TRANZEO
EMC LABS INC

EMC Test Report

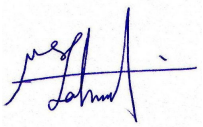
FCCID: QRF-CU900NT3

900 MHz Wireless Network Adapter
Tranzeo Wireless Technologies Inc.

Date: 6 February, 2007

Report No.: 060207.1

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



Cam Finnigan
EMC Engineer

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EMC Coordinator

Revision History

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1.0 General Information

1.1 EUT Description

Product Name	Wireless Network Adapter
Company Name	Tranzeo Wireless Technologies Inc.
FCC ID	QRF-CU900NT3
Model No.	TR-900II-N, TR-900II-8
Frequency Range	902- 928MHz
Number of Channels	7
Transmit Rate	54 Mbps maximum bit rate specification
Type of Modulation	900 MHz: DSSS, OFDM
Antenna Type	External; Integrated
Antenna Gain	902-928MHz: 14 dBi MAX
Product Software Revision	TR900-3.3.0Rt
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-900II-N	PH-ENGR1
Tranzeo Wireless	TR-900II-8	PH-ENGR2

Frequency of each channel:

20MHz BW		10MHz BW		5MHz BW	
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
Channel 1	915	Channel 1	910	Channel 1	908
		Channel 2	920	Channel 2	913
				Channel 3	918
				Channel 4	923

The TR-900II-8 is fitted with an integrated 900 MHz 8 dBi patch antenna. The TR-900II-N is fitted with a standard N type connector and is used with external antennas. This device operates over the frequency range of 908-923 MHz.

As a wireless bridge, this device includes a 900 MHz receive function as well as a 900 MHz 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 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 IEEE 802.11b/g compliant wireless networks. It uses an integrated or external antenna, depending on its model, coupled with an 802.11b/g transceiver to connect to remote wireless clients. The transceiver operates in the frequency band 902-928 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 used at 900 MHz. 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 Protection (WEP) algorithm is used for secure communications. The device's standard compliance ensures that it can communicate with any 802.11b/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 TR-900II-N and TR-900II-8 unit fitted with an integrated antenna were tested.

The EUT was mounted on 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.
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-900II-8 EUT was tested with its integrated 8dBi antenna. The TR-900II-N EUT was tested with the following external antennas:

900 MHz Antennas	
TR-900V-90-14	14 dBi Vertical Sector antenna
TR-OD900-12	12 dBi 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-2007
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 Block to Ethernet switch	2 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

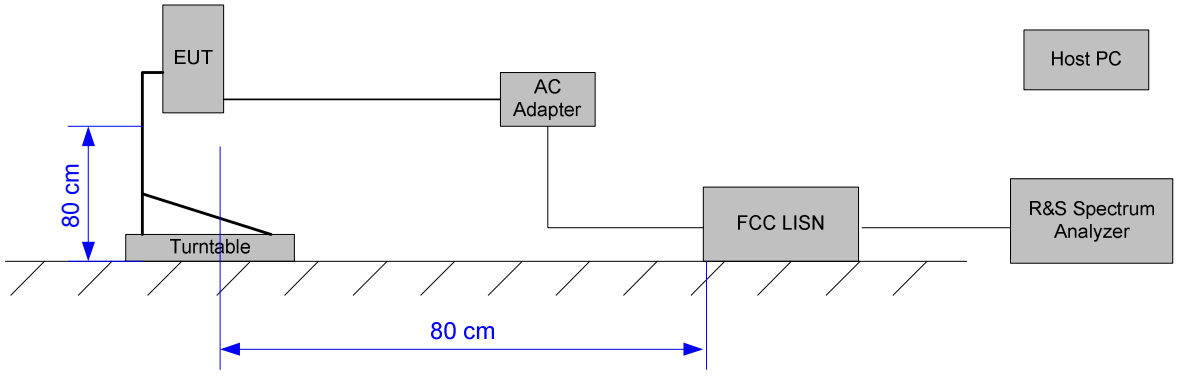
Frequency (MHz)	Maximum Level (dBuV) Quasi-Peak	Maximum Level (dBuV) Average
0.15-0.50	66-56 (Log Delta)	56-46 (Log Delta)
0.50-5.00	56	46
5.00-30.0	60	50

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 for each channel bandwidth configuration. All modulation types were tested. 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

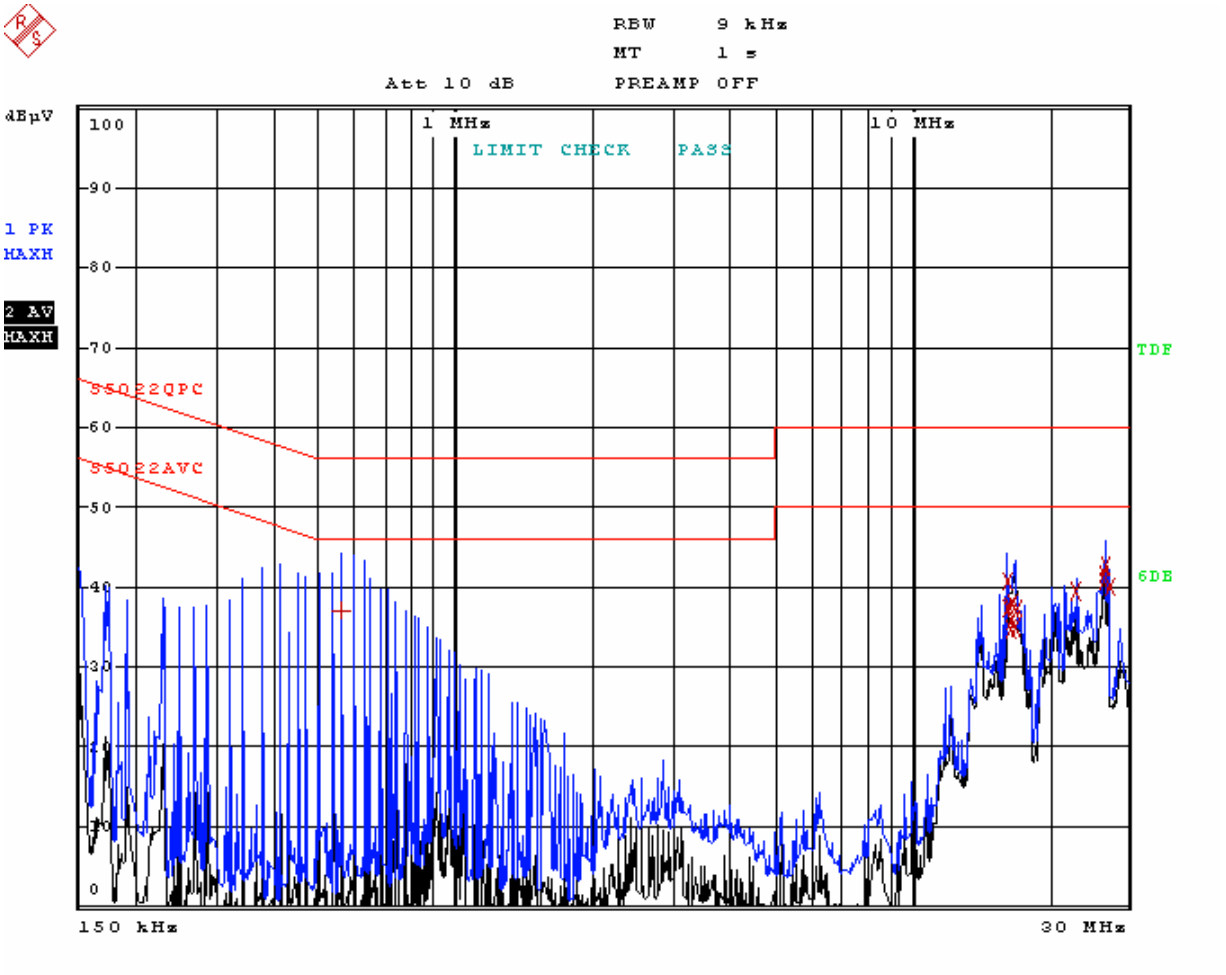


Note: The unused LISN terminal is terminated with a 50 ohms terminator.

2.4 Test Results

2.4.1 Test Data

EUT – Line-b Mode (Ch Freq: 923MHz)



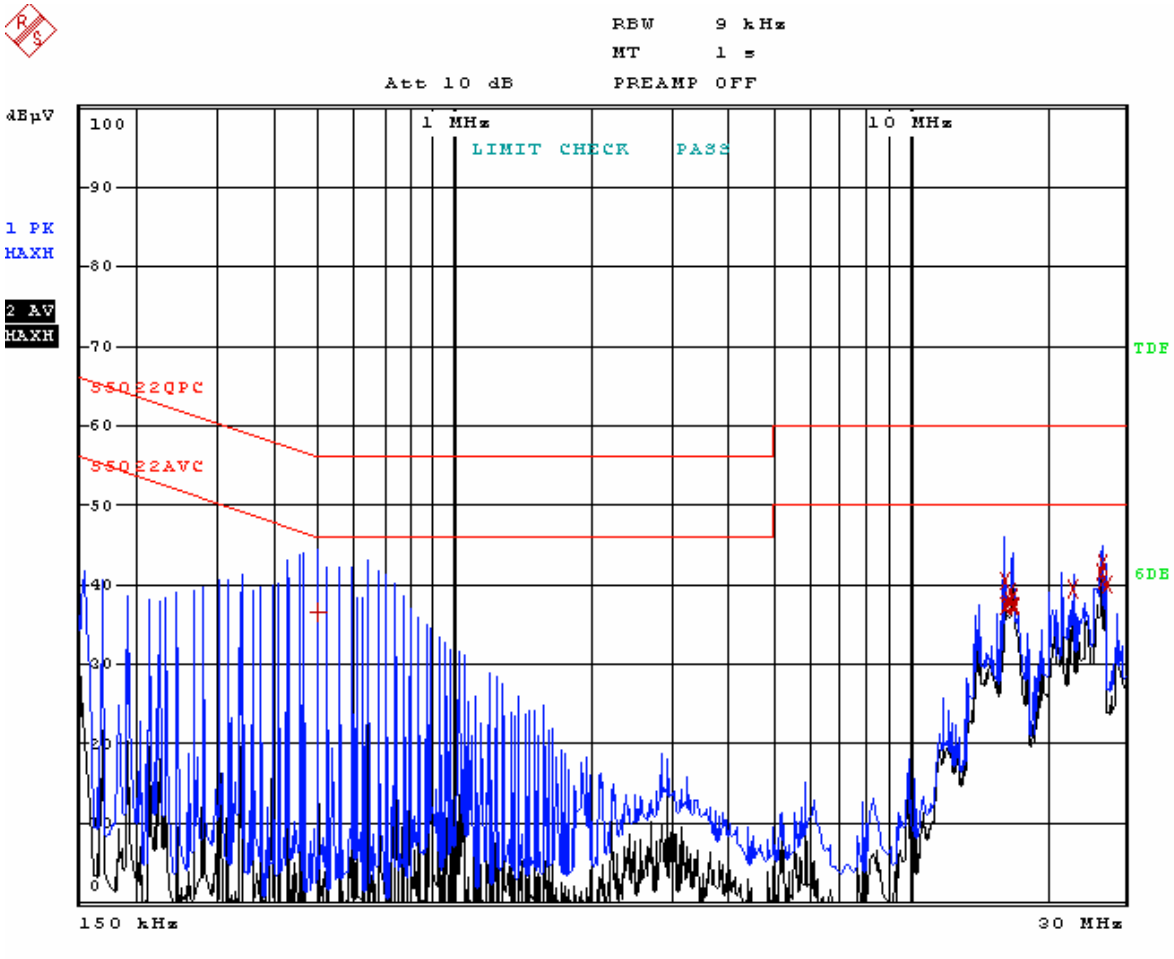
EDIT PEAK LIST (Final Measurement Results)

Trace1:	55022QPC
Trace2:	55022AVC
Trace3:	---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	558 kHz	37.23	-18.76
2	Average	16.17 MHz	37.44	-12.55
2	Average	16.23 MHz	40.71	-9.28
2	Average	16.474 MHz	37.75	-12.24
2	Average	16.534 MHz	35.79	-14.20
2	Average	16.654 MHz	34.73	-15.26
2	Average	16.778 MHz	38.04	-11.95
2	Average	16.842 MHz	36.76	-13.23
2	Average	16.958 MHz	34.97	-15.03
2	Average	17.082 MHz	37.38	-12.62
2	Average	23.13 MHz	39.48	-10.51
2	Average	26.486 MHz	41.73	-8.27
2	Average	26.55 MHz	40.69	-9.30
2	Average	26.61 MHz	42.71	-7.28
2	Average	27.158 MHz	40.15	-9.84

Note: All data points are corrected for insertion loss.

