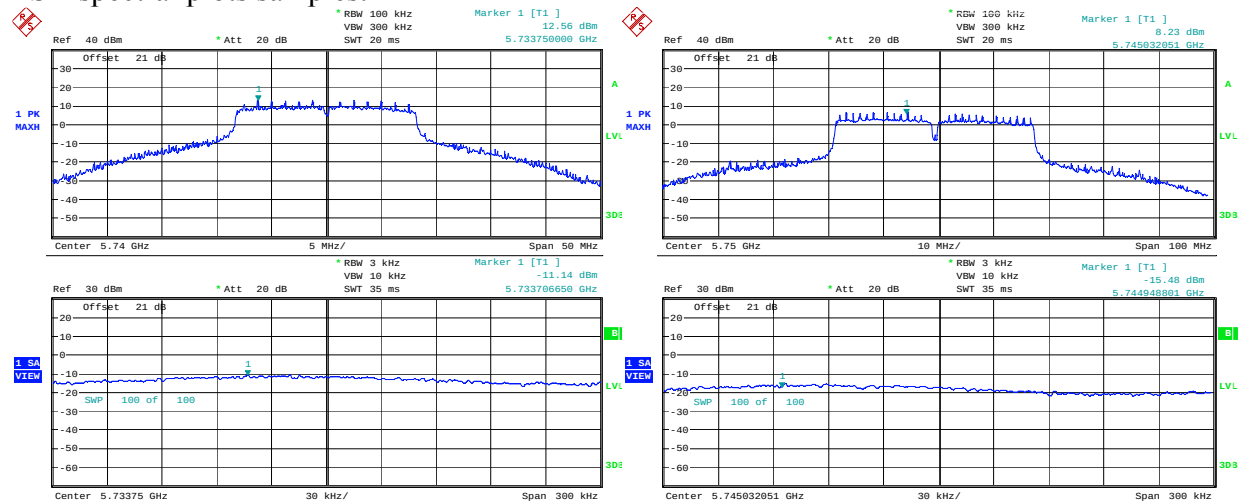
Clause 15.247(e) Power Spectral Density for Digitally Modulated Devices

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 Results: Pass

The Power Spectral Density was measured on the antenna port by means of a spectrum analyzer and following procedure described in 'PSD Option 2' in FCC guidelines for Measurement of Digital Transmission Systems operating under Section 15.247

PSD spectral plots samples:



Date: 25.JUN.2009 13:12:17

Date: 25.JUN.2009 15:29:16

PSD

20 MHz channel

Frequency (MHz)	G _{ANT} (dBi)	Antenna number	Cable loss (dB)	G _{ANT+CABLE} (dBi)	SW power setting	PSD Conducted (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)
5740	10	1, 2	1	9	36	-12.23	8.00	20.23
5790	10	1, 2	1	9	40	-12.10	8.00	20.10
5835	10	1, 2	1	9	40	-11.83	8.00	19.83
5740	15	3	1	14	38	-11.45	8.00	19.45
5790	15	3	1	14	40	-12.10	8.00	20.10
5835	15	3	1	14	39	-11.83	8.00	19.83
5740	19	6	1	18	40	-11.14	8.00	19.14
5790	19	6	1	18	40	-12.10	8.00	20.10
5835	19	6	1	18	40	-11.83	8.00	19.83
5740	22.5	5	1	21.5	40	-11.14	8.00	19.14
5790	22.5	5	1	21.5	40	-12.10	8.00	20.10
5835	22.5	5	1	21.5	40	-11.83	8.00	19.83
5740	23	4	1	22	40	-11.14	8.00	19.14
5790	23	4	1	22	40	-12.10	8.00	20.10
5835	23	4	1	22	40	-11.83	8.00	19.83
5740	10.5	7	1	9.5	40	-11.14	8.00	19.14
5790	10.5	7	1	9.5	40	-12.10	8.00	20.10
5835	10.5	7	1	9.5	40	-11.83	8.00	19.83
5740	15	8	1	14	40	-11.14	8.00	19.14
5790	15	8	1	14	40	-12.10	8.00	20.10
5835	15	8	1	14	40	-11.83	8.00	19.83
5740	29	9	1	28	33	-13.84	8.00	21.84
5790	29	9	1	28	34	-13.55	8.00	21.55
5835	29	9	1	28	40	-11.83	8.00	19.83

Antenna Type	Antenna Gain, dBi	Antenna number	Antenna Info
Omni directional Rod	10	1	Maxrad, MHO515010NM
		2	MTI, MT-462008/N/A
90 degrees Sectional	15	3	Maxrad, Panel Antenna, WISP4959018MBV
Flat	23	4	Huber&Suhner, SPA 5600/9/23/0/V
	22.5	5	MTI, MT-485028/N
	19	6	MTI, MT-485001
Patch	10.5	7	BelAir, B1BB025AA-A01
	15	8	BelAir, BAM Antenna BEL10008-A0
Dish parabolic	29	9	Maxrad, Dish, MPRC2449

Only *Omni-Directional Rod* and *90 degrees Sectional* antennas (1, 2 and 3) are point-to-multipoint antennas. The rest of antennas are directional or point-to point antennas.

