



Test Report: 6W78095, issue 2


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

Apparatus: 2.6 GHz WRM Radio Module

FCC ID: RAR20007001

In Accordance With: FCC Part 27 Miscellaneous Wireless
Communications Services

Tested By: Nemko Canada Inc.
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Authorized By: 
Jason Nixon, Telecom Specialist

Date: April 3, 2007

Total Number of Pages: 29

Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 27. Conducted measurements were performed in accordance with ANSI TIA-603-B-2002. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed:	2.6 GHz WRM Radio Module
Specification:	FCC Part 27 Miscellaneous Wireless Communications Services
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release

Author: Xu Jin, Wireless Specialist

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.

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Section 1: Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows: 2.6 GHz WRM Radio Module

1.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
1	2.6GHz WRM Radio Module	K001803240
2	LPM Card B2CC020AA-B	K001017419

The first samples were received on: Dec. 7, 2006

1.3 Technical Specifications of the EUT

Manufacturer:	BelAir Networks Inc.
Operating Frequency:	2626.75-2687.25MHz
Emission Designator:	5M4G7W
Modulation:	IEEE 802.16
Rated Conducted Output Power	20dBm*
Antenna Data:	<ul style="list-style-type: none">• MTI Wireless Edge MT-36012/SV 10 dBi patch antenna• MTI Wireless Edge MT-36013/SV 10 dBi patch antenna• MTI Wireless Edge MT-364002/A 16 dBi
Antenna Connector:	MCX

* Manufacture's rated power is average power measured using a wide band power meter with a thermocouple detector. TDD mode and 64 QAM modulation was used during the test.

Section 2: Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:
FCC Part 27 Miscellaneous Wireless Communications Services

2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

2.3 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

2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	FSP	FA001920	March 17/07
Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	May 16/07
Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	May 16/07
Biconical Antenna	EMCO	3109	FA000805	May 03/07
Log Periodic Antenna	EMCO	3148	FA001355	May 16/07
Horn Antenna	EMCO	3115	FA000649	Jan. 12/07
18.0 – 40.0GHz Horn Antenna	EMCO	3116	FA001847	May 03/07
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	Aug 02/07
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	Aug 02/07
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	Aug 02/07
5.0 - 18GHz Amplifier	Narda	DWT-186N23U40	FA001409	COU
18.0 – 26.0 GHz Amplifier	NARDA	BBS-1826N612	FA001550	COU
26 – 40.0 GHz Amplifier	NARDA	DBL-2640N610	FA001556	COU
Power Meter	HP	4418B	FA001678	May 16/07
Power Probe	HP	8487A	FA001741	May 22/07
Climate Chamber	Thermotron	SM-16C	15649-S	COU
Thermometer	Fluke	52 ^{K/J}	FA001247	Jan 10, 2007

Section 3: Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

3.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

3.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

3.4 Test Deleted

No Tests were deleted from this assessment.

3.5 Additional Observations

There were no additional observations made during this assessment.

Section 4: Results Summary

This section contains the following:

FCC Part 27: 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 section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

4.1 FCC Part 27: Test Results

Clause	Test Method	Test Description	Required	Result
27.50(h)	2.1046	Equivalent isotropically radiated power	Y	PASS
27.53(l)	2.1049	Occupied bandwidth	Y	PASS
27.53(l)	2.1051	Spurious emissions at the antenna terminal	Y	PASS
27.53(l)	2.1053	Field strength of spurious radiation	Y	PASS
27.54	2.1055	Frequency stability	Y	PASS

Appendix A: Test Results

Clause 27.50(h) Equivalent Isotropically Radiated Power

(h) The following power limits shall apply in the BRS and EBS:

(1) Main, booster and base stations.

(i) The maximum EIRP of a main, booster or base station shall not exceed $33 \text{ dBW} + 10\log(X/Y) \text{ dBW}$, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

Test Conditions:

Sample Number:	1,2	Temperature:	21°C
Date:	Dec.7, 2006	Humidity:	52%
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Results: Pass

Test Data: See attached tables and Plots

Limit: $33\text{dBW} + 10 * \log(5.5/5.5) = 63\text{dBm}$ EIRP

Setting Remarks:

- RF output power was determined by the channel power measurement function of the spectrum analyzer.
- Low, medium and high frequencies were tested.
- Spectrum analyzer settings:
 RBW/VBW: 300KHz/1MHz
 Channel bandwidth: 5.5MHz
 Detector: Peak and RMS (both data were presented)
- $\text{EIRP} = \text{Measured Output Power (dBm)} + \text{Antenna Gain (dBi)}$

