

EMC Test Report

TR-900

2.4 GHz Wireless Network Adapter

Tranzeo Wireless Technologies Inc.

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Report No.: 280706.2

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



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Revision History

Section 2.0 – Revised with additional data as per TCB request.

Section 5.4.2 – Revised with additional data as per TCB request.

Section 9.0 – Revised per TCB request.

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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-TR900
Model No.	TR-900-8f; TR-900-11f ; TR-900-Nf
Frequency Range	902-928 MHz
Number of Channels	11
Transmit Rate	11Mbps maximum bit rate specification
Type of Modulation	Direct Sequence Spread Spectrum
Antenna Type	Integrated and external
Antenna Gain	2400-2483.5: 24 dBi MAX
Product Software	Tranzeo Production Firmware 2.10 E08
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-900-8f	TR-900-EUT1
Tranzeo Wireless	TR-900-11f	TR-900-EUT2
Tranzeo Wireless	TR-900-Nf	TR-900-EUT3

Frequency of each channel:

5 Mhz		10 Mhz		20 Mhz	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
Channel 1	908	Channel 1	910	Channel 1	915
Channel 2	913	Channel 2	920		
Channel 3	918				
Channel 4	923				

The three products, TR-900-8f, TR-900-11f, and TR-900-Nf, are a product family. They are functionally identical except for the following:

- The TR-900-8f is fitted with an 8 dBi gain antenna.
- The TR-900-11f is fitted with a 11 dBi gain antenna.
- The TR-900-Nf is fitted with a standard Type N antenna connector.

This device includes a 900 Mhz receive function and a 900 Mhz digital modulation transmit function. The unit is fitted with an integrated antenna. 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 TR-900 is a wireless network bridge designed specifically for outdoor applications. The device provides a bridge between IEEE802.3 wired Ethernet LANs and wireless networks. It uses an external antenna coupled with a digital modulation 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 typically mounted on the exterior of a building for broadband internet access.

The type of RF modulation is DSSS and OFDM. The device can transmit data at a bit rate of up to 54 Mbps or a real-world data rate of approximately 30 Mbps. 64/128 bit Wired Equivalent Protection (WEP) algorithm is used for secure communications.

In its default configuration the device uses a 20 MHz channelization. The device can optionally be configured to use 5 and 10 MHz channels with $\frac{1}{4}$ and $\frac{1}{2}$ the throughput respectively.

The firmware used with the device prevents the use of channels outside the 902-928 MHz band. The output power of the radio is also controlled by the firmware to ensure compliance with EIRP limits.

The TR-900 product (including the TR-900-8f, TR-900-11f, and TR-900-Nf) is used exclusively in a professionally installed, fixed point-to-point environment.

1.3 EUT Testing Configuration

The three products, the TR-900-8f, TR-900-11f, and TR-900-Nf, are a product family. Extensive testing was performed to determine worst case. Data is presented for worst case measurements only.

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 second Ethernet port was populated with 1 m of 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-900-Nf EUT was tested with the following external antennas:

12 dBi Omni – TR-OD900-12
14 dBi Sector – TR-900V-90-14

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-2006
Rohde & Schwarz	NRP	Power Meter	100055	02-Aug-2006
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
Cat 5 LAN	Populate 2 nd 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.

1 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 μ H/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. 1

