TRANZEO
EMC LABS INC

EMC Test Report

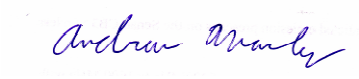
FCCID: QRF-QSFNYON3

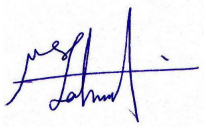
2.4 GHz and 5.8 GHz Wireless Network Adapter
Tranzeo Wireless Technologies Inc.

Date: 5 February 2008

Report No.: 230307.2

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





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Revision History

1. Although this product is already certified under FCCID: QRF-NYYON23, the FCCID has been changed to QRF-QSFNYON3 in order to add operation in the UNII bands.
2. A reference to ANSI C63.4:2003 was added in section 1.1 to confirm that the measurements were done according to the standard.
3. A statement was added in section 6.4.2 to confirm compliance with the average limits for band edge measuremetns.

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1.0 General Information

1.1 EUT Description

Product Name	Wireless Access Point, CPE
Company Name	Tranzeo Wireless Technologies Inc
FCC ID	QRF-QSFNYON3
Model No.	TR-6000-N; TR-6000-15; TR-6000-19: TR-multi-N; TR-multi-2; TR-5a-N; TR-5a
Frequency Range	2400-2483.5 MHz; 5725-5850 MHz
Number of Channels	45
Transmit Rate	54 Mbps maximum bit rate specification
Type of Modulation	2.4 GHz: DSSS, OFDM; 5.8 GHz: OFDM
Antenna Type	Integrated and external
Antenna Gain	2400-2483.5: 24 dBi MAX; 5725-5850 32 dBi MAX
Product Software Revision	TR6-3.3.0Rt
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	TR-multi-N	AG623-ENGR1
Tranzeo Wireless	TR-6000-19	AG623-ENGR4
Tranzeo Wireless	TR-5a-20	AG623-ENGR5
Tranzeo Wireless	TR-5a-24	AG623-ENGR6

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					
20MHz BW (5 Channels)		**10MHz BW (10 Channels)**		**5MHz BW (19 Channels)**	
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
Channel 149	5745	Ch 148	5745	Ch 148	5745
Channel 153	5765	Ch 150	5755	Ch 149	5750
Channel 157	5785	Ch 152	5765	Ch 150	5755
Channel 161	5805	…	…	…	…
Channel 165	5825	Ch 166	5835	Ch 166	5745

The products, TR-multi-N, TR-multi-2, TR-6000-15, TR-6000-19, TR-5a-20, TR-5a-24, are a product family. They use the same radio and are identical except for the following:

- The TR-multi-N is fitted with a standard Type N antenna connector. This device can operate at either 2.4 or 5.8 GHz depending on the antenna configuration.
- The TR-multi-2 is fitted with a dual-band panel antenna. This device can operate at either 2.4 or 5.8 GHz.
- The TR-6000-15 is fitted with an integrated 2.4 GHz 15 dBi patch antenna. This device operates at 2.4 GHz.
- The TR-6000-19 is fitted with an integrated 2.4 GHz 19 dBi patch antenna. This device operates at 2.4 GHz.
- The TR-5a-20 is fitted with an integrated 5.8 GHz patch antenna. This device operates at 5.8 GHz
- The TR-5a-24 is fitted with an integrated 5.8 GHz patch antenna. This device operates at 5.8 GHz.

In addition to the tested samples described above, the product will also be marketed as the TR-6000-N and TR-5a-N. These two models operate exclusively at 2.4 and 5.8 GHz respectively. These models are fitted with standard Type N connectors and are electrically and physically identical to the model TR-multi-N.

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 models according to the ANSI C63.4:2003 test methods to demonstrate compliance with FCC Part 15, Subpart B, and Subpart C, as well as Industry Canada RSS-210 Issue 6 for digitally modulated devices.

1.2 Operational Description

The device is a wireless network bridge designed specifically for outdoor applications. The device provides a bridge between IEEE802.3 wired Ethernet LANs and IEEE802.11a/b/g compliant wireless networks. It uses an external antenna, or an internal antenna in case of the integrated units, coupled with an 802.11a/b/g transceiver to connect to remote wireless clients. The transceiver operates in the frequency bands 2400-2483.5 and 5725-5850 MHz. The device transmits digital network data. The unit is mounted externally in fixed point-to-point installations. It is mounted on the exterior of a building typically for broadband internet access.

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 products, TR-multi-N, TR-multi-2, TR-6000-15, TR-6000-19, TR-5a-20, TR-5a-24, are a product family. The device fitted with a standard Type N connector was tested with the highest gain antenna of each type. Data is presented for the worst case configuration in each frequency band.

Each unit fitted with an integrated antenna was tested. Data is presented for the dual-band antenna as well as the worst case single band units.

The EUT was mounted to a custom non-metallic stand to ease polarization changes and 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. For the Type N connector unit, the antenna was connected to the EUT via 1 m of coaxial shielded cable.

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 an access point 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 TR-multi-N EUT was tested with the following external antennas:

2.4 GHz Antennas	
TR-GD-24-24 TR-24H-90-17 TR-VA24-16 TR-ODH24-13 TR-OD-24-12	24 dBi Grid Antenna 17 dBi Sector Antenna 16 dBi Yagi Antenna 13 dBi Horizontal Omni Antenna 12 dBi Vertical Omni Antenna
5 GHz Antennas	
TR-5.8-32DB-ANT TR-GD58-26 TR-58V-60-17 TR-58H-90-16 TR-HTQ-5.8-12	32 dBi Dish Antenna 26 dBi Grid Antenna 17 dBi Vertical Sector Antenna 16 dBi Horizontal Sector Antenna 12 dBi Vertical Omni Antenna

1.5 EUT Modifications

No modifications were necessary for this unit to comply with FCC Part 15 and Industry Canada RSS-210 Issue 6.

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 Part 15, Subparts B and C, as well as Industry Canada RSS-210 Issue 6.

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

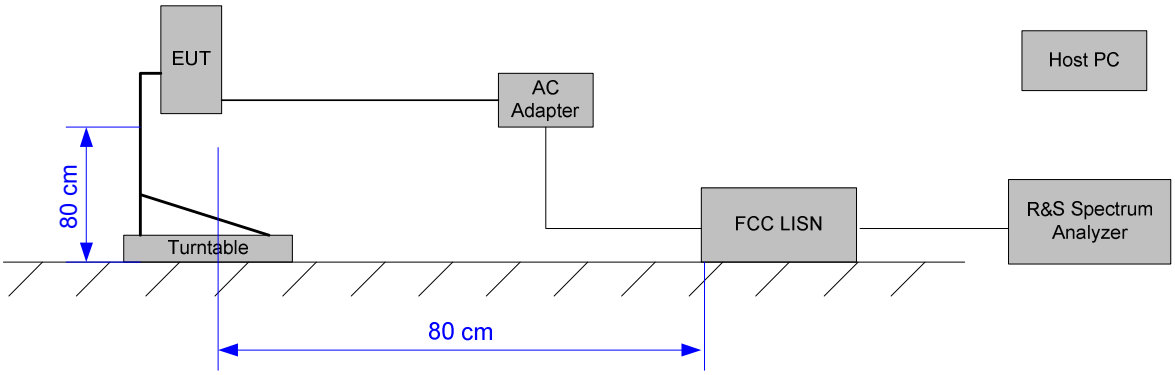
Frequency (MHz)	Maximum Level (dBuV) Quasi-Peak	Maximum Level (dBuV) Average
0.15-0.50	66-56 (Log Delta)	56-46 (Log Delta)
0.50-5.00	56	46
5.00-30.0	60	50

2.3 Test Setup

The EUT was exercised using bandwidth test software at the highest possible data rate. Testing was performed on low, middle and high channels in 2.4 and 5.8 GHz frequency bands. All modulation types and emission bandwidths were tested at each frequency band. 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 Test Data Peak Detector

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Margin (dB)	Limit (dBµV)
0.155651	52.4	1000.000	9.000	On	N	13.4	65.8
0.157058	52.5	1000.000	9.000	On	N	13.3	65.8
0.158477	52.3	1000.000	9.000	On	N	13.5	65.8
0.165933	51.9	1000.000	9.000	On	N	13.6	65.5
0.168945	52.0	1000.000	9.000	On	N	13.5	65.5
0.172012	51.7	1000.000	9.000	On	N	13.7	65.4
0.217120	50.0	1000.000	9.000	On	N	14.1	64.1
0.343512	46.3	1000.000	9.000	On	N	14.2	60.5
0.937971	34.4	1000.000	9.000	On	N	21.6	56.0
0.941728	34.4	1000.000	9.000	On	N	21.6	56.0
0.947393	34.3	1000.000	9.000	On	N	21.7	56.0
0.951188	34.2	1000.000	9.000	On	N	21.8	56.0
1.320213	45.3	1000.000	9.000	On	N	10.7	56.0

2.4.2 Test Data Average Detector

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Margin (dB)	Limit (dBµV)
0.551138	37.6	1000.000	9.000	On	N	8.4	46.0
0.937971	11.5	1000.000	9.000	On	N	34.5	46.0
0.943613	15.3	1000.000	9.000	On	N	30.7	46.0
0.947393	14.4	1000.000	9.000	On	N	31.6	46.0
0.951188	11.0	1000.000	9.000	On	N	35.0	46.0
1.129608	37.5	1000.000	9.000	On	L1	8.5	46.0
1.320213	44.3	1000.000	9.000	On	L1	1.7	46.0
1.410240	38.0	1000.000	9.000	On	L1	8.0	46.0
1.470700	36.2	1000.000	9.000	On	L1	9.8	46.0
22.654799	35.9	1000.000	9.000	On	L1	14.1	50.0

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 5, 10 and 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

Mode DSSS/ Channel BW = 5MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
2412	19.16	30	PASS
2437	19.95	30	PASS
2462	14	30	PASS

Mode DSSS/ Channel BW = 10MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
2412	19.07	30	PASS
2437	19.58	30	PASS
2462	14.14	30	PASS

Mode OFDM/ Channel BW = 5MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
2412	19.72	30	PASS
2437	20.13	30	PASS
2462	14.26	30	PASS

Mode OFDM/ Channel BW = 10MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
2412	19.59	30	PASS
2437	20.22	30	PASS
2462	15.28	30	PASS

Mode OFDM/ Channel BW = 20MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
2412	19.35	30	PASS
2437	19.73	30	PASS
2462	15.1	30	PASS

3.4.2 5.8 GHz frequency band

Mode OFDM/ Channel BW = 5MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
5740	15.49	30	PASS
5785	14.94	30	PASS
5830	15.6	30	PASS

Mode OFDM/ Channel BW = 10MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
5740	15.66	30	PASS
5780	15.25	30	PASS
5830	15.88	30	PASS

Mode OFDM/ Channel BW = 20MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
5745	16.83	30	PASS
5785	16.22	30	PASS
5825	16.88	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

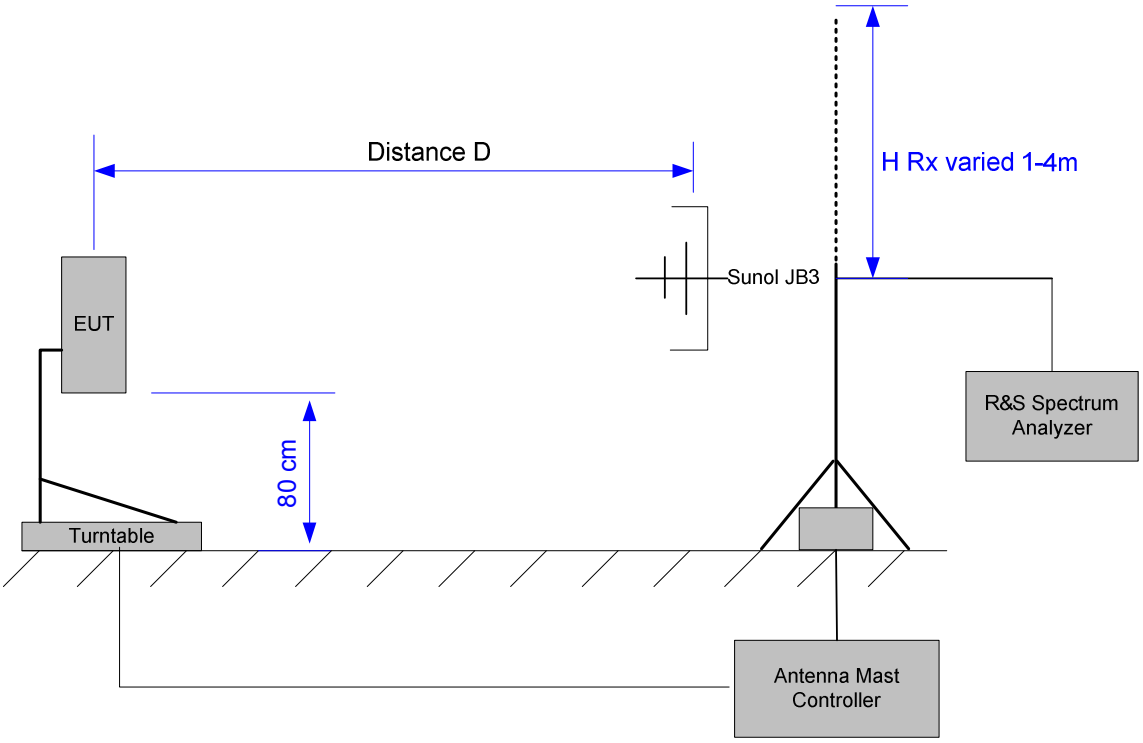
Frequency (MHz)	Maximum Field Strength (uV/m @ 3m)	Maximum Field Strength (dBuV/m @ 3m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-1000	500	54.0

4.3 Test Setup

All sample units were tested. The TR-multi-N was tested with all antennas. The EUT was exercised using beaconing mode at the highest possible transmit rate. The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 5, 10 and 20 MHz bandwidths for both 2.4 and 5.8 GHz frequency bands. The TR-multi-N is connected to the external antenna via 1m of coaxial shielded cable. Only worst case data is shown below.

Note: For testing purposes and 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, 2.4 GHz Frequency Band

4.4.1 24 dBi Grid Antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)
204.680000	42.9	0.6	43.5	162.0	H	96.0
82.960000	39.1	0.9	40.0	216.0	H	261.0
152.840000	41.6	1.9	43.5	276.0	V	105.0
437.520000	43.4	2.6	46.0	215.0	H	285.0
44.520000	36.9	3.1	40.0	102.0	V	92.0
196.840000	39.1	4.4	43.5	263.0	H	174.0
83.800000	33.7	6.3	40.0	226.0	H	285.0
208.160000	35.3	8.2	43.5	262.0	H	15.0
530.600000	36.3	9.7	46.0	276.0	H	4.0
86.040000	28.7	11.3	40.0	276.0	H	-14.0
209.200000	29.6	13.9	43.5	262.0	H	274.0
47.680000	22.3	17.7	40.0	142.0	V	255.0
131.480000	23.6	19.9	43.5	102.0	H	5.0
141.360000	13.4	30.1	43.5	254.0	H	74.0
456.520000	15.5	30.5	46.0	243.0	V	-8.0
153.160000	11.0	32.5	43.5	105.0	V	267.0
169.160000	10.5	33.0	43.5	266.0	H	167.0
171.480000	10.1	33.4	43.5	276.0	H	78.0

Note: All data points are corrected for insertion loss.