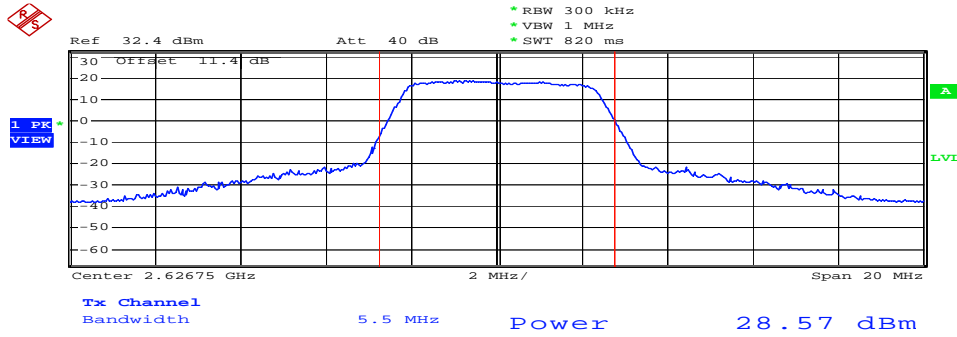
MTI Wireless Edge 10dBi patch antenna

Frequency (MHz)	Measured Output Power (dBm)-PK	Measured Output Power (dBm)-Avg.	Antenna Gain (dBi)	EIRP (dBm) Peak	EIRP (dBm) Avg.
2626.75	28.57	19.04	10	38.57	29.04
2651.5	29.01	19.51	10	39.01	29.51
2687.25	29.16	19.72	10	39.16	29.72

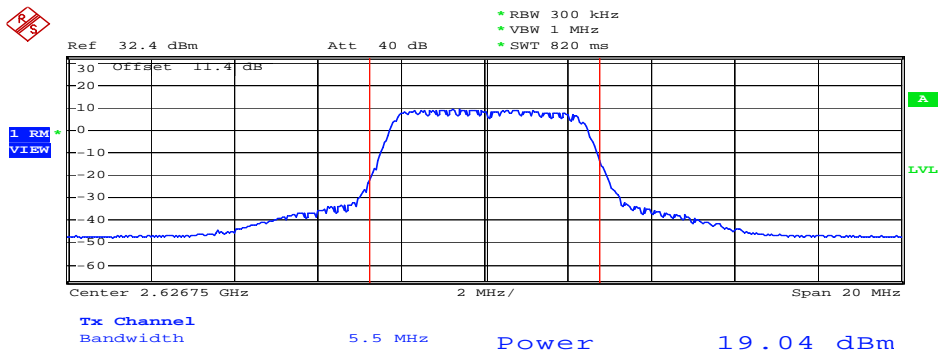
MTI Wireless Edge 16dBi antenna

Frequency (MHz)	Measured Output Power (dBm)-PK	Measured Output Power (dBm)-Avg.	Antenna Gain (dBi)	EIRP (dBm) Peak	EIRP (dBm) Avg.
2626.75	28.57	19.04	16	44.57	35.04
2651.5	29.01	19.51	16	45.01	35.51
2687.25	29.16	19.72	16	45.16	35.72

Operation frequency 2626.75MHz.

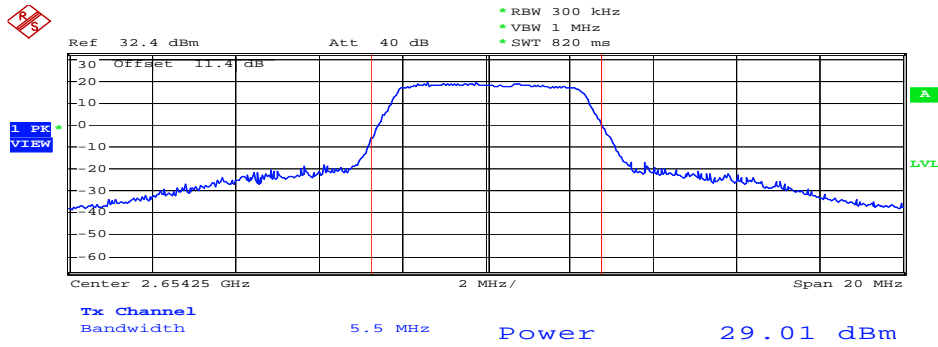


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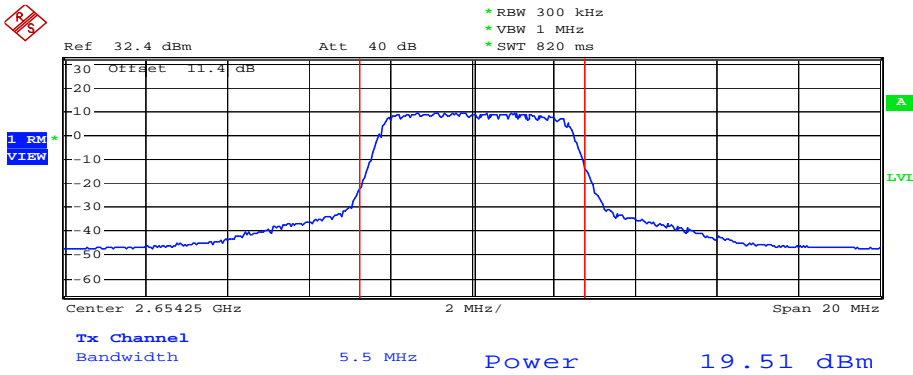


