TRANZEO
EMC LABS INC

EMC Test Report

FCCID: QRF-XBYPZ11

2.4/5.8 GHz Outdoor Access Point
Tranzeo Wireless Technologies Inc.

Testing body:	Tranzeo EMC Labs Inc. 19473 Fraser Way, Pitt Meadows, BC, Canada V3Y 2V4
Client:	Tranzeo Wireless Technologies Inc. 19473 Fraser Way, Pitt Meadows, BC, Canada V3Y 2V4

The test results indicated in this report refer exclusively to the equipment under test specified below. It is not permitted to transfer the results to other systems or configurations.

Order number: 68

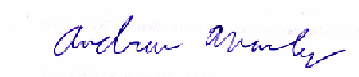
Type of test: Testing of electromagnetic disturbances characteristics
Testing of electromagnetic immunity characteristics

Date the EUT was received: October 20th, 2008

Date of test: October 20th, 2008 to November 7th, 2008

Report No.: 111208.1

Pitt Meadows, 12 November, 2008



EMC Manager: Andrew Marles EMC Engineer: Bruce Balston

Revision History

Table of Contents

1.0 General Information

1.1 EUT Description

Product Name	2.4/5.8 GHz Outdoor Access Point
Manufacturer	Tranzeo Wireless Technologies Inc
FCC ID	QRF-XBYPZ11
Model No.	EL-500AG
Frequency Range	2412-2462 / 5745-5825 MHz
Number of channels	11 at 2.4GHz, 5 at 5.8GHz
Bandwidth	20 MHz
Transmit Rate	54 Mbps maximum bit rate specification
Type of Modulation	2.4 GHz: DSSS, OFDM; 5.8 GHz: OFDM
Antenna Type	External
Antenna Gain	2412-2462: 26 dBi MAX; 5745-5825 32 dBi MAX
Product Software Revision	ENROUTETAI_20080923_04_01_0249
Test Software	Bandwidth test software
Operator Channel Selection	By software
Power Adapter	Tranzeo Wireless Supplied SP48-181000
	Input: AC 120V 60Hz, 25.9 W
	Output: DC 18 V, 1000 mA
	Serial: 0504

Product samples tested:

Manufacturer	Model No.	Serial No.
Tranzeo Wireless	EL-500AG	EL-500AG Eng1

Frequency of each channel:

2.4 GHz Frequency Band					
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
Channel 1	2412	Channel 5	2432	Channel 9	2452
Channel 2	2417	Channel 6	2437	Channel 10	2457
Channel 3	2422	Channel 7	2442	Channel 11	2462
Channel 4	2427	Channel 8	2447		

5.8 GHz Frequency Band	
Channel	**Frequency**
Channel 149	5745
Channel 153	5765
Channel 157	5785
Channel 161	5805
Channel 165	5825

The model mentioned above is fitted with standard Type N connector for use with an external antenna for each radio.

As an IEEE 802.11a/b/g compliant wireless bridge, this device includes a 2.4 and 5.8 GHz receive function as well as a 2.4 and 5.8 GHz digital modulation transmit function. There are no user serviceable parts inside the unit. It is factory sealed in a one-time use manner and inaccessible to the end user.

The tests were performed on production sample model to demonstrate compliance with FCC CFR 47 Part 15, Subpart B, and Subpart C, as well as Industry Canada RSS-210 Issue 7 for digitally modulated devices.

1.2 Operational Description

The device is a wireless outdoor access point designed specifically for wireless networks. The device has an access point radio for 802.11 a/b/g client devices. It uses external antenna. The transceivers operate in the frequency bands 2412-2462 and 5745-5825 MHz. The device transmits digital network data. The unit is mounted in fixed point-to- point installations. The device can be used to create either a stand alone or an internet extension network.

The type of RF modulation is DSSS and OFDM. Both DSSS and OFDM are used at 2.4 GHz while at 5.8 GHz only OFDM is used. The device can transmit data at a bit rate of 11 Mbps in DSSS mode and 54 Mbps in OFDM mode or a real-world data rate of approximately 4 and 27 Mbps respectively. A 128 bits Wired Equivalent Privacy (WEP) algorithm is used for secure communications. The device's standard compliance ensures that it can communicate with any 802.11a/b/g network.

The firmware used with the device prevents the use of channels outside the specified frequency bands.

The product is used exclusively in a professionally installed, fixed point-to-point environment.

1.3 EUT Testing Configuration

The device fitted with standard Type N connector was tested with the highest gain antenna. Data is presented for the worst case configuration.

The EUT was mounted to a custom non-metallic stand to best represent a typical user installation. The EUT was connected to the host PC so that it could be cycled through the various test modes and channels.

The EUT was tested in the following modes:

- **Standby/Receive mode:** In this mode the EUT beacons at the lowest possible rate while searching for a client with which to establish communication.

- **Data transfer mode:** In this mode the EUT is exercised with commercially available bandwidth test software. A link is established between two PCs through the unit and a client and data is transmitted at the highest possible rate.
- **Beaconing Mode:** In this mode the EUT is set to transmit network configuration beacons at the highest possible rate.

1.4 EUT Antennas

The EUT was tested with the following external antennas:

2.4 GHz Antennas	
TR-OD24-12	Vertical Omni
TR-ODH24-13	Horizontal Omni
TR-SA24-90-9	Vertical Sector
TR-24H-90-17	Horizontal Sector
TR-PAN24-15	Panel
5.8 GHz Antennas	
TR-HTQ-5.8-12 TR-58V-60-17 TR-5.8-32Db-Ant TR-5X-Ant-24	Vertical Omni Vertical Sector Dish Panel

1.5 EUT Modifications

No modifications were necessary for this unit to comply with FCC Part 15 and Industry Canada RSS-210 Issue 7.

1.6 Test Facilities

Tranzeo EMC Labs
19473 Fraser Way
Pitt Meadows, BC V3Y 2V4
Canada

Phone: (604) 460-6002
Fax: (604) 460-6005

FCC registration number: 960532
Industry Canada Number: 5238A

1.7 Test Equipment

Manufacturer	Model	Description	Serial No.	Cal Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/R
Sunol Sciences	Custom	Mast Motor	TREML0001	N/R
Sunol Sciences	JB3	Antenna	A042004	02-Jun-2007
Sunol Sciences	DRH-118	Antenna	A052804	02-Jun-2007

Com-Power	LI-115	LISN	241037	30-Jan-2008
Rohde & Schwarz	FSP40	Spectrum Analyzer	100184	24-Aug-2007
Rohde & Schwarz	NRP	Power Meter	100055	02-Aug-2007
Rohde & Schwarz	ESCI	EMI Receiver	100123	02-Jun-2007

1.8 Test System Details

The following auxiliary equipment and cables were used for performing the tests:

Manufacturer	Model	Description	Serial No.
Soyo	PW-930S	Laptop PC	6188
Pheenet	SW-05P	5 port switch	C0104260954
Tranzeo	POE-1	DC injection unit	n/a

Signal Cable Type	Signal Cable Description	Length
Cat 5 LAN	EUT to DC injection unit	50 m
Cat 5 LAN	DC injection unit to Ethernet switch	2 m
Cat 5 LAN	Populate 2nd Ethernet port	1 m

1.9 Test Results

The EUT complies with FCC CFR 47 Part 15, Subparts B and C, as well as Industry Canada RSS-210 Issue 7.

2.0 Conducted Emissions

2.1 Test Standard

FCC Part 15, Subpart C, Section 15.207a.

| *a) Except as shown in Paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.* |

2.2 Test Limits

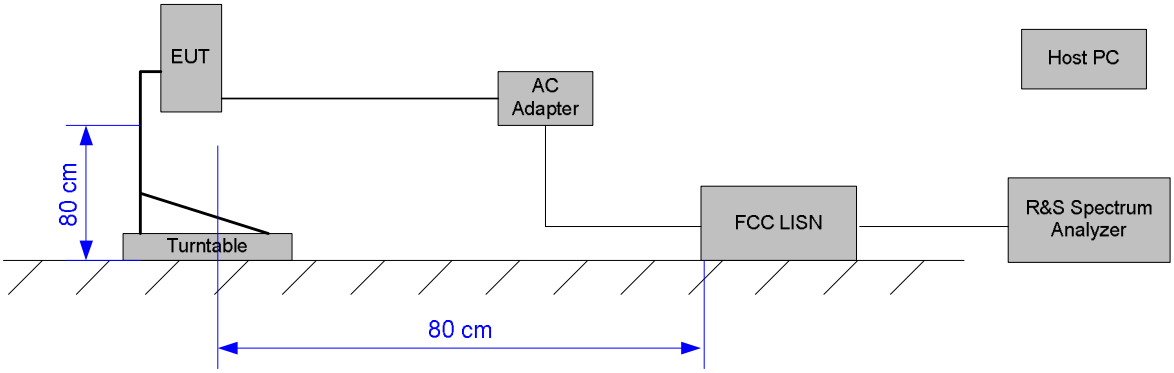
Frequency (MHz)	Maximum Level (dBuV) Quasi-Peak	Maximum Level (dBuV) Average
0.15-0.50	66-56 (Log Delta)	56-46 (Log Delta)
0.50-5.00	56	46
5.00-30.0	60	50

2.3 Test Setup

Both 2.4/5.8 GHz radio was exercised in consecutive order after establishing link between DUT and a client device at the highest possible transmit rate. Testing was performed on low, middle and high channels in 2.4 and 5.8 GHz frequency bands. Only worst case data is shown below.

Note: For testing purposes only, to ensure worst case performance in all testing configurations, the radio is configured to transmit at the maximum possible RF power.

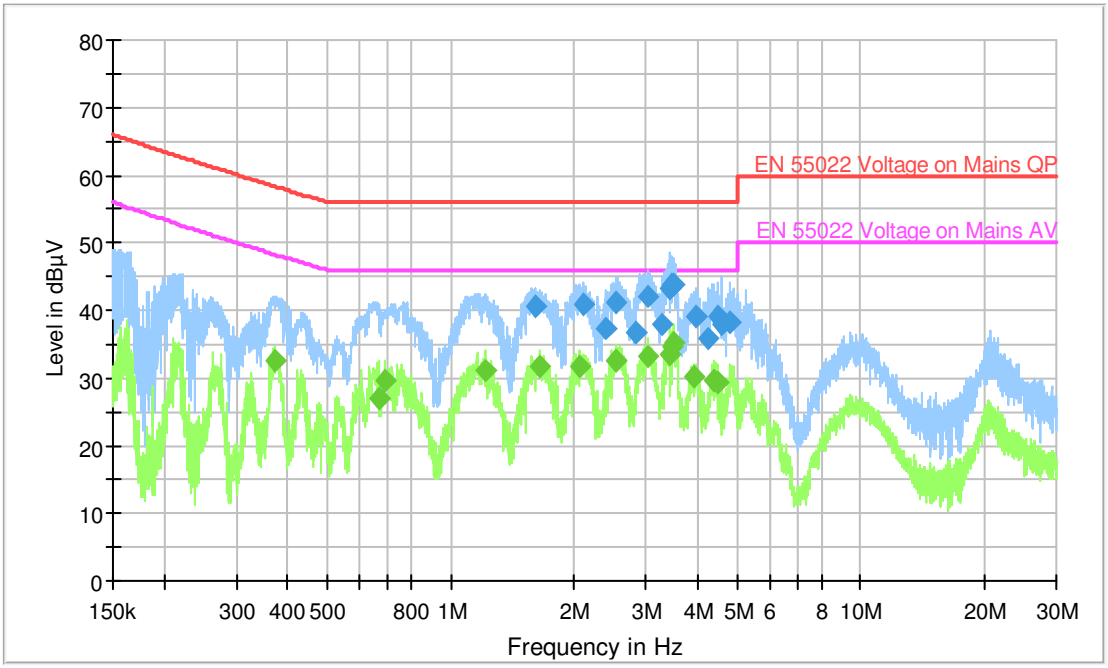
2.3.1 Test Setup Block Diagram



Note: The unused LISN terminal is terminated with a 50 ohms terminator.