4.4.2 13 dBi Horizontal Omni Antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)
193.480000	42.8	0.7	43.5	265.0	H	73.0
152.840000	41.9	1.6	43.5	260.0	V	258.0
56.800000	35.2	4.8	40.0	260.0	H	164.0
84.520000	30.9	9.1	40.0	264.0	H	163.0
54.400000	30.1	9.9	40.0	257.0	H	100.0
207.720000	33.3	10.2	43.5	272.0	H	15.0
207.120000	32.6	10.9	43.5	261.0	H	186.0
85.520000	28.5	11.5	40.0	264.0	H	15.0
184.880000	31.9	11.6	43.5	234.0	H	285.0
183.200000	29.3	14.2	43.5	267.0	H	105.0
58.560000	25.3	14.7	40.0	272.0	H	171.0
892.760000	22.6	23.4	46.0	165.0	V	174.0
56.960000	15.8	24.2	40.0	264.0	H	168.0
155.480000	17.7	25.8	43.5	113.0	V	15.0
456.520000	15.5	30.5	46.0	193.0	V	195.0
160.280000	12.7	30.8	43.5	143.0	H	-5.0
147.320000	11.8	31.7	43.5	261.0	V	-14.0
156.920000	11.1	32.4	43.5	271.0	H	15.0
169.400000	10.2	33.3	43.5	255.0	V	277.0

Note: All data points are corrected for insertion loss.

4.4.3 17 dBi Sector antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)
82.880000	39.5	0.5	40.0	259.0	H	181.0
445.000000	45.4	0.6	46.0	259.0	V	184.0
530.960000	44.3	1.7	46.0	265.0	H	87.0
193.440000	40.6	2.9	43.5	265.0	H	265.0
204.680000	36.9	6.6	43.5	164.0	H	105.0
493.720000	39.0	7.0	46.0	261.0	H	88.0
207.280000	32.1	11.4	43.5	163.0	H	272.0
86.040000	28.5	11.5	40.0	272.0	H	15.0
54.520000	28.3	11.7	40.0	113.0	H	177.0
84.520000	27.3	12.7	40.0	272.0	H	104.0
182.000000	22.6	20.9	43.5	162.0	H	163.0
890.960000	23.1	22.9	46.0	143.0	V	-14.0
157.040000	15.6	27.9	43.5	265.0	H	277.0
154.040000	12.9	30.6	43.5	115.0	H	78.0
118.120000	11.9	31.6	43.5	265.0	V	104.0
161.480000	11.6	31.9	43.5	259.0	V	88.0
161.400000	10.2	33.3	43.5	163.0	H	168.0
224.880000	8.8	37.2	46.0	271.0	V	255.0

Note: All data points are corrected for insertion loss.

4.4.4 12 dBi Vertical Omni Antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Antenna height (cm)	Turntable position (deg)
493.720000	43.2	2.8	46.0	264.0	-4.0
87.120000	37.0	3.0	40.0	265.0	255.0
500.000000	41.1	4.9	46.0	113.0	163.0
152.480000	36.4	7.1	43.5	103.0	270.0
207.800000	34.1	9.4	43.5	272.0	163.0
206.360000	31.9	11.6	43.5	114.0	163.0
56.760000	28.1	11.9	40.0	165.0	0.0
86.080000	27.7	12.3	40.0	272.0	173.0
56.880000	27.6	12.4	40.0	204.0	285.0
180.760000	28.0	15.5	43.5	104.0	94.0
892.760000	27.5	18.5	46.0	165.0	100.0
931.880000	25.0	21.0	46.0	194.0	277.0
144.720000	15.0	28.5	43.5	193.0	-14.0
134.440000	14.3	29.2	43.5	272.0	4.0
162.720000	12.3	31.2	43.5	215.0	278.0
445.000000	14.8	31.2	46.0	215.0	97.0
133.680000	12.1	31.4	43.5	271.0	15.0

Note: All data points are corrected for insertion loss.

4.4.5 16 dBi Yagi antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)
86.840000	39.8	0.2	40.0	213.0	H	-5.0
205.480000	42.7	0.8	43.5	214.0	H	187.0
874.440000	44.2	1.8	46.0	145.0	V	100.0
82.920000	37.9	2.1	40.0	265.0	H	86.0
147.360000	39.2	4.3	43.5	113.0	V	96.0
192.320000	38.7	4.8	43.5	259.0	H	253.0
181.800000	37.2	6.3	43.5	271.0	H	-8.0
208.280000	36.0	7.5	43.5	272.0	H	-5.0
530.400000	36.4	9.6	46.0	272.0	H	285.0
54.440000	28.4	11.6	40.0	193.0	H	0.0
44.480000	27.7	12.3	40.0	272.0	H	173.0
54.560000	25.7	14.3	40.0	143.0	H	81.0
887.560000	23.7	22.3	46.0	101.0	H	255.0
160.560000	20.8	22.7	43.5	193.0	H	183.0
145.320000	13.8	29.7	43.5	259.0	V	105.0
167.600000	13.4	30.1	43.5	244.0	V	174.0
133.720000	12.2	31.3	43.5	239.0	H	285.0
123.200000	12.0	31.5	43.5	103.0	V	-2.0

Note: All data points are corrected for insertion loss.

The data above is for 20 MHz bandwidth in OFDM mode at channel 11 (2462MHz) which is the worst case configuration.

4.5 Test Results, 5.8 GHz Frequency Band

4.5.1 32 dBi Dish antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
639.240000	45.5	265.0	H	285.0	13.2	0.50	46.00
107.280000	42.5	255.0	H	169.0	3.9	1.00	43.50
205.400000	42.4	261.0	H	99.0	4.2	1.10	43.50
154.320000	41.8	165.0	V	0.0	4.6	1.70	43.50
91.680000	41.5	272.0	H	0.0	-0.5	2.00	43.50
55.440000	38.0	271.0	H	162.0	-0.9	2.00	40.00
58.840000	36.9	271.0	H	75.0	-0.8	3.10	40.00
194.040000	37.8	215.0	H	12.0	4.3	5.70	43.50
208.840000	36.7	264.0	H	165.0	3.4	6.80	43.50
86.880000	33.1	261.0	H	78.0	-1.0	6.90	40.00
783.240000	37.1	205.0	V	185.0	14.5	8.90	46.00
184.840000	34.5	272.0	H	9.0	3.4	9.00	43.50
55.800000	29.9	262.0	H	105.0	-0.9	10.10	40.00
531.480000	35.3	214.0	H	194.0	11.2	10.70	46.00
194.400000	32.0	255.0	H	272.0	4.3	11.50	43.50
84.280000	27.2	259.0	H	89.0	-0.9	12.80	40.00
54.440000	25.4	264.0	H	195.0	-0.8	14.60	40.00
132.320000	3.8	263.0	H	14.0	5.5	39.70	43.50

Note: All data points are corrected for insertion loss.

4.5.2 24 dBi Integrated antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
91.680000	42.1	272.0	H	74.0	-0.5	1.40	43.50
112.400000	41.6	265.0	H	85.0	4.8	1.90	43.50
107.240000	41.1	243.0	H	271.0	3.9	2.40	43.50
193.040000	40.1	258.0	H	285.0	4.1	3.40	43.50
55.480000	35.9	264.0	H	268.0	-0.9	4.10	40.00
89.760000	39.3	272.0	H	0.0	-0.9	4.20	43.50
101.920000	38.6	272.0	H	13.0	2.5	4.90	43.50
639.240000	40.6	193.0	H	95.0	13.2	5.40	46.00
83.000000	34.0	272.0	H	89.0	-0.9	6.00	40.00
59.000000	31.3	271.0	H	9.0	-0.8	8.70	40.00
84.160000	30.1	272.0	H	12.0	-0.9	9.90	40.00
86.800000	26.7	264.0	H	195.0	-1.0	13.30	40.00
871.040000	31.1	256.0	V	194.0	15.3	14.90	46.00
532.280000	26.7	248.0	H	253.0	11.2	19.30	46.00
931.920000	19.4	114.0	V	258.0	16.2	26.60	46.00
161.200000	13.6	244.0	V	194.0	4.4	29.90	43.50
860.760000	14.0	143.0	V	13.0	15.3	32.00	46.00
173.880000	0.8	165.0	V	272.0	3.8	42.70	43.50

Note: All data points are corrected for insertion loss.

The data above is for 5 MHz bandwidth in OFDM mode at channel 156 (5785 MHz) which is the worst case configuration.

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 = 30 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 30 dBc limit for emissions outside of the operational frequency band.

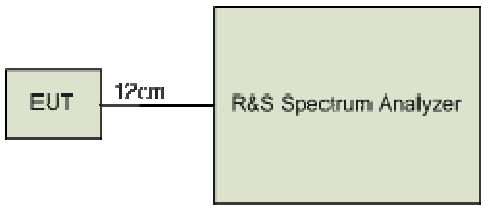
In addition to conducted measurements, extensive radiated testing above 1 GHz is performed. The measurement antenna is scanned around all sides of the EUT to identify signals of interest. Additional measurements at an appropriate measurement distance are performed to ensure that emissions were at maximum.

All units were tested. The TR-multi-N was tested with all antennas. The EUT was exercised using beaconing mode at the highest possible transmit rate. Testing was performed on low, middle and high channels in both 2.4 and 5.8 GHz frequency bands. All combinations of the modulation schemes and emission bandwidths were tested. Only worst case data is shown below.

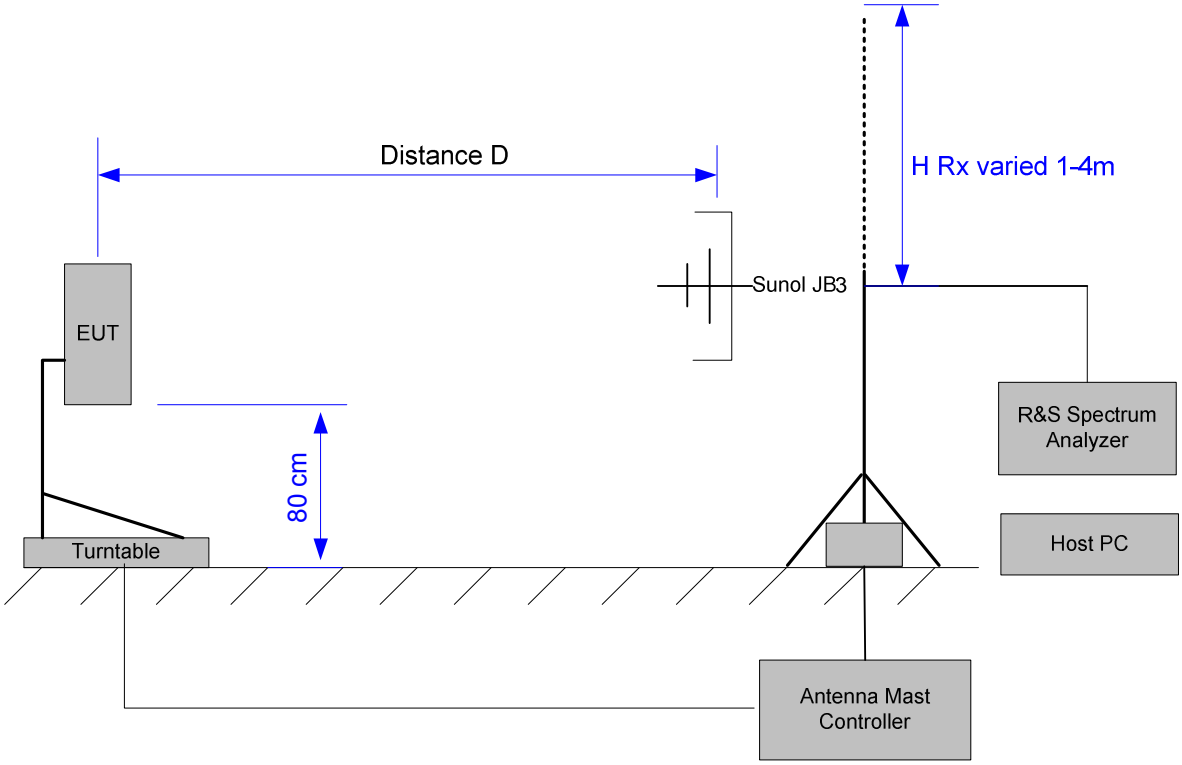
The antenna is connected to the EUT equipped with a Type N connecter via 1 m of coaxial shielded cable.

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)

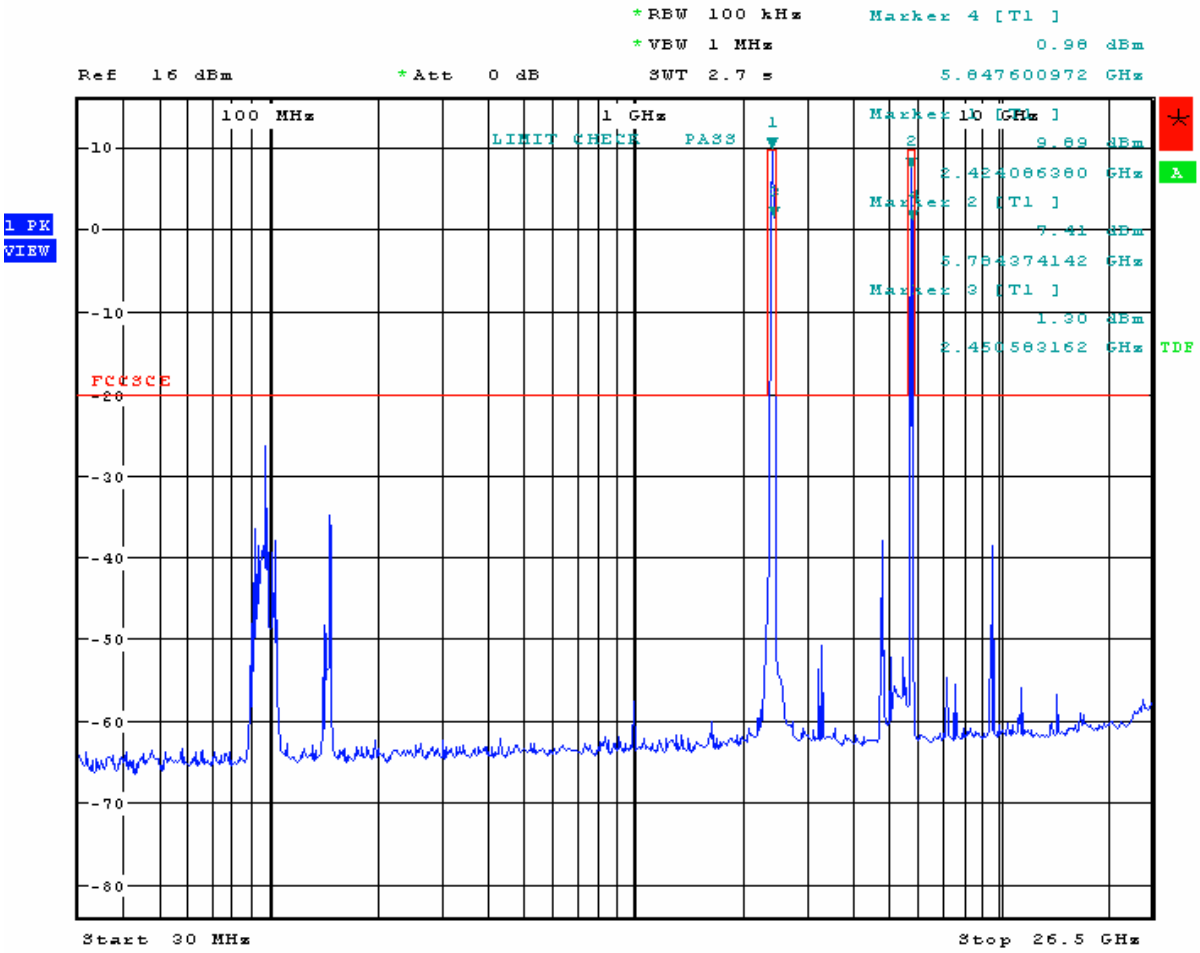


5.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



5.4 Test Results

5.4.1 Test Results 15.247–Harmonics -30 dBc



The above plot shows the worst case conducted output of the transmitter. It should be noted that the EUT is not transmitting on two channels simultaneously. However, the unit is cycled through low, mid and high channels at different bandwidth and modulation configurations. All conducted harmonics are at least 30 dBc.