Date: 7.DEC.2006 20:24:22

Operation Frequency 2654.25MHz

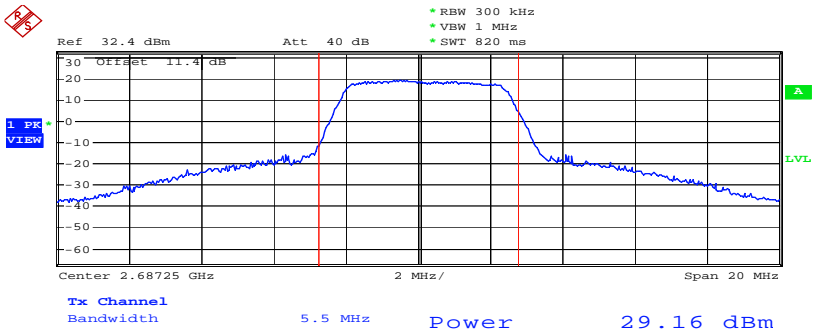


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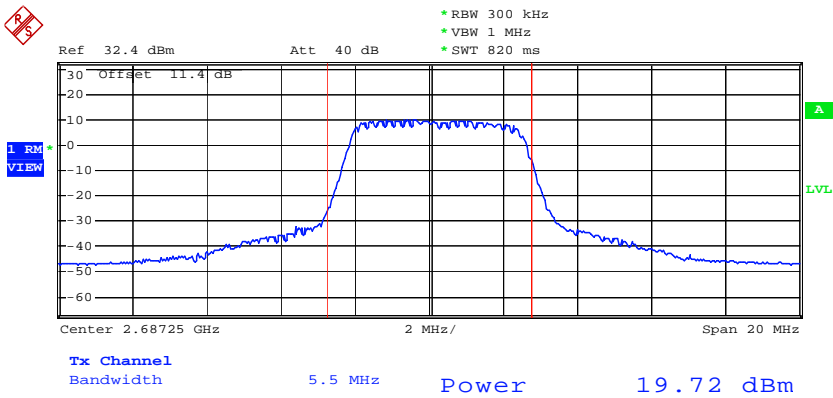


Date: 7.DEC.2006 20:28:53

Operation Frequency 2687.25MHz



Date: 7.DEC.2006 20:31:36



Date: 7.DEC.2006 20:30:39

Clause 27.53(l)(6) Occupied Bandwidth

(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

Test Conditions:

Sample Number:	1, 2	Temperature:	21°C
Date:	Dec .7, 2006	Humidity:	52%
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Results: Pass

Test Data: See attached tables and plots.

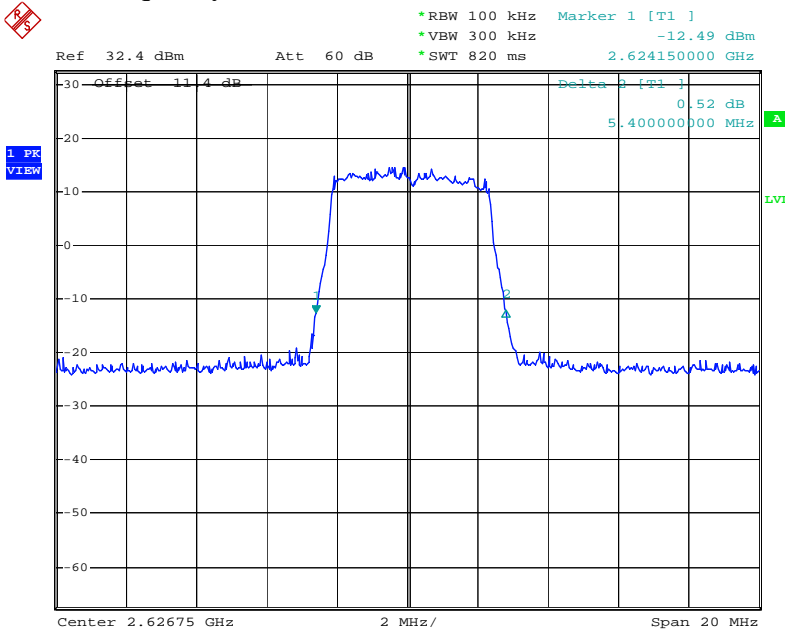
Setting remarks

1. 26dB occupied bandwidth was measured using the spectrum analyzer.
2. Low, medium and high frequencies were tested.
3. Spectrum analyzer settings:
 RBW/VBW: 100KHz/300KHz (more than 1% of the emission bandwidth was used)
 Detector: Peak