EUT – Line-g Mode (Ch Freq: 913MHz)



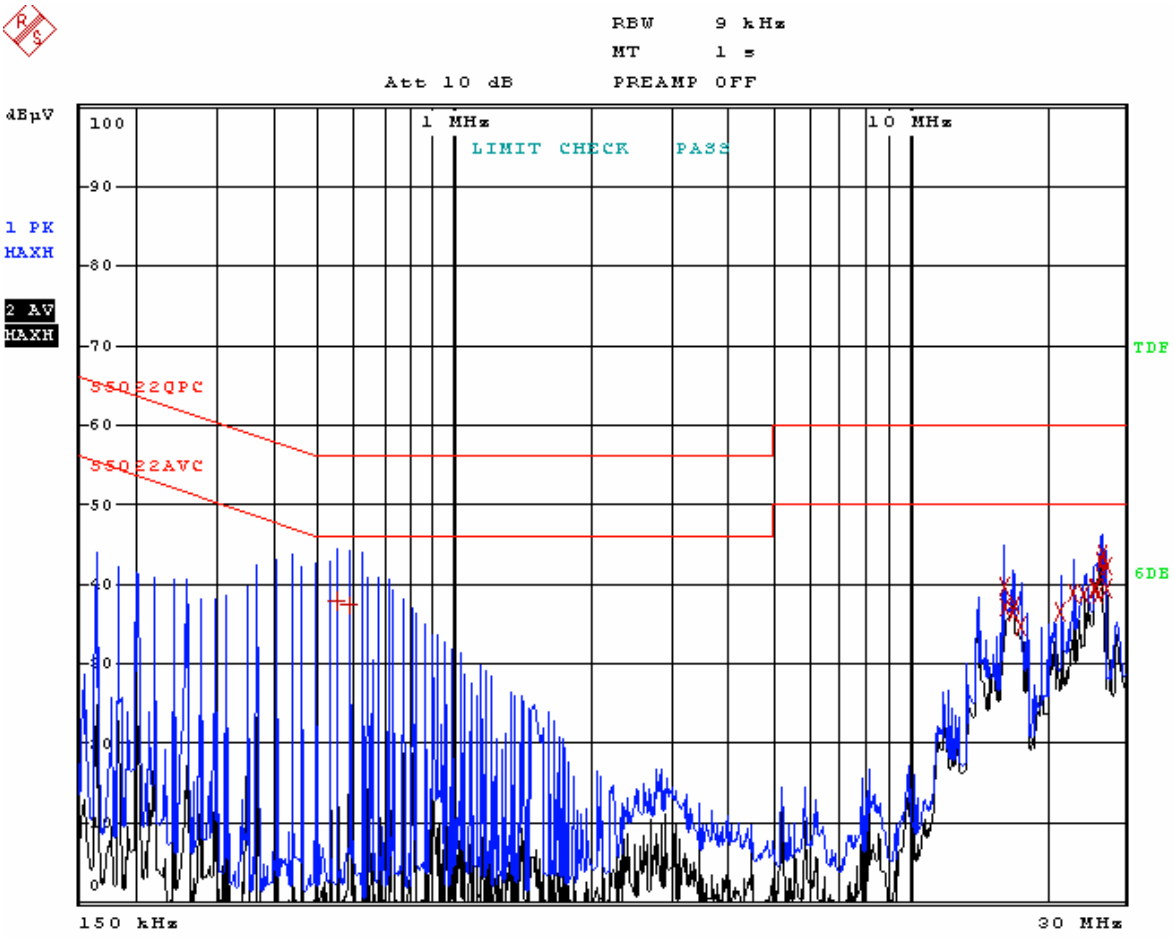
EDIT PEAK LIST (Final Measurement Results)

Trace1:	55022QPC
Trace2:	55022AVC
Trace3:	---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	498 kHz	36.65	-19.37
2	Average	16.17 MHz	37.35	-12.64
2	Average	16.23 MHz	40.64	-9.35
2	Average	16.474 MHz	37.67	-12.32
2	Average	16.770 MHz	37.97	-12.02
2	Average	16.830 MHz	39.32	-10.67
2	Average	16.902 MHz	38.48	-11.51
2	Average	16.962 MHz	37.32	-12.67
2	Average	17.082 MHz	37.33	-12.66
2	Average	23.13 MHz	39.43	-10.56
2	Average	26.486 MHz	41.72	-8.27
2	Average	26.55 MHz	40.67	-9.32
2	Average	26.61 MHz	42.71	-7.28
2	Average	27.150 MHz	40.14	-9.85

Note: All data points are corrected for insertion loss.

EUT – Neutral-b Mode (Ch Freq: 910MHz)



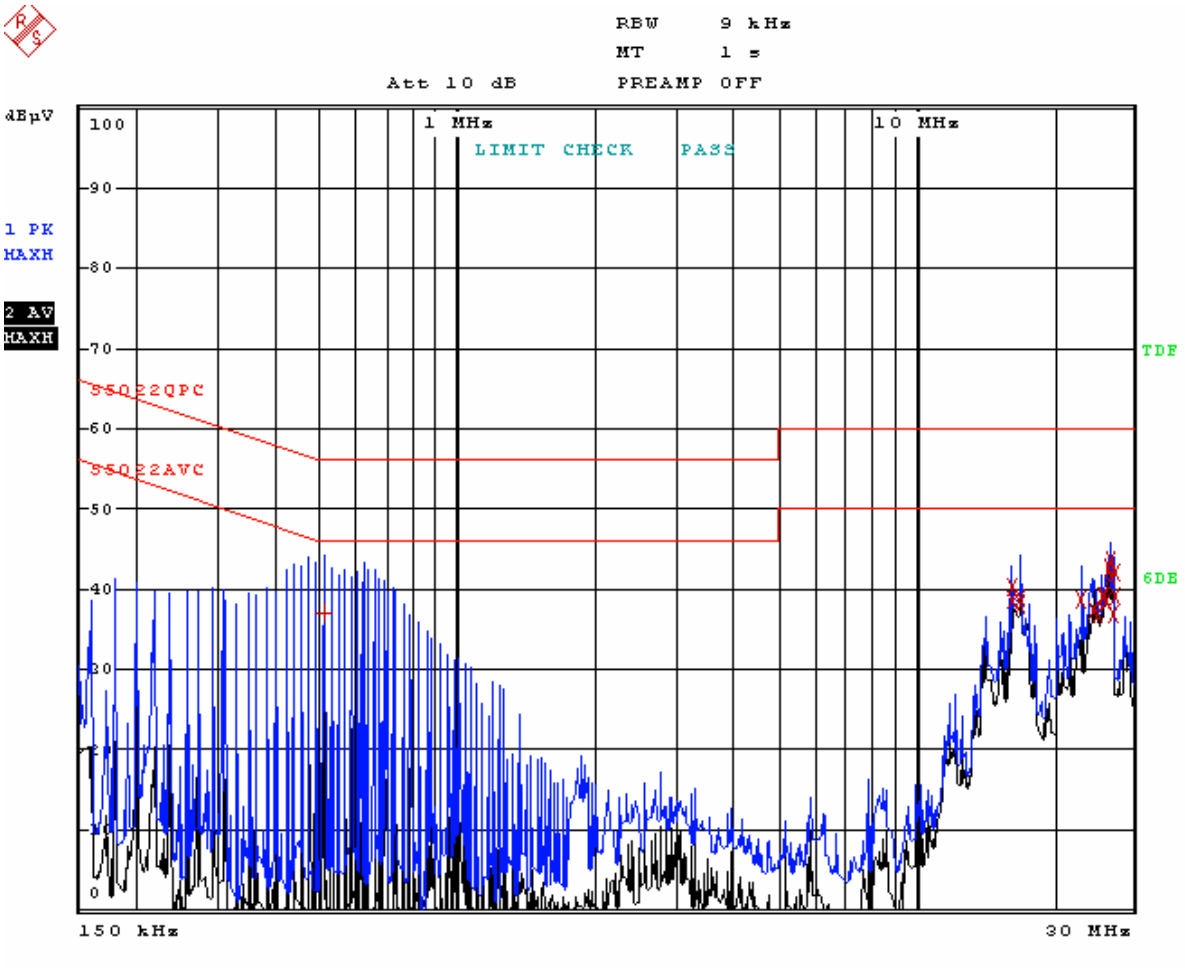
EDIT PEAK LIST (Final Measurement Results)

Trace1:	55022QPC
Trace2:	55022AVC
Trace3:	---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	550 kHz	37.00	-10.11
1	Quasi Peak	586 kHz	37.47	-10.52
2	Average	16.17 MHz	37.11	-12.00
2	Average	16.226 MHz	39.75	-10.24
2	Average	16.842 MHz	36.57	-13.43
2	Average	17.082 MHz	37.30	-12.69
2	Average	17.694 MHz	34.66	-15.33
2	Average	21.662 MHz	36.62	-13.37
2	Average	23.13 MHz	39.04	-10.95
2	Average	24.35 MHz	38.77	-11.22
2	Average	25.694 MHz	39.57	-10.42
2	Average	25.870 MHz	39.52	-10.47
2	Average	25.998 MHz	38.61	-11.38
2	Average	26.486 MHz	42.81	-7.18
2	Average	26.55 MHz	41.80	-8.19
2	Average	26.61 MHz	43.83	-6.16
2	Average	27.158 MHz	42.26	-7.73
2	Average	27.342 MHz	39.41	-10.58

Note: All data points are corrected for insertion loss.

EUT – Neutral-g Mode (Ch Freq: 920MHz)



EDIT PEAK LIST (Final Measurement Results)

Trace1:	55022QPC
Trace2:	55022AVC
Trace3:	---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	510 kHz	37.11	-18.88
2	Average	16.166 MHz	38.77	-11.22
2	Average	16.23 MHz	40.20	-9.79
2	Average	16.838 MHz	39.00	-10.99
2	Average	16.902 MHz	38.13	-11.86
2	Average	23.13 MHz	38.83	-11.17
2	Average	24.534 MHz	37.51	-12.48
2	Average	24.962 MHz	36.91	-13.08
2	Average	25.694 MHz	39.36	-10.63
2	Average	25.878 MHz	39.34	-10.65
2	Average	25.998 MHz	38.41	-11.58
2	Average	26.486 MHz	42.58	-7.41
2	Average	26.55 MHz	41.59	-8.40
2	Average	26.61 MHz	43.63	-6.36
2	Average	26.854 MHz	36.85	-13.14
2	Average	27.158 MHz	42.11	-7.88
2	Average	27.342 MHz	39.30	-10.69

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 in 20 MHz, 10MHz and 5MHz bandwidths.

Power is measured using the channel power measurement feature of the spectrum analyzer.

3.3.1 Test Setup Block Diagram

3.4 Test Results

Mode DSSS/ Channel BW = 5MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
908	25.3	30	PASS
913	24.4	30	PASS
923	24.63	30	PASS

Mode DSSS/ Channel BW = 10MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
910	24.69	30	PASS
920	24.51	30	PASS

Mode OFDM/ Channel BW = 5MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
908	25.26	30	PASS
913	23.99	30	PASS
923	25.21	30	PASS

Mode OFDM/ Channel BW = 10MHz			
Frequency(MHz)	**Measurement(dBm)**	**Limit**	**Result**
910	24.94	30	PASS
920	24.8	30	PASS

Channel BW = 20MHz				
Frequency(MHz)	**Mode**	**Measurement(dBm)**	**Limit**	**Result**
915	DSSS	23.7	30	PASS
	OFDM	24.84	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

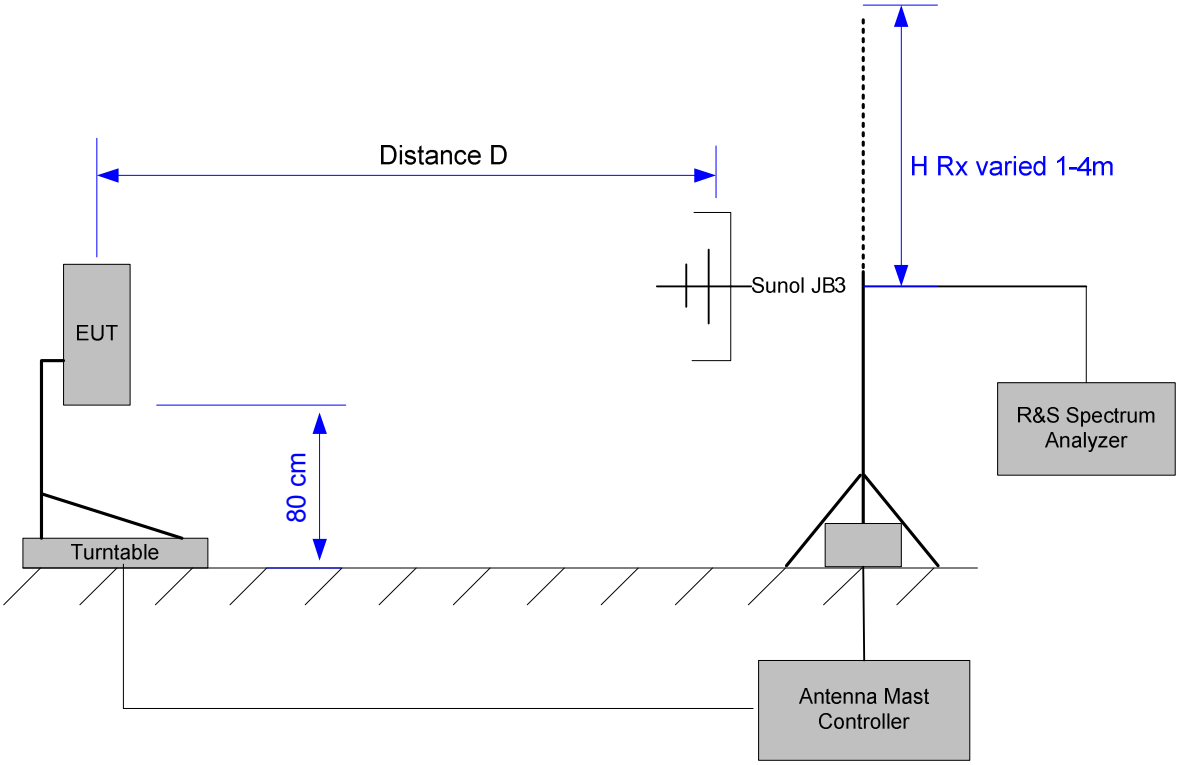
Frequency (MHz)	Maximum Field Strength (uV/m @ 3m)	Maximum Field Strength (dBuV/m @ 3m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-1000	500	54.0