5.4.2 Test Results 15.247– 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 antenna configuration in each frequency band.

External 24 dBi 2.4 GHz Grid Antenna

Frequency (MHz)	Reading Type	Reading dBuV/m@3m)	Limit (dBuV/m)	Margin (dB)	Result
4874.0	Peak	73.8	74.0	0.2	Pass
4874.0	Average	52.49	54.0	1.51	Pass
7310.0	Peak	71.60	74.0	2.4	Pass
7310.0	Average	50.29	54.0	3.71	Pass
9747.0	Peak	64.4	74.0	9.6	Pass
9747.0	Average	43.09	54.0	10.91	Pass

External 32 dBi 5.8 GHz Dish Antenna

Frequency (MHz)	Reading Type	Reading dBuV/m@3m)	Limit (dBuV/m)	Margin (dB)	Result
11661.0	Peak	67.70	74.0	6.3	Pass
11661.0	Average	46.39	54.0	7.61	Pass
17564.0	Peak	69.70	74.0	4.3	Pass
17564.0	Average	48.39	54.0	5.61	Pass

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

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 30 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).)

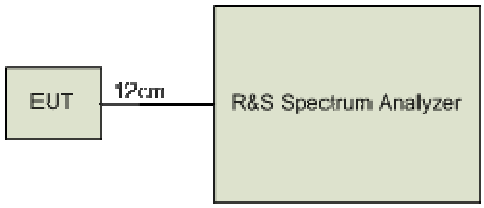
6.3 Test Setup

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

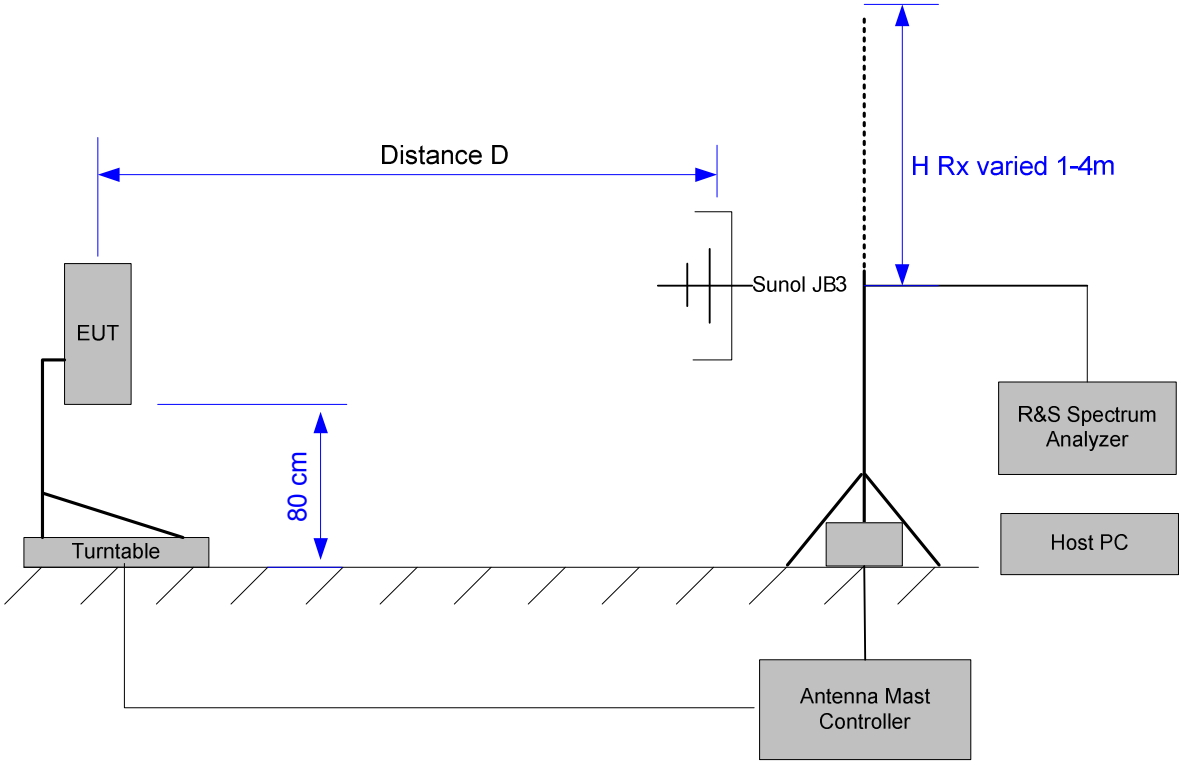
The test is performed at low and high channels. Compliance in the 5725-5850 MHz band is established through conducted measurements. Compliance with the 15.209 restricted band requirements of the 2400-2483.5 MHz band is established through radiated measurements. Data is presented for the worst case configuration, the external 24 dBi grid antenna.

Please note that in the following plots the EUT is not transmitting on two channels simultaneously.

6.3.1 Test Setup Block Diagram – Conducted Measurements)

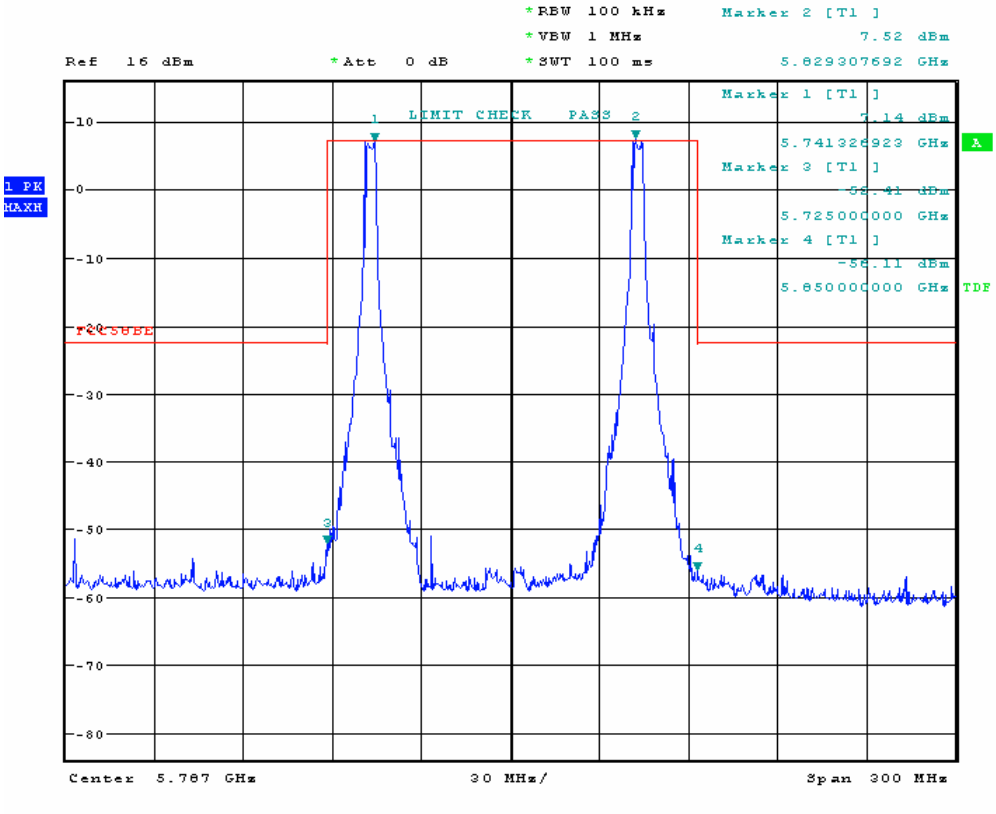


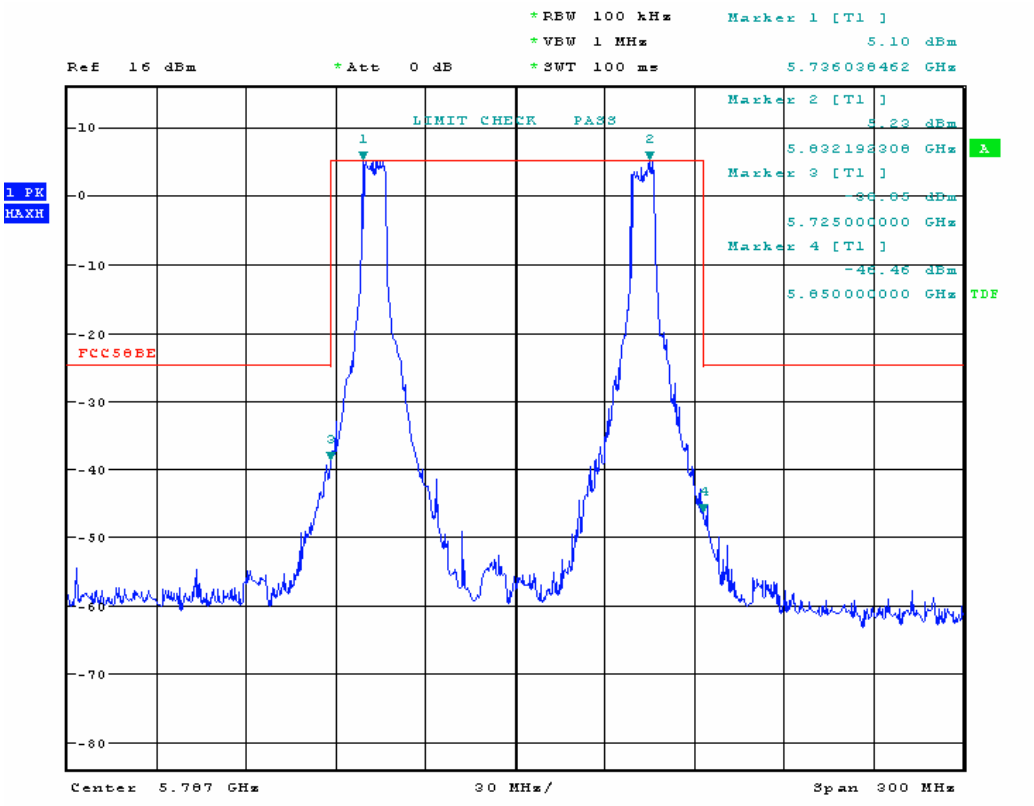
6.3.2 Test Setup Block Diagram – Radiated Measurements

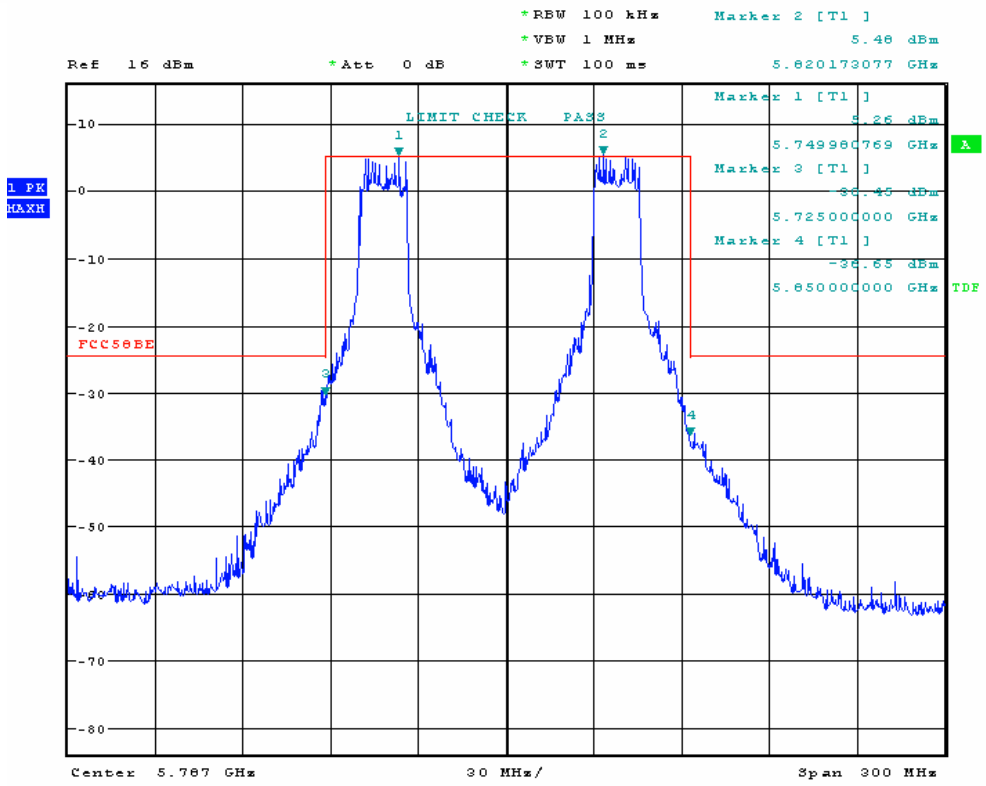


6.4 Test Results

6.4.1 5725-5850 MHz, Conducted Measurements







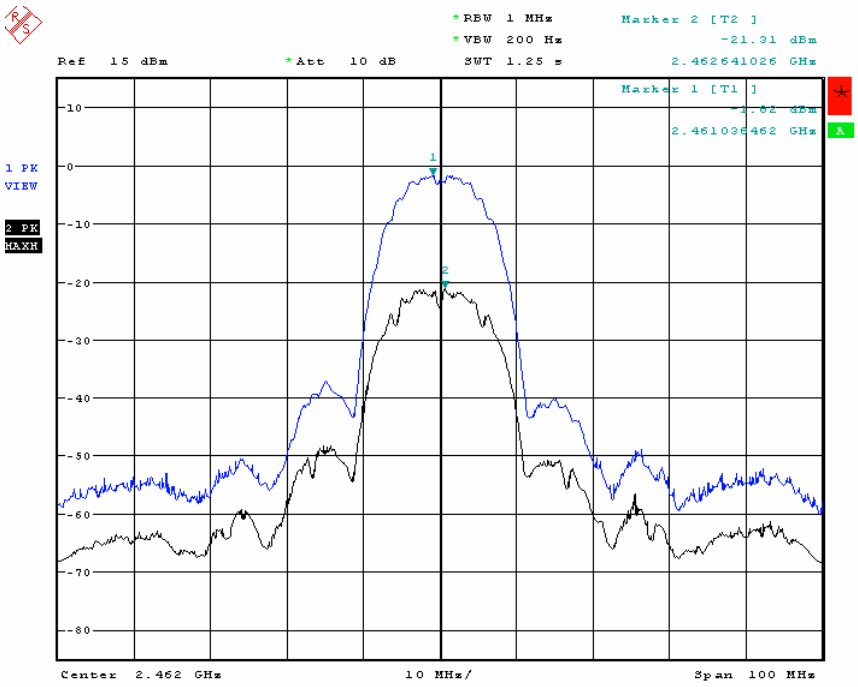
All emissions outside of the 5725-5850 MHz frequency band are attenuated by at least 30 dB.