26dB Bandwidth Test Data

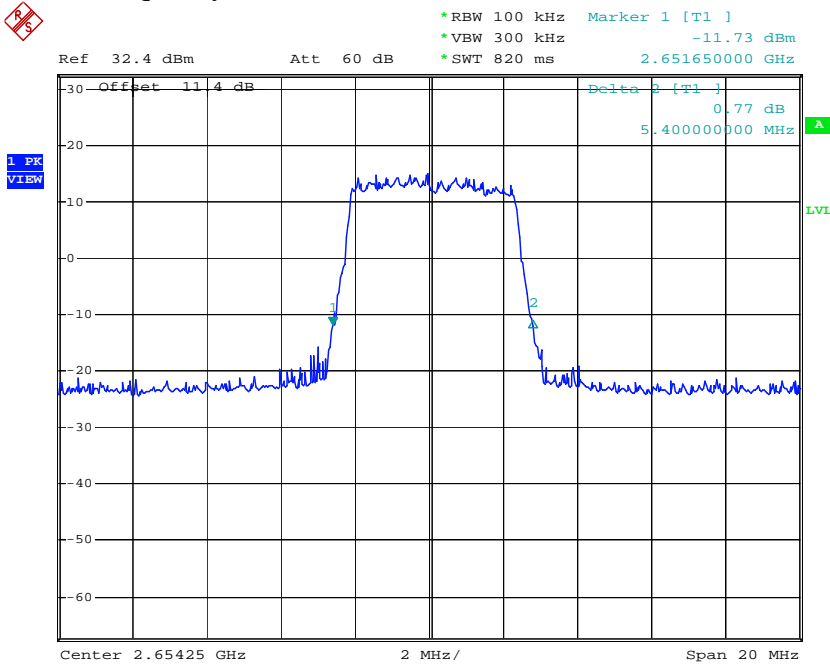
Frequency (MHz)	Occupied Bandwidth (MHz)
2626.75	5.4
2651.5	5.4
2687.25	5.36

Operation Frequency 2626.75MHz



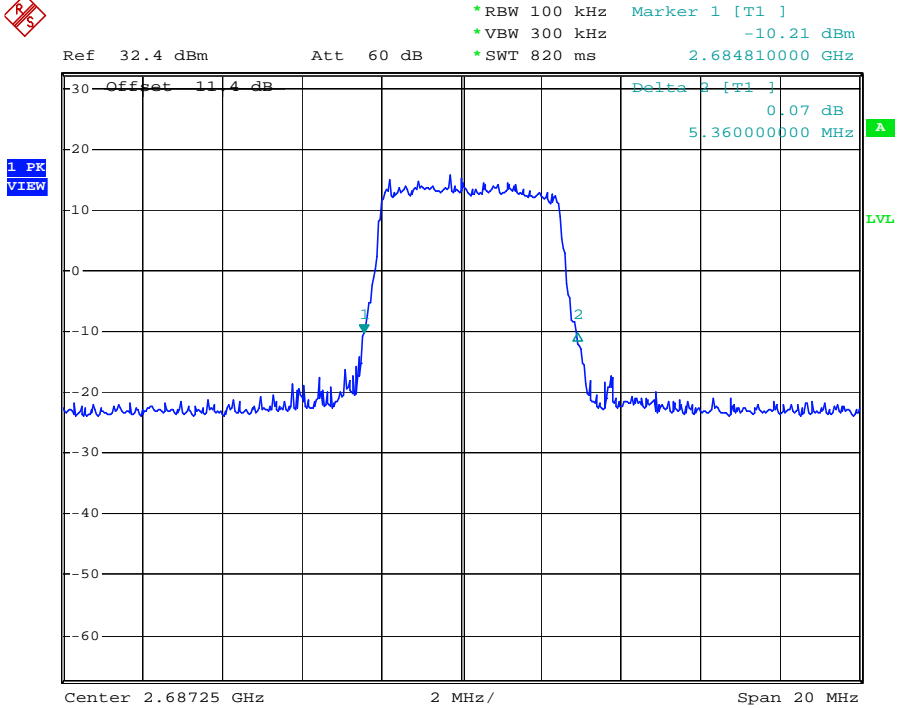
Date: 7.DEC.2006 20:50:51

Operation Frequency 2654.25MHz



Date: 7.DEC.2006 20:49:08

Operation Frequency 2687.25MHz



Date: 7.DEC.2006 20:56:13

Clause 27.53(I). Spurious emissions at the antenna terminal

(1) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts.

(2) For fixed and temporary fixed digital stations, the attenuation shall be not less than $43 + 10 \log (P)$ dB, unless a documented interference complaint is received from an adjacent channel licensee. Provided that the complaint cannot be mutually resolved between the parties, both licensees of existing and new systems shall reduce their out-of-band emissions by at least $67 + 10 \log (P)$ dB measured at 3 MHz from their channel's edges for distances between stations exceeding 1.5 km.