2.4 Test Results

2.4.1 **2.4 GHz**



Test Data Peak Detector

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.605917	40.6	1000.00	9.000	On	L1	0.6	15.4	56.0
2.105514	41.0	1000.00	9.000	On	L1	0.6	15.0	56.0
2.397663	37.4	1000.00	9.000	On	L1	0.6	18.6	56.0
2.520531	41.3	1000.00	9.000	On	L1	0.6	14.7	56.0
2.819088	36.7	1000.00	9.000	On	L1	0.6	19.3	56.0
3.035501	42.0	1000.00	9.000	On	L1	0.5	14.0	56.0
3.258741	38.0	1000.00	9.000	On	L1	0.5	18.0	56.0
3.412066	43.1	1000.00	9.000	On	L1	0.5	12.9	56.0
3.446341	43.7	1000.00	9.000	On	L1	0.5	12.3	56.0
3.491413	44.0	1000.00	9.000	On	L1	0.5	12.0	56.0
3.975862	39.0	1000.00	9.000	On	L1	0.5	17.0	56.0
4.238501	35.9	1000.00	9.000	On	L1	0.5	20.1	56.0
4.478025	39.2	1000.00	9.000	On	L1	0.5	16.8	56.0
4.577583	37.9	1000.00	9.000	On	L1	0.5	18.1	56.0
4.773836	38.2	1000.00	9.000	On	L1	0.5	17.8	56.0

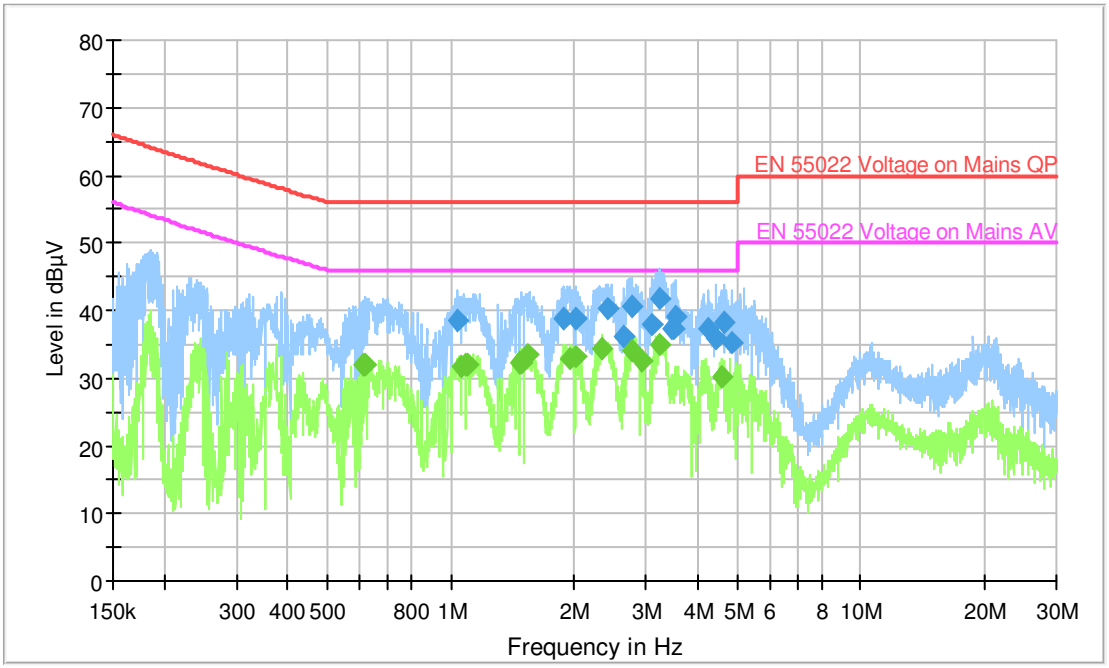
Note: All data points are corrected for insertion loss.

Test Data Average Detector

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.374345	32.6	1000.00	9.000	On	L1	0.6	15.6	48.2
0.666400	26.9	1000.00	9.000	On	L1	0.7	19.1	46.0
0.692889	29.5	1000.00	9.000	On	L1	0.7	16.5	46.0
1.215110	31.0	1000.00	9.000	On	L1	0.6	15.0	46.0
1.639980	31.8	1000.00	9.000	On	L1	0.6	14.2	46.0
2.055607	31.7	1000.00	9.000	On	L1	0.6	14.3	46.0
2.520531	32.5	1000.00	9.000	On	L1	0.6	13.5	46.0
2.538227	32.7	1000.00	9.000	On	L1	0.6	13.3	46.0
3.020369	33.1	1000.00	9.000	On	L1	0.5	12.9	46.0
3.412066	33.5	1000.00	9.000	On	L1	0.5	12.5	46.0
3.446341	34.5	1000.00	9.000	On	L1	0.5	11.5	46.0
3.491413	35.3	1000.00	9.000	On	L1	0.5	10.7	46.0
3.924536	30.2	1000.00	9.000	On	L1	0.5	15.8	46.0
4.402580	29.5	1000.00	9.000	On	L1	0.5	16.5	46.0
4.500460	29.2	1000.00	9.000	On	L1	0.5	16.8	46.0

Note: All data points are corrected for insertion loss.

2.4.2 **5.8 GHz**



Test Data Peak Detector

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.039679	38.5	1000.00	9.000	On	L1	0.7	17.5	56.0
1.876891	38.7	1000.00	9.000	On	L1	0.6	17.3	56.0
2.010900	38.8	1000.00	9.000	On	L1	0.6	17.2	56.0
2.416911	40.2	1000.00	9.000	On	L1	0.6	15.8	56.0
2.636486	36.2	1000.00	9.000	On	L1	0.6	19.8	56.0
2.768823	40.7	1000.00	9.000	On	L1	0.6	15.3	56.0
3.099888	37.9	1000.00	9.000	On	L1	0.5	18.1	56.0
3.239257	41.8	1000.00	9.000	On	L1	0.5	14.2	56.0
3.460147	37.5	1000.00	9.000	On	L1	0.5	18.5	56.0
3.484441	37.5	1000.00	9.000	On	L1	0.5	18.5	56.0
3.530011	39.0	1000.00	9.000	On	L1	0.5	17.0	56.0
4.246982	37.5	1000.00	9.000	On	L1	0.5	18.5	56.0
4.424637	35.9	1000.00	9.000	On	L1	0.5	20.1	56.0
4.618947	38.1	1000.00	9.000	On	L1	0.5	17.9	56.0
4.836270	35.3	1000.00	9.000	On	L1	0.5	20.7	56.0

Note: All data points are corrected for insertion loss.

Test Data Average Detector

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.610900	32.1	1000.00	9.000	On	L1	0.7	13.9	46.0
0.617654	32.1	1000.00	9.000	On	L1	0.7	13.9	46.0
1.059612	31.8	1000.00	9.000	On	L1	0.7	14.2	46.0
1.083170	31.9	1000.00	9.000	On	L1	0.7	14.1	46.0
1.097336	32.1	1000.00	9.000	On	L1	0.7	13.9	46.0
1.464832	32.4	1000.00	9.000	On	L1	0.6	13.6	46.0
1.488446	32.2	1000.00	9.000	On	L1	0.6	13.8	46.0
1.536822	33.4	1000.00	9.000	On	L1	0.6	12.6	46.0
1.959316	32.9	1000.00	9.000	On	L1	0.6	13.1	46.0
2.016939	33.3	1000.00	9.000	On	L1	0.6	12.7	46.0
2.345516	34.3	1000.00	9.000	On	L1	0.6	11.7	46.0
2.768823	34.1	1000.00	9.000	On	L1	0.6	11.9	46.0
2.910711	32.5	1000.00	9.000	On	L1	0.6	13.5	46.0
3.248985	34.9	1000.00	9.000	On	L1	0.5	11.1	46.0
4.600517	30.3	1000.00	9.000	On	L1	0.5	15.7	46.0

Note: All data points are corrected for insertion loss.

3.0 Peak Power Output

3.1 Test Standard

FCC CFR47, Part 15, Subpart B 15.247b.

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

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 watt. As an alternative to a peak power measurement, compliance with the 1 watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power *is the highest total transmit power occurring in any mode.*

(4) The conducted output power limit specified in Paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in Paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values 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.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(iii) Fixed, point-to-point operation, as used in Paragraphs (c)(4)(i) and (c)(4)(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. |

3.2 Test Limits

The maximum conducted output power shall not exceed 30 dBm.

3.3 Test Setup

This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 20 MHz bandwidths for both 2.4 and 5.8 GHz frequency bands. Power is measured using the channel power measurement feature of the spectrum analyzer.

3.3.1 Test Setup Block Diagram

3.4 Test Results

3.4.1 2.4 GHz frequency band

Channel	Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
1	2412	27.43	30	PASS
6	2437	27.27	30	PASS
11	2462	26.30	30	PASS

3.4.2 5.8 GHz frequency band

Channel	Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
149	5745	26.64	30	PASS
157	5785	25.57	30	PASS
165	5825	24.64	30	PASS

4.0 Radiated Emissions, General Requirements

4.1 Test Standard

FCC Part 15, Subpart C, Section 15.209, Radiated Emission Limits, General Requirements.

| *(a) 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 (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

*** Except as provided in Paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., Sections 15.231 and 15.241.*

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. |

4.2 Test Limits

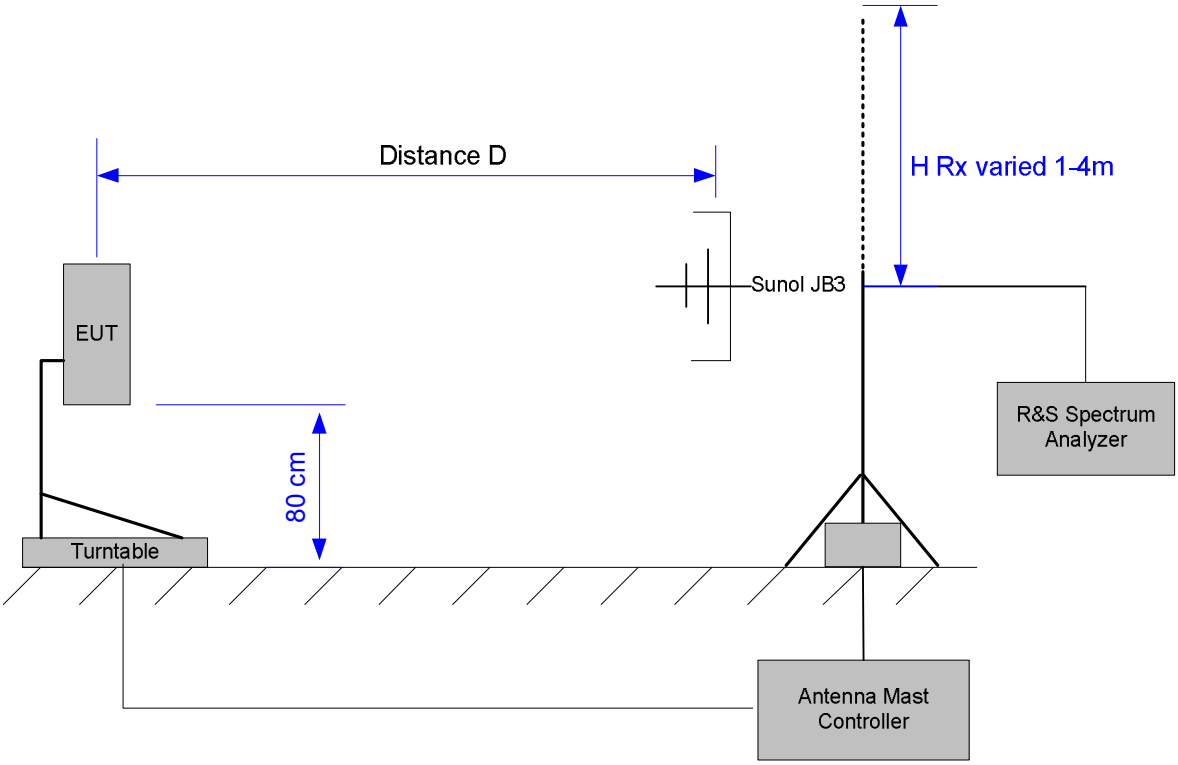
Frequency (MHz)	Maximum Field Strength (uV/m @ 3m)	Maximum Field Strength (dBuV/m @ 3m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-1000	500	54.0

4.3 Test Setup

The DUT was tested when both 2.4/5.8 GHz radio was exercised in consecutive order at the highest possible transmit rate. The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable for both 2.4 and 5.8 GHz frequency bands. Only worst case data is shown below.

Note: For testing purposes only, to ensure worst case performance in all testing configurations, the radio is configured to transmit at the maximum possible RF power.

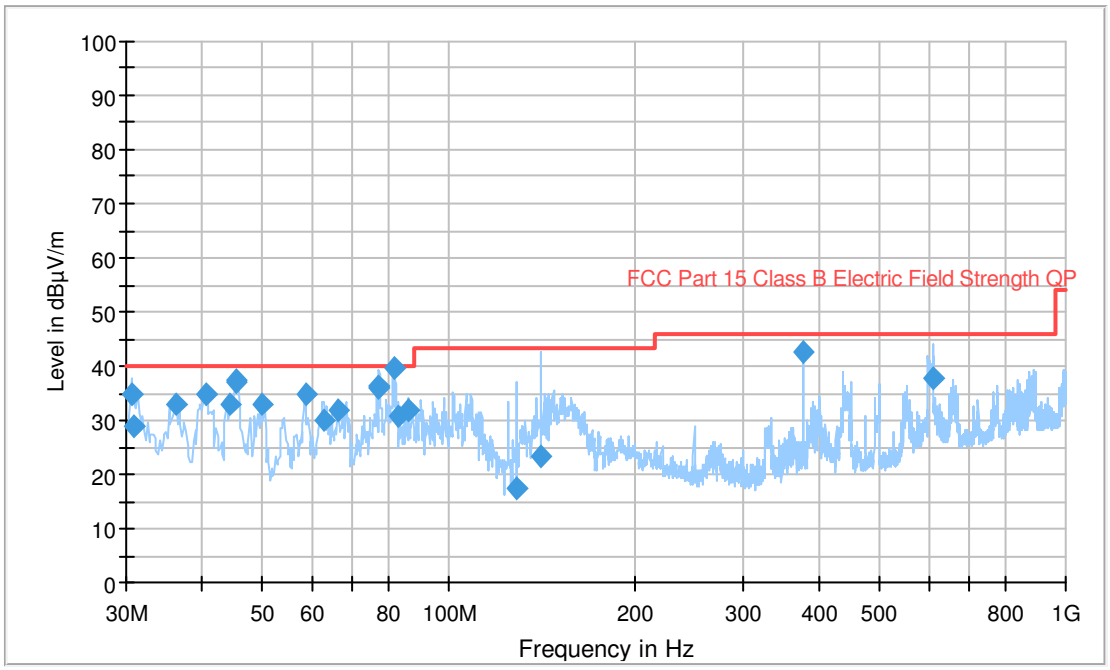
4.3.1 Test Setup Block Diagram



Note: Measurements below 1 GHz were performed with the Sunol JB3 antenna with a measurement distance of 3 m. Compliance above 1 GHz is covered in Section 5.0.