6.4.2 2400-2483.5 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. All external antennas were tested.

Antenna	Freq (MHz)	Mode	Peak 1M/1M @3m (dBuV/m)	100k/100k Delta (dB)	BE Reading (dBuV/m@3m)	Limit (dBuV/m@3m)	Margin
Grid	2412	b Mode	122.8	52.85	69.95	74	4.05
		g Mode	116.2	46.15	70.05	74	3.95
	2462	b Mode	121.8	50.11	71.69	74	2.31
		g Mode	121.9	48.57	73.33	74	0.67
Yagi	2412	b Mode	115.7	45.08	70.62	74	3.38
		g Mode	118.7	53.1	65.6	74	8.4
	2462	b Mode	121.5	52.24	69.26	74	4.74
		g Mode	116.4	44.67	71.73	74	2.27
Vertical Omni	2412	b Mode	115.5	43.89	71.61	74	2.39
		g Mode	112.7	42.02	70.68	74	3.32
	2462	b Mode	116	47.36	68.64	74	5.36
		g Mode	112.9	39.77	73.13	74	0.87
Horizontal Omni	2412	b Mode	116	50.85	65.15	74	8.85
		g Mode	113.9	40.65	73.25	74	0.75
	2462	b Mode	116.4	45.64	70.76	74	3.24
		g Mode	111.8	41.94	69.86	74	4.14
Sector	2412	b Mode	116.3	51.54	64.76	74	9.24
		g Mode	116.7	44.12	72.58	74	1.42
	2462	b Mode	113.6	52.14	61.46	74	12.54
		g Mode	114.4	42.63	71.77	74	2.23
Integrated 19dBi	2412	b Mode	117.6	53.04	64.56	74	9.44
		g Mode	118.8	46.52	72.28	74	1.72
	2462	b Mode	118.1	48.02	70.08	74	3.92
		g Mode	118	45.08	72.92	74	1.08

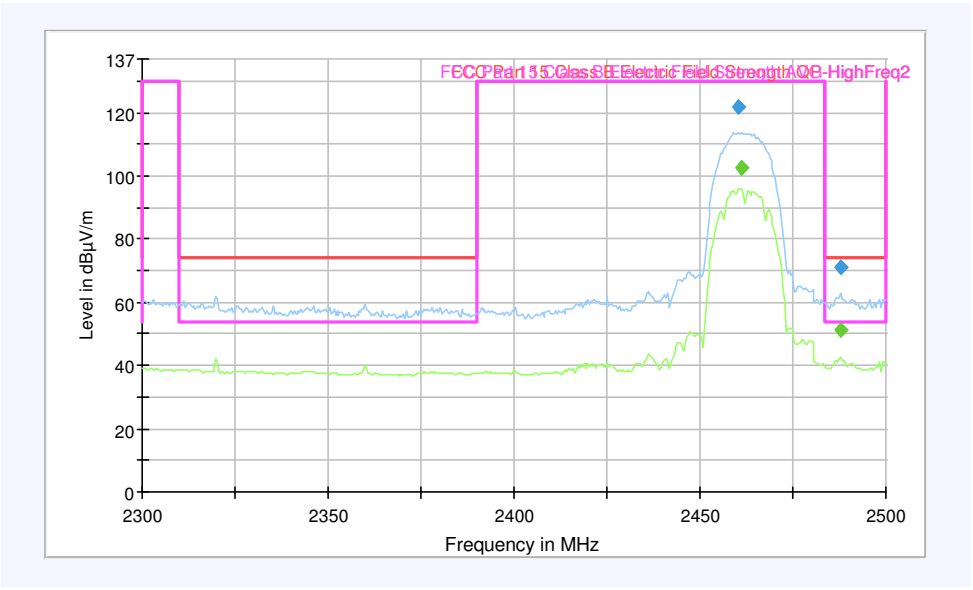
Note: The peak to average correction factor is 21.31 dB as shown in the figure below. Therefore, considering that the average limit is 20 dB less than the peak limit, we conclude conformance with the average limit.



Peak to Average Correction Factor

The peak is measured with RBW = VBW = 1MHz. For the average measurement the VBW was reduced down to the Hz range.

To confirm the validity of the average measurement above, the measurement was repeated using the average detector as shown below.



Blue Trace, Peak Detector

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2460.40000	121.5	1000.000	118.0	H	11.0	32.3	8.5	130.0
2488.00000	71.0	1000.000	118.0	H	11.0	32.4	3.0	74.0

Green Trace, Average Detector

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2461.20000	102.5	1000.000	118.0	H	12.0	32.3	27.5	130.0
2488.00000	51.0	1000.000	118.0	H	11.0	32.4	3.0	54.0

It is concluded that the result of both methods are identical and that the referenced peaks in the restricted bands were considered in the band-edge evaluation, and that they comply with the radiated restricted band peak and average limits of 15.209.

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

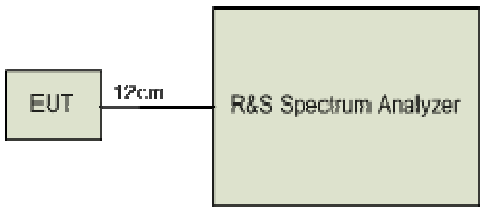
The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3 Test Setup

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

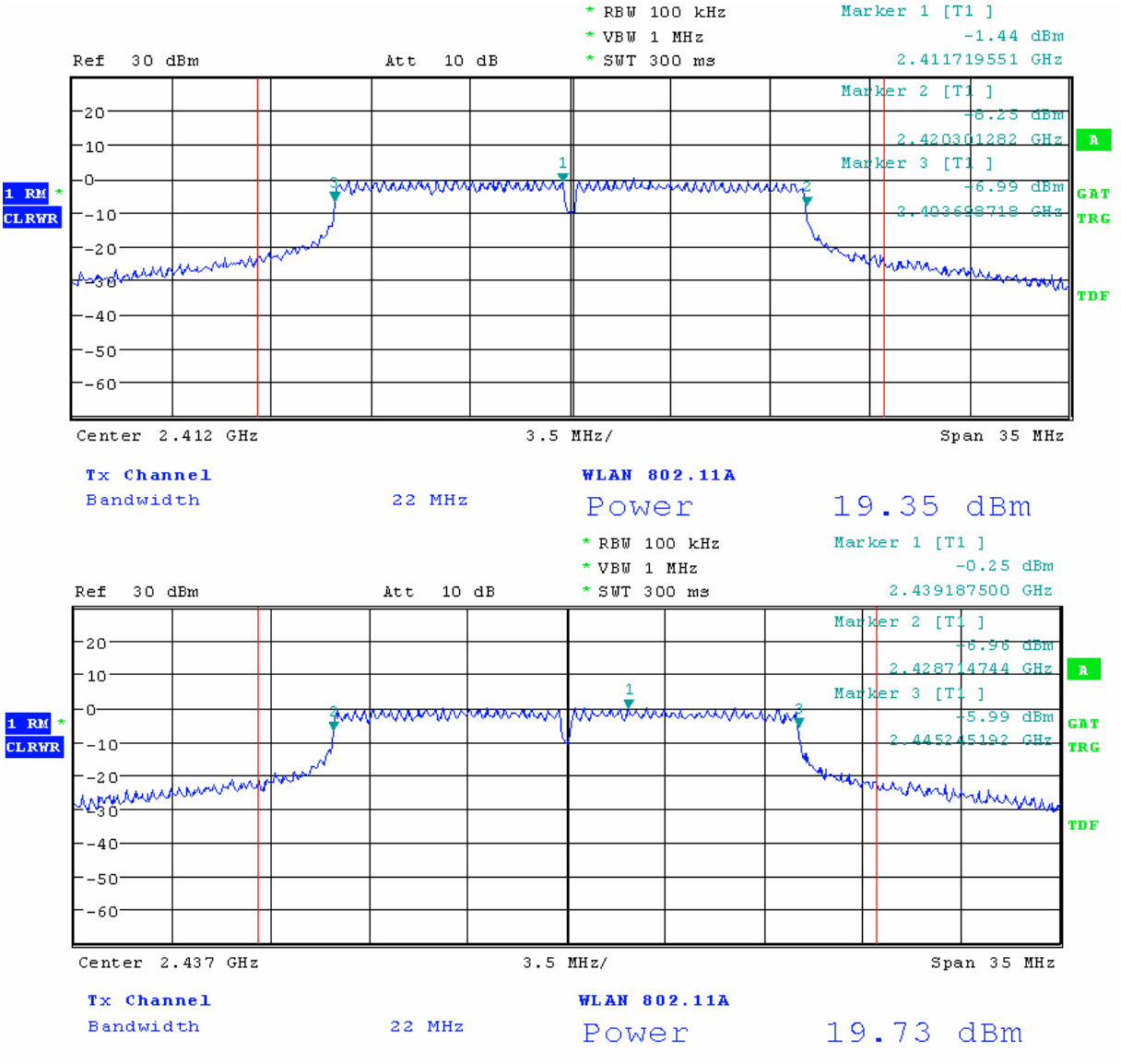
The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 5, 10 and 20 MHz bandwidths for both 2.4 and 5.8 GHz frequency bands.

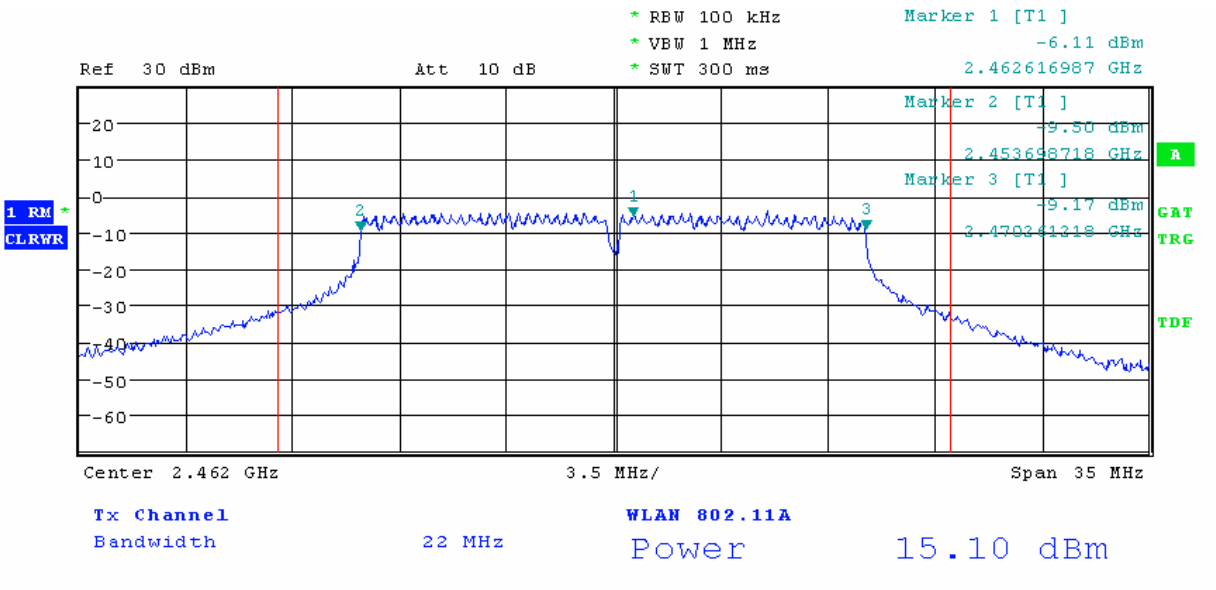
7.3.1 Test Setup Block Diagram



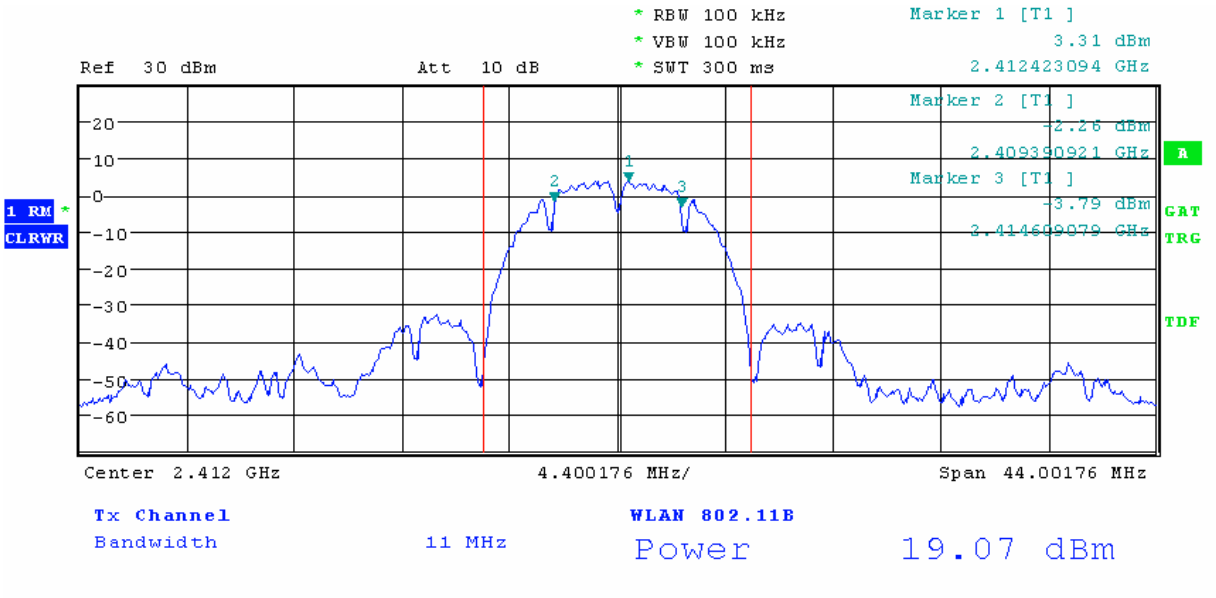
7.4 Test Results, 6 dB Occupied Bandwidth at 2.4 GHz Frequency band