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

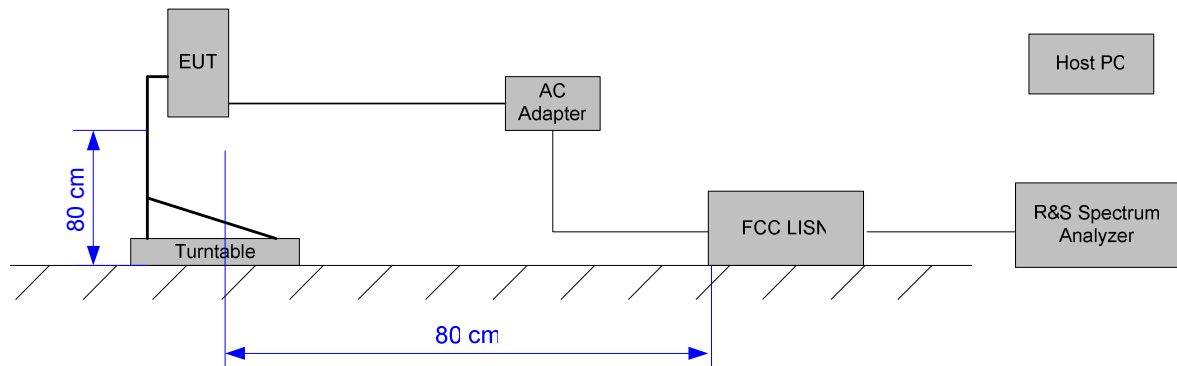
2.3 Test Setup

The EUT was exercised using bandwidth test software at the highest possible data rate. Testing was performed on low, middle and high channels where applicable. All modulation types and emission bandwidths were tested. The 2nd Ethernet port is populated with 1 m of cable. 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

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
1 Quasi Peak	170 kHz	57.62	-7.33
2 Average	170 kHz	30.58	-24.37
1 Quasi Peak	186 kHz	56.97	-7.23
2 Average	186 kHz	30.82	-23.38
1 Quasi Peak	198 kHz	56.38	-7.31
2 Average	198 kHz	29.05	-24.63
1 Quasi Peak	206 kHz	56.21	-7.15
2 Average	206 kHz	28.16	-25.19
1 Quasi Peak	214 kHz	55.86	-7.18
2 Average	214 kHz	27.98	-25.06
1 Quasi Peak	226 kHz	55.40	-7.18
2 Average	226 kHz	26.56	-26.03
1 Quasi Peak	234 kHz	55.21	-7.08
2 Average	234 kHz	25.99	-26.31
1 Quasi Peak	262 kHz	54.22	-7.14
2 Average	262 kHz	26.38	-24.98
1 Quasi Peak	270 kHz	53.97	-7.14
2 Average	270 kHz	24.91	-26.20
1 Quasi Peak	298 kHz	52.98	-7.31
2 Average	298 kHz	24.55	-25.74

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dB μ V	DELTA LIMIT dB
1 Quasi Peak	306 kHz	52.80	-7.27
2 Average	306 kHz	22.76	-27.31
1 Quasi Peak	318 kHz	52.34	-7.41
2 Average	318 kHz	28.80	-20.95
1 Quasi Peak	326 kHz	52.11	-7.43
2 Average	326 kHz	24.30	-25.24
1 Quasi Peak	354 kHz	51.11	-7.75
2 Average	354 kHz	21.59	-27.27
1 Quasi Peak	362 kHz	51.07	-7.61
2 Average	362 kHz	20.31	-28.36
1 Quasi Peak	390 kHz	49.79	-8.27
2 Average	390 kHz	18.91	-29.15
1 Quasi Peak	398 kHz	49.51	-8.37
2 Average	398 kHz	18.66	-29.23
1 Quasi Peak	414 kHz	48.87	-8.69
2 Average	414 kHz	18.17	-29.39
1 Quasi Peak	418 kHz	48.78	-8.70
2 Average	418 kHz	17.96	-29.52
1 Quasi Peak	446 kHz	47.72	-9.22
2 Average	446 kHz	19.77	-27.17

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dB μ V	DELTA LIMIT dB
1 Quasi Peak	482 kHz	46.26	-10.04
2 Average	482 kHz	15.63	-30.67
1 Quasi Peak	506 kHz	45.23	-10.76
2 Average	506 kHz	14.68	-31.31
1 Quasi Peak	510 kHz	45.01	-10.98
2 Average	510 kHz	14.55	-31.44
1 Quasi Peak	518 kHz	44.56	-11.43
2 Average	518 kHz	14.29	-31.70
1 Quasi Peak	538 kHz	43.60	-12.39
2 Average	538 kHz	13.87	-32.12
1 Quasi Peak	546 kHz	43.13	-12.86
2 Average	546 kHz	30.76	-15.23
1 Quasi Peak	574 kHz	41.70	-14.30
2 Average	574 kHz	12.39	-33.60
1 Quasi Peak	582 kHz	41.21	-14.78
2 Average	582 kHz	12.26	-33.73
1 Quasi Peak	598 kHz	40.23	-15.76
2 Average	598 kHz	19.46	-26.53
1 Quasi Peak	610 kHz	39.52	-16.47
2 Average	610 kHz	10.20	-35.79