4.4 Test Results

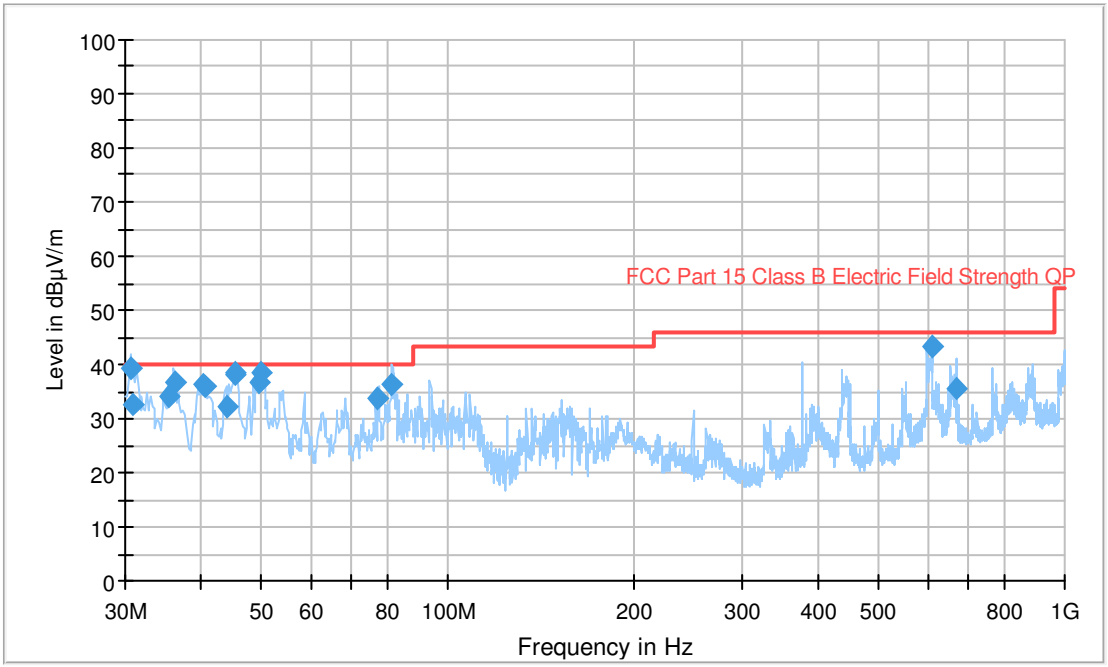
4.4.1 2.4 GHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
81.498480	39.5	1000.00	120.000	150.0	H	29.0	9.0	0.50	40.00
45.250320	37.3	1000.00	120.000	100.0	H	187.0	11.5	2.70	40.00
45.259040	37.1	1000.00	120.000	100.0	H	187.0	11.5	2.90	40.00
374.996560	42.5	1000.00	120.000	100.0	H	97.0	17.4	3.50	46.00
77.195280	36.2	1000.00	120.000	146.0	H	11.0	9.2	3.80	40.00
77.201600	36.0	1000.00	120.000	146.0	H	12.0	9.2	4.00	40.00
58.716560	34.9	1000.00	120.000	100.0	H	20.0	8.4	5.10	40.00
40.345360	34.8	1000.00	120.000	100.0	H	179.0	14.7	5.20	40.00
30.643481	34.6	1000.00	120.000	100.0	H	60.0	22.1	5.40	40.00
44.366560	33.1	1000.00	120.000	100.0	H	187.0	11.9	6.90	40.00
36.134480	32.8	1000.00	120.000	100.0	H	128.0	17.9	7.20	40.00
49.844880	32.8	1000.00	120.000	100.0	H	187.0	9.3	7.20	40.00
86.058800	31.9	1000.00	120.000	145.0	H	30.0	8.9	8.10	40.00
610.947360	37.9	1000.00	120.000	182.0	H	-7.0	21.8	8.10	46.00
66.269120	31.9	1000.00	120.000	100.0	H	20.0	9.1	8.10	40.00
82.920000	30.6	1000.00	120.000	162.0	H	21.0	9.0	9.40	40.00
62.972000	30.2	1000.00	120.000	147.0	H	21.0	8.8	9.80	40.00
30.932960	29.0	1000.00	120.000	100.0	H	151.0	21.9	11.00	40.00
140.884560	23.2	1000.00	120.000	147.0	H	151.0	14.6	20.30	43.50
128.578080	17.5	1000.00	120.000	262.0	V	258.0	15.2	26.00	43.50

Note: All data points are corrected for insertion loss.

4.4.2 5.8 GHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.644426	39.1	1000.00	120.000	100.0	H	78.0	22.1	0.90	40.00
45.258960	38.4	1000.00	120.000	100.0	H	70.0	11.5	1.60	40.00
49.853520	38.4	1000.00	120.000	100.0	H	180.0	9.3	1.60	40.00
45.262080	38.2	1000.00	120.000	100.0	H	89.0	11.4	1.80	40.00
610.888160	43.2	1000.00	120.000	181.0	V	196.0	21.5	2.80	46.00
36.143120	36.8	1000.00	120.000	100.0	H	0.0	17.9	3.20	40.00
49.605520	36.5	1000.00	120.000	100.0	H	128.0	9.3	3.50	40.00
40.106000	36.4	1000.00	120.000	100.0	H	0.0	14.9	3.60	40.00
81.176880	36.1	1000.00	120.000	150.0	H	0.0	9.0	3.90	40.00
40.330720	35.7	1000.00	120.000	100.0	H	88.0	14.7	4.30	40.00
35.319360	34.0	1000.00	120.000	100.0	H	61.0	18.5	6.00	40.00
77.192960	33.6	1000.00	120.000	145.0	H	162.0	9.2	6.40	40.00
30.821360	32.7	1000.00	120.000	138.0	H	151.0	21.9	7.30	40.00
43.799200	32.1	1000.00	120.000	100.0	H	250.0	12.3	7.90	40.00
665.976160	35.6	1000.00	120.000	145.0	V	195.0	22.0	10.40	46.00

Note: All data points are corrected for insertion loss.

5.0 Harmonic and Spurious Emissions

5.1 Test Standard

FCC CFR 47, Part 15, Subpart B 15.247d.

| *(d) 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).* |

5.2 Test Limits

2400-2483.5 MHz limits:

- Fundamental Limit = 30 dBm
- Harmonics and Spurious Emissions = 20 dBc
- Restricted Band Emissions = AVG 54 dBuV, PK 74dBuV

5.3 Test Setup – Spurious Emissions

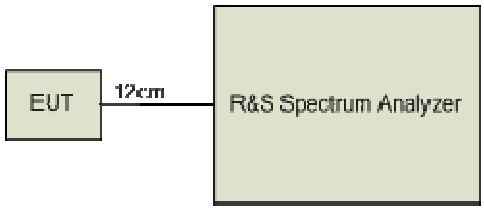
Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels. Conducted scans are used to determine compliance with the 20 dBc limit for emissions outside of the operational frequency band.

In addition to conducted measurements, extensive radiated testing above 1 GHz is performed. The measurement antenna is scanned around all sides of the EUT to identify signals of interest. Additional measurements at an appropriate measurement distance are performed to ensure that emissions were at maximum.

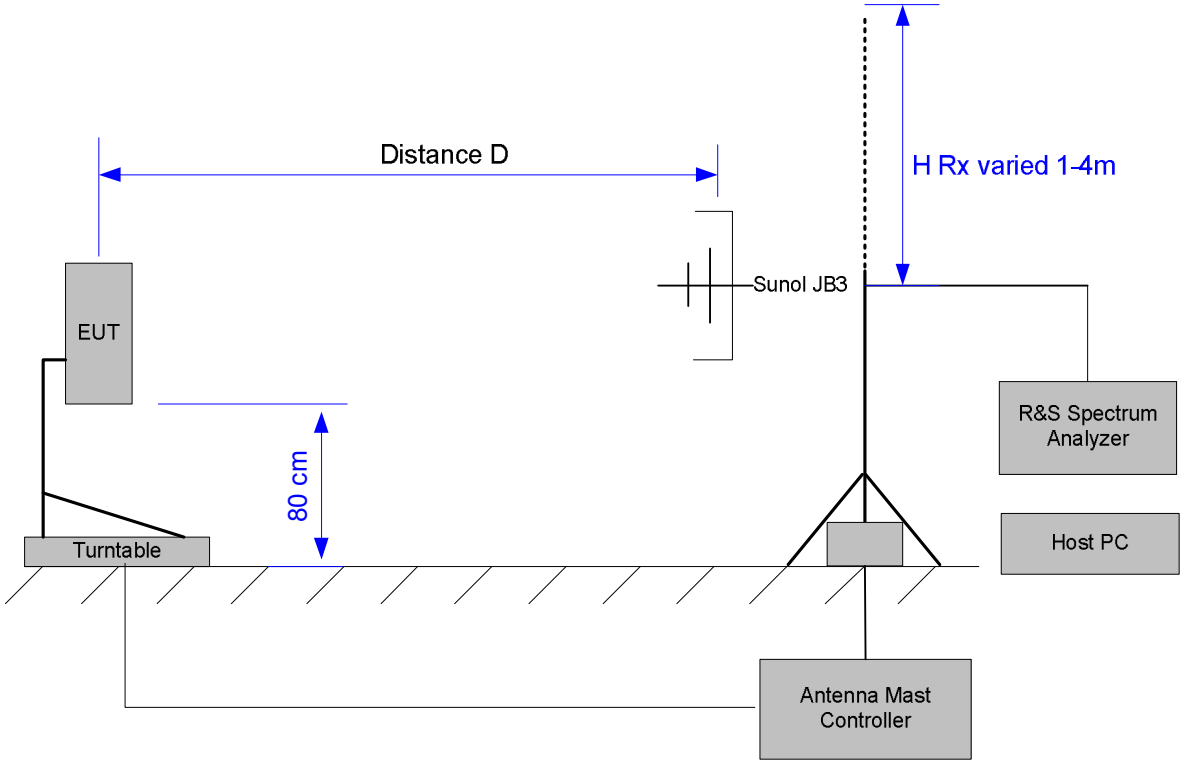
The EUT was tested with external antennas. Each radio was exercised at the highest possible transmit rate. Testing was performed on low, middle and high channels in both 2.4 and 5.8 GHz frequency band consecutively. Only worst case data is shown below.

Note: For testing purposes only, to ensure worst case performance in all configurations, the radio is configured to transmit at the maximum possible RF power.