(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

Test Conditions:

Sample Number:	1,2	Temperature:	21°C
Date:	Dec.7, 2006	Humidity:	52%
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

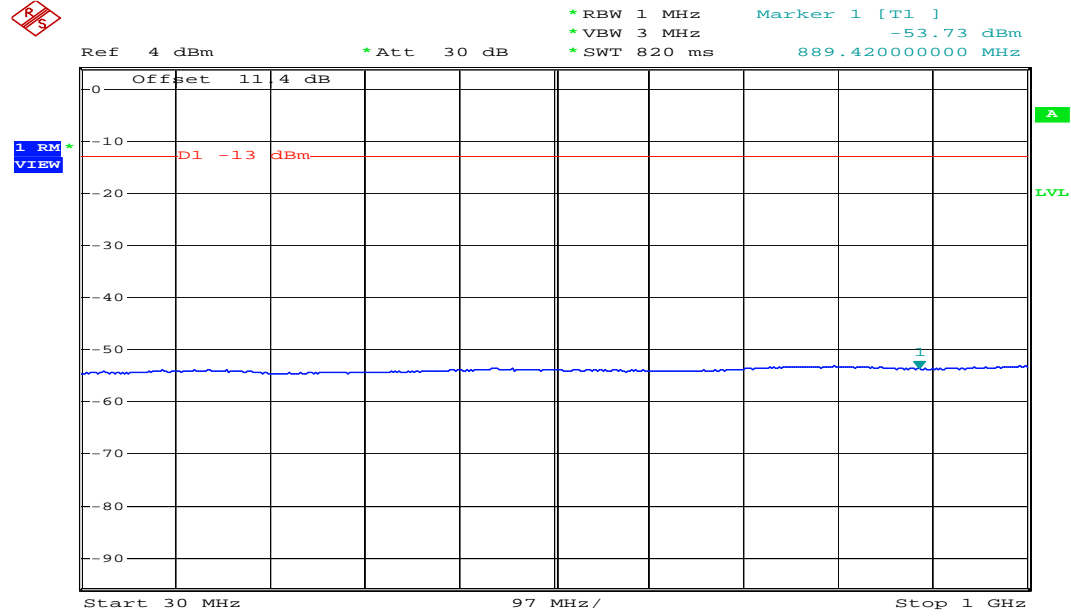
Test Results: Complies

Test Data: See Attached Plots.

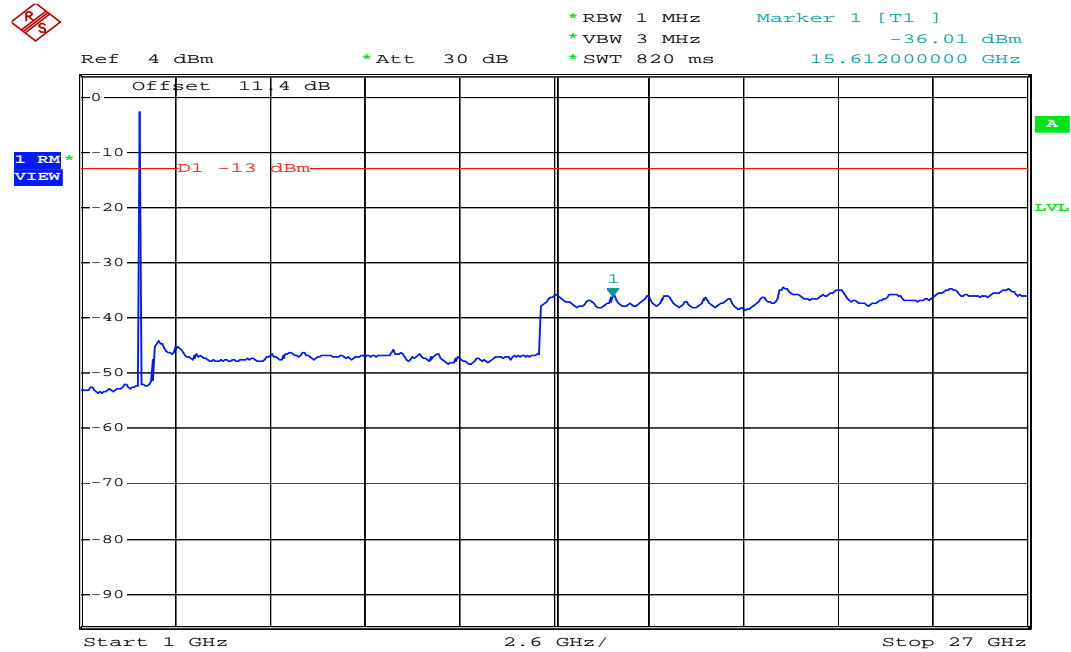
Setting Remarks:

1. Conducted spurious emission measurement was conducted.
2. Frequency scan started from 30MHz to 10th Harmonics. The measurement was performed using RM detector with 1MHz/3MHz RBW/VBW settings.
3. Band edge check was conducted with the EUT operated the nearest channel to the band edge.
4. To measure the emission level at the 1 MHz bands immediately outside the frequency band, RBW/VBW in the spectrum analyzer was set up as 100KHz/300KHz, which is more than 1% of the emission bandwidth. RM detector was applied.
5. To measure the emission level more than the 1 MHz bands outside the frequency band, RBW/VBW in the spectrum analyzer was set up as 100KHz/300KHz, with the measured power being integrated to 1MHz. The RM detector was applied.