4.3 Test Setup

The EUT was exercised using beaconing mode at the highest possible transmit rate. Testing was performed on low, middle and high channels in 20 MHz, 10MHz and 5MHz bandwidths for both DSSS and OFDM modes. 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 14 dBi Vertical Sector antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
635.760000	45.5	260.0	V	171.0	22.1	0.50	46.00
625.000000	45.4	140.0	H	195.0	22.5	0.60	46.00
800.000000	45.1	100.0	H	194.0	24.8	0.90	46.00
82.560000	35.0	255.0	H	285.0	8.7	5.00	40.00
208.640000	37.1	238.0	H	195.0	13.0	6.40	43.50
207.080000	36.8	338.0	H	276.0	13.3	6.70	43.50
84.520000	32.3	350.0	H	5.0	8.5	7.70	40.00
171.680000	18.2	209.0	H	0.0	13.2	25.30	43.50
141.360000	18.0	159.0	V	74.0	14.9	25.50	43.50
123.200000	15.7	259.0	V	99.0	15.3	27.80	43.50
147.400000	15.3	252.0	V	164.0	14.5	28.20	43.50
161.200000	13.5	350.0	H	195.0	13.8	30.00	43.50
121.000000	12.3	308.0	H	268.0	15.1	31.20	43.50
133.120000	11.9	260.0	V	5.0	15.3	31.60	43.50

Note: All data points are corrected for insertion loss.

4.4.2 12 dBi Omni antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
101.880000	43.3	309.0	H	88.0	2.5	0.20	43.50
112.400000	42.8	310.0	H	262.0	4.8	0.70	43.50
579.240000	44.7	110.0	H	285.0	12.1	1.30	46.00
625.000000	43.4	136.0	H	165.0	13.0	2.60	46.00
107.120000	40.4	302.0	H	186.0	3.9	3.10	43.50
489.240000	42.1	257.0	H	278.0	10.7	3.90	46.00
91.680000	38.9	309.0	H	285.0	-0.5	4.60	43.50
193.040000	38.6	309.0	H	72.0	4.1	4.90	43.50
208.880000	36.7	312.0	H	194.0	3.4	6.80	43.50
192.840000	36.7	238.0	H	88.0	4.1	6.80	43.50
55.000000	31.8	288.0	H	77.0	-0.9	8.20	40.00
86.840000	29.1	259.0	H	13.0	-1.0	10.90	40.00
530.920000	33.1	309.0	H	74.0	11.2	12.90	46.00
181.960000	29.1	309.0	H	10.0	3.3	14.40	43.50
196.840000	27.7	209.0	H	194.0	4.8	15.80	43.50
136.840000	4.1	338.0	V	185.0	5.6	39.40	43.50
154.320000	3.0	338.0	V	89.0	4.6	40.50	43.50

Note: All data points are corrected for insertion loss.

4.4.3 Integrated 8 dBi 900 MHz antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
107.320000	42.1	300.0	H	266.0	3.9	1.40	43.50
625.000000	43.7	100.0	V	187.0	12.6	2.30	46.00
91.680000	39.4	309.0	H	280.0	-0.5	4.10	43.50
99.920000	38.2	308.0	H	164.0	1.9	5.30	43.50
489.240000	39.5	288.0	H	271.0	10.7	6.50	46.00
193.640000	36.9	289.0	H	11.0	4.2	6.60	43.50
204.760000	36.5	213.0	H	178.0	4.3	7.00	43.50
969.760000	46.6	109.0	V	177.0	16.5	7.40	54.00
58.840000	30.4	214.0	H	184.0	-0.8	9.60	40.00
963.360000	43.8	110.0	V	176.0	16.5	10.20	54.00
55.680000	28.5	305.0	H	11.0	-0.9	11.50	40.00
126.320000	25.1	188.0	H	271.0	5.7	18.50	43.50
410.840000	23.7	138.0	V	12.0	8.6	22.30	46.00
153.960000	10.9	309.0	V	179.0	4.7	32.60	43.50
123.200000	2.1	138.0	H	266.0	5.6	41.40	43.50
161.240000	1.5	210.0	H	270.0	4.3	42.00	43.50

Note: All data points are corrected for insertion loss.

The data above is for 5 MHz bandwidth in DSSS mode at channel 1 (908 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

902-928 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

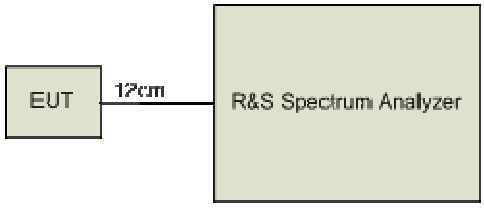
Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels. Conducted scans are used to determine compliance with the 30 dBc limit for emissions outside of the operational frequency band.

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.

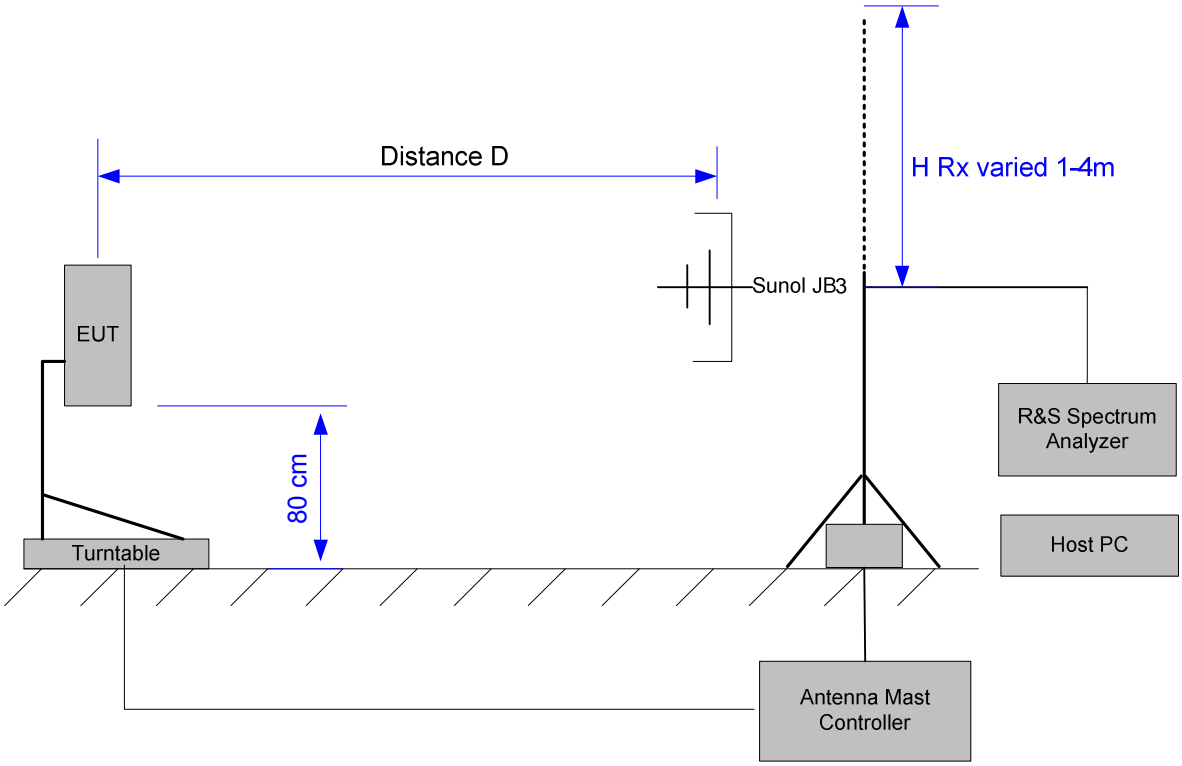
The TR-900II-8 was tested with its integrated antenna. The TR-900II-N was tested with all external antennas. The EUT was exercised using beaconing mode at the highest possible transmit rate. Testing was performed on low, middle and high channels in 20 MHz, 10MHz and 5MHz bandwidths for both DSSS and OFDM modes.

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)

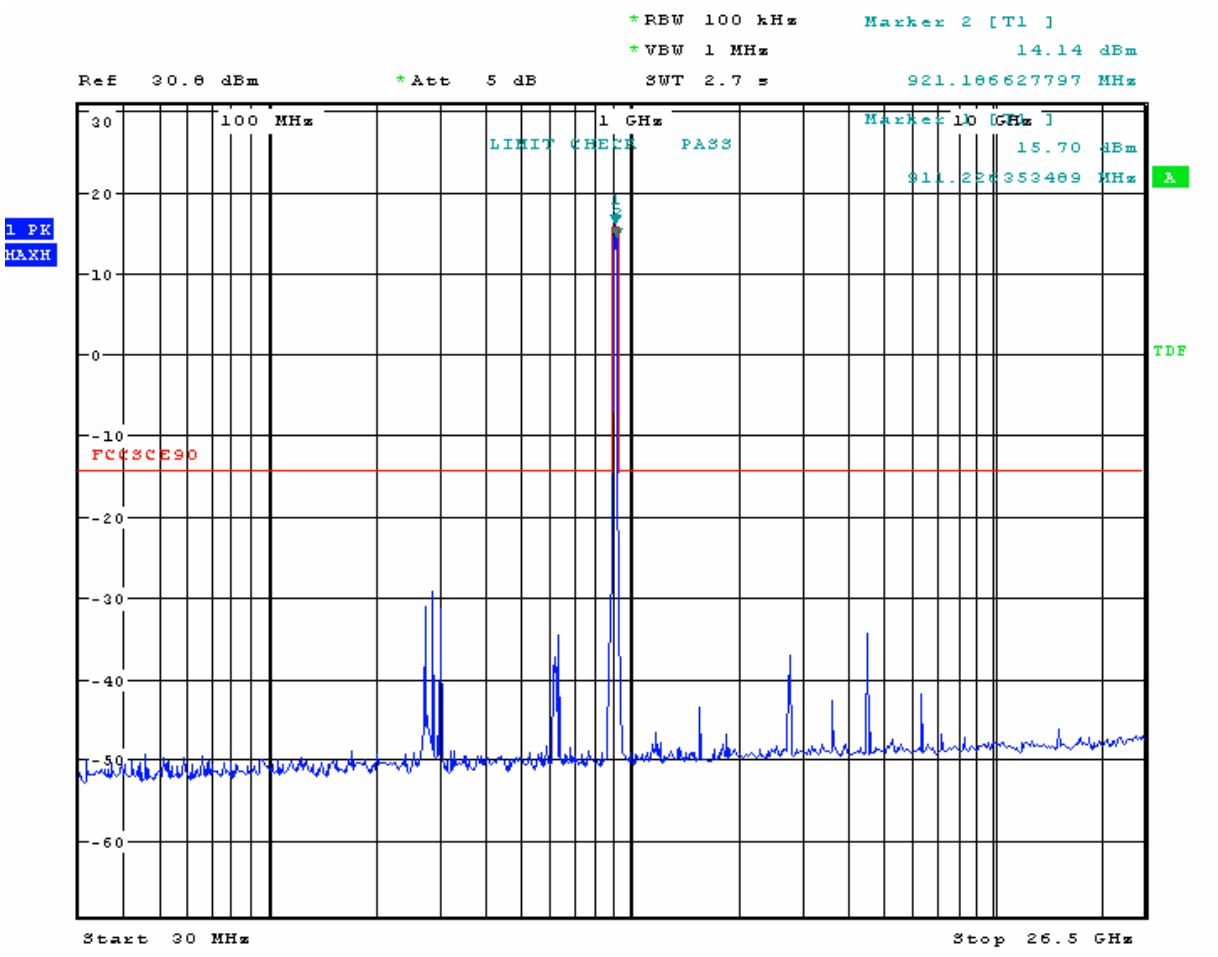


5.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



5.4 Test Results

5.4.1 Test Results 15.247–Harmonics -30 dBc



The above plot shows the conducted output of the transmitter. There are no conducted harmonics within the 30 dBc limit.

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 configuration, being 5 MHz bandwidth in OFDM mode at channel 4 (923 MHz).