5.3.1 Test Setup Block Diagram – Conducted Measurements (Harmonics)

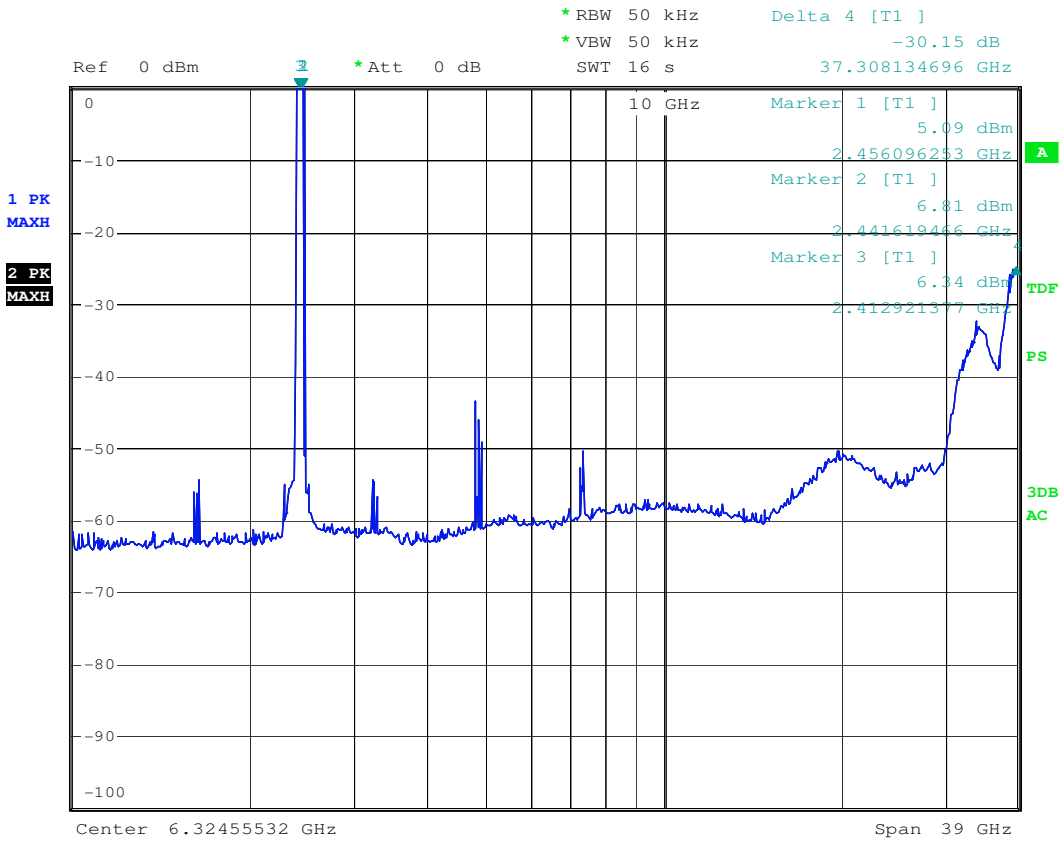


5.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



5.4 Test Results (Conducted mode)

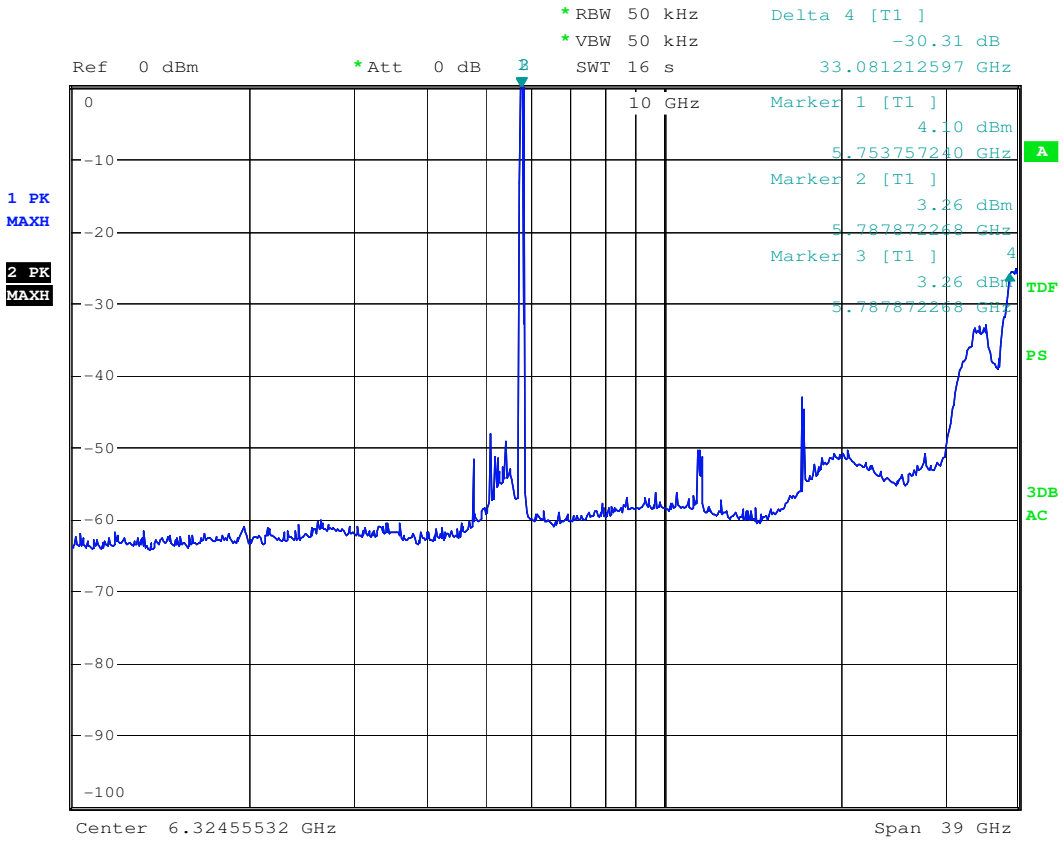
5.4.1 2.4 GHz



Date: 6.NOV.2008 19:25:38

The above plot shows the worst case conducted output of the 2.4 GHz transmitter. It should be noted that the EUT is not transmitting on three channels simultaneously. However, the unit is cycled through low, mid and high channels. All conducted harmonics are at least 20 dBc.

5.4.2 5.8 GHz



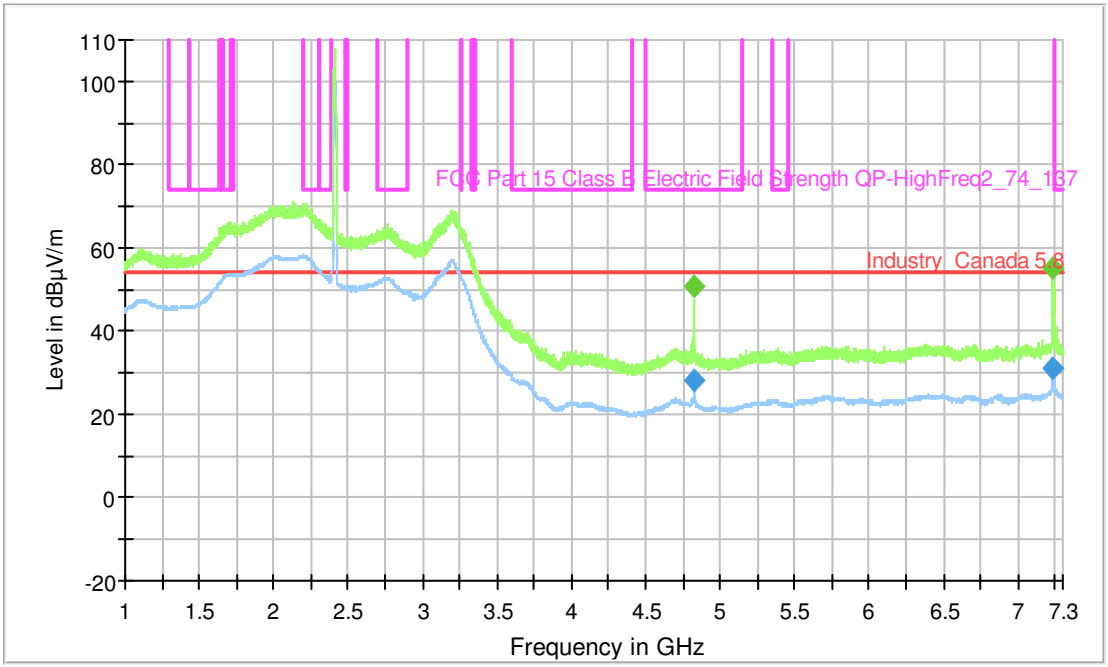
Date: 6.NOV.2008 19:41:30

The above plot shows the worst case conducted output of the 5.8 GHz transmitter. It should be noted that the EUT is not transmitting on three channels simultaneously. However, the unit is cycled through low, mid and high channels. All conducted harmonics are at least 20 dBc.

5.4.3 Test Results (Radiated mode) - Restricted Bands (Spurious Emissions)

The following data is taken from frequencies identified during radiated pre-testing at 1 m. Data presented below was taken at a measurement distance of 3 m. Data is presented for the worst case configuration in each frequency band.

2.4 GHz



Average detector

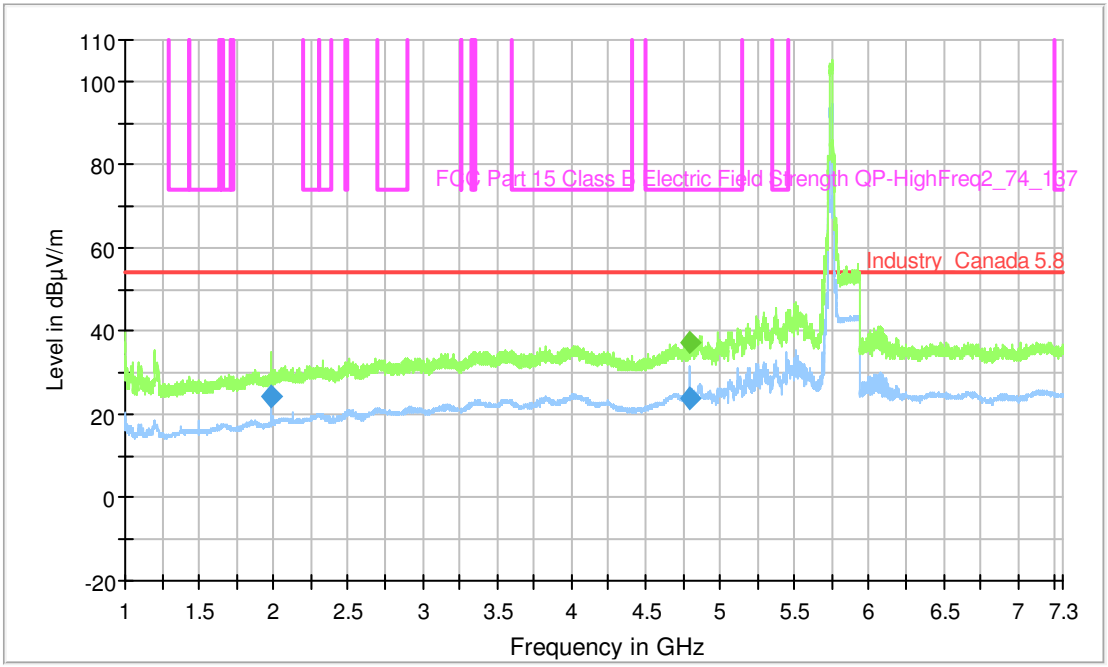
Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4824.00000	28.0	1000.000	100.0	V	87.0	-2.8	26.0	54.0
7238.00000	31.1	1000.000	180.0	V	270.0	2.5	22.9	54.0

Peak detector

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4823.60000	50.6	1000.000	100.0	V	87.0	-2.8	23.4	74.0
7238.00000	55.1	1000.000	180.0	V	267.0	2.5	81.9	137.0

No other emissions were detected within 20 dB of the limit.

5.8 GHz

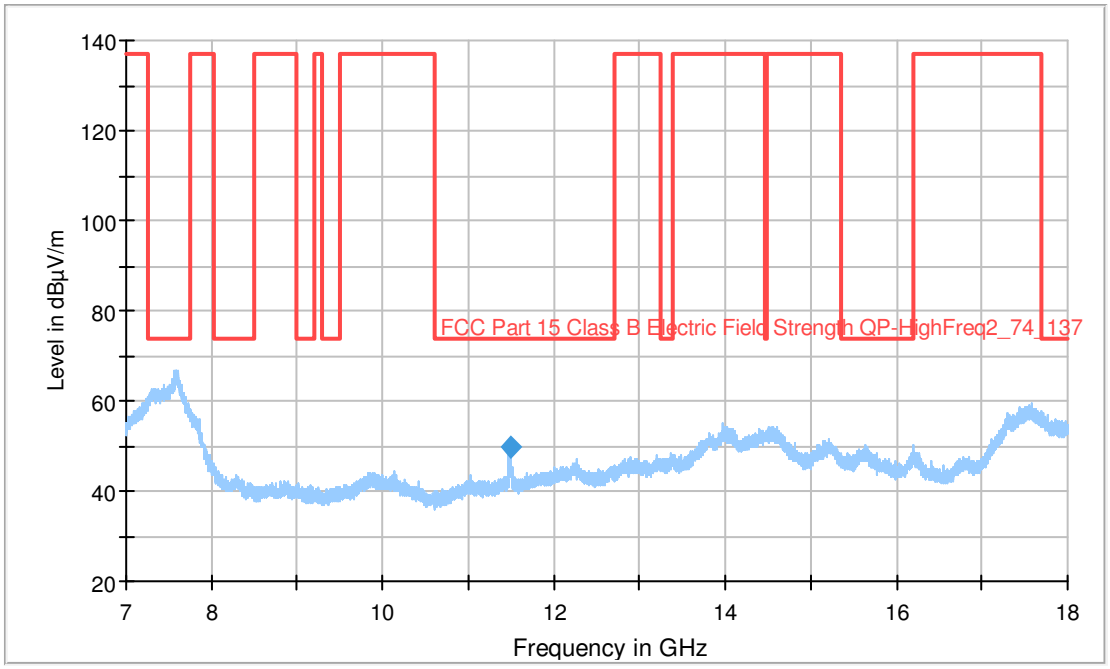


Average detector

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1981.20000	24.4	1000.000	200.0	V	180.0	-10.3	29.6	54.0
4795.20000	23.8	1000.000	220.0	V	90.0	-3.4	30.2	54.0

Peak detector

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4795.20000	37.2	1000.000	220.0	V	90.0	-3.4	36.8	74.0



Peak detector

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
11493.20000	49.9	1000.000	190.0	V	270.0	12.9	24.1	74.0

6.0 Band Edge

6.1 Test Standard

FCC CFR 47, Part 15, Subpart B 15.247d.

| *(d) 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).* |

6.2 Test Limits

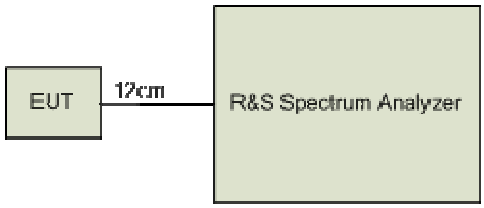
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). (See Section 15.205(c).)