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dB μ V	DELTA LIMIT dB
2 Average	610 kHz	10.20	-35.79
2 Average	17.694 MHz	36.62	-13.37
1 Quasi Peak	17.694 MHz	40.60	-19.39
2 Average	18.246 MHz	35.26	-14.73
1 Quasi Peak	18.246 MHz	40.26	-19.73
2 Average	18.914 MHz	33.64	-16.35
2 Average	19.71 MHz	38.92	-11.08
1 Quasi Peak	19.71 MHz	44.05	-15.94
2 Average	20.322 MHz	36.48	-13.51
1 Quasi Peak	20.322 MHz	41.00	-18.99
2 Average	20.87 MHz	34.64	-15.35
1 Quasi Peak	21.054 MHz	42.68	-17.31
2 Average	21.662 MHz	39.24	-10.75
2 Average	22.458 MHz	37.97	-12.02
2 Average	23.13 MHz	41.11	-8.88
1 Quasi Peak	23.13 MHz	47.30	-12.69
1 Quasi Peak	24.35 MHz	44.36	-15.63
2 Average	24.534 MHz	36.82	-13.17
1 Quasi Peak	24.534 MHz	42.54	-17.46
2 Average	25.694 MHz	35.76	-14.23

Note: All data points are corrected for insertion loss.

EUT – Neutral

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
1 Quasi Peak	166 kHz	59.33	-5.82
2 Average	166 kHz	31.99	-23.16
1 Quasi Peak	182 kHz	59.83	-4.56
2 Average	182 kHz	32.62	-21.76
1 Quasi Peak	186 kHz	58.60	-5.61
2 Average	186 kHz	31.98	-22.22
1 Quasi Peak	218 kHz	58.53	-4.35
2 Average	218 kHz	29.08	-23.80
1 Quasi Peak	222 kHz	57.91	-4.83
2 Average	222 kHz	28.60	-24.13
1 Quasi Peak	242 kHz	57.48	-4.54
2 Average	242 kHz	27.82	-24.20
1 Quasi Peak	254 kHz	57.29	-4.33
2 Average	254 kHz	28.29	-23.33
1 Quasi Peak	258 kHz	57.16	-4.33
2 Average	258 kHz	27.87	-23.61
1 Quasi Peak	274 kHz	56.93	-4.06
2 Average	274 kHz	27.13	-23.86
1 Quasi Peak	278 kHz	56.82	-4.04
2 Average	278 kHz	26.28	-24.59

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
1 Quasi Peak	294 kHz	56.10	-4.30
2 Average	294 kHz	28.60	-21.80
1 Quasi Peak	310 kHz	55.88	-4.09
2 Average	310 kHz	25.12	-24.84
1 Quasi Peak	314 kHz	55.71	-4.14
2 Average	314 kHz	26.83	-23.02
1 Quasi Peak	346 kHz	55.25	-3.80
2 Average	346 kHz	30.87	-18.18
1 Quasi Peak	350 kHz	55.19	-3.76
2 Average	350 kHz	27.23	-21.72
1 Quasi Peak	366 kHz	55.01	-3.57
2 Average	366 kHz	24.45	-24.14
1 Quasi Peak	370 kHz	55.20	-3.29
2 Average	370 kHz	24.43	-24.06
1 Quasi Peak	402 kHz	54.52	-3.28
2 Average	402 kHz	23.32	-24.48
1 Quasi Peak	406 kHz	54.35	-3.37
2 Average	406 kHz	23.16	-24.56
1 Quasi Peak	438 kHz	53.84	-3.25
2 Average	438 kHz	26.04	-21.06