Operation frequency 2626.75MHz



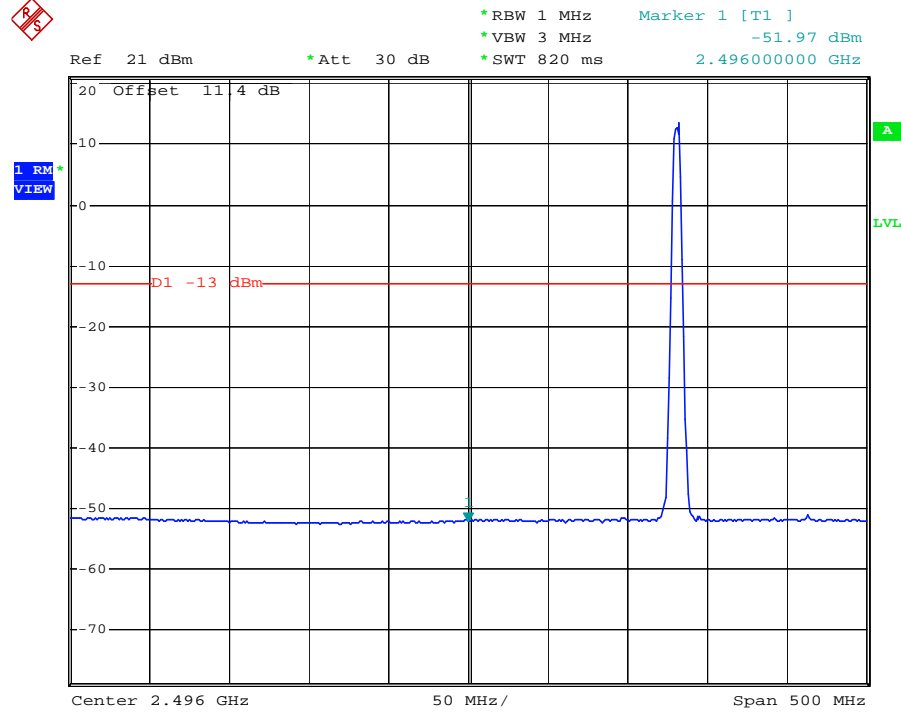
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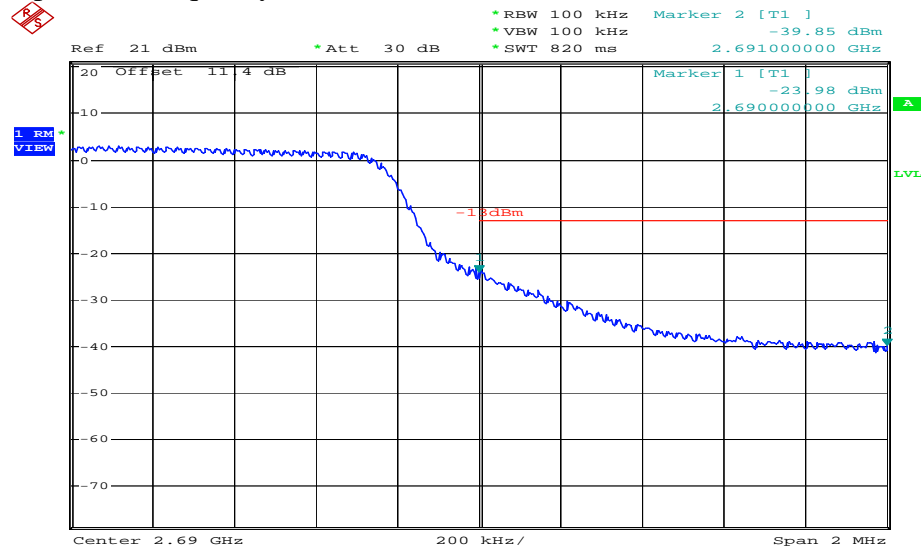
Bandedge checking