6.3 Test Setup

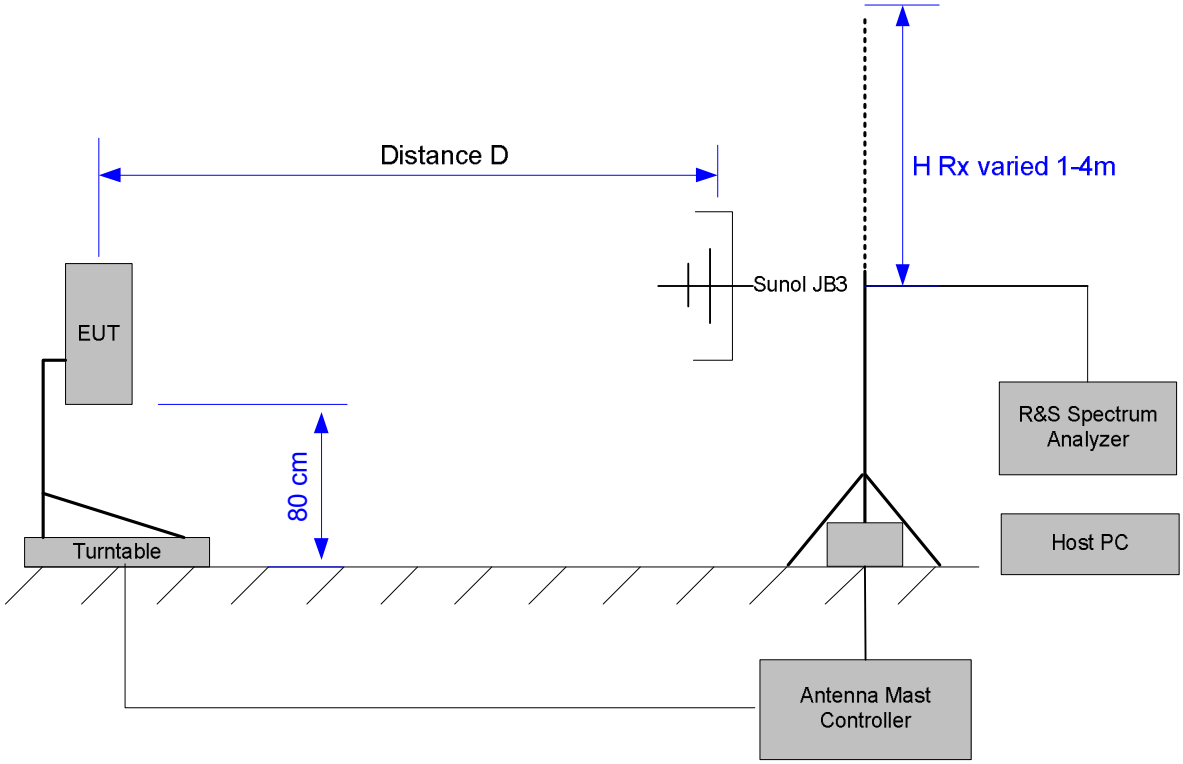
Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels.

The test is performed at low and high channels. Compliance in the 5725-5850 MHz band is established through conducted measurements. Compliance with the 15.209 restricted band requirements of the 2400-2483.5 MHz band is established through radiated measurements. Data is presented for the worst case configuration.

6.3.1 Test Setup Block Diagram – Conducted Measurements

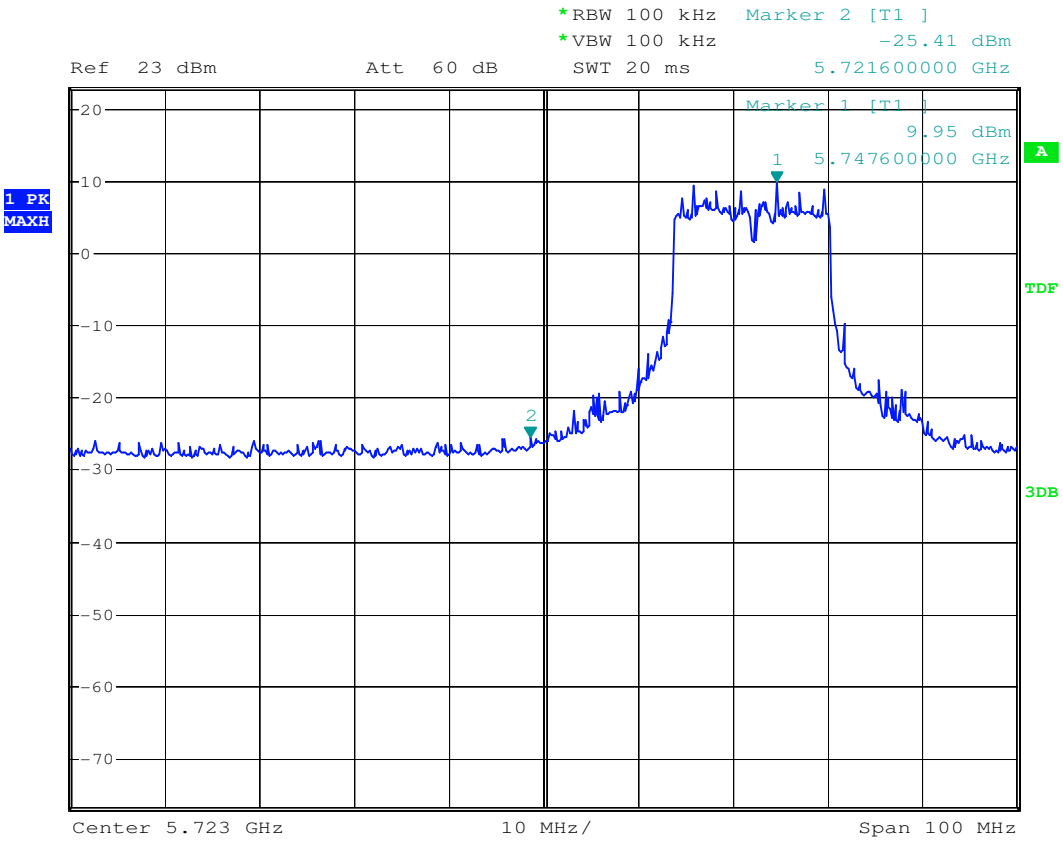


6.3.2 Test Setup Block Diagram – Radiated Measurements



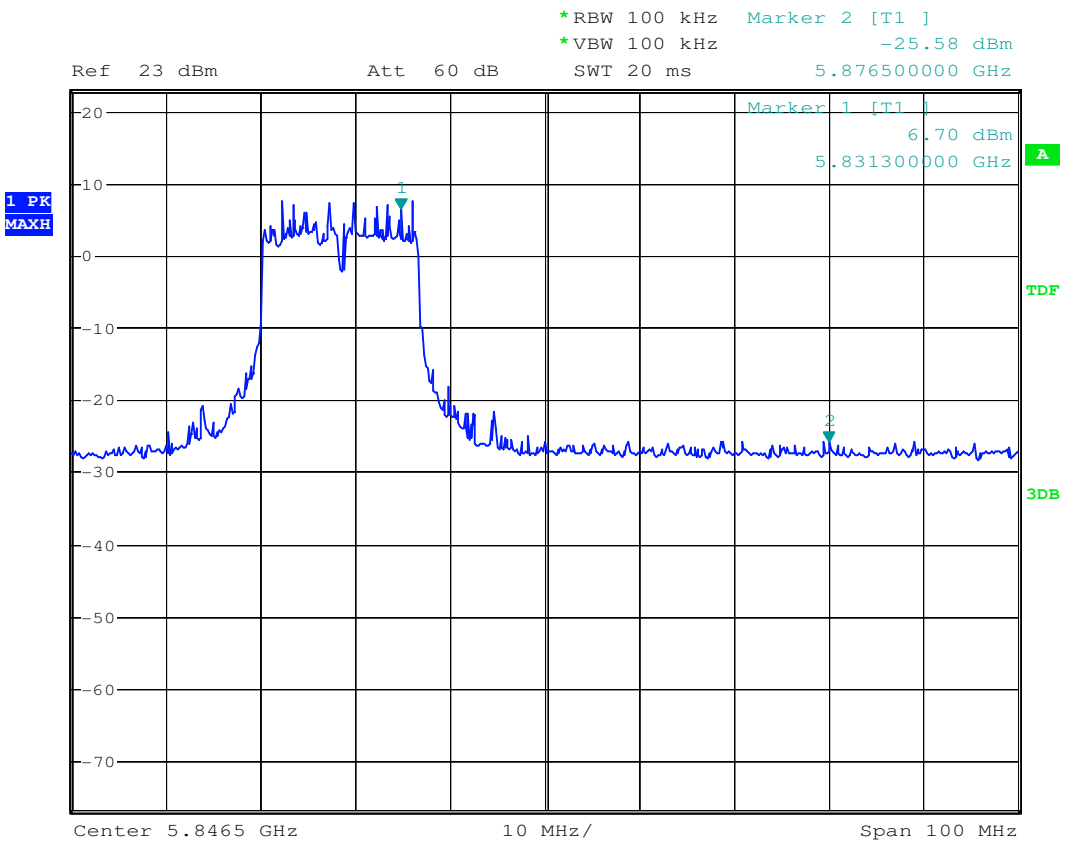
6.4 Test Results

6.4.1 5745-5825 MHz, Conducted Measurements



Radiated Spurious Emission 1-17G V H (AMB<>M1-4)

Date: 28.AUG.2008 18:34:58



Radiated Spurious Emission 1-17G V H (AMB<>M1-4)

Date: 28.AUG.2008 18:39:58

Chan	Hi Reading (dBm)	Low Reading (dBm)	Delta	Limit (dBc)	Margin (dB)	Result
149	9.95	-25.41	-35.36	-20	15.36	PASS
165	6.70	-25.50	-32.20	-20	12.20	PASS

All emissions outside of the 5725-5850 MHz frequency band are attenuated by at least 20 dB.

6.4.2 2412-2462 MHz, Radiated Measurements

This measurement is performed using the peak-delta method. The delta is measured using bandwidth settings of RBW, VBW = 100 KHz. This delta is then subtracted from the peak radiated power which is measured using settings of RBW, VBW = 1 MHz. Only the worst case configuration is shown below.

Freq (MHz)	Mode	Peak 1M/1M (dBuV/m@3m)	Delta 100k/100k (dB)	BE Reading (dBuV/m@3m)	Limit (dBuV/m@3m)	Margin
2412	b Mode	129.8	55.9	73.9	74	0.10
2462	b Mode	128.8	57.70	71.10	74	2.90

7.0 Occupied Bandwidth

7.1 Test Standard

FCC CFR47, Part 15, Subpart B 15.247a.

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

(2) 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. |

7.2 Test Limits

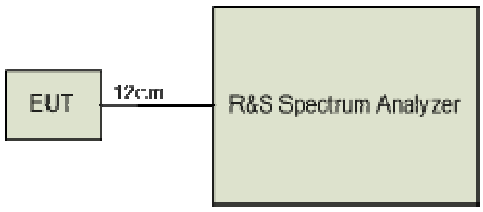
The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3 Test Setup

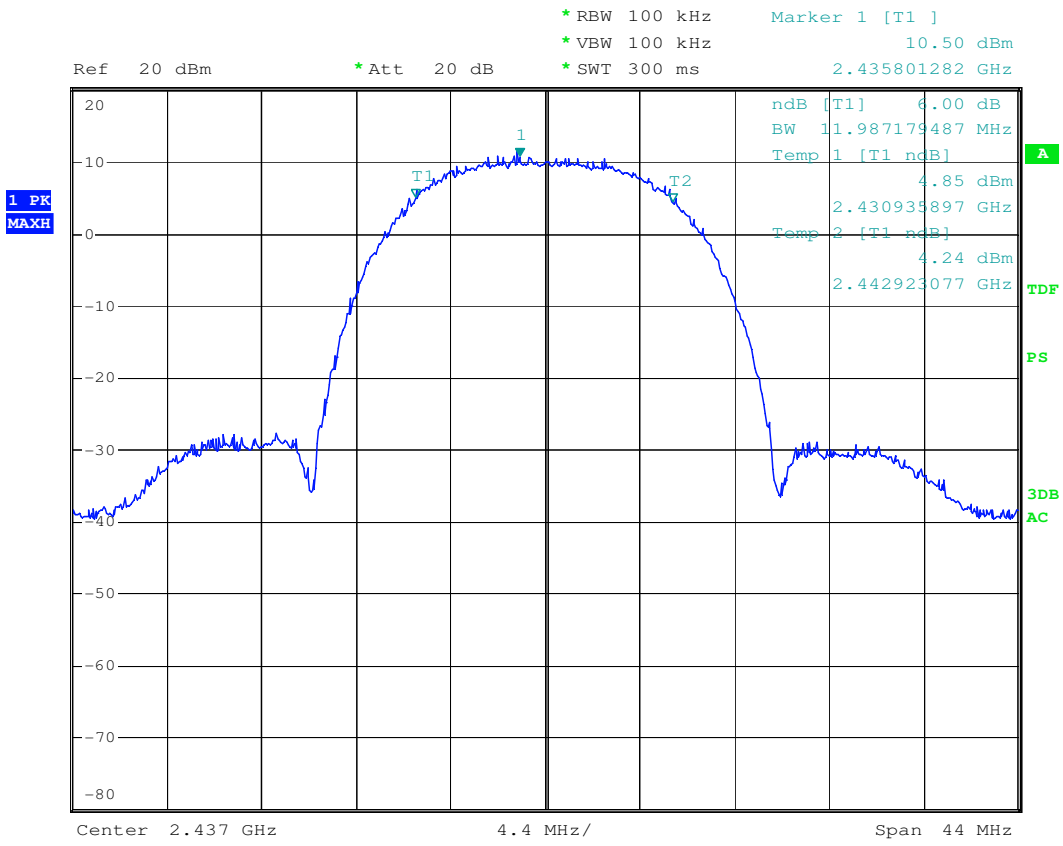
This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