Vertical Sector					
Freq (GHz)	**Reading Type**	**Reading (dBuV/m)**	**Limit (dBuV/m)**	**Margin**	**Result**
2.339	Peak	48.6	74	-25.4	Pass
	Average	20.51	54	-33.49	Pass
2.466	Peak	57.43	74	-16.57	Pass
	Average	29.34	54	-24.66	Pass
2.769	Peak	72.35	74	-1.65	Pass
	Average	44.26	54	-9.74	Pass
3.692	Peak	48.89	74	-25.11	Pass
	Average	20.8	54	-33.2	Pass
4.616	Peak	58.16	74	-15.84	Pass
	Average	30.07	54	-23.93	Pass

Omni Antenna					
Freq (GHz)	**Reading Type**	**Reading (dBuV/m)**	**Limit (dBuV/m)**	**Margin**	**Result**
2.338	Peak	49.57	74	-24.43	Pass
	Average	49.57	54	-4.43	Pass
2.468	Peak	57.32	74	-16.68	Pass
	Average	57.32	54	3.32	Pass
2.767	Peak	70.49	74	-3.51	Pass
	Average	70.49	54	16.49	Pass
3.691	Peak	60.58	74	-13.42	Pass
	Average	60.58	54	6.58	Pass
4.618	Peak	69.1	74	-4.9	Pass
	Average	69.1	54	15.1	Pass

Integrated 8dBi Antenna					
Freq (GHz)	**Reading Type**	**Reading (dBuV/m)**	**Limit (dBuV/m)**	**Margin**	**Result**
2.424	Peak	54.3	74	-19.7	Pass
	Average	26.21	54	-27.79	Pass
2.464	Peak	57.53	74	-16.47	Pass
	Average	29.44	54	-24.56	Pass
2.767	Peak	64.17	74	-9.83	Pass
	Average	36.08	54	-17.92	Pass
3.696	Peak	53.89	74	-20.11	Pass
	Average	25.8	54	-28.2	Pass
4.616	Peak	59.28	74	-14.72	Pass
	Average	31.19	54	-22.81	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).)

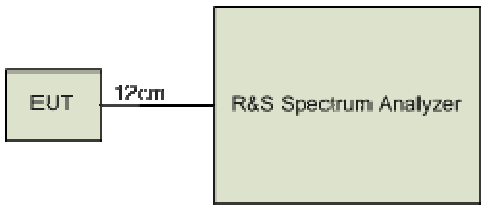
6.3 Test Setup

Conducted measurements are made on the EUT to ensure compliance with the required emission levels.

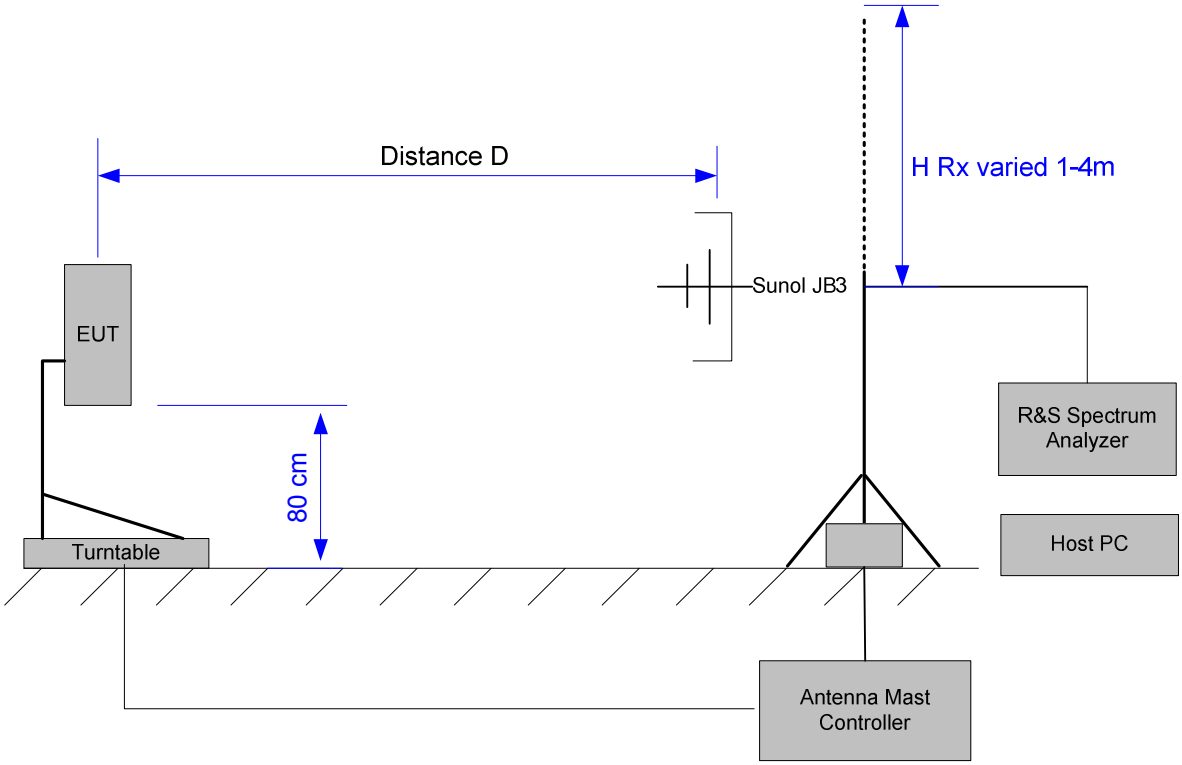
The test is performed at low and high channels. Compliance in the 902-928 MHz band is established through conducted measurements.

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)