PSD

40 MHz channel

Frequency (MHz)	G _{ANT} (dBi)	Antenna number	Cable loss (dB)	G _{ANT+CABLE} (dBi)	SW power setting	PSD Conducted (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)
5750	10	1, 2	1	9	37	-16.47	8.00	24.47
5790	10	1, 2	1	9	40	-16.59	8.00	24.59
5825	10	1, 2	1	9	40	-15.51	8.00	23.51
5750	15	3	1	14	40	-15.48	8.00	23.48
5790	15	3	1	14	40	-16.59	8.00	24.59
5825	15	3	1	14	40	-15.51	8.00	23.51
5750	19	6	1	18	40	-15.48	8.00	23.48
5790	19	6	1	18	40	-16.59	8.00	24.59
5825	19	6	1	18	40	-15.51	8.00	23.51
5750	22.5	5	1	21.5	40	-15.48	8.00	23.48
5790	22.5	5	1	21.5	40	-16.59	8.00	24.59
5825	22.5	5	1	21.5	40	-15.51	8.00	23.51
5750	23	4	1	22	40	-15.48	8.00	23.48
5790	23	4	1	22	40	-16.59	8.00	24.59
5825	23	4	1	22	40	-15.51	8.00	23.51
5750	10.5	7	1	9.5	40	-15.48	8.00	23.48
5790	10.5	7	1	9.5	40	-16.59	8.00	24.59
5825	10.5	7	1	9.5	40	-15.51	8.00	23.51
5750	15	8	1	14	40	-15.48	8.00	23.48
5790	15	8	1	14	40	-16.59	8.00	24.59
5825	15	8	1	14	40	-15.51	8.00	23.51
5750	29	9	1	28	40	-15.48	8.00	23.48
5790	29	9	1	28	40	-16.59	8.00	24.59
5825	29	9	1	28	40	-15.51	8.00	23.51

Antenna Type	Antenna Gain, dBi	Antenna number	Antenna Info
Omni directional Rod	10	1	Maxrad, MHO515010NM
		2	MTI, MT-462008/N/A
90 degrees Sectional	15	3	Maxrad, Panel Antenna, WISP4959018MBV
Flat	23	4	Huber&Suhner, SPA 5600/9/23/0/V
	22.5	5	MTI, MT-485028/N
	19	6	MTI, MT-485001
Patch	10.5	7	BelAir, B1BB025AA-A01
	15	8	BelAir, BAM Antenna BEL10008-A0
Dish parabolic	29	9	Maxrad, Dish, MPRC2449

Only *Omni-Directional Rod* and *90 degrees Sectional* antennas (1, 2 and 3) are point-to-multipoint antennas. The rest of antennas are directional or point-to point antennas.

Appendix B : Setup Photographs

Conducted Emissions Setup:

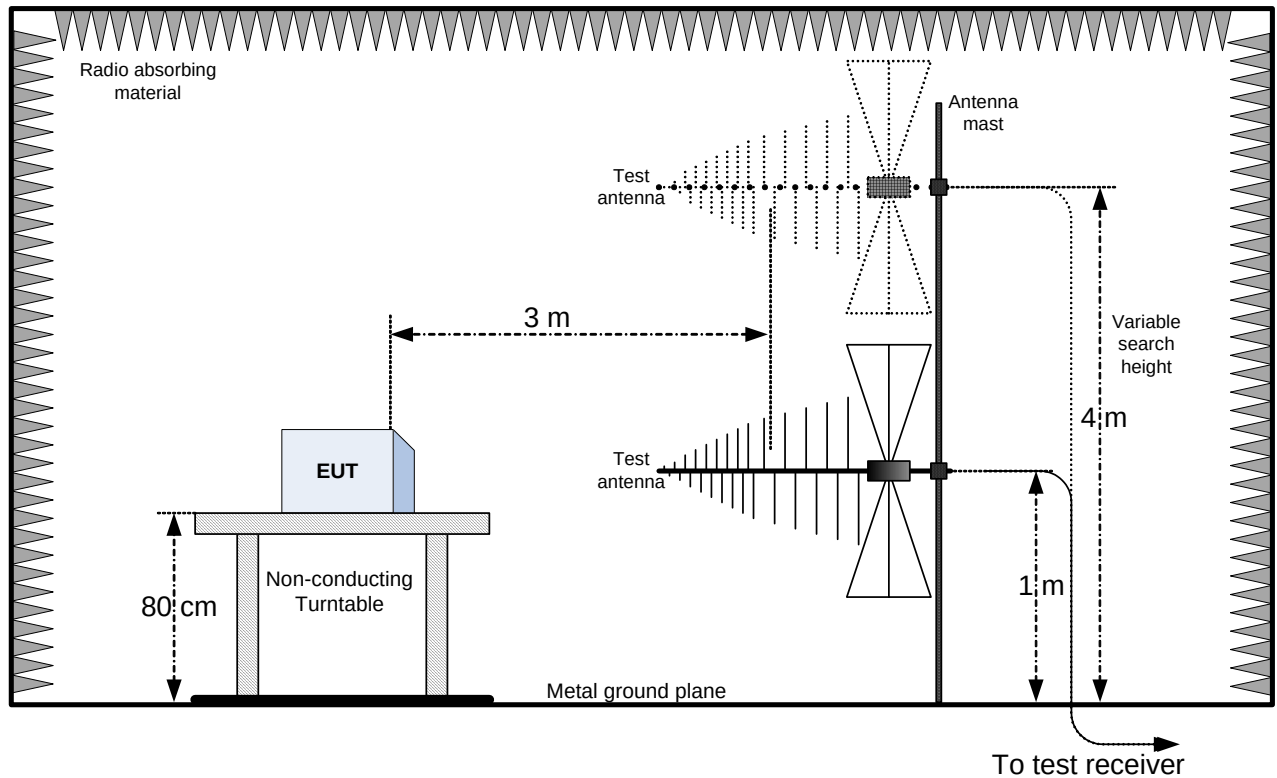


Spurious Emissions Setup:



Appendix C : Block Diagram of Test Setups

Radiated Emissions above 30 MHz Test Site



Conducted Emissions Test Site