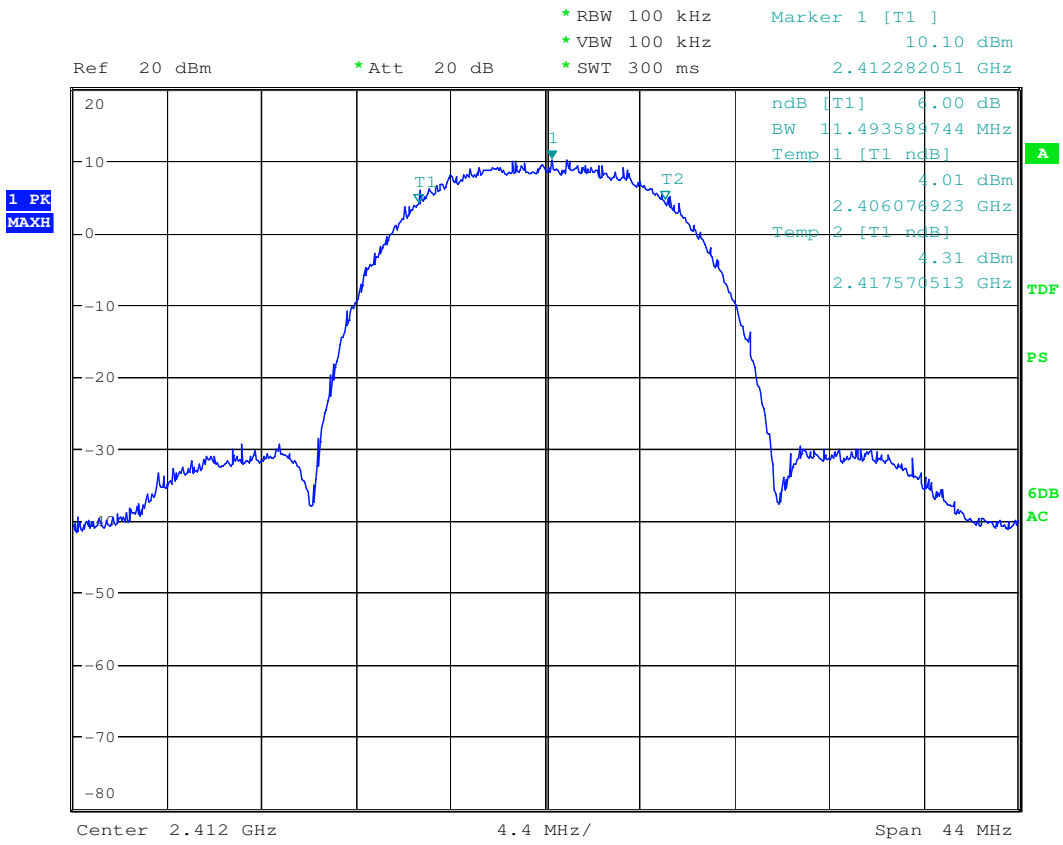
The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 20 MHz bandwidths for both 2.4 and 5.8 GHz frequency bands.

7.3.1 Test Setup Block Diagram

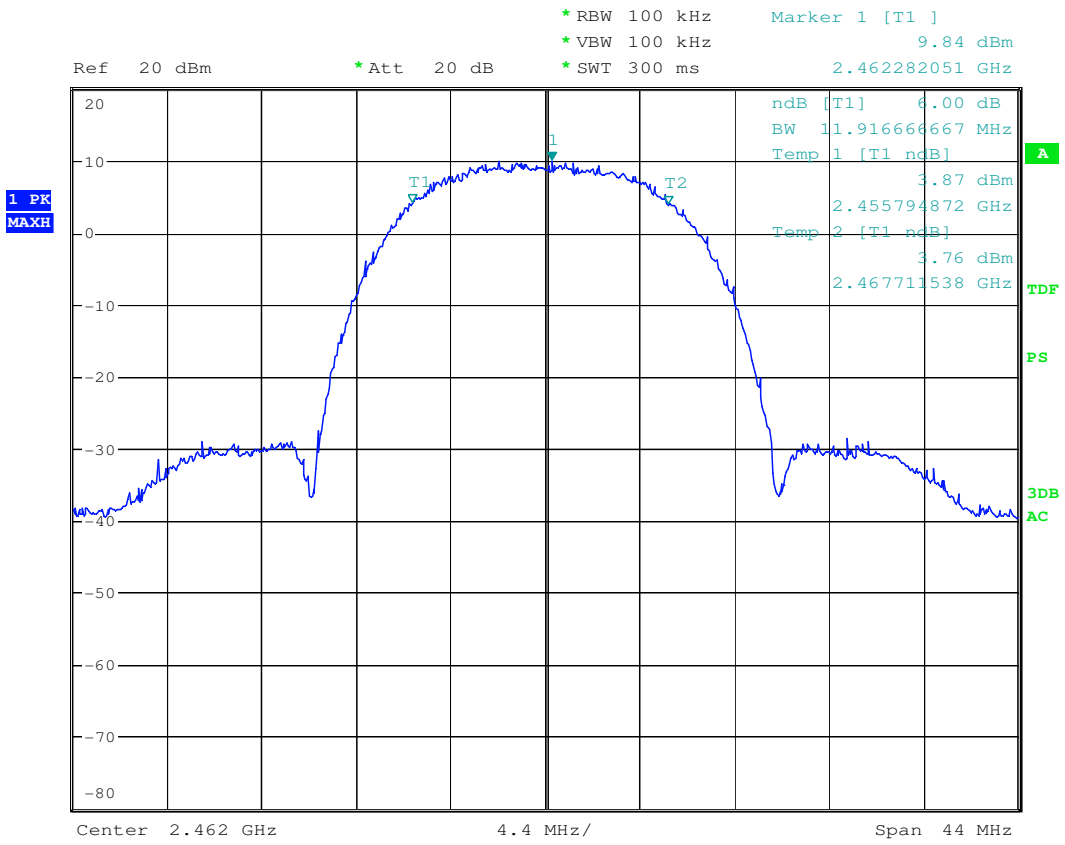


7.4 Test Results, 6 dB Occupied Bandwidth at 2.4 GHz Frequency band





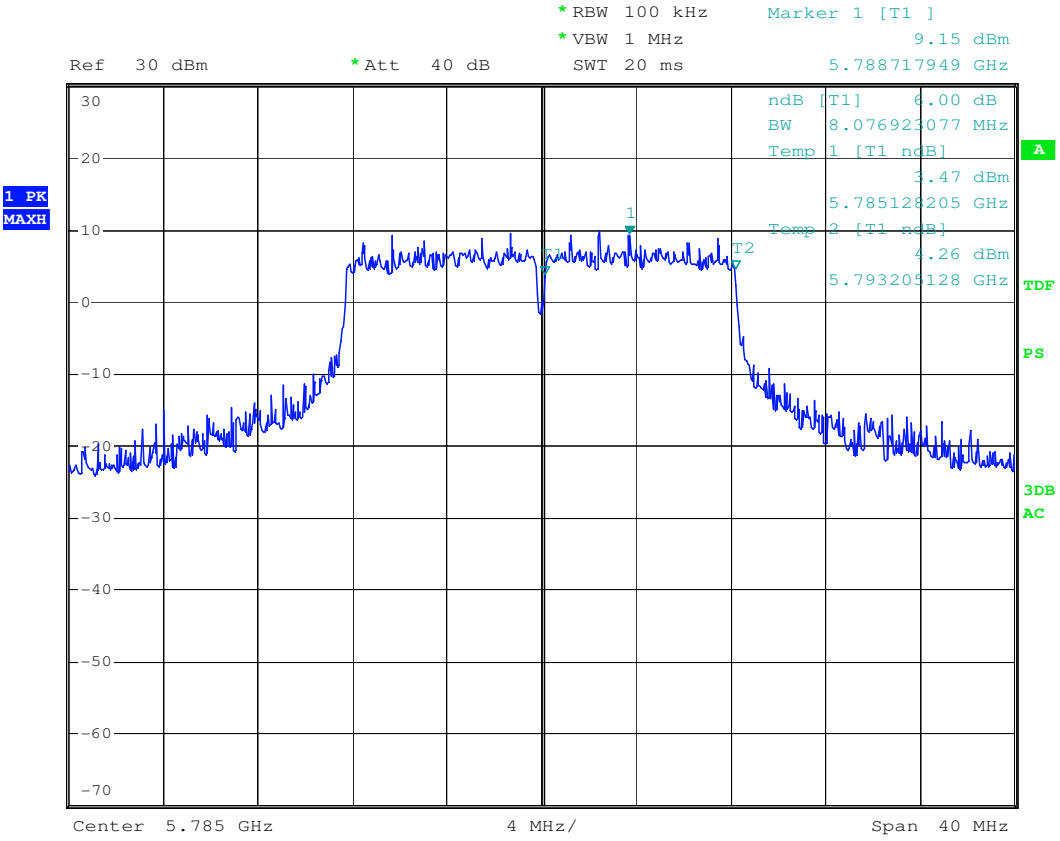
Date: 7.NOV.2008 19:38:07



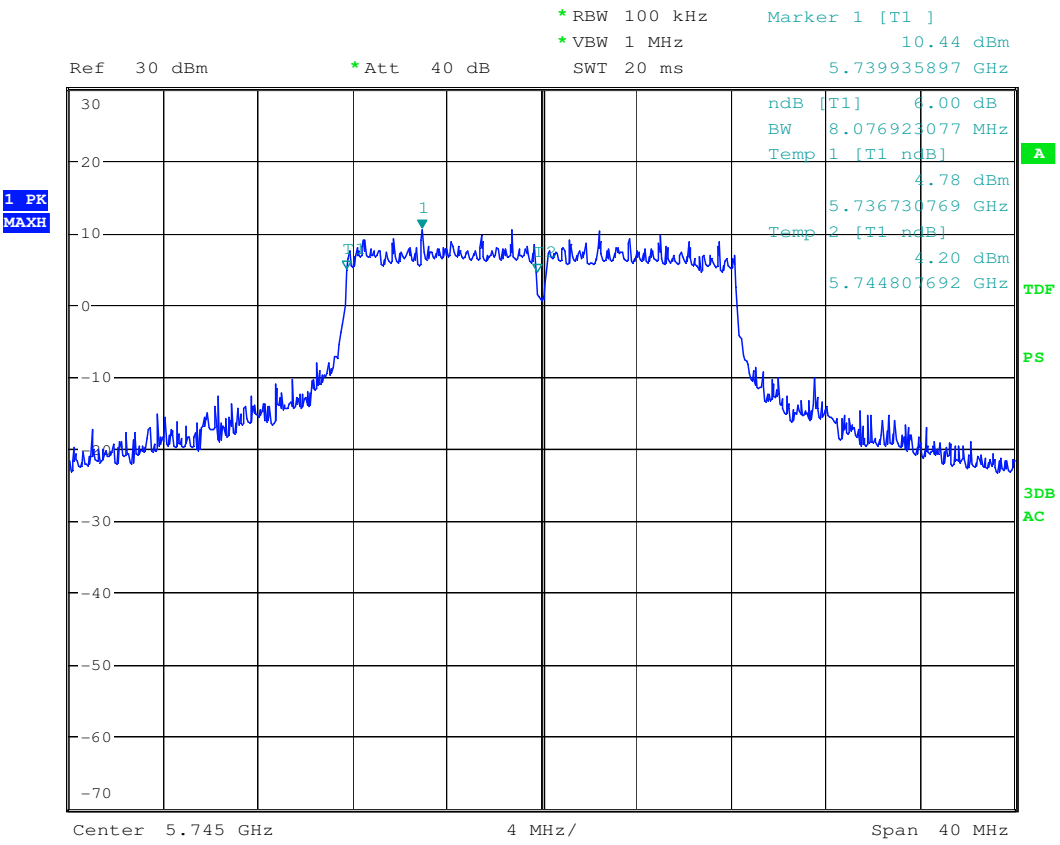
7.4.1 Data Table – Occupied Bandwidth

Channel	Frequency(MHz)	Occupied Bandwidth(MHz)	Limit	Result
Ch 1	2412	11.493	0.5	PASS
Ch 6	2437	11.987	0.5	PASS
Ch 11	2462	11.916	0.5	PASS