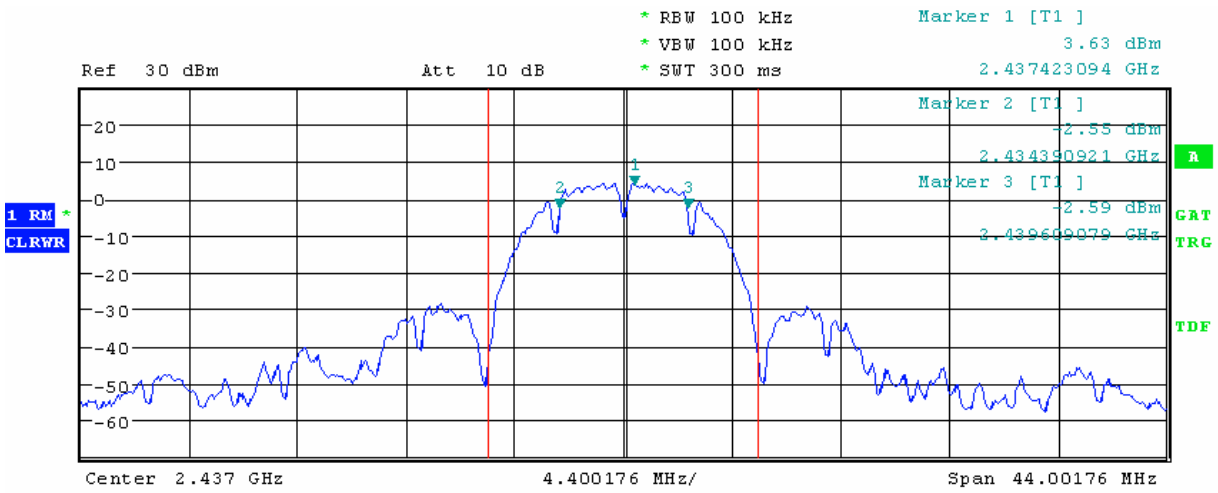
7.4.1 20MHz Bandwidth

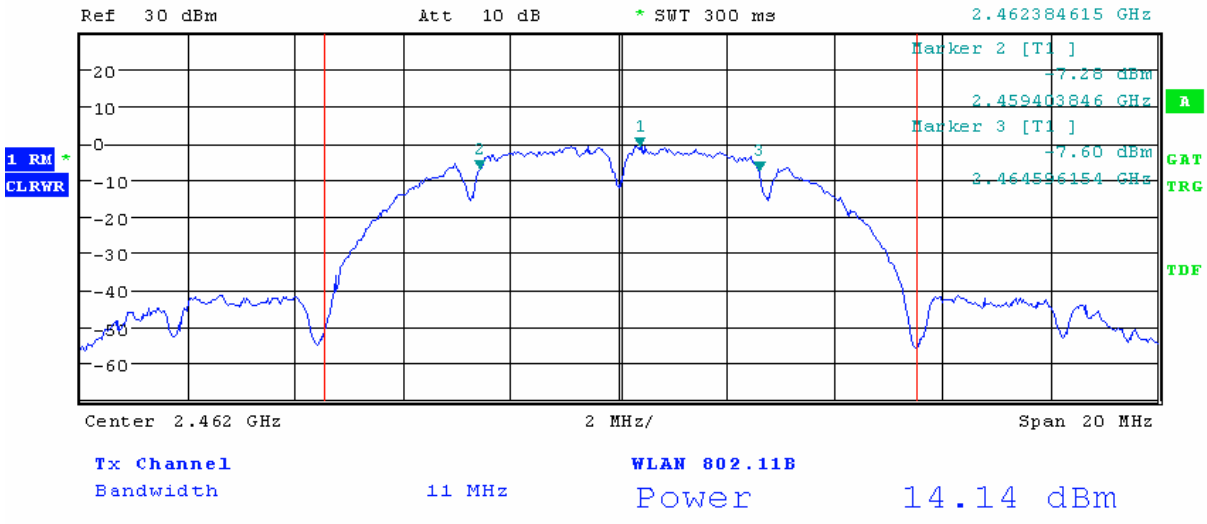


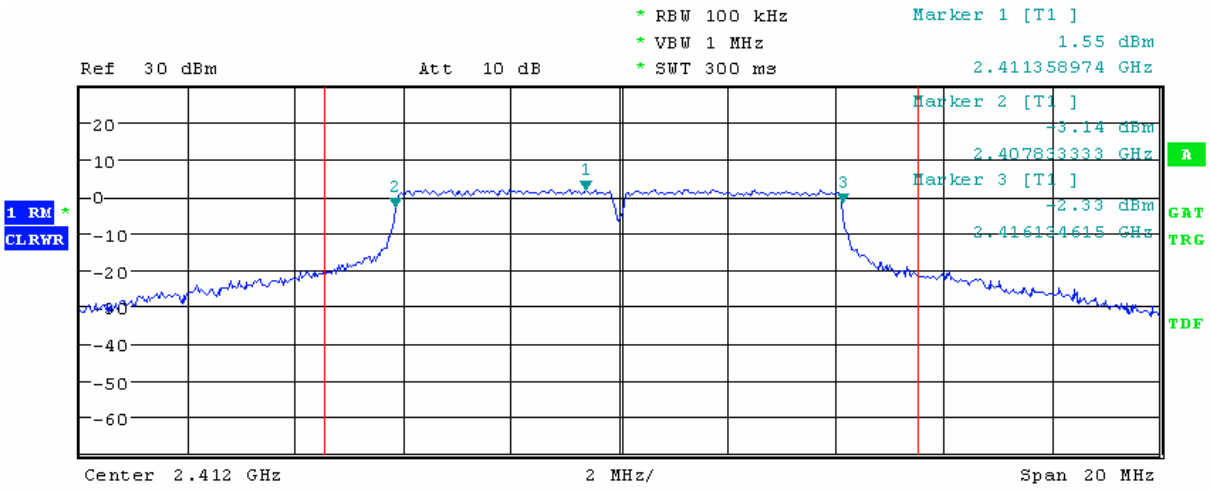


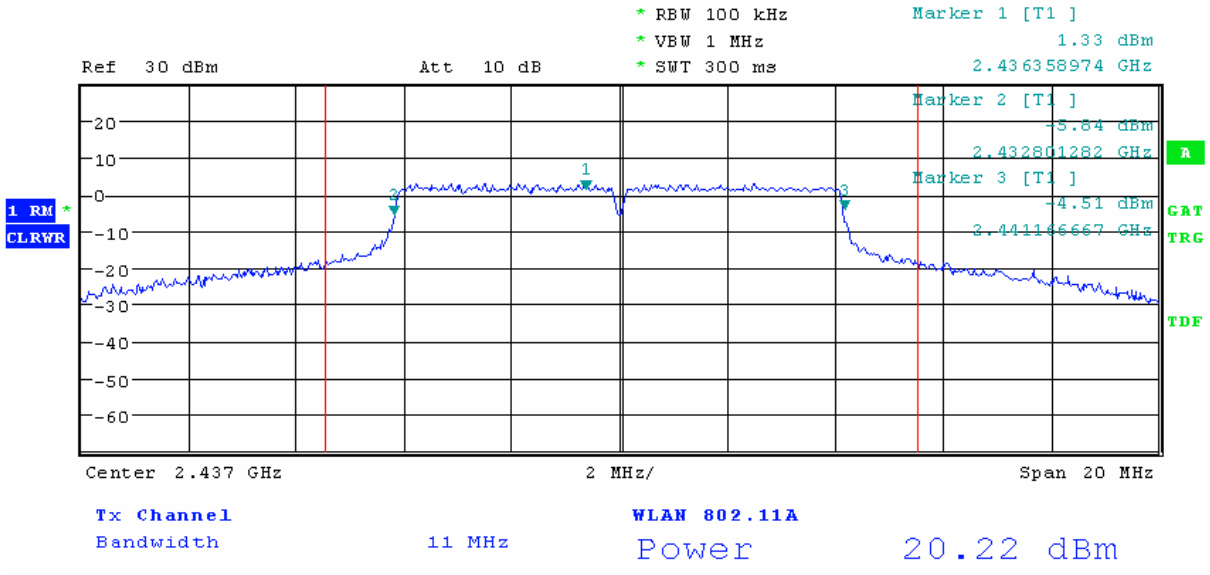
7.4.2 10MHz Bandwidth

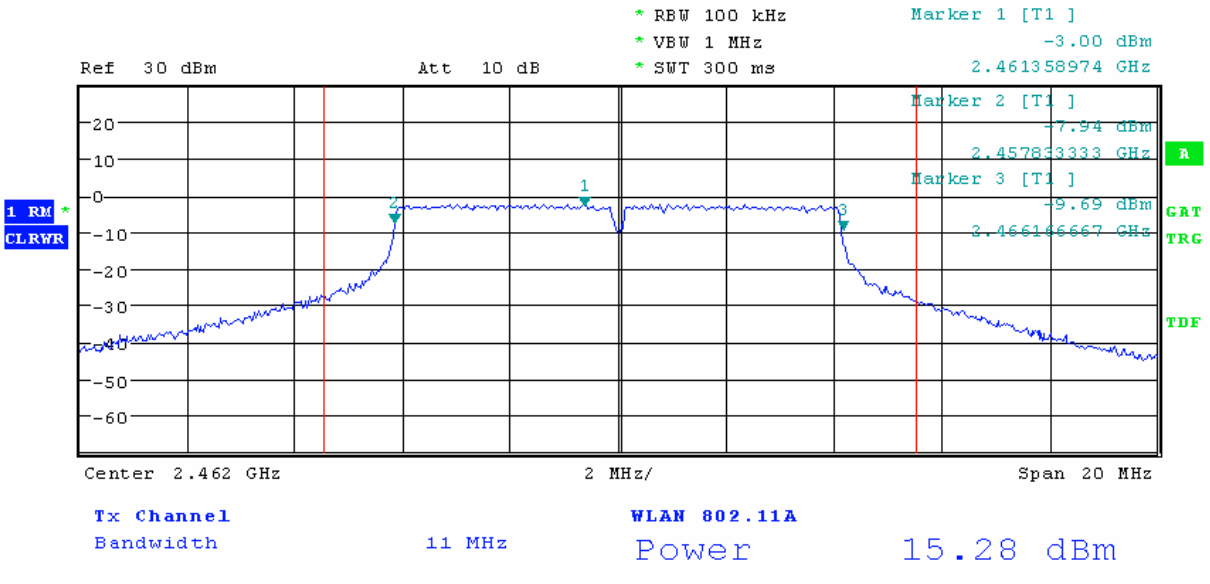



* RBW 100 kHz
* VBW 100 kHz
* SWT 300 ms
Marker 1 [T1]
3.63 dBm
2.437423094 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
-2.55 dBm
2.434390921 GHz
Marker 3 [T1]
-2.59 dBm
2.439609079 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.437 GHz
4.400176 MHz/
Span 44.00176 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11B
Power
19.58 dBm

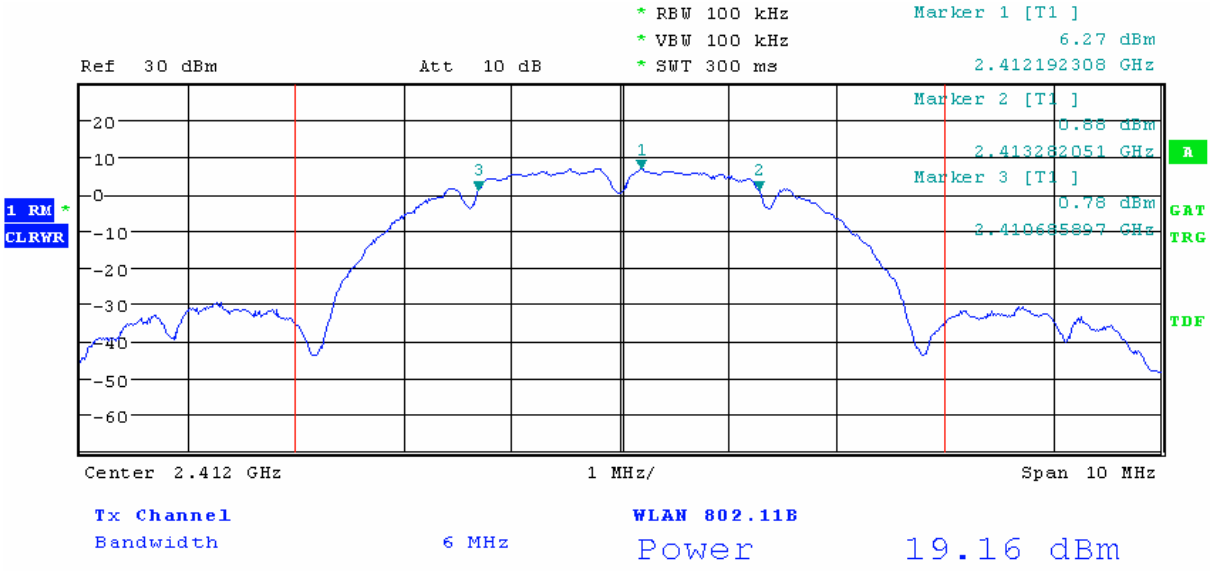

* RBW 100 kHz
* VBW 100 kHz
* SWT 300 ms
Marker 1 [T1]
-1.44 dBm
2.462384615 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
-7.28 dBm
2.459403846 GHz
Marker 3 [T1]
-7.60 dBm
2.464596154 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.462 GHz
2 MHz/
Span 20 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11B
Power
14.14 dBm

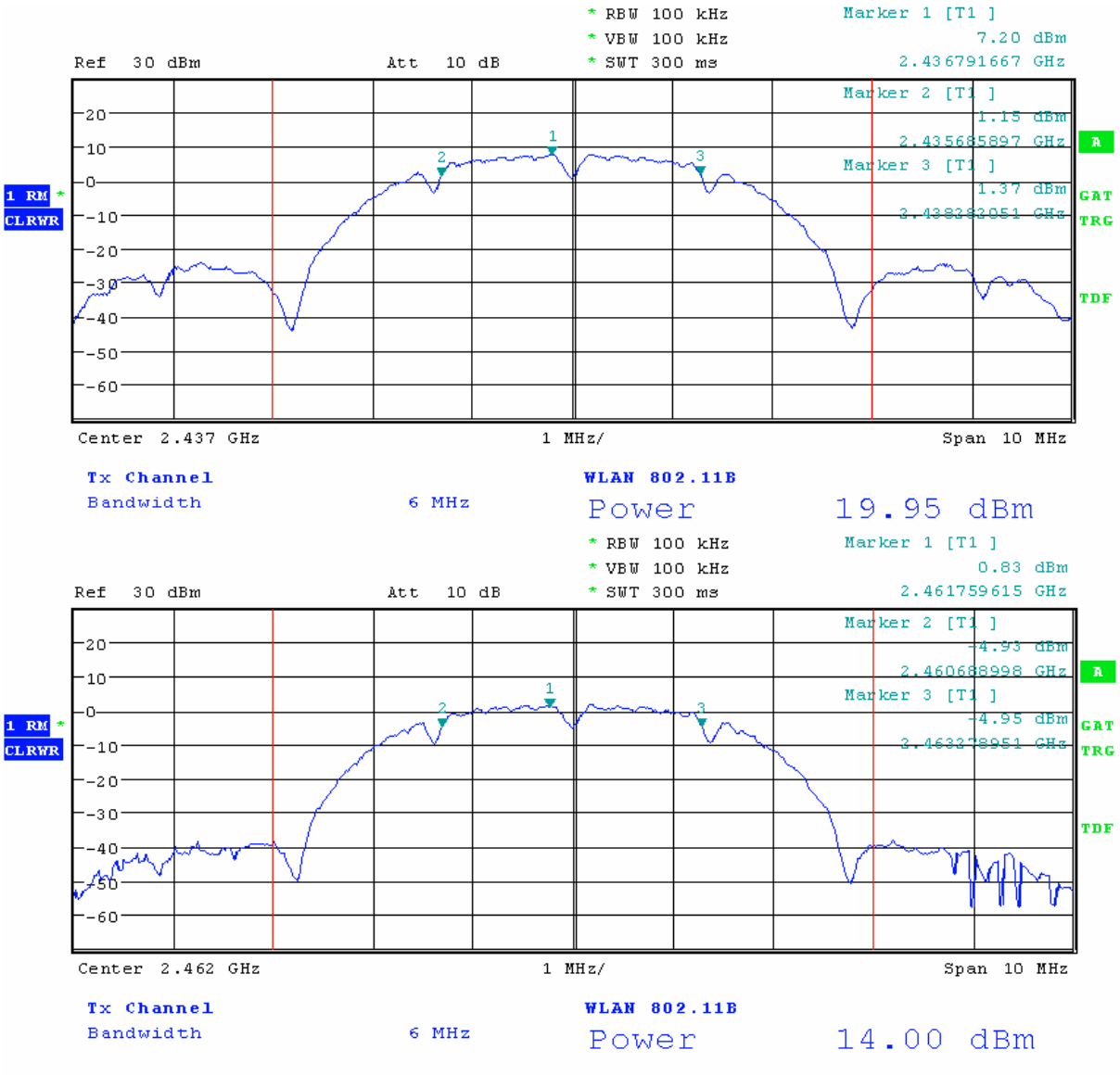

* RBW 100 kHz
* VBW 1 MHz
* SWT 300 ms
Marker 1 [T1]
1.55 dBm
2.411358974 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
-3.14 dBm
2.407833333 GHz
Marker 3 [T1]
-2.33 dBm
3.416134615 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.412 GHz
2 MHz/
Span 20 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11A
Power
19.59 dBm