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dB μ V	DELTA LIMIT dB
1 Quasi Peak	442 kHz	53.80	-3.22
2 Average	442 kHz	27.26	-19.76
1 Quasi Peak	458 kHz	53.47	-3.25
2 Average	458 kHz	22.42	-24.30
1 Quasi Peak	462 kHz	53.41	-3.24
2 Average	462 kHz	22.32	-24.33
1 Quasi Peak	494 kHz	52.55	-3.54
2 Average	494 kHz	21.33	-24.76
1 Quasi Peak	498 kHz	52.50	-3.52
2 Average	498 kHz	21.30	-24.72
1 Quasi Peak	530 kHz	51.50	-4.49
2 Average	530 kHz	20.48	-25.51
1 Quasi Peak	534 kHz	51.35	-4.64
2 Average	534 kHz	20.23	-25.76
1 Quasi Peak	554 kHz	50.52	-5.47
2 Average	554 kHz	31.59	-14.41
1 Quasi Peak	566 kHz	50.01	-5.98
2 Average	566 kHz	16.89	-29.10
1 Quasi Peak	586 kHz	49.01	-6.98
2 Average	586 kHz	21.87	-24.12

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dB μ V	DELTA LIMIT dB
1 Quasi Peak	590 kHz	48.88	-7.11
2 Average	590 kHz	22.04	-23.95
1 Quasi Peak	626 kHz	46.62	-9.37
2 Average	626 kHz	16.04	-29.95
1 Quasi Peak	646 kHz	45.07	-10.92
2 Average	646 kHz	18.04	-27.95
1 Quasi Peak	658 kHz	44.01	-11.98
2 Average	658 kHz	14.11	-31.89
1 Quasi Peak	682 kHz	41.70	-14.29
2 Average	682 kHz	13.89	-32.10
1 Quasi Peak	1.118 MHz	41.20	-14.79
2 Average	1.118 MHz	14.32	-31.67
1 Quasi Peak	1.154 MHz	41.60	-14.39
2 Average	1.154 MHz	14.40	-31.59
1 Quasi Peak	1.19 MHz	41.53	-14.46
2 Average	1.19 MHz	13.71	-32.28
1 Quasi Peak	1.226 MHz	41.43	-14.56
2 Average	1.226 MHz	13.50	-32.49
1 Quasi Peak	1.282 MHz	40.96	-15.03
2 Average	1.282 MHz	12.50	-33.49

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	55022QPC		
Trace2:	55022AVC		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dB μ V	DELTA LIMIT dB
1 Quasi Peak	1.374 MHz	38.85	-17.14
1 Quasi Peak	1.378 MHz	38.67	-17.32
2 Average	1.378 MHz	10.16	-35.83
1 Quasi Peak	18.366 MHz	40.86	-19.13
1 Quasi Peak	19.71 MHz	45.26	-14.73
1 Quasi Peak	20.258 MHz	43.94	-16.06
1 Quasi Peak	21.662 MHz	44.68	-15.31
1 Quasi Peak	22.458 MHz	41.75	-18.24
1 Quasi Peak	23.066 MHz	41.04	-18.95
1 Quasi Peak	24.35 MHz	42.40	-17.59
1 Quasi Peak	24.534 MHz	40.50	-19.49
1 Quasi Peak	25.694 MHz	40.85	-19.15
1 Quasi Peak	25.878 MHz	41.28	-18.71
1 Quasi Peak	26.486 MHz	42.69	-17.30
1 Quasi Peak	26.61 MHz	43.41	-16.58
1 Quasi Peak	28.686 MHz	41.47	-18.52
1 Quasi Peak	29.238 MHz	39.31	-20.68

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.

1 (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. 1

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 modulation in 5, 10 and 20 Mhz bandwidths.