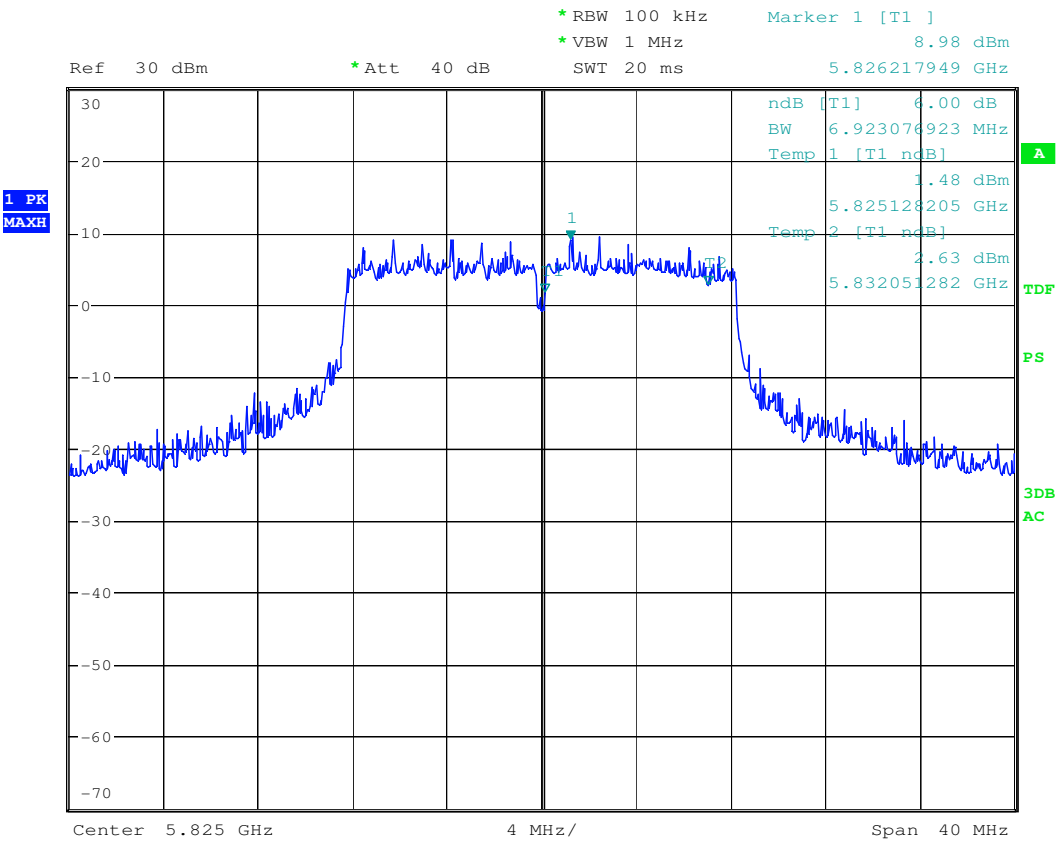
7.5 Test Results, 6 dB Occupied Bandwidth at 5.8 GHz Frequency band



Date: 7.NOV.2008 19:12:06



Date: 7.NOV.2008 19:14:45



Date: 7.NOV.2008 19:07:07

7.5.1 Data Table – Occupied Bandwidth

Mode OFDM/ Channel BW = 20MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 149	5745	8.077	0.5	PASS
Ch 157	5785	8.077	0.5	PASS
Ch 165	5825	6.923	0.5	PASS

8.0 Power Spectral Density

8.1 Test Standard

FCC CFR 47, Part 15, Subpart B 15.247e.

| *(e) 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.* |

8.2 Test Limits

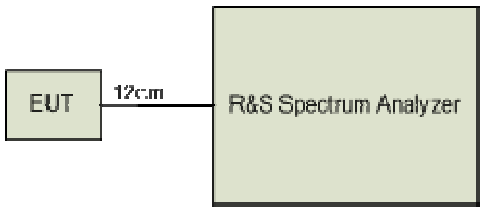
The transmitted power density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3 Test Setup

This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

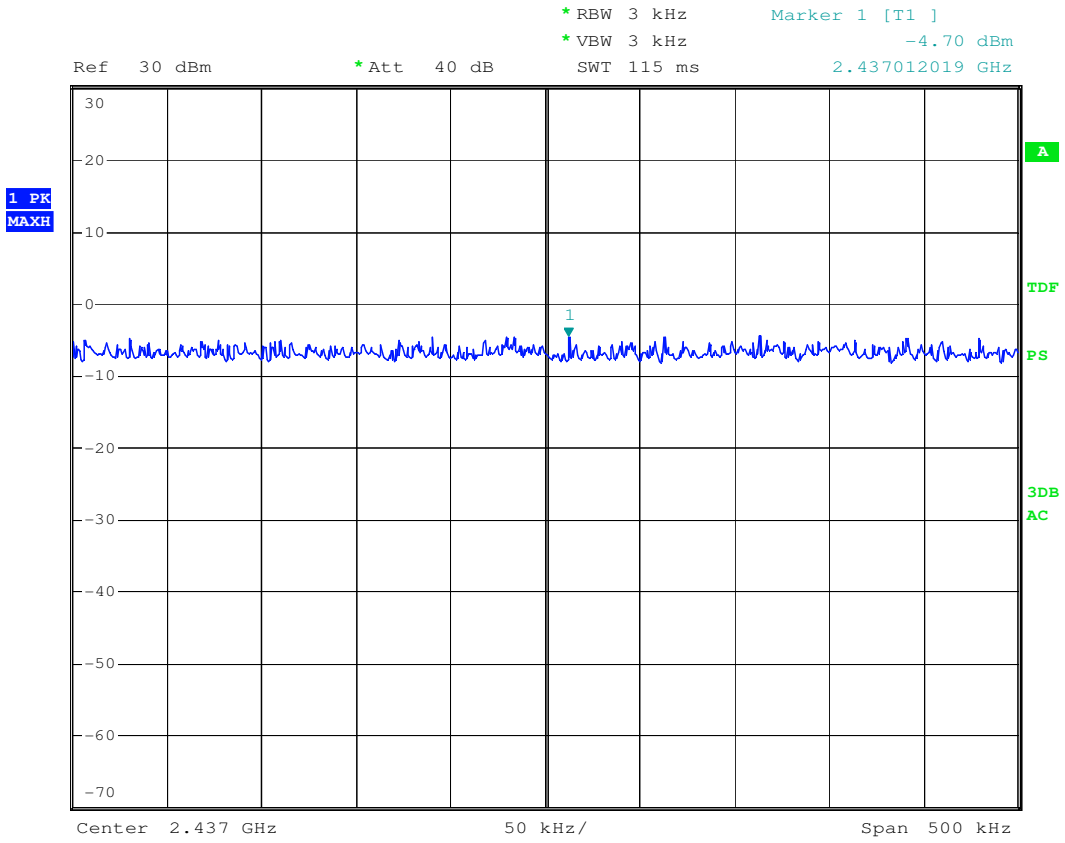
The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 20 MHz bandwidths for both 2.4 and 5.8 GHz frequency bands.