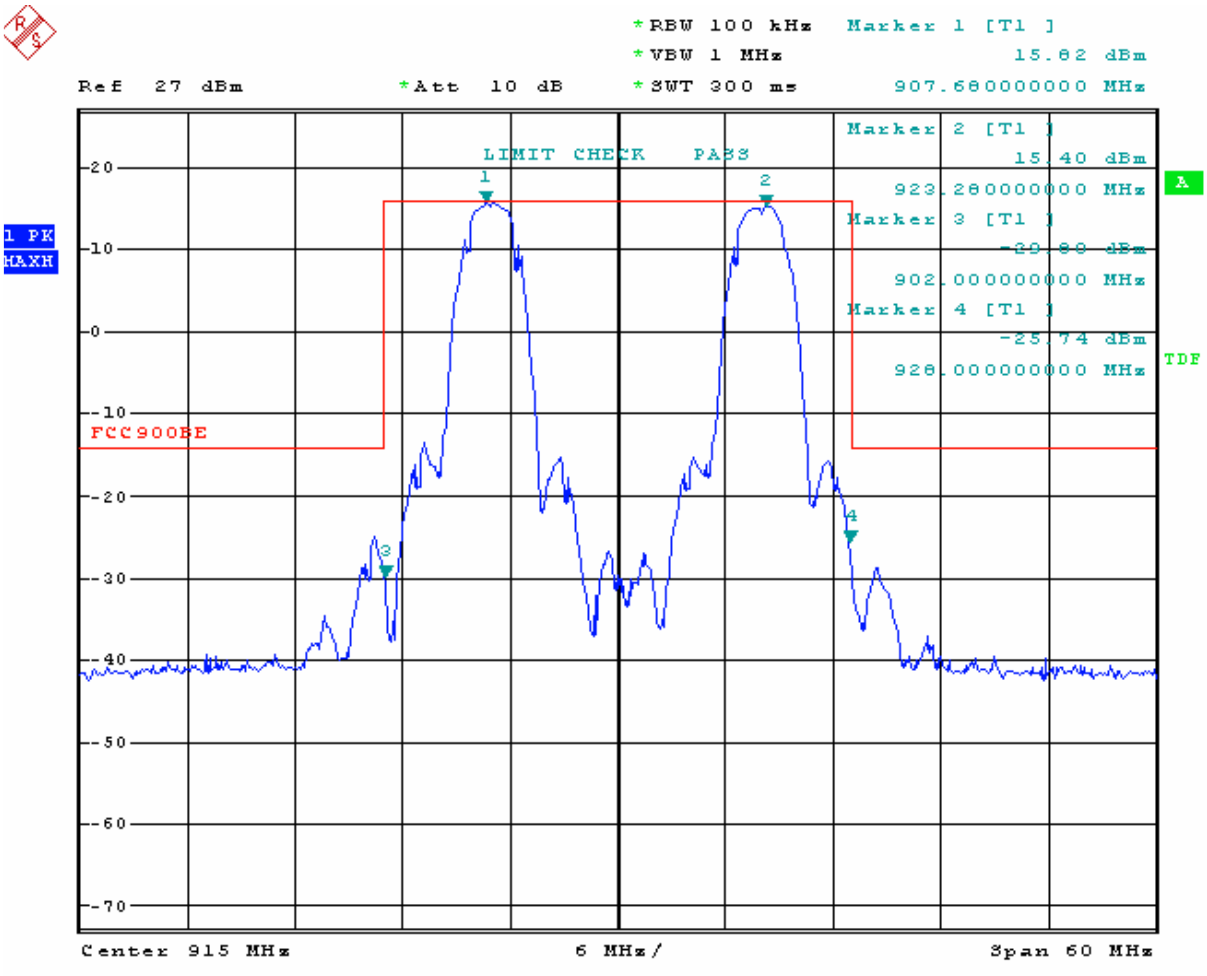


6.3.2 Test Setup Block Diagram – Radiated Measurements

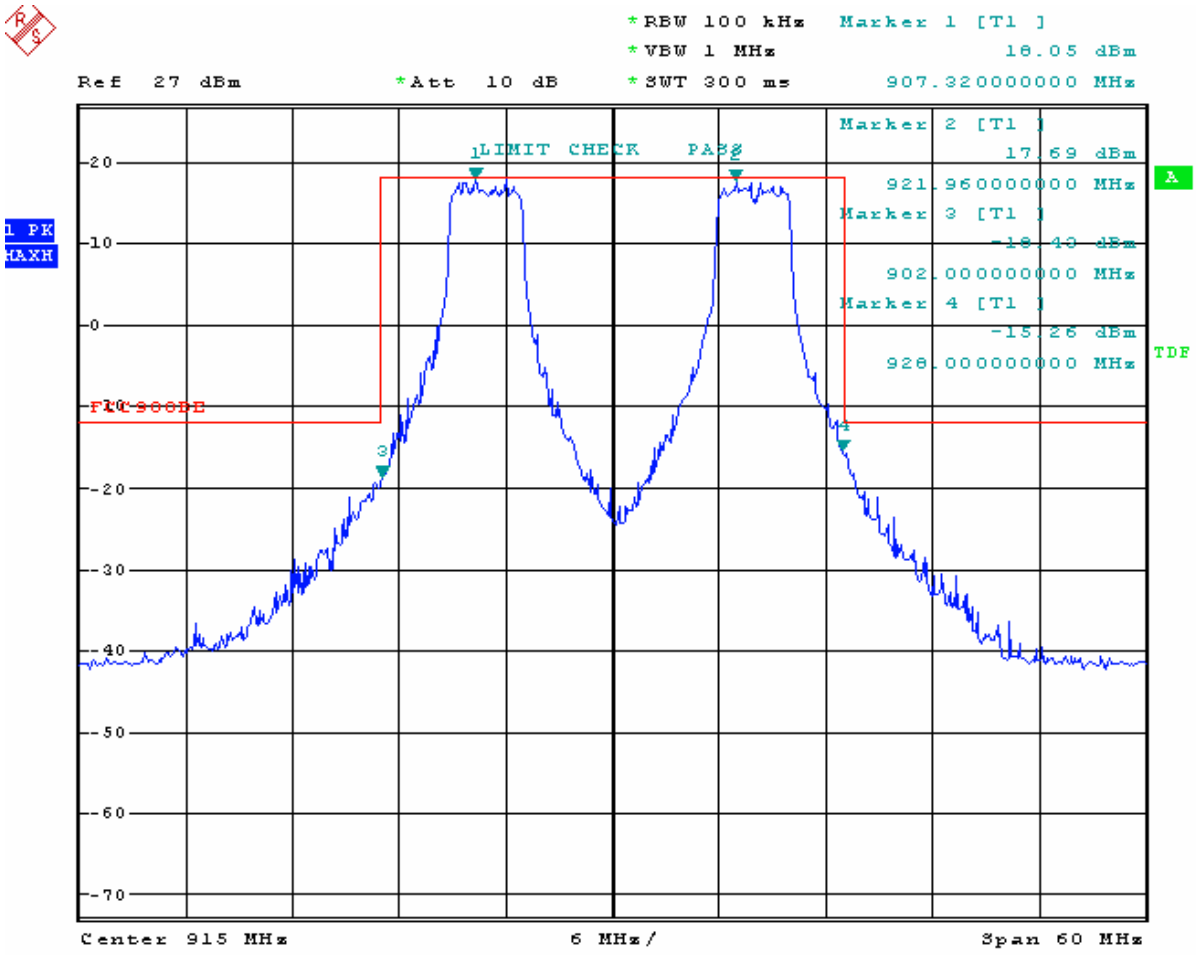


6.4 Test Results, 902-928 MHz, Conducted Measurements

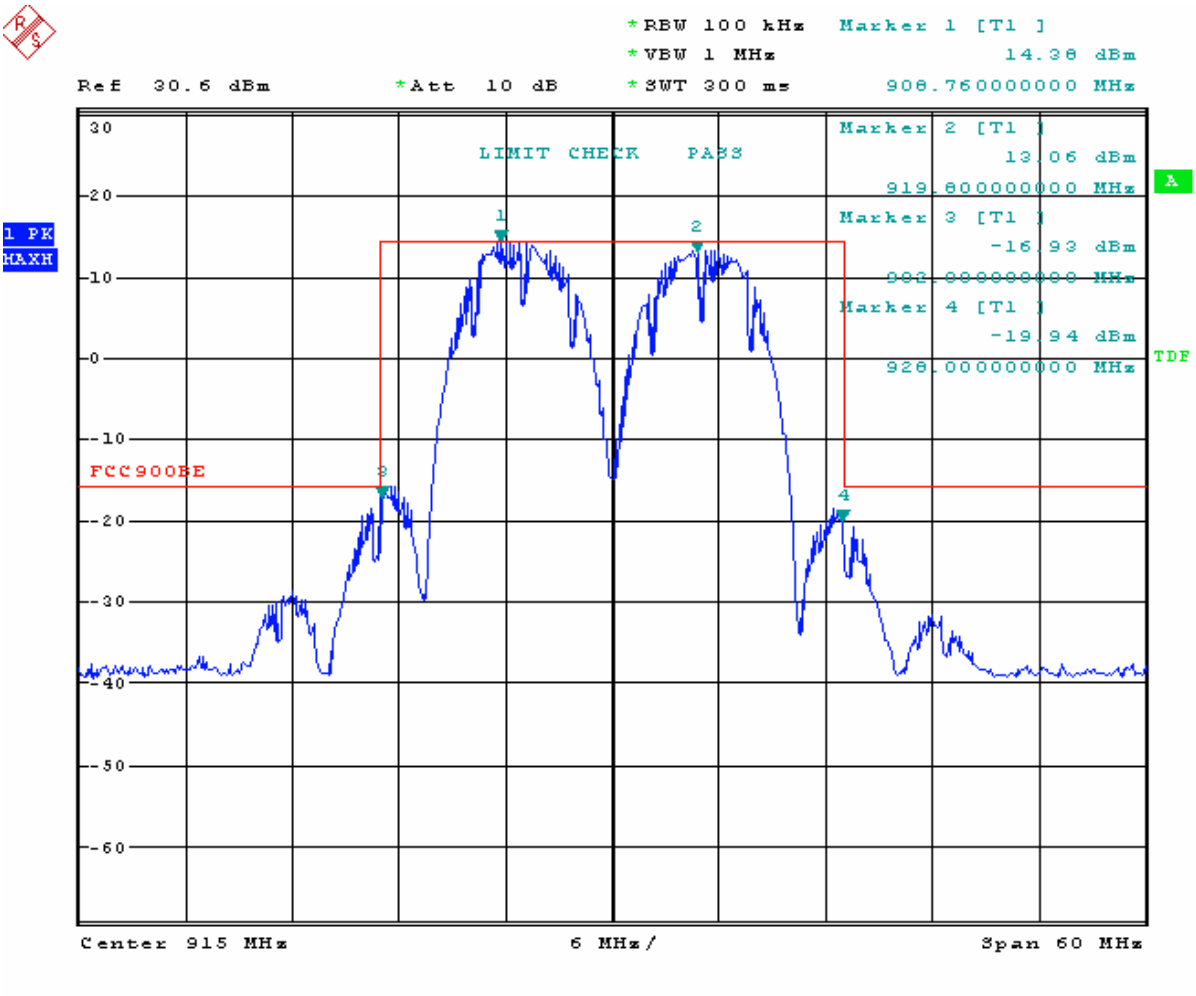
6.4.1 5MHz Bandwidth, DSSS



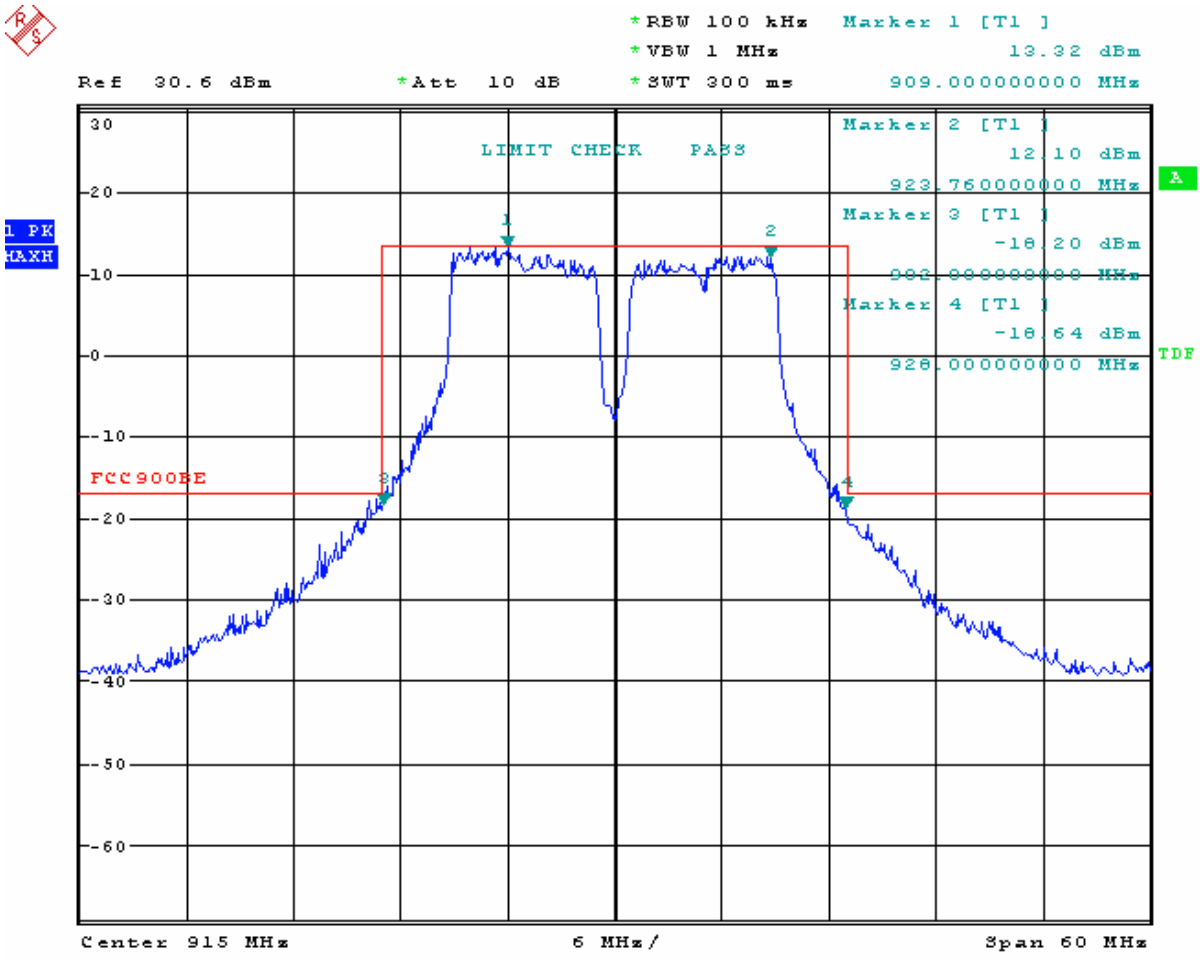
6.4.2 5MHz Bandwidth, OFDM



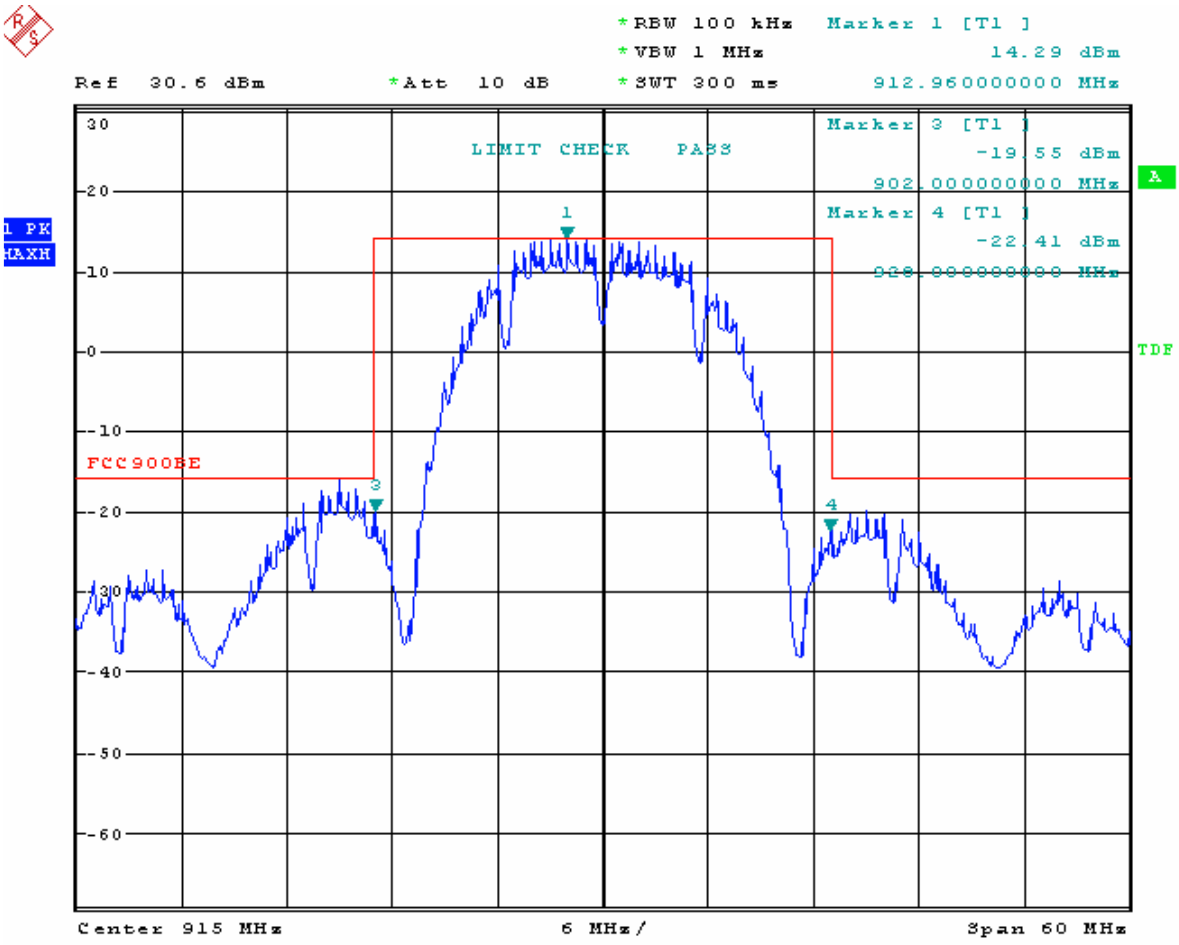
6.4.3 10MHz Bandwidth, DSSS



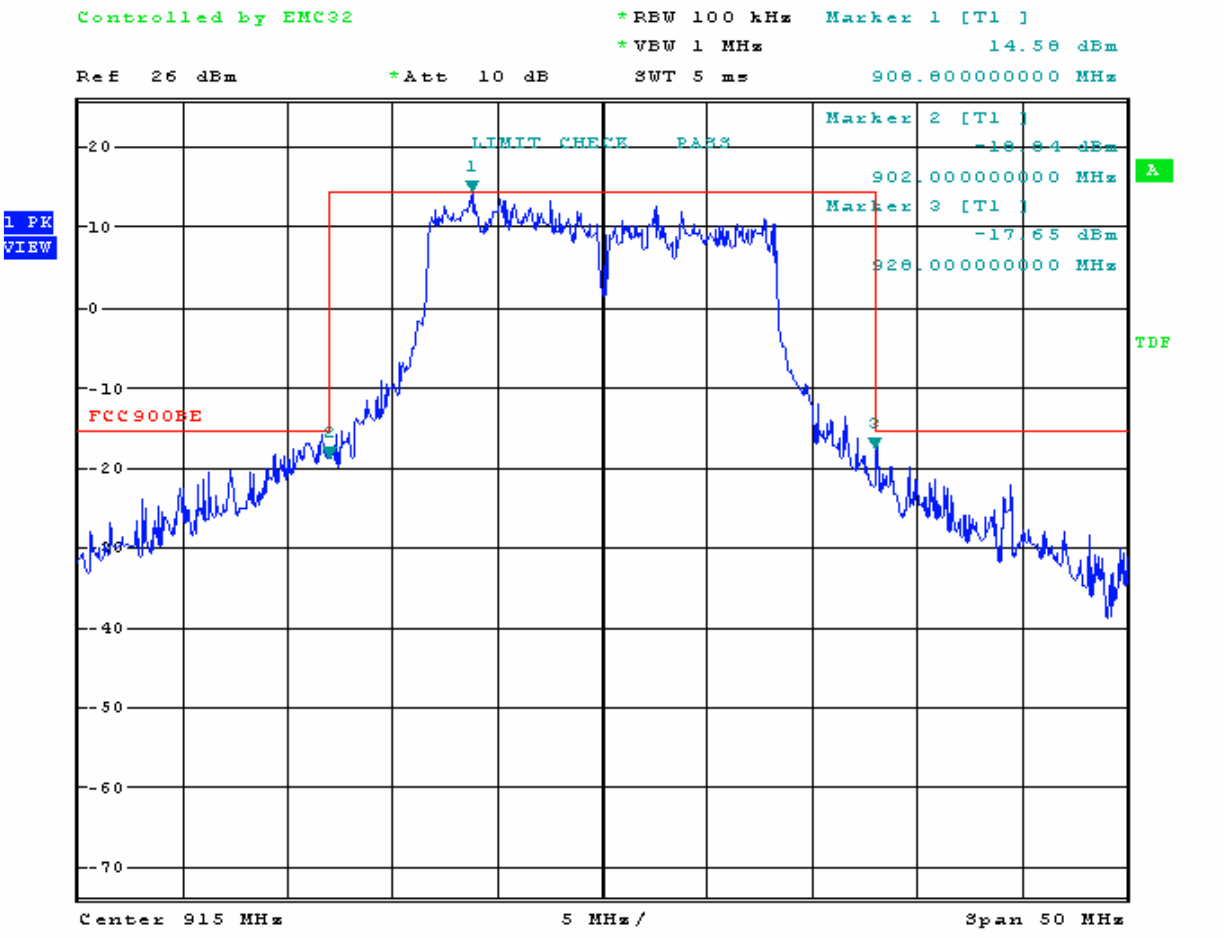
6.4.4 10MHz Bandwidth, OFDM



6.4.5 20MHz Bandwidth, DSSS



6.4.6 20MHz Bandwidth, OFDM



All emissions outside the 902-928 MHz frequency band are attenuated by at least 30 dB.