3.3.1 Test Setup Block Diagram



3.4 Test Results

Mode	Channel		
DSSS	5 Mhz		
Frequency	Measurement	Limit	Result
908	21.8	30	PASS
918	20.25	30	PASS
923	22.34	30	PASS

Mode	Channel		
DSSS	10 Mhz		
Frequency	Measurement	Limit	Result
910	20.47	30	PASS
920	20.81	30	PASS

Mode	Channel		
DSSS	20 Mhz		
Frequency	Measurement	Limit	Result
915	19.36	30	PASS

Mode	Channel		
OFDM	5 Mhz		
Frequency	Measurement	Limit	Result
908	20.7	30	PASS
918	21.76	30	PASS
923	23.1	30	PASS

Mode	Channel		
OFDM	10 Mhz		
Frequency	Measurement	Limit	Result
910	20.18	30	PASS
920	22.3	30	PASS

Mode	Channel		
OFDM	20 Mhz		
Frequency	Measurement	Limit	Result
915	17.91	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

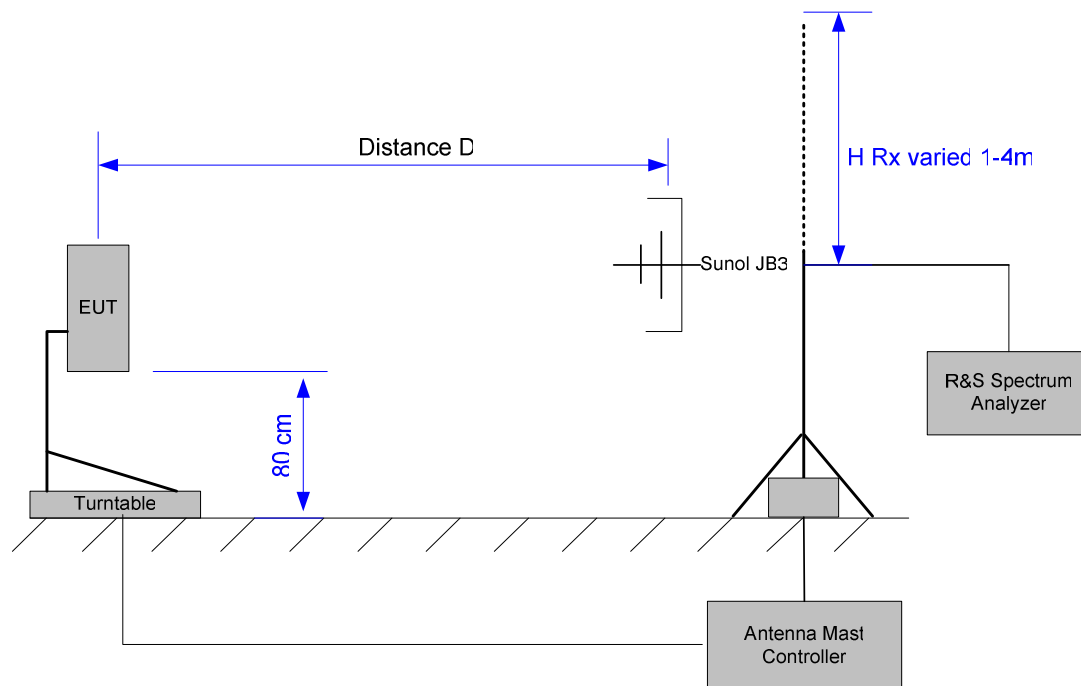
Frequency (MHz)	Maximum Field Strength ($\mu\text{V/m}$ @ 3M)	Maximum Field Strength (dB $\mu\text{V/m}$ @ 3m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-1000	500	54.0

4.3 Test Setup

All three units were tested. The TR-900-Nf was tested with all antennas. Each unit was tested in both horizontal and vertical orientations. The EUT was exercised using beaconing mode at the highest possible transmit rate. Testing was performed on low, middle and high channels where applicable. All modulation types and emission bandwidths were tested. The 2nd Ethernet port is populated with 1 m of cable. 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

Reading Type	Polarization	Frequency (MHz)	Level (dBuV/m@3m)	Margin (dB)
QP	Horiz	225.000	28.27	-17.72
QP	Horiz	275.000	34.45	-11.55
QP	Horiz	434.000	38.85	-7.14
QP	Horiz	496.000	45.65	-0.36
QP	Horiz	558.040	37.16	-8.83
QP	Horiz	744.040	36.27	-9.72
QP	Vert	30.620	30.07	-9.92
QP	Vert	434.000	38.04	-7.95
QP	Vert	496.000	45.09	-0.90

Note: All data points are corrected for insertion loss.