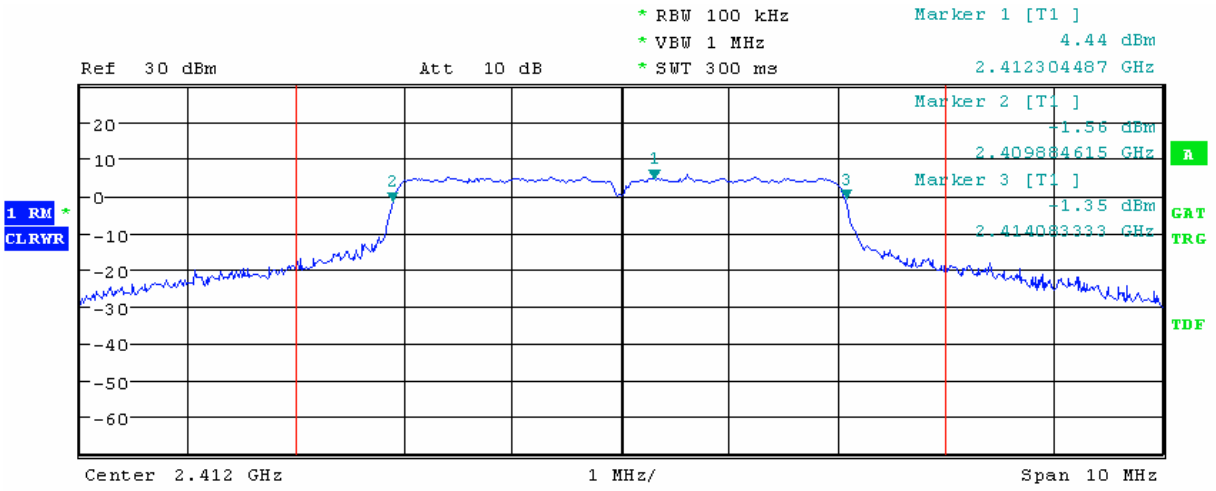

* RBW 100 kHz
* VBW 1 MHz
* SWT 300 ms
Marker 1 [T1]
1.33 dBm
2.436358974 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
-5.84 dBm
2.432861282 GHz
Marker 3 [T1]
-4.51 dBm
3.441166667 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.437 GHz
2 MHz/
Span 20 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11A
Power
20.22 dBm

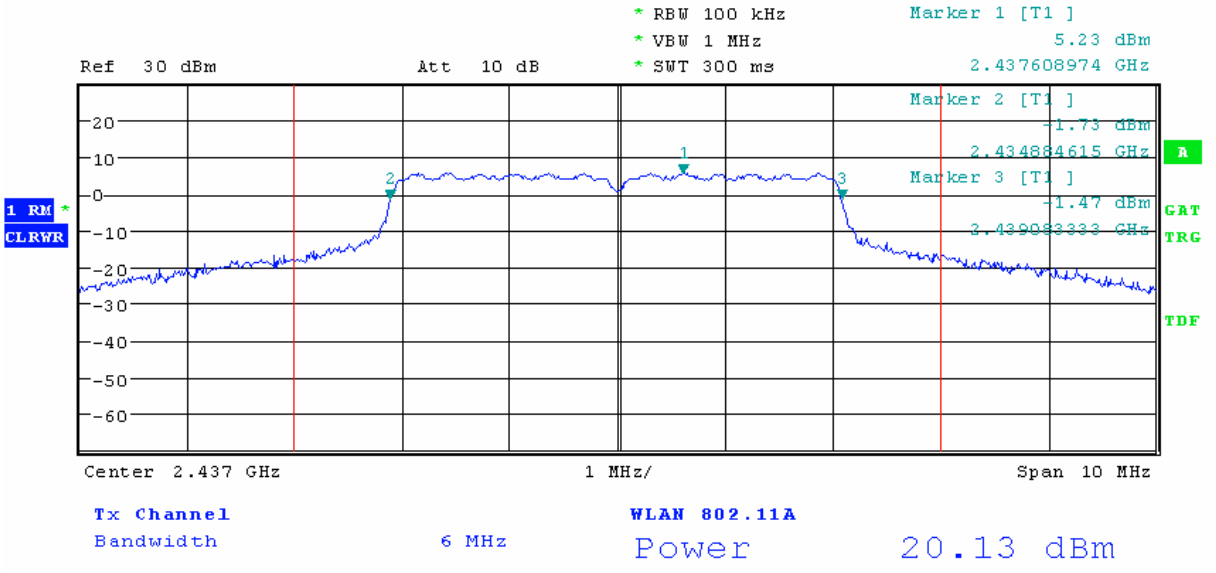


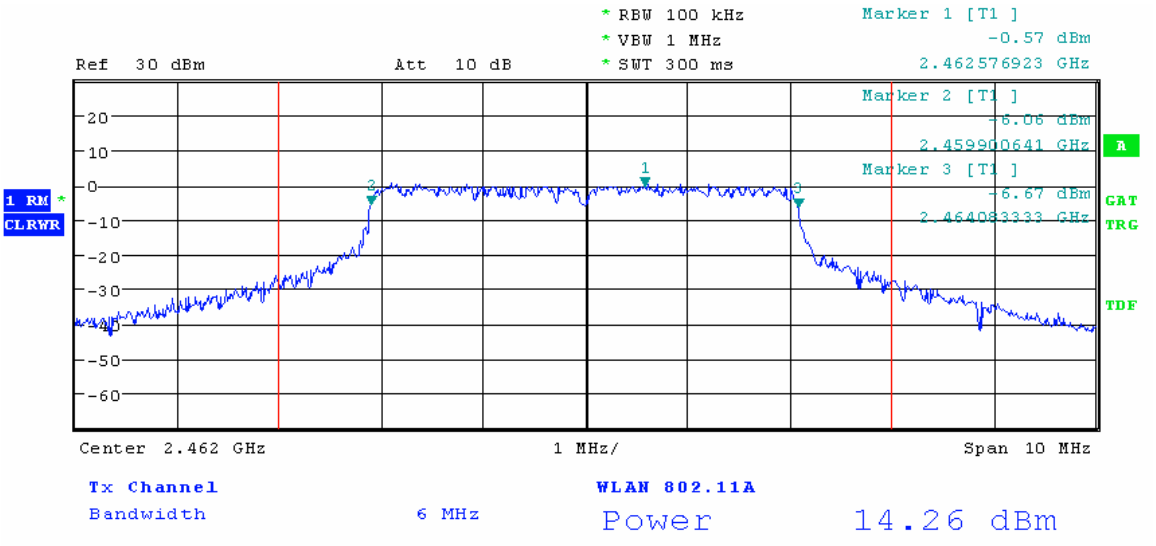
7.4.3 5MHz Bandwidth




* RBW 100 kHz
* VBW 100 kHz
* SWT 300 ms
Marker 1 [T1]
7.20 dBm
2.436791667 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
1.15 dBm
2.435685897 GHz
Marker 3 [T1]
1.37 dBm
2.438283051 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.437 GHz
1 MHz/
Span 10 MHz
Tx Channel
Bandwidth
6 MHz
WLAN 802.11B
Power
19.95 dBm
* RBW 100 kHz
* VBW 100 kHz
* SWT 300 ms
Marker 1 [T1]
0.83 dBm
2.461759615 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
-4.93 dBm
2.460688998 GHz
Marker 3 [T1]
-4.95 dBm
2.463378951 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.462 GHz
1 MHz/
Span 10 MHz
Tx Channel
Bandwidth
6 MHz
WLAN 802.11B
Power
14.00 dBm


* RBW 100 kHz
* VBW 1 MHz
* SWT 300 ms
Marker 1 [T1]
4.44 dBm
2.412304487 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
-1.56 dBm
2.409884615 GHz
Marker 3 [T1]
-1.35 dBm
2.414083333 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.412 GHz
1 MHz/
Span 10 MHz
Tx Channel
Bandwidth
6 MHz
WLAN 802.11A
Power
19.72 dBm


* RBW 100 kHz
* VBW 1 MHz
* SWT 300 ms
Marker 1 [T1]
5.23 dBm
2.437608974 GHz
Ref 30 dBm
Att 10 dB
Marker 2 [T1]
-1.73 dBm
2.434884615 GHz
Marker 3 [T1]
-1.47 dBm
2.439083333 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 2.437 GHz
1 MHz/
Span 10 MHz
Tx Channel
Bandwidth
6 MHz
WLAN 802.11A
Power
20.13 dBm



7.4.4 Data Table – Occupied Bandwidth

Mode DSSS/ Channel BW = 5MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 1	2412	2.60	0.5	PASS
Ch 6	2437	2.60	0.5	PASS
Ch 11	2462	2.60	0.5	PASS

Mode DSSS/ Channel BW = 10MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 1	2412	5.30	0.5	PASS
Ch 6	2437	5.20	0.5	PASS
Ch 11	2462	5.20	0.5	PASS

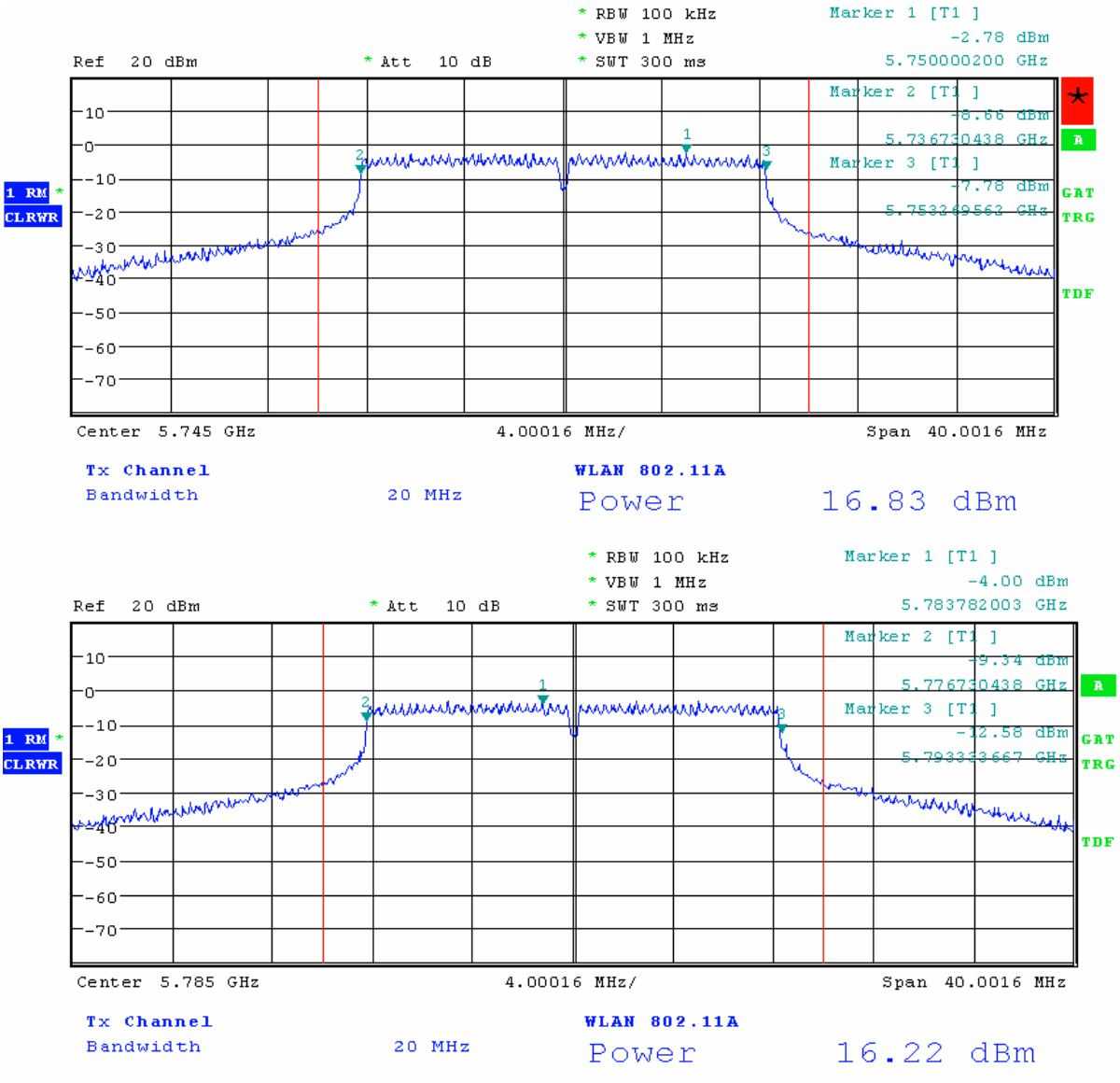
Mode OFDM/ Channel BW = 5MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 1	2412	4.20	0.5	PASS
Ch 6	2437	4.20	0.5	PASS
Ch 11	2462	4.20	0.5	PASS

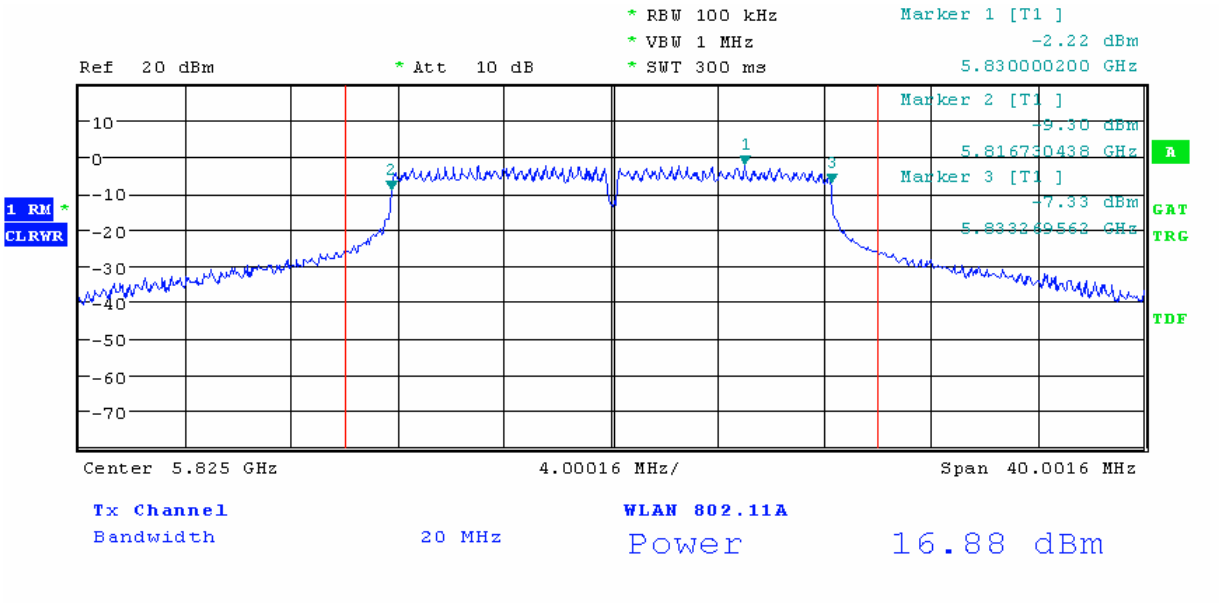
Mode OFDM/ Channel BW = 10MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 1	2412	8.30	0.5	PASS
Ch 6	2437	8.40	0.5	PASS
Ch 11	2462	8.40	0.5	PASS