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

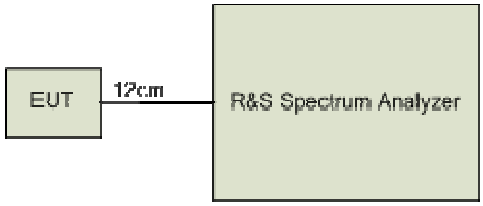
The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3 Test Setup

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

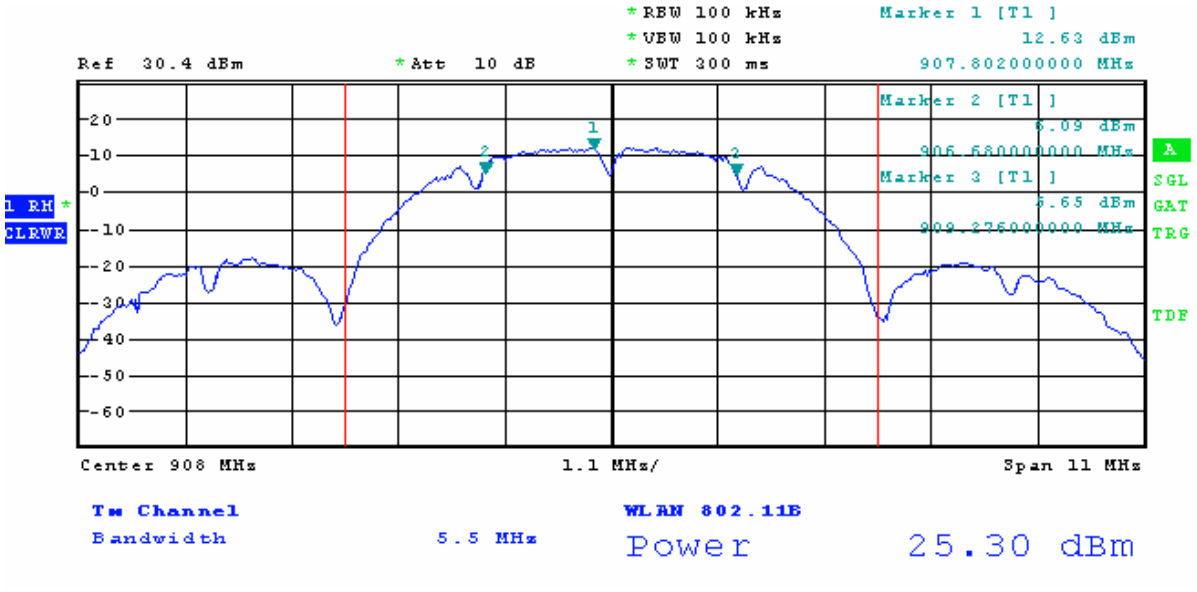
The test is performed at low, middle and high channels using both OFDM and DSSS modulations in 20 MHz, 10MHz and 5MHz bandwidths.

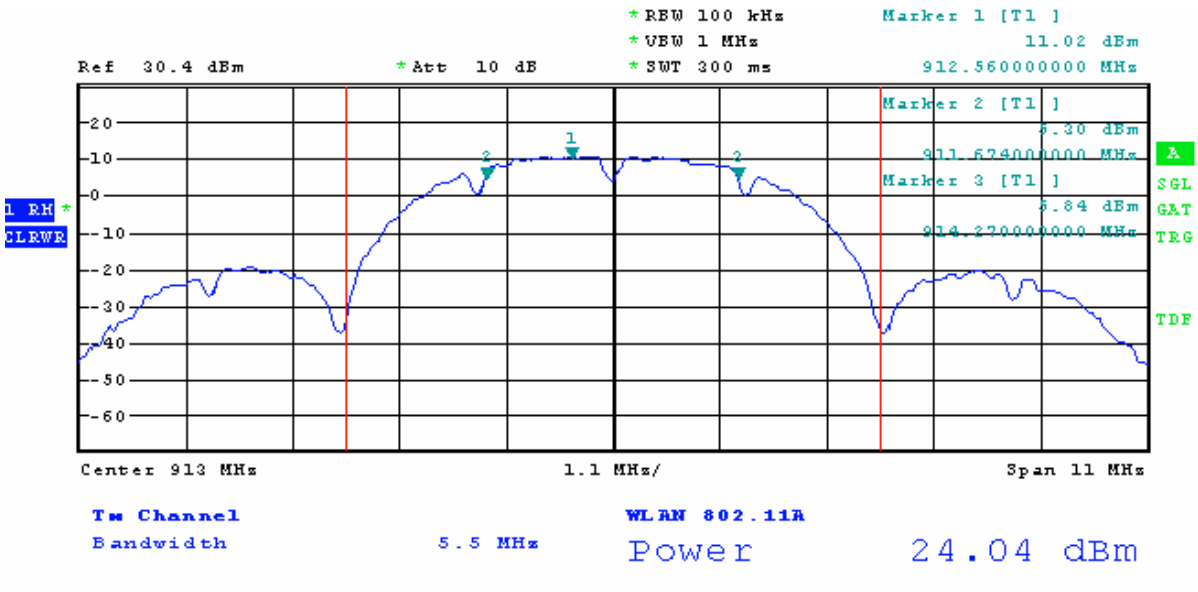
7.3.1 Test Setup Block Diagram

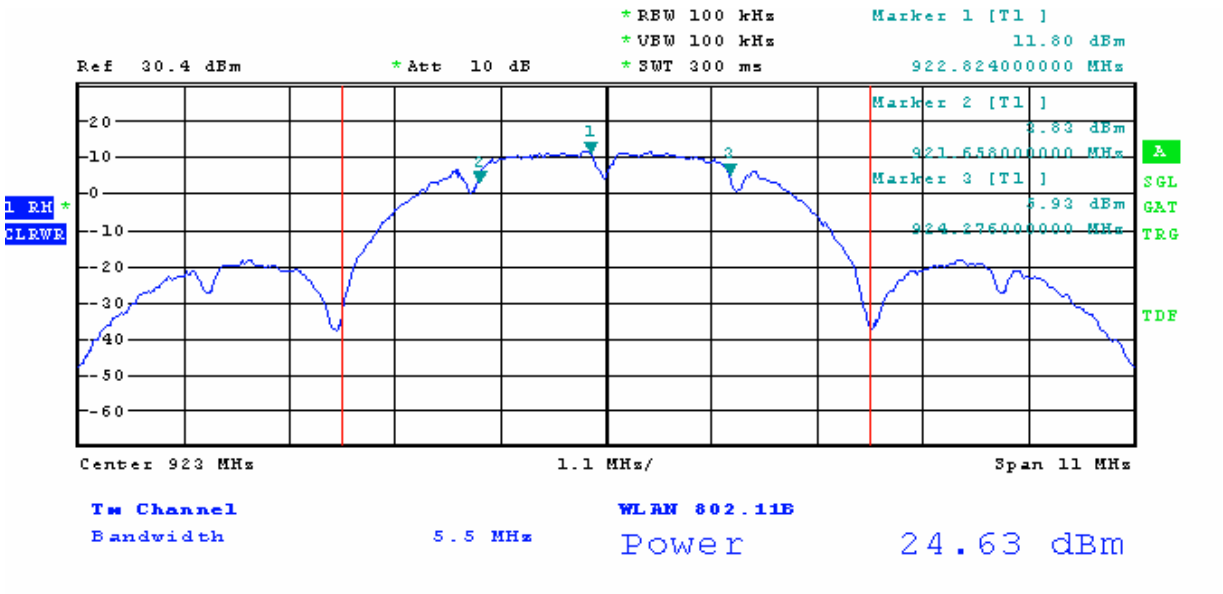


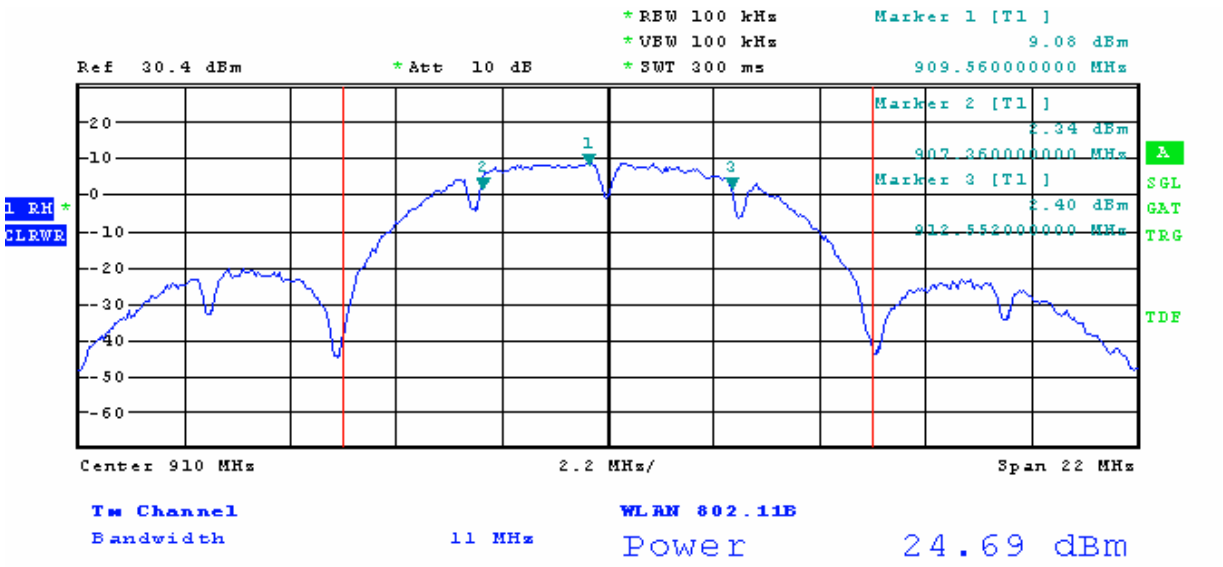
7.4 Test Results, 6 dB Occupied Bandwidth