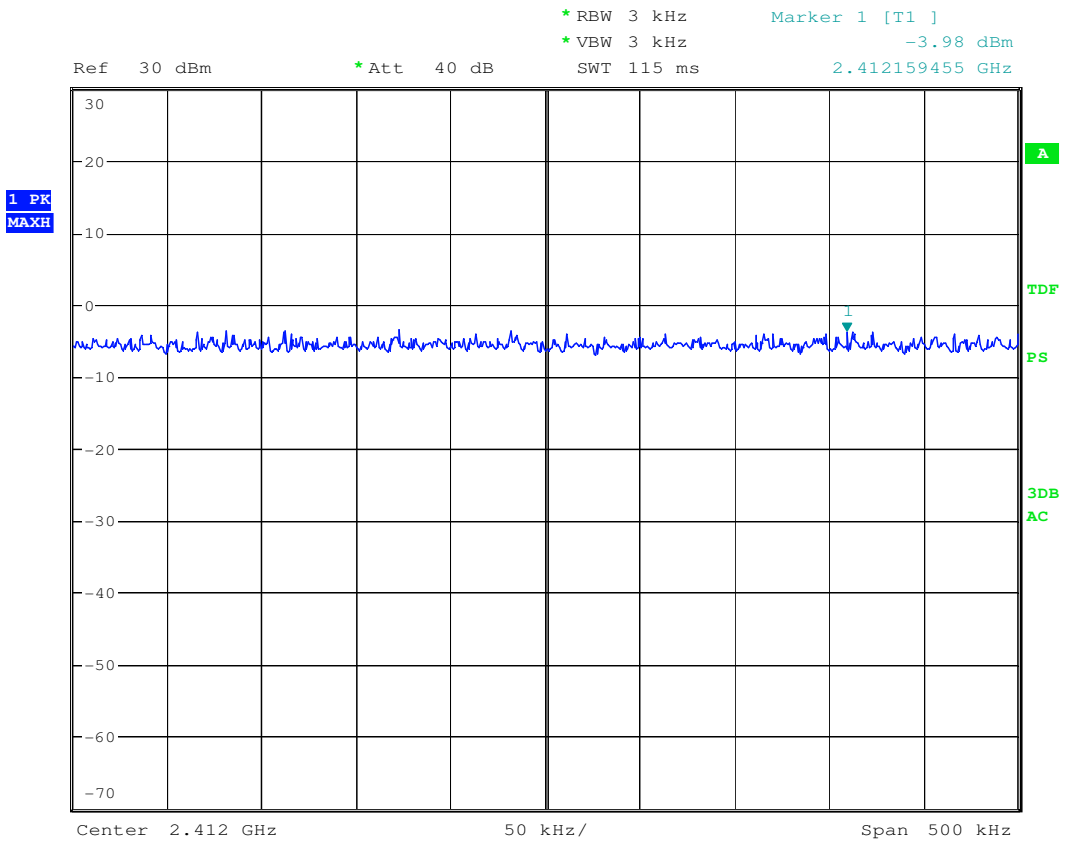
8.3.1 Test Setup Block Diagram



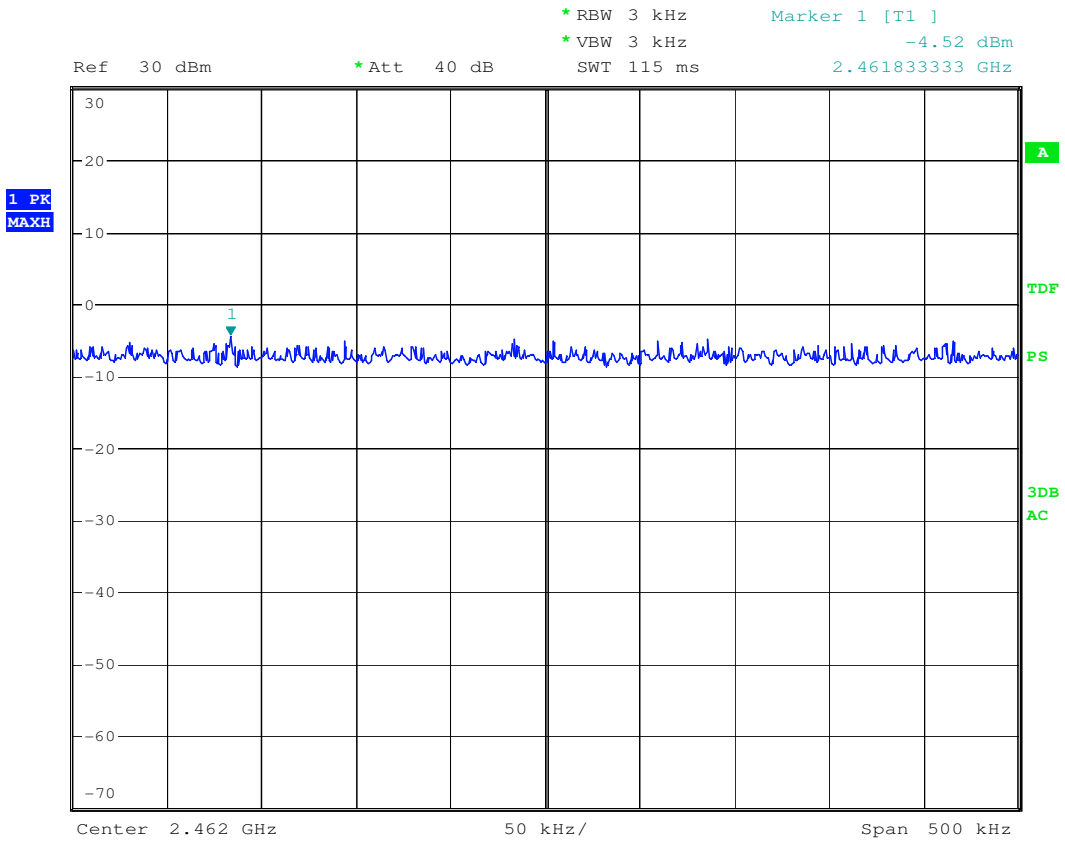
8.4 Test Results

8.4.1 2.4 GHz frequency band



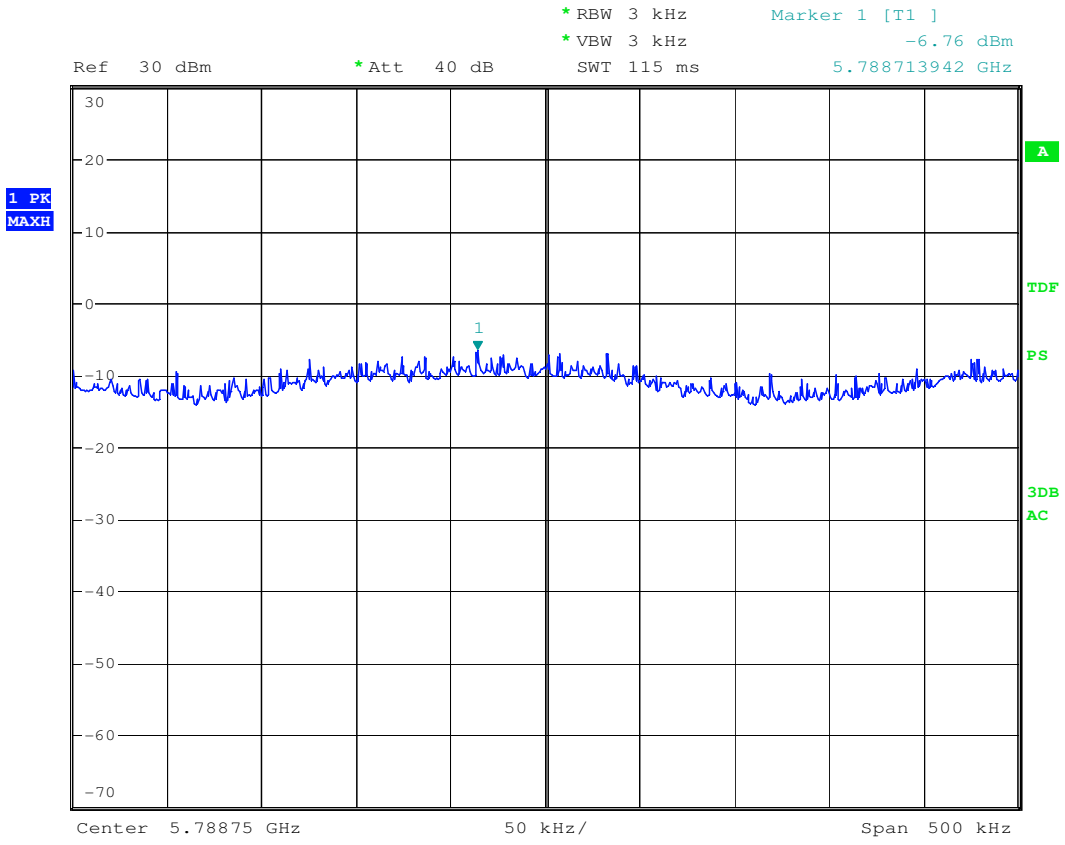


Date: 7.NOV.2008 18:36:57

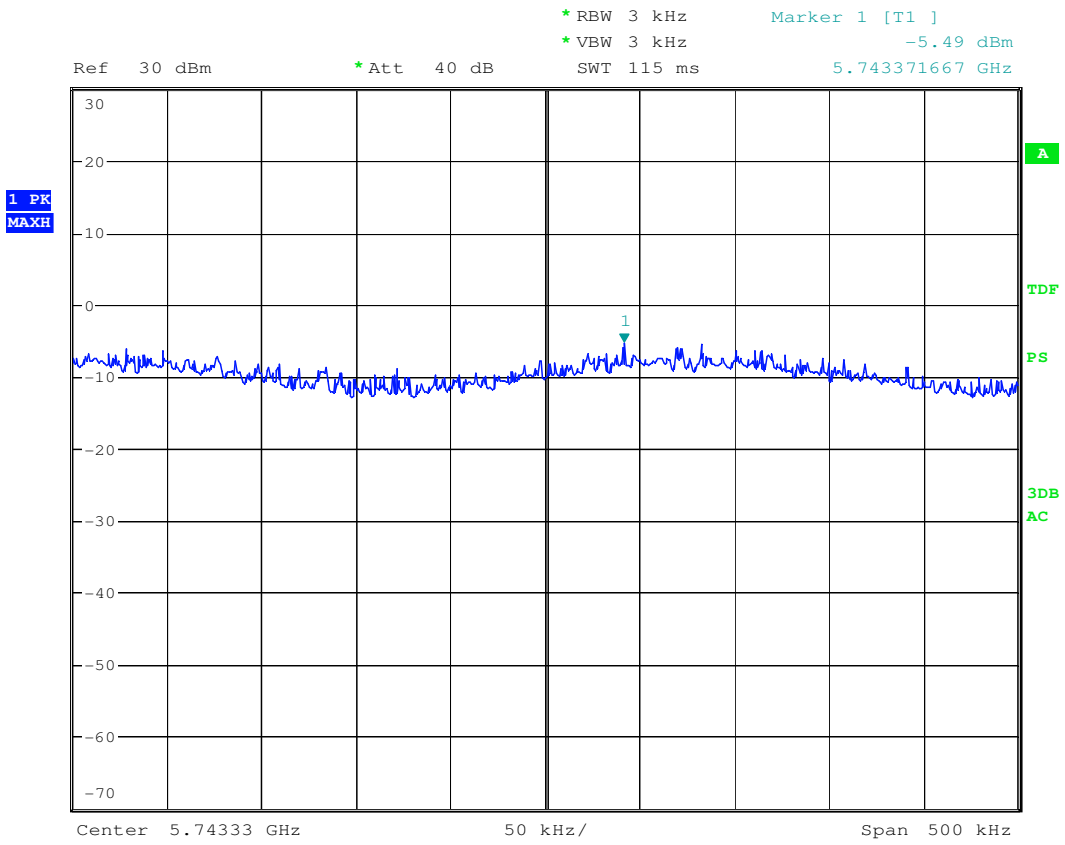


Frequency(MHz)	PSD in 3 KHz (dBm)	Limit (dBm)	Result
2412.2	-3.98	8	PASS
2438.7	-4.70	8	PASS
2461.0	-4.52	8	PASS

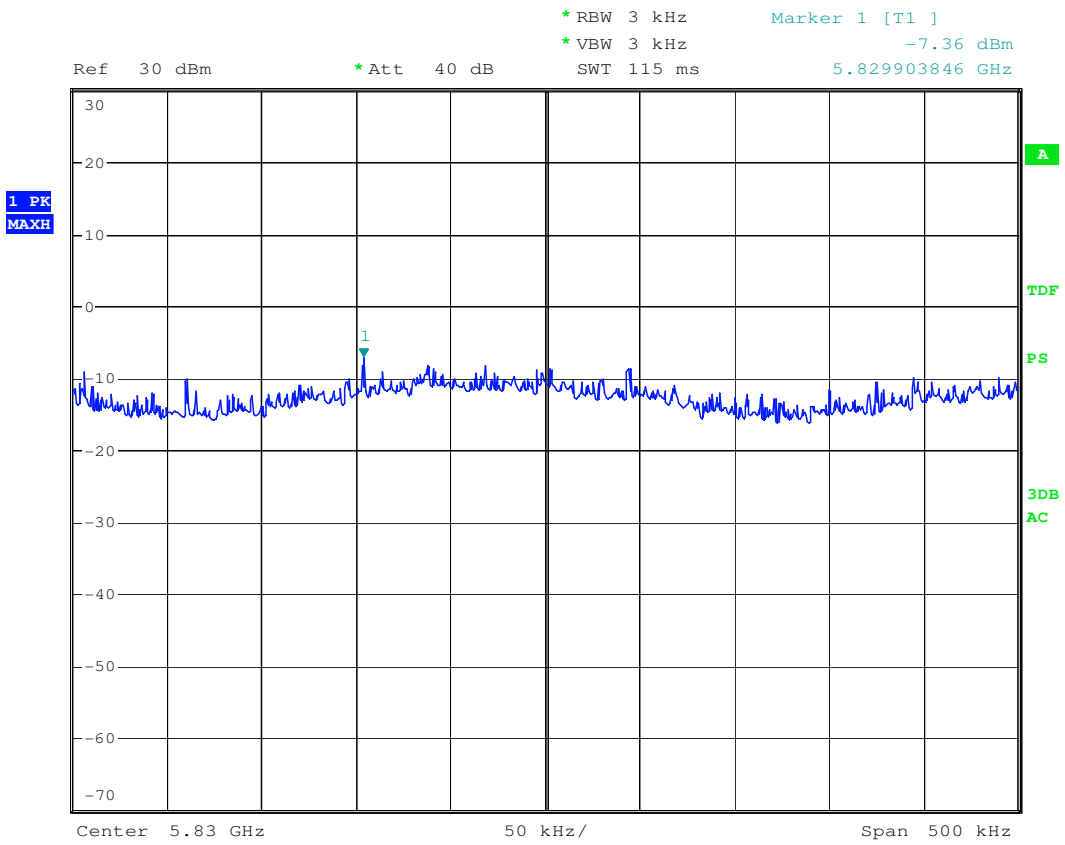
8.4.2 5.8 GHz frequency band



Date: 7.NOV.2008 18:51:07



Date: 7.NOV.2008 18:47:44



Date: 7.NOV.2008 18:54:14

Frequency(MHz)	PSD in 3 KHz (dBm)	Limit	Result
5743.4	-5.49	8	PASS
5788.7	-6.76	8	PASS
5829.9	-7.36	8	PASS

9.0 RF Exposure Evaluation

FCC 1.1310 states the criteria listed in the table below shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Section 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Section 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation".

Frequency Range (MHZ)	Electric Field Strength (V/m)	Magnetic Field Strength (A/M)	Power Density (mW/cm^2)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

9.1 EUT Operating Condition

The maximum antenna gain is 26 dBi at 2.4 GHz and 32 dBi at 5.8 GHz.

9.2 RF exposure evaluation distance calculation FCC 1.304

2.4GHz radio with 26 dBi antenna

Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
2412	27.43	26	130.4
2437	27.27	26	129.9
2462	26.30	26	116.3

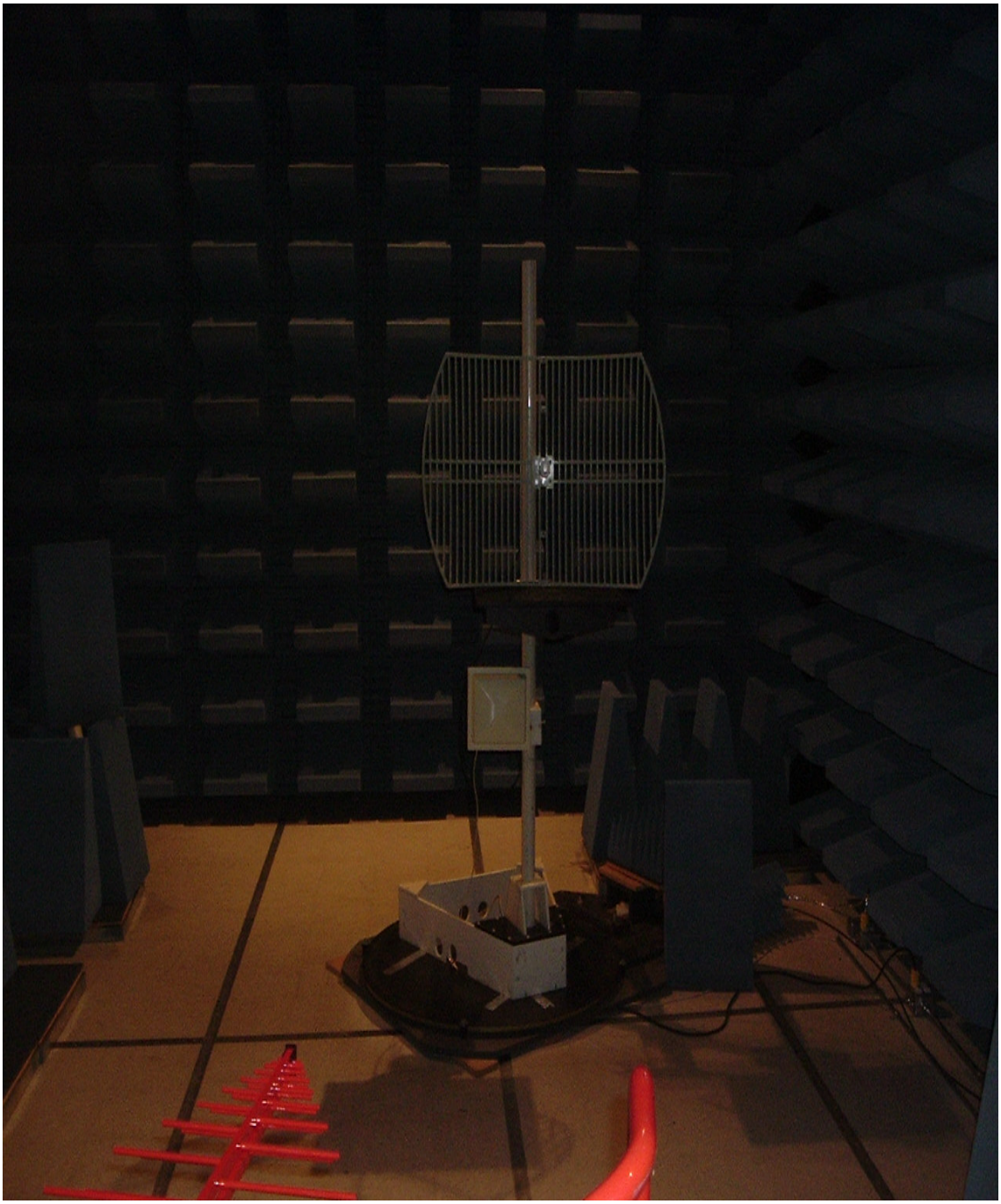
5.8GHz radio with 32 dBi antenna

Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
5745	26.64	32	241.1
5785	25.57	32	213.1
5825	24.64	32	191.6

As shown above, the minimum distance where the MPE limit is reached is 241.1 cm for the EUT.

10.0 Test Photos

10.1 Radiated emissions setup



10.2 Conducted emissions setup