Mode OFDM/ Channel BW = 20MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 1	2412	16.70	0.5	PASS
Ch 6	2437	16.50	0.5	PASS
Ch 11	2462	16.60	0.5	PASS

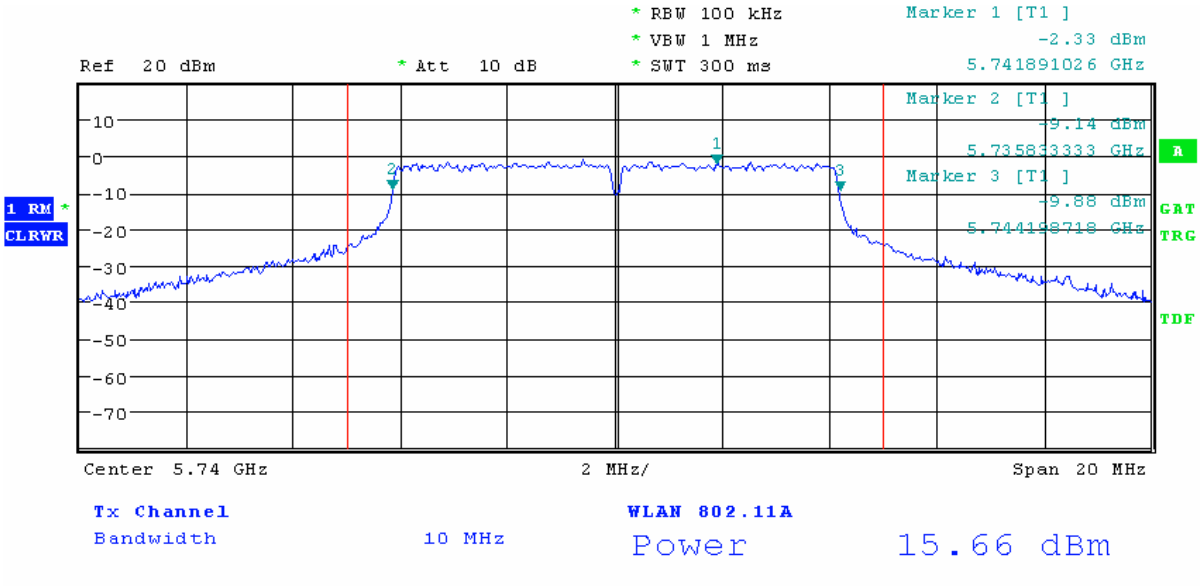
7.5 Test Results, 6 dB Occupied Bandwidth at 5.8 GHz Frequency band

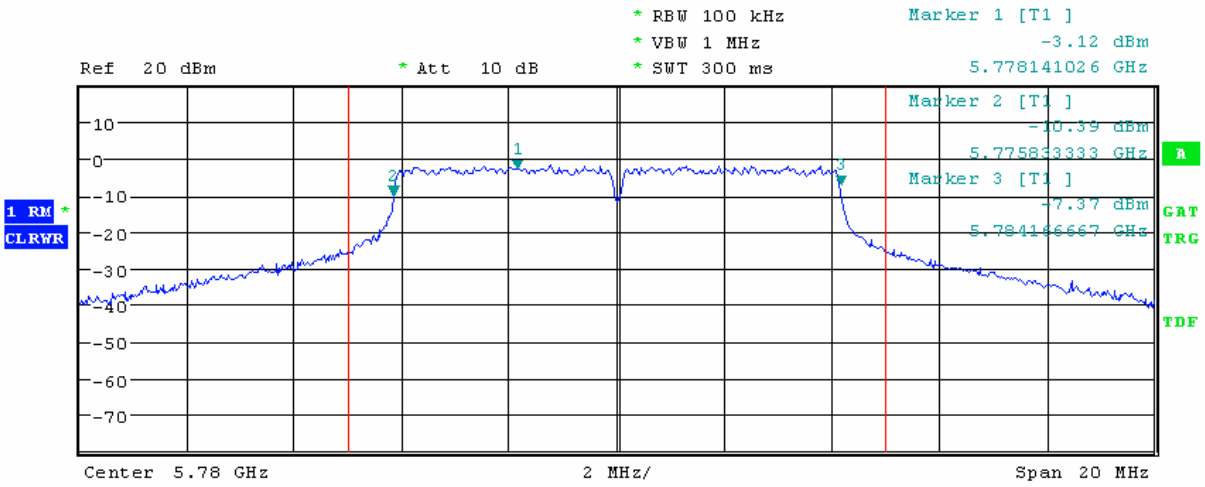
7.5.1 20MHz Bandwidth

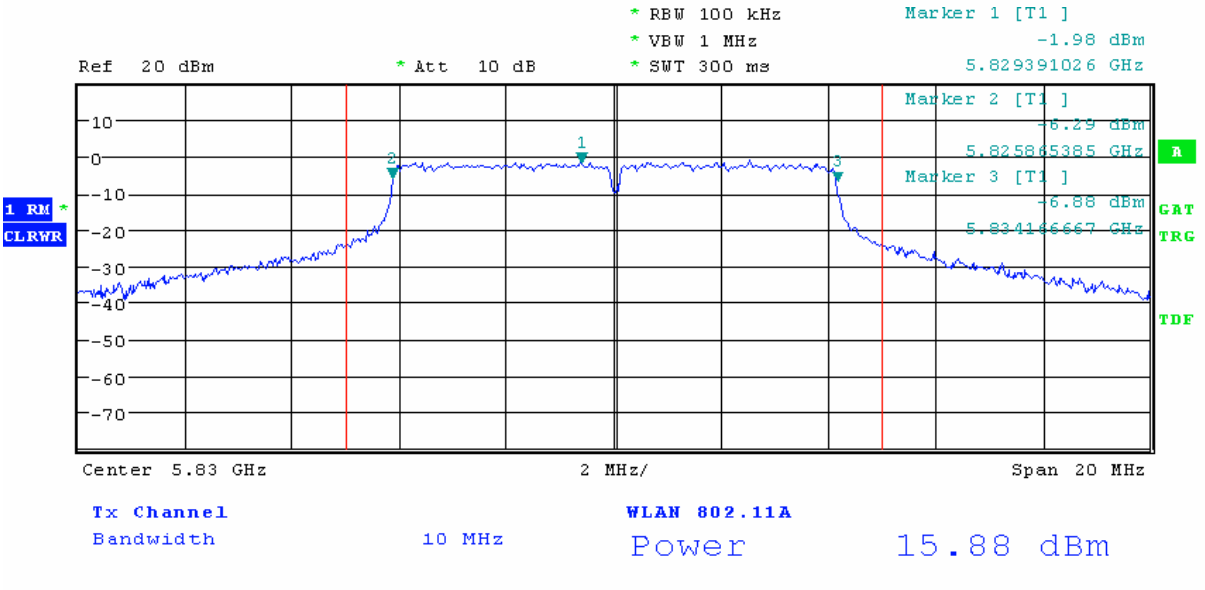




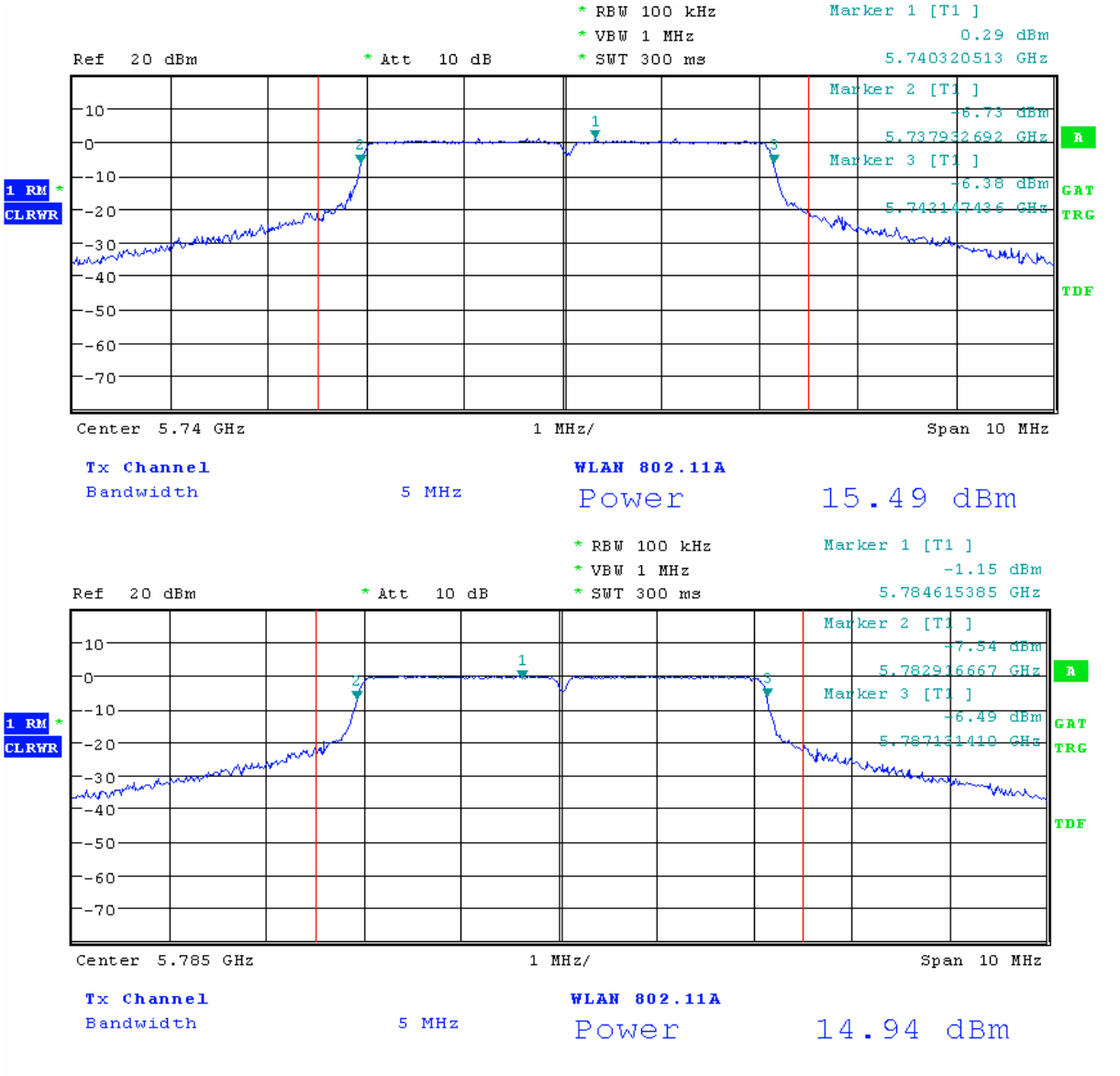
7.5.2 10MHz Bandwidth

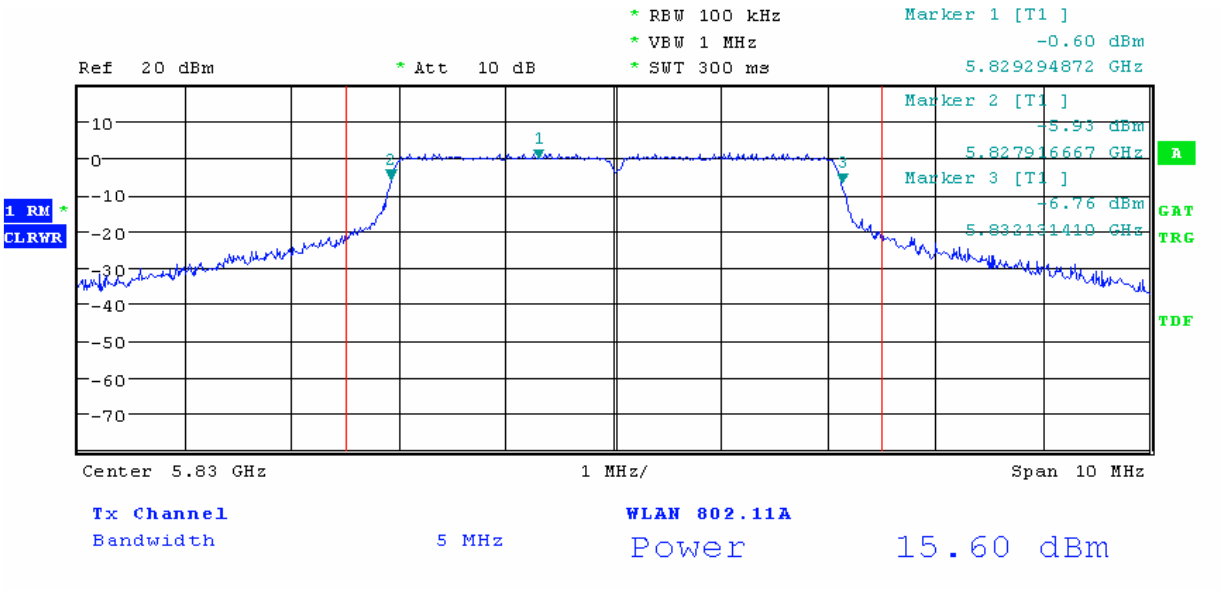



* RBW 100 kHz
* VBW 1 MHz
* SWT 300 ms
Marker 1 [T1]
-3.12 dBm
5.778141026 GHz
Ref 20 dBm
* Att 10 dB
Marker 2 [T1]
-10.39 dBm
5.775833333 GHz
Marker 3 [T1]
-7.37 dBm
5.784166667 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 5.78 GHz
2 MHz/
Span 20 MHz
Tx Channel
Bandwidth
10 MHz
WLAN 802.11A
Power
15.25 dBm


* RBW 100 kHz
* VBW 1 MHz
* SWT 300 ms
Marker 1 [T1]
-1.98 dBm
5.829391026 GHz
Ref 20 dBm
* Att 10 dB
Marker 2 [T1]
-6.29 dBm
5.825865385 GHz
Marker 3 [T1]
-6.88 dBm
5.834166667 GHz
1 RM
CLRWR
A
GAT
TRG
TDF
Center 5.83 GHz
2 MHz/
Span 20 MHz
Tx Channel
Bandwidth
10 MHz
WLAN 802.11A
Power
15.88 dBm

7.5.3 5MHz Bandwidth





7.5.4 Data Table – Occupied Bandwidth

Mode OFDM/ Channel BW = 5MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 148	5740	4.20	0.5	PASS
Ch 156	5785	4.20	0.5	PASS
Ch 166	5830	4.20	0.5	PASS

Mode OFDM/ Channel BW = 10MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 148	5740	8.4	0.5	PASS
Ch 156	5780	8.4	0.5	PASS
Ch 166	5830	8.3	0.5	PASS

Mode OFDM/ Channel BW = 20MHz				
Channel	**Frequency(MHz)**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
Ch 149	5745	16.6	0.5	PASS
Ch 157	5785	16.6	0.5	PASS
Ch 165	5825	16.6	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

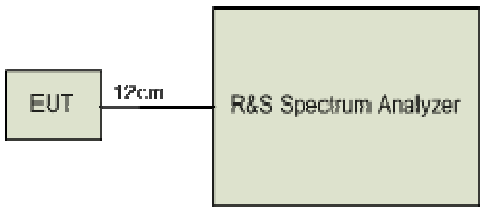
The transmitted power density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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 5, 10 and 20 MHz bandwidths for both 2.4 and 5.8 GHz frequency bands.