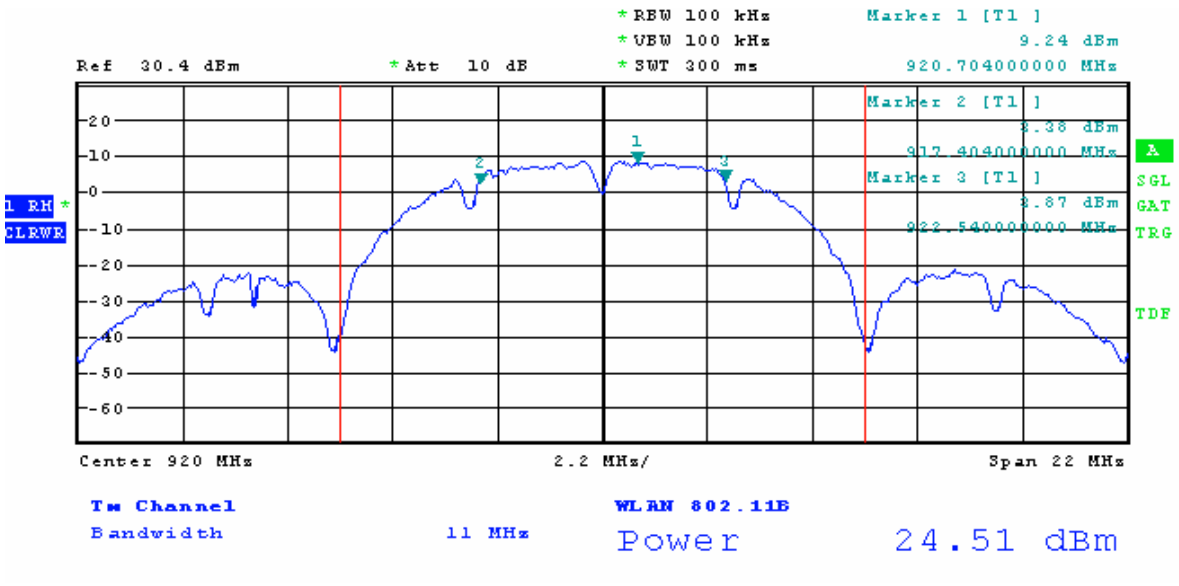
7.4.1 DSSS

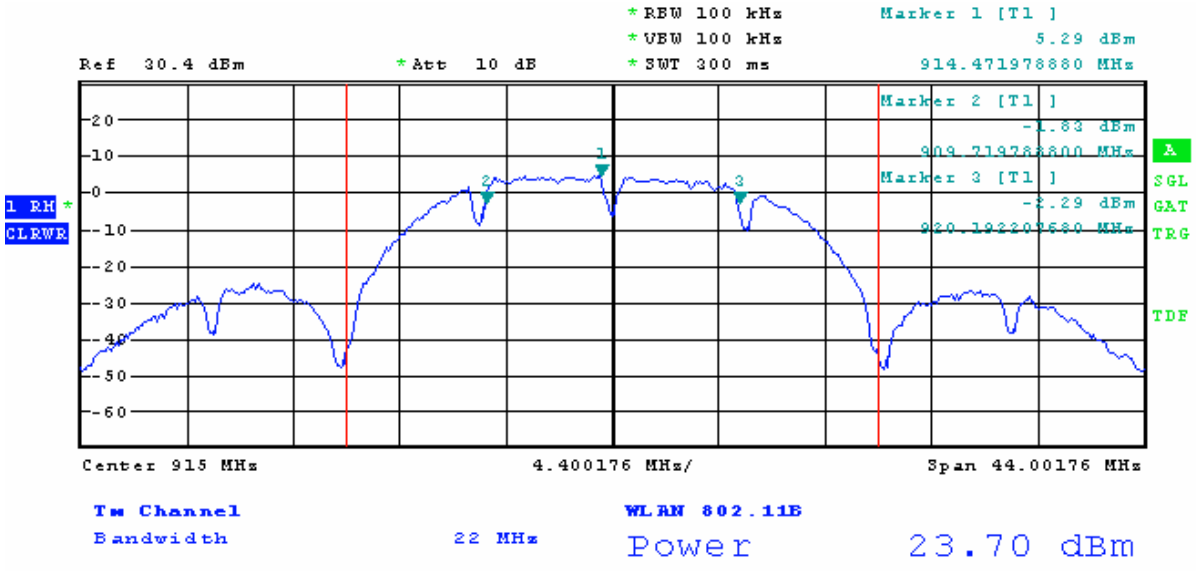




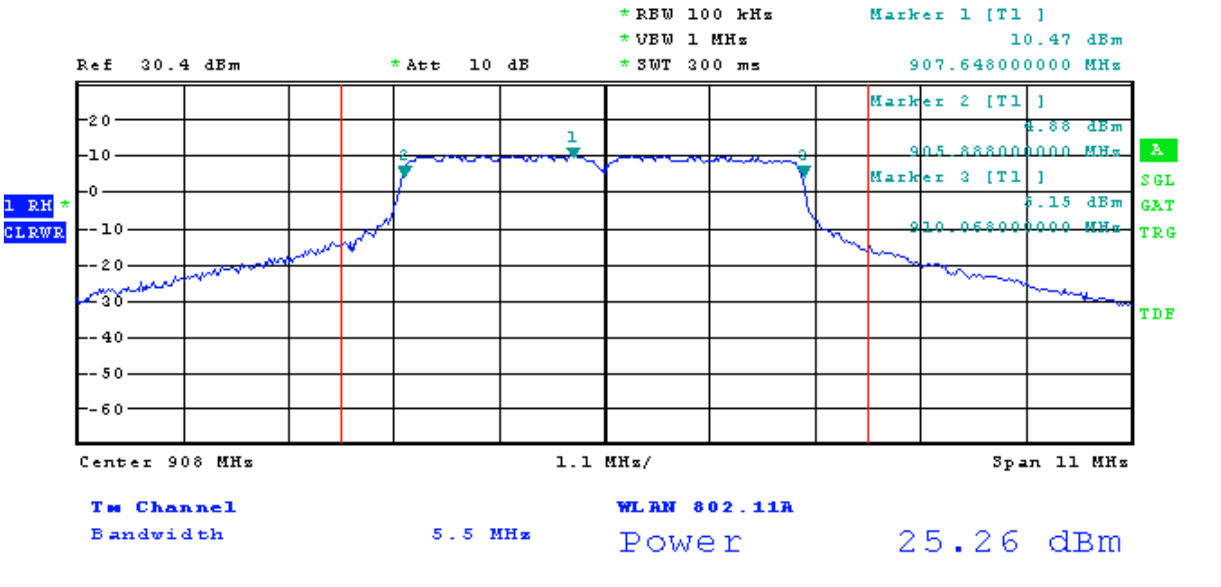

*RBW 100 kHz
*VBW 100 kHz
*SWT 300 ms
Marker 1 [T1]
11.80 dBm
922.824000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
3.83 dBm
921.656000000 MHz
Marker 3 [T1]
5.93 dBm
924.376000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
Center 923 MHz
1.1 MHz/
Span 11 MHz
Tx Channel
Bandwidth
5.5 MHz
WLAN 802.11B
Power
24.63 dBm

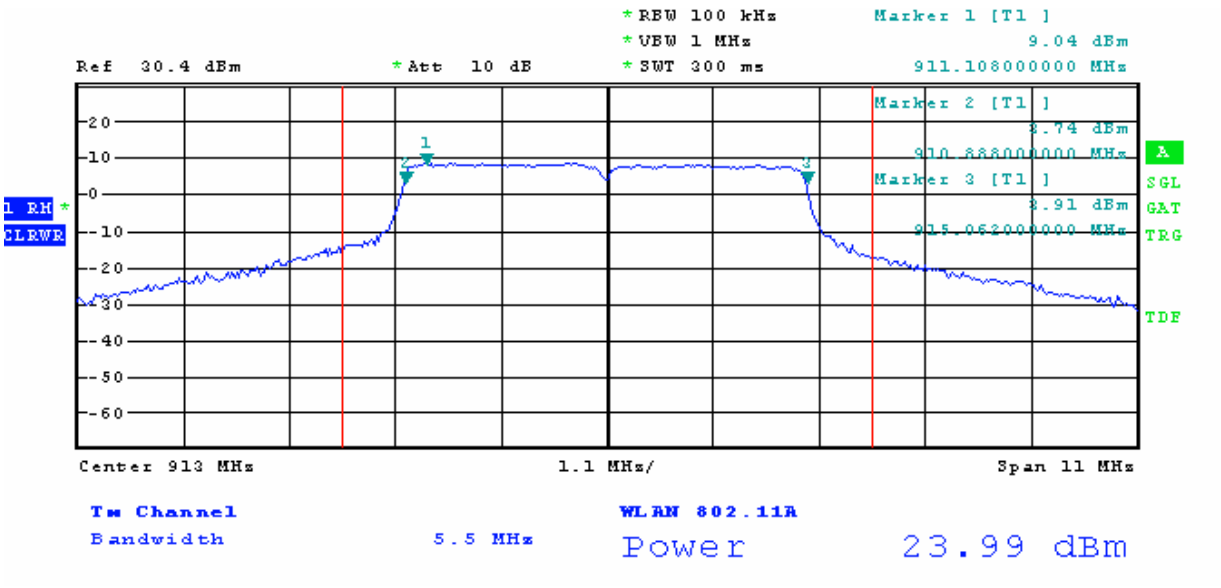

*RBW 100 kHz
*VBW 100 kHz
*SWT 300 ms
Marker 1 [T1]
9.08 dBm
909.560000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
2.34 dBm
907.360000000 MHz
Marker 3 [T1]
2.40 dBm
912.552000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
Center 910 MHz
2.2 MHz/
Span 22 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11B
Power
24.69 dBm

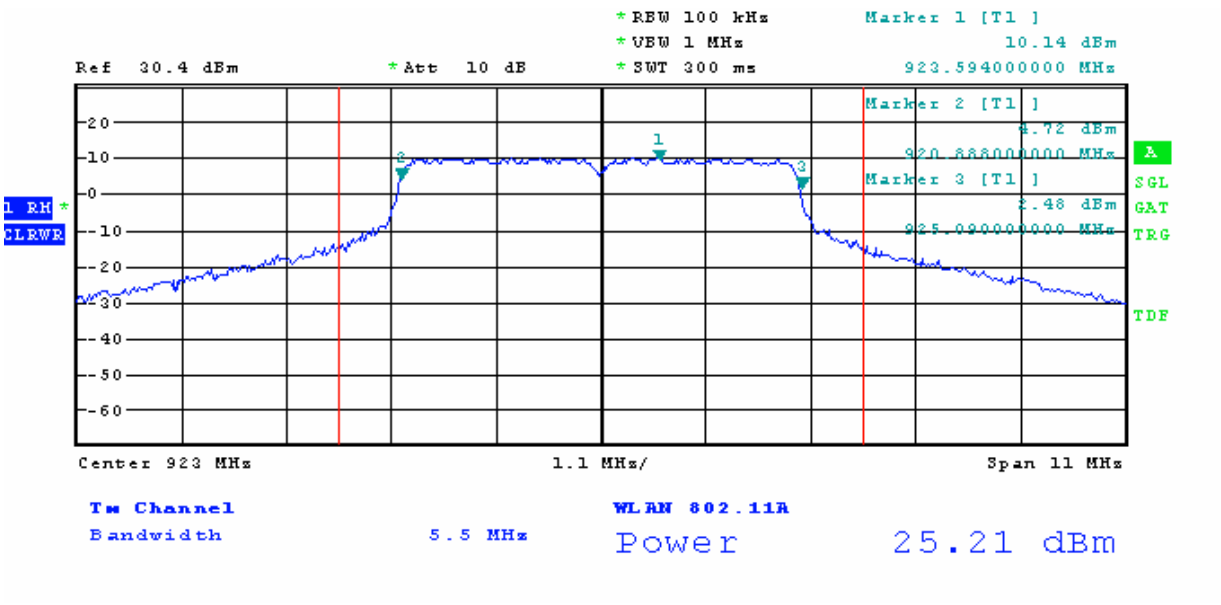

*RBW 100 kHz
*VBW 100 kHz
*SWT 300 ms
Marker 1 [T1]
9.24 dBm
920.704000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
2.38 dBm
917.404000000 MHz
Marker 3 [T1]
2.87 dBm
922.540000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
20
10
0
-10
-20
-30
-40
-50
-60
Center 920 MHz
2.2 MHz/
Span 22 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11B
Power
24.51 dBm

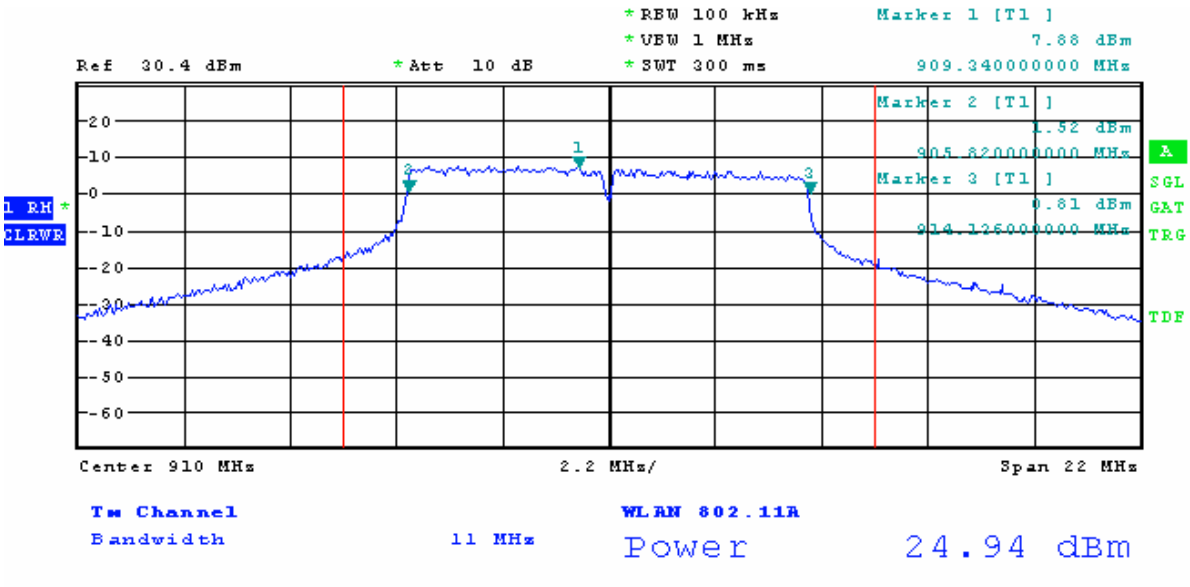

*RBW 100 kHz
*VBW 100 kHz
*SWT 300 ms
Marker 1 [T1]
5.29 dBm
914.471978880 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
-1.83 dBm
Marker 3 [T1]
-2.29 dBm
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
20
10
0
-10
-20
-30
-40
-50
-60
Center 915 MHz
4.400176 MHz/
Span 44.00176 MHz
Tx Channel
Bandwidth
22 MHz
WLAN 802.11B
Power
23.70 dBm