Operation Frequency 2626.75MHz

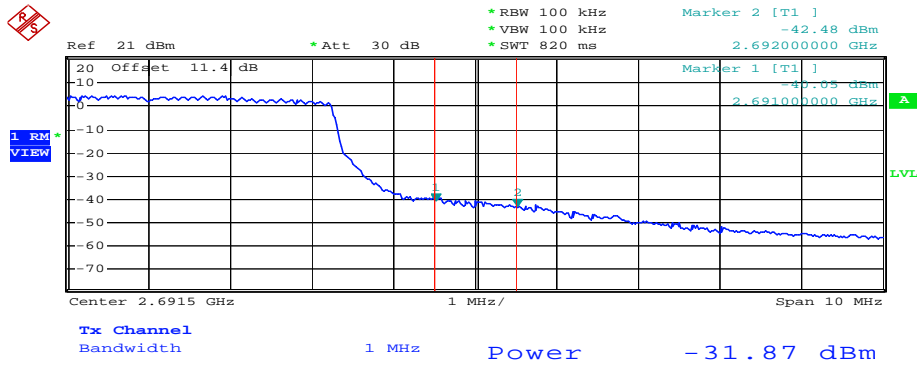


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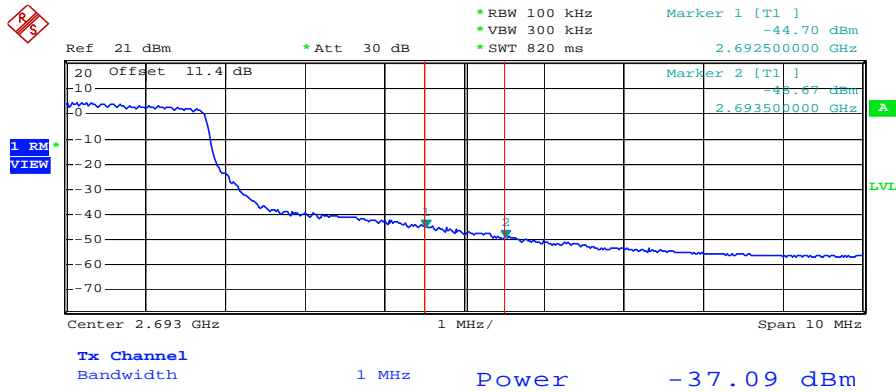
Operation frequency 2687.25MHz



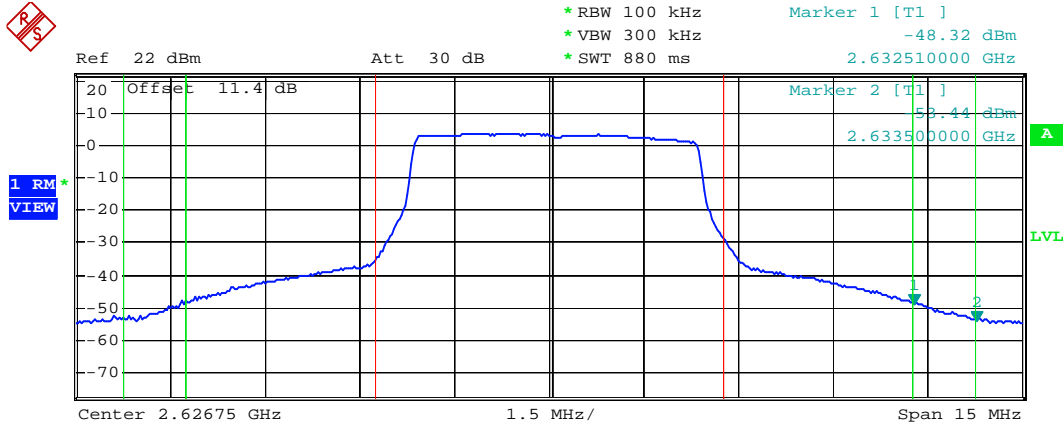
Date: 8.DEC.2006 00:07:51



Date: 8.DEC.2006 00:14:10



Date: 8.DEC.2006 00:23:51



Tx Channel			
Bandwidth	5.5 MHz	Power	19.17 dBm
Adjacent Channel			
Bandwidth	1 MHz	Lower	-41.57 dBm
Spacing	6.25 MHz	Upper	-41.29 dBm

Date: 12.DEC.2006 22:05:12

Clause 27.53(l) Field Strength of Spurious Radiation

(1) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts.

(2) For fixed and temporary fixed digital stations, the attenuation shall be not less than $43 + 10 \log (P)$ dB, unless a documented interference complaint is received from an adjacent channel licensee. Provided that the complaint cannot be mutually resolved between the parties, both licensees of existing and new systems shall reduce their out-of-band emissions by at least $67 + 10 \log (P)$ dB measured at 3 MHz from their channel's edges for distances between stations exceeding 1.5 km.

(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

Test Conditions:

Sample Number:	1,2	Temperature:	21°C
Date:	Dec.14, 2006	Humidity:	52%
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Results:

See Attached Table for Results

Additional Observations:

All measurements were performed using a peak detector with 100kHz RBW/VBW below 1GHz and 1MHz RBW/VBW above 1GHz at a distance of 3 meters.

The spectrum was searched from 30MHz to the 10th Harmonic. The low, medium and high frequency have been evaluated.