8.3.1 Test Setup Block Diagram



8.4 Test Results 15.247

The calculations below are based on the measurements done at 100 KHz RBW and shown in section 7 for occupied bandwidth. A factor of 15.23 dB = (10log(100 kHz/3 kHz) is subtracted from the reading of marker 1 for correction to 3 KHz. Other tests have included graphical outputs.

8.4.1 2.4 GHz frequency band, Data Table – Power Spectral Density

Mode DSSS/ Channel BW = 5MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
2412	6.27	-8.96	8	PASS
2437	7.2	-8.03	8	PASS
2462	0.83	-14.40	8	PASS

Mode DSSS/ Channel BW = 10MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
2412	3.31	-11.92	8	PASS
2437	3.63	-11.60	8	PASS
2462	-1.44	-16.67	8	PASS

Mode OFDM/ Channel BW = 5MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
2412	4.44	-10.79	8	PASS
2437	5.23	-10.00	8	PASS
2462	-0.57	-15.80	8	PASS

Mode OFDM/ Channel BW = 10MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
2412	1.55	-13.68	8	PASS
2437	1.33	-13.90	8	PASS
2462	-3	-18.23	8	PASS

Mode OFDM/ Channel BW = 20MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
2412	-1.44	-16.67	8	PASS
2437	-0.25	-15.48	8	PASS
2462	-6.11	-21.34	8	PASS

8.4.2 5.8 GHz frequency band, Data Table – Power Spectral Density

Mode DSSS/ Channel BW = 5MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
5740	0.29	-14.94	8	PASS
5785	-1.15	-16.38	8	PASS
5830	-0.6	-15.83	8	PASS

Mode OFDM/ Channel BW = 10MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
5740	-2.33	-17.56	8	PASS
5780	-3.12	-18.35	8	PASS
5830	-1.98	-17.21	8	PASS

Mode OFDM/ Channel BW = 20MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
5745	-2.78	-18.01	8	PASS
5785	-4.00	-19.23	8	PASS
5825	-2.22	-17.45	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 24 dBi at 2.4 GHz and 32 dBi at 5.8 GHz.

9.2 RF exposure evaluation distance calculation

EUT with 24 dBi antenna

Mode OFDM/ Channel BW = 10MHz			
Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
2412	19.59	24	42.6
2437	20.22	24	45.8
2462	15.28	24	26.1

EUT with 32 dBi antenna

Mode OFDM/ Channel BW = 20MHz			
Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
5745	16.83	32	73.6
5785	16.22	32	72.8
5825	16.88	32	78.6

As shown above, the minimum distance where the MPE limit is reached is 78.6 cm for the EUT.

10.0 Test Photos

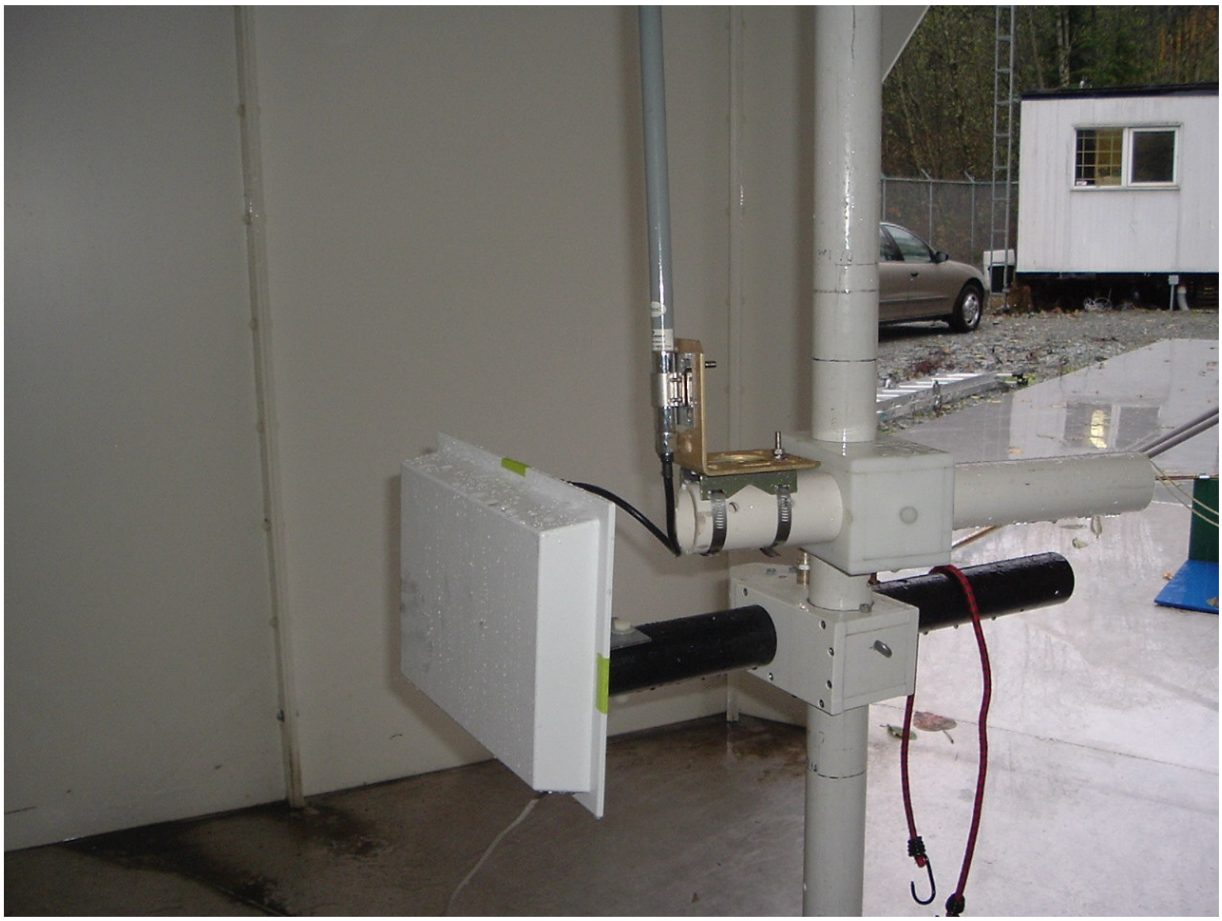
10.1 2.4 GHz frequency band

10.1.1 Grid

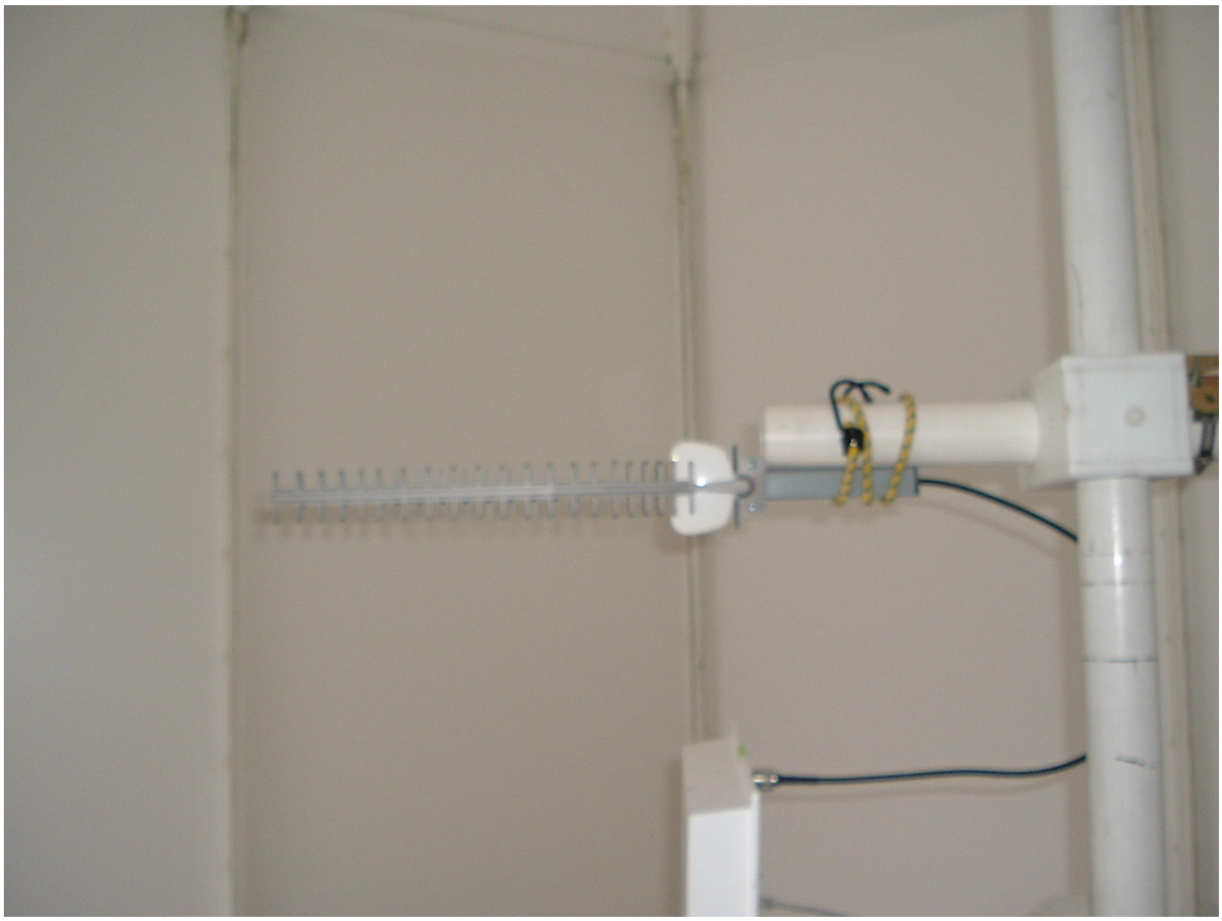
10.1.2 Sector

10.1.3 Horizontal Omni

10.1.4 Vertical Omni



10.1.5 Yagi



10.1.6 Integrated 19dBi antenna

10.2 5.8 GHz frequency band

10.2.1 Dish antenna(32 dBi)

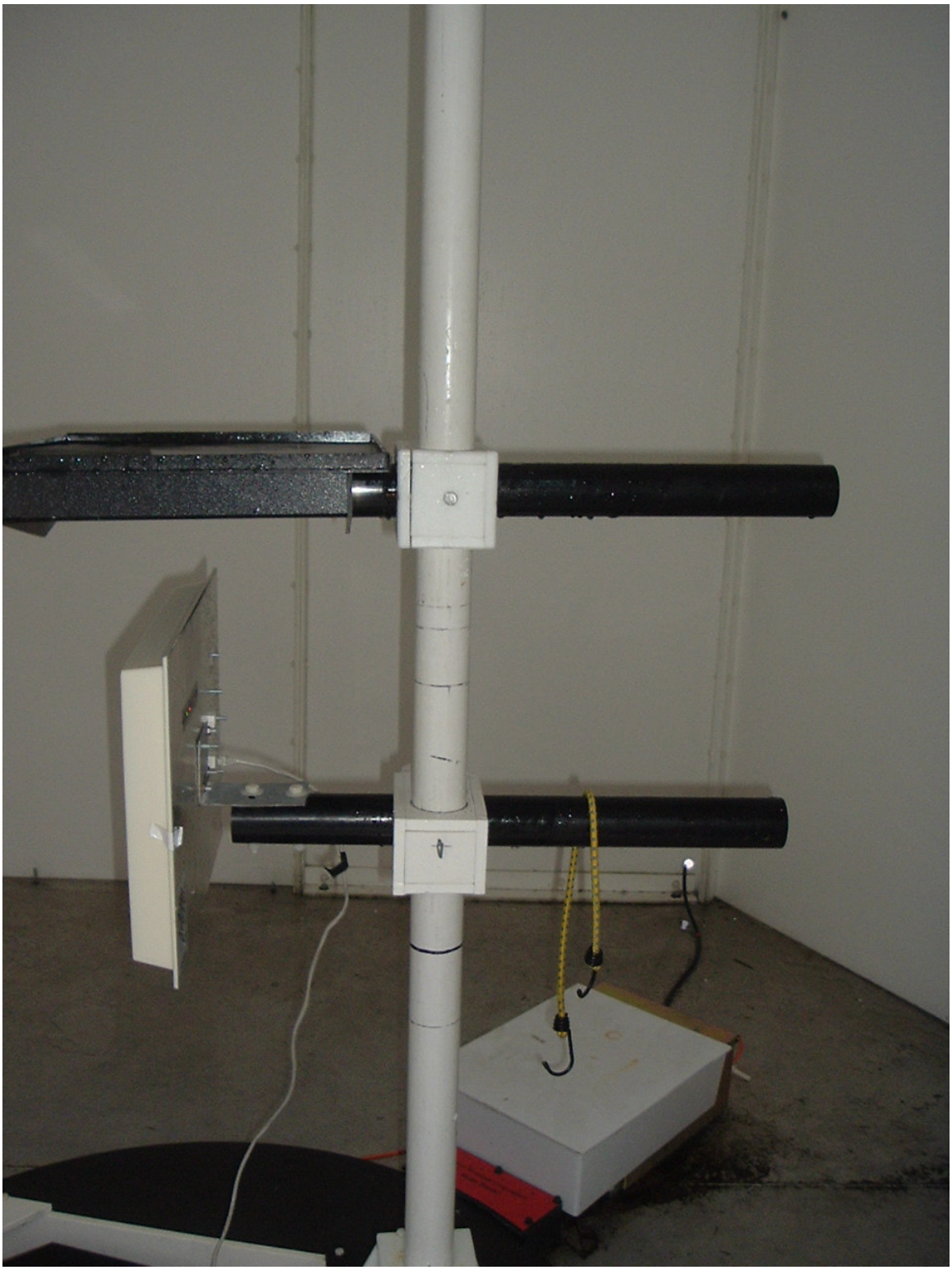
10.2.2 Grid antenna(26 dBi)

10.2.3 Vertical Sector antenna 17dBi

10.2.4 Horizontal Sector antenna 16dBi

10.2.5 Vertical Omni antenna 12dBi

10.2.6 Integrated 24dBi antenna



10.3 Conducted Emissions Setup