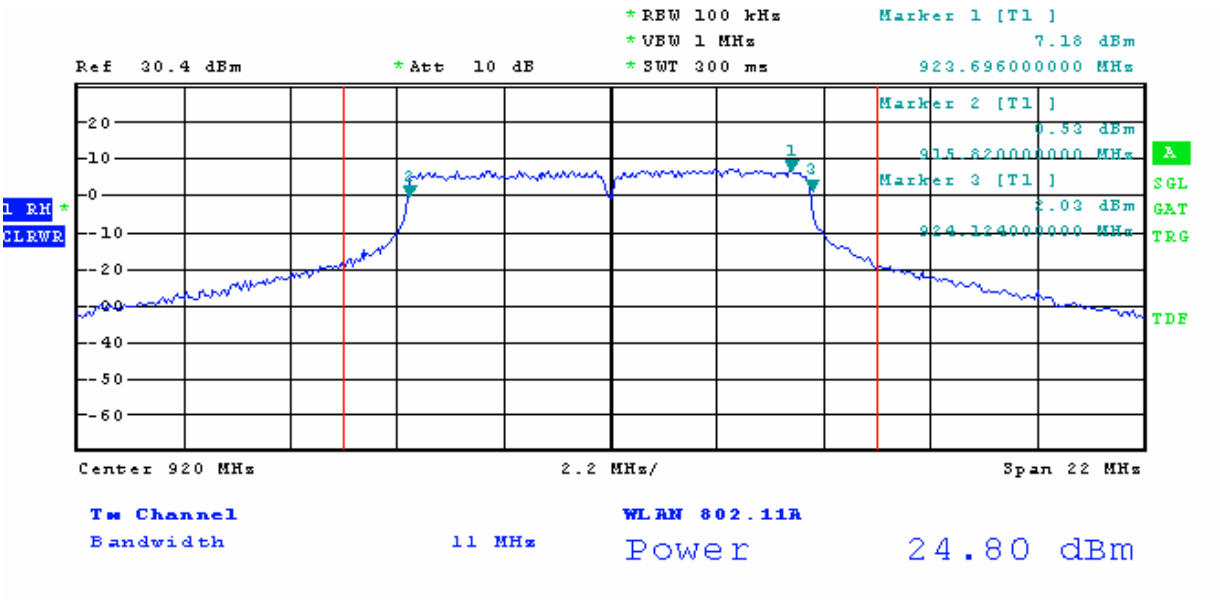
7.4.2 OFDM

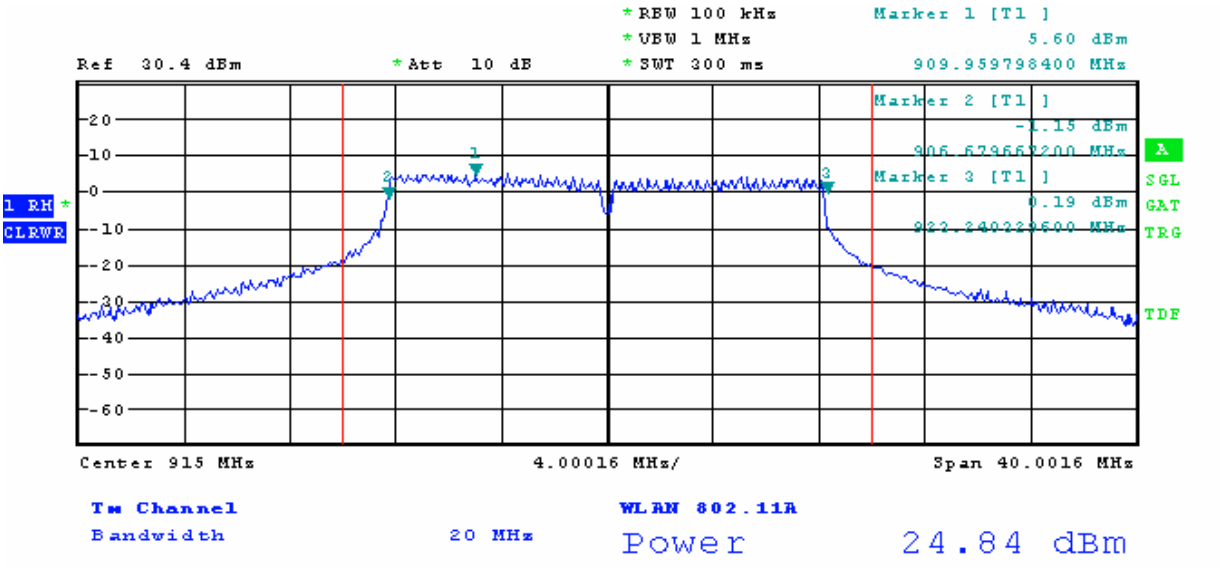

*RBW 100 kHz
*VBW 1 MHz
*SWT 300 ms
Marker 1 [T1]
10.47 dBm
907.648000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
4.88 dBm
905.888000000 MHz
Marker 3 [T1]
5.15 dBm
910.068000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
Center 908 MHz
1.1 MHz/
Span 11 MHz
Tx Channel
Bandwidth
5.5 MHz
WLAN 802.11A
Power
25.26 dBm


*RBW 100 kHz
*VBW 1 MHz
*SWT 300 ms
Marker 1 [T1]
9.04 dBm
911.108000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
8.74 dBm
910.888000000 MHz
Marker 3 [T1]
8.91 dBm
915.052000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
Center 913 MHz
1.1 MHz/
Span 11 MHz
Tx Channel
Bandwidth
5.5 MHz
WLAN 802.11A
Power
23.99 dBm


*RBW 100 kHz
*VBW 1 MHz
*SWT 300 ms
Marker 1 [T1]
10.14 dBm
923.594000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
4.72 dBm
920.888000000 MHz
Marker 3 [T1]
2.48 dBm
925.090000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
-20
-10
-0
--10
--20
--30
--40
--50
--60
Center 923 MHz
1.1 MHz/
Span 11 MHz
Tx Channel
Bandwidth
5.5 MHz
WLAN 802.11A
Power
25.21 dBm


*RBW 100 kHz
*VBW 1 MHz
*SWT 300 ms
Marker 1 [T1]
7.88 dBm
909.340000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
1.52 dBm
905.820000000 MHz
Marker 3 [T1]
0.81 dBm
914.126000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
-20
-10
-0
--10
--20
--30
--40
--50
--60
Center 910 MHz
2.2 MHz/
Span 22 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11A
Power
24.94 dBm


*RBW 100 kHz
*VBW 1 MHz
*SWT 300 ms
Marker 1 [T1]
7.18 dBm
923.696000000 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
0.53 dBm
915.820000000 MHz
Marker 3 [T1]
2.03 dBm
924.124000000 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
Center 920 MHz
2.2 MHz/
Span 22 MHz
Tx Channel
Bandwidth
11 MHz
WLAN 802.11A
Power
24.80 dBm


*RBW 100 kHz
*VBW 1 MHz
*SWT 300 ms
Marker 1 [T1]
5.60 dBm
909.959798400 MHz
Ref 30.4 dBm
*Att 10 dB
Marker 2 [T1]
-1.15 dBm
906.679668200 MHz
Marker 3 [T1]
0.19 dBm
922.240229600 MHz
1 RH *
CLRWR
A
SGL
GAT
TRG
TDF
Center 915 MHz
4.00016 MHz/
Span 40.0016 MHz
Tx Channel
Bandwidth
20 MHz
WLAN 802.11A
Power
24.84 dBm

Data Table – Occupied Bandwidth

Mode DSSS/ Channel BW = 5MHz			
Frequency(MHz)	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
908	2.60	0.5	PASS
913	2.60	0.5	PASS
923	2.62	0.5	PASS

Mode DSSS/ Channel BW = 10MHz			
Frequency(MHz)	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
910	5.29	0.5	PASS
920	5.14	0.5	PASS

Mode OFDM/ Channel BW = 5MHz			
Frequency(MHz)	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
908	4.18	0.5	PASS
913	4.17	0.5	PASS
923	4.20	0.5	PASS

Mode OFDM/ Channel BW = 10MHz			
Frequency(MHz)	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
910	8.32	0.5	PASS
920	8.31	0.5	PASS

Channel BW = 20MHz				
Frequency(MHz)	**Mode**	**Occupied Bandwidth(MHz)**	**Limit**	**Result**
915	DSSS	10.47	0.5	PASS
	OFDM	16.66	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

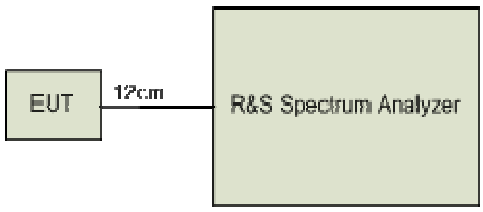
The transmitted power density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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 in 20 MHz, 10MHz and 5MHz bandwidths.

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 is subtracted from the reading of marker 1 for correction to 3 KHz.

Data Table – Power Spectral Density

Mode DSSS/ Channel BW = 5MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
908	12.63	-2.60	8	PASS
913	11.02	-4.21	8	PASS
923	11.8	-3.43	8	PASS

Mode DSSS/ Channel BW = 10MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
910	9.08	-6.15	8	PASS
920	9.24	-5.99	8	PASS

Mode OFDM/ Channel BW = 5MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
908	10.47	-4.76	8	PASS
913	9.04	-6.19	8	PASS
923	10.14	-5.09	8	PASS

Mode OFDM/ Channel BW = 10MHz				
Frequency(MHz)	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
910	7.88	-7.35	8	PASS
920	7.18	-8.05	8	PASS

Channel BW = 20MHz					
Frequency(MHz)	**Mode**	**Measurement in 100 KHz (dBm)**	**PSD in 3 KHz (dBm)**	**Limit**	**Result**
915	DSSS	5.29	-9.94	8	PASS
	OFDM	5.6	-9.63	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 14 dBi at 900 MHz.

9.2 RF exposure evaluation distance calculation

EUT with 14 dBi antenna

Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
908	25.3	14	33.5
910	24.94	14	32.1
913	24.4	14	30.1
915	24.84	14	31.6
920	24.8	14	31.4
923	25.21	14	32.8

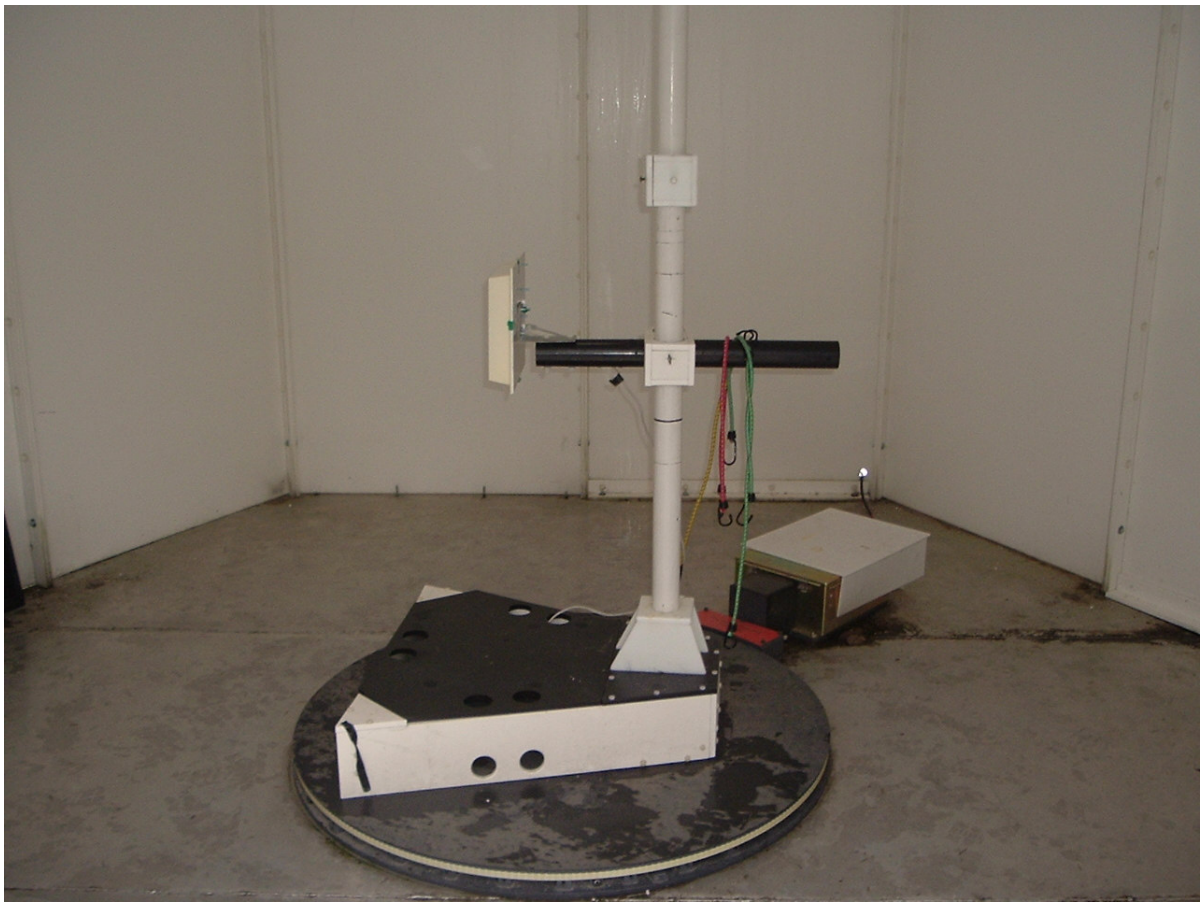
As shown above, the minimum distance where the MPE limit is reached is 33.5 cm for the EUT.

10.0 Test Photos

10.1 14dBi Vertical Sector antenna

10.2 12dBi Omni antenna

10.3 8dBi Integrated Antenna, Radiated Emissions Test Setup



10.4 Conducted Emissions Setup