Only worst case data was reported

Freq. (MHz)	Ant.	Pol. V/H	RCVD Signal (dBμV)	Sig Sub. Factor (dB)	Signal Substitution Power (dBm)	Limit (dBm)	Margin (dB)
300.0200	LP1	H	23.4	-81.5	-58.1	-13	45.1
300.0200	LP1	V	22.0	-80.6	-58.6	-13	45.6
456.8000	LP1	H	17.2	-80.7	-63.5	-13	50.5
456.8000	LP1	V	14.3	-79.2	-64.9	-13	51.9
1056.0000	Horn2	H	60.6	-119.1	-58.5	-13	45.5
1056.0000	Horn2	V	63.0	-119.1	-56.1	-13	43.1
1152.0000	Horn2	H	61.6	-119.2	-57.6	-13	44.6
1152.0000	Horn2	V	59.0	-118.7	-59.7	-13	46.7
1332.0000	Horn2	H	54.6	-119.7	-65.1	-13	52.1
1332.0000	Horn2	V	49.1	-119.7	-70.6	-13	57.6

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipol

Clause 27.54 Frequency Stability

§27.54 Frequency stability. - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Test Conditions:

Sample Number:	1, 2	Temperature:	23°C
Date:	Dec. 11, 2006	Humidity:	50%
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Wireless Lab

Test Results: Complies

Test Conditions Ambient Temperature: 23°C
 Extreme Temperature: -30°C to +50°C
 Extreme Voltage Conditions: +/-15% of 120VAC

Test Data: See attached tables.

Note: The EUT could not be operated at the un-modulated mode, the test had to be conducted with the following method.

The EUT was connected to a spectrum analyzer. The peak value of the EUT across the whole emission bandwidth was then measured with max hold function. The negative frequency FL was noted at -26dBc relative to the peak value, while positive frequency FH was measured at -26dBc relative to the peak value also. The center frequency was then calculated as (FL+FH)/2.

Frequency Stability Test Data

Test Condition	Measured Frequency FL (MHz)	Measured Frequency FH (MHz)	Carrier Frequency (FL+FH)/2 (MHz)	Frequency Drift (ppm)
+23°C, 120VAC	2624.4414020	2629.3437550	2626.8925785	---
+23°C, 138VAC	2624.4415130	2629.3437684	2626.8926407	0.02
+23°C, 102VAC	2624.4408620	2629.3498720	2626.8953670	1.06
+50°C, 120VAC	2624.4738610	2629.3195130	2626.8966870	1.56
+40°C, 120VAC	2624.440456	2629.373516	2626.9069860	5.48
+30°C, 120VAC	2624.4559230	2629.3523650	2626.9041440	4.40
+20°C, 120VAC	2624.4157090	2629.3680350	2626.8918720	-0.27
+10°C, 120VAC	2624.4602980	2629.3424610	2626.9013795	3.35
0°C, 120VAC	2624.4055100	2629.4117150	2626.9086125	6.10
-10°C, 120VAC	2624.4284630	2629.3218070	2626.8751350	-6.64
-20°C, 120VAC	2624.3903930	2629.3918830	2626.8911380	-0.55
-30°C, 120VAC	2624.3661790	2629.3667228	2626.8664509	-9.95

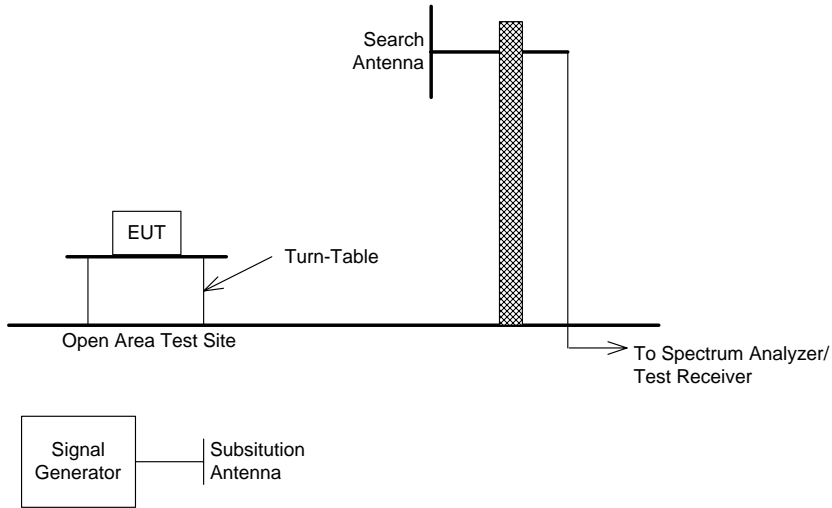
Appendix B: Setup Photographs

Radiated Spurious Emissions Setup:

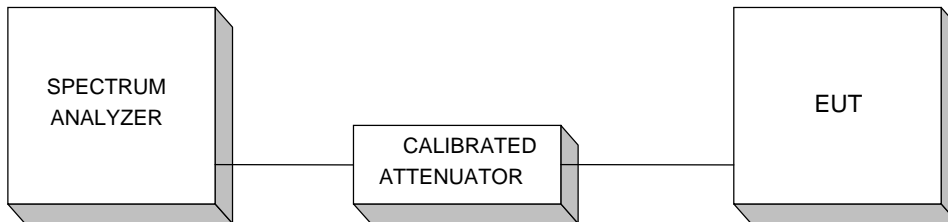


Appendix C: Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Measurement



Frequency Stability Test