5.0 Harmonic and Spurious Emissions

5.1 Test Standard

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

1 (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)). 1

5.2 Test Limits

2400-2483.5 MHz limits:

- Fundamental Limit = 137 dBuV
- Harmonics and Spurious Emissions = 30 dBc
- Restricted Band Emissions = AVG 54 dBuV, PK 74dBuV

5.3 Test Setup – Spurious Emissions

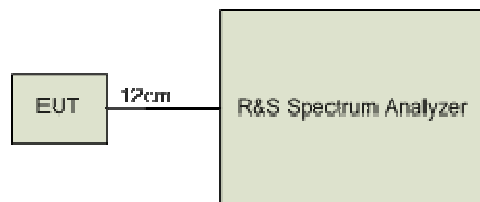
Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels. Conducted scans are used to determine compliance with the 30 dBc limit for emissions outside of the operational frequency band.

In addition to conducted measurements, extensive radiated testing above 2 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.

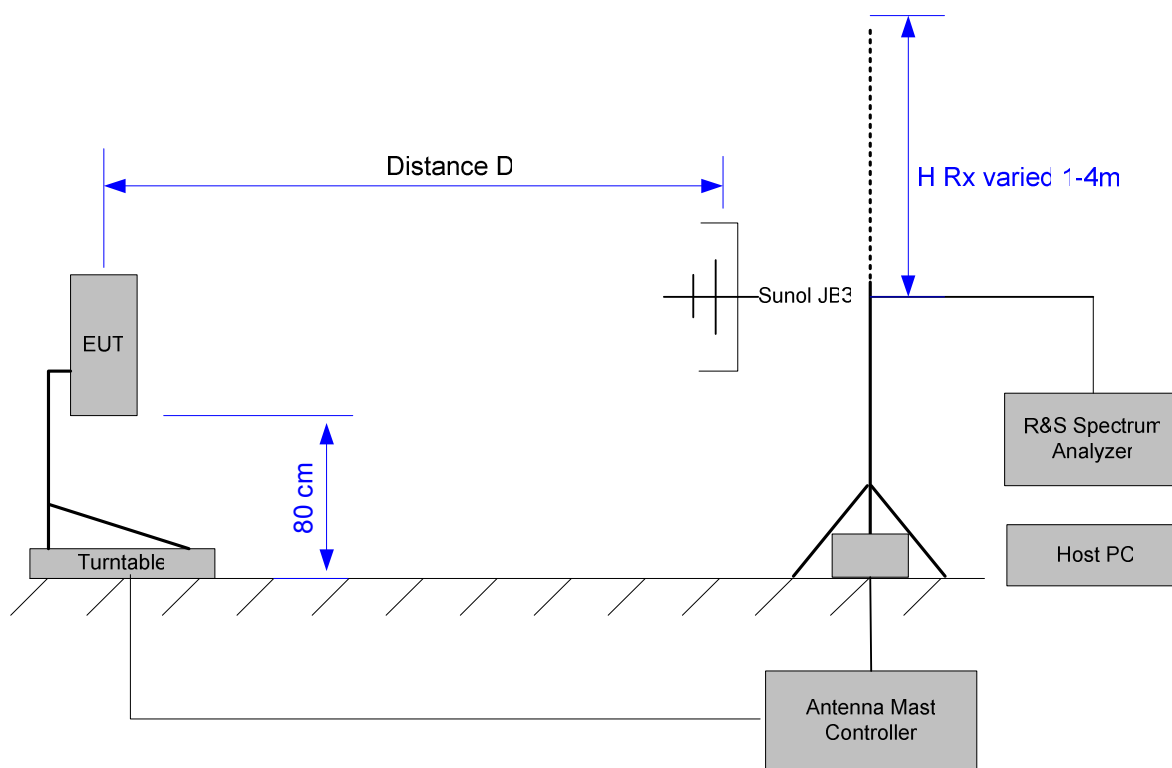
The antenna is connected to the EUT equipped with a Type N connector via 1 m of coaxial shielded cable.

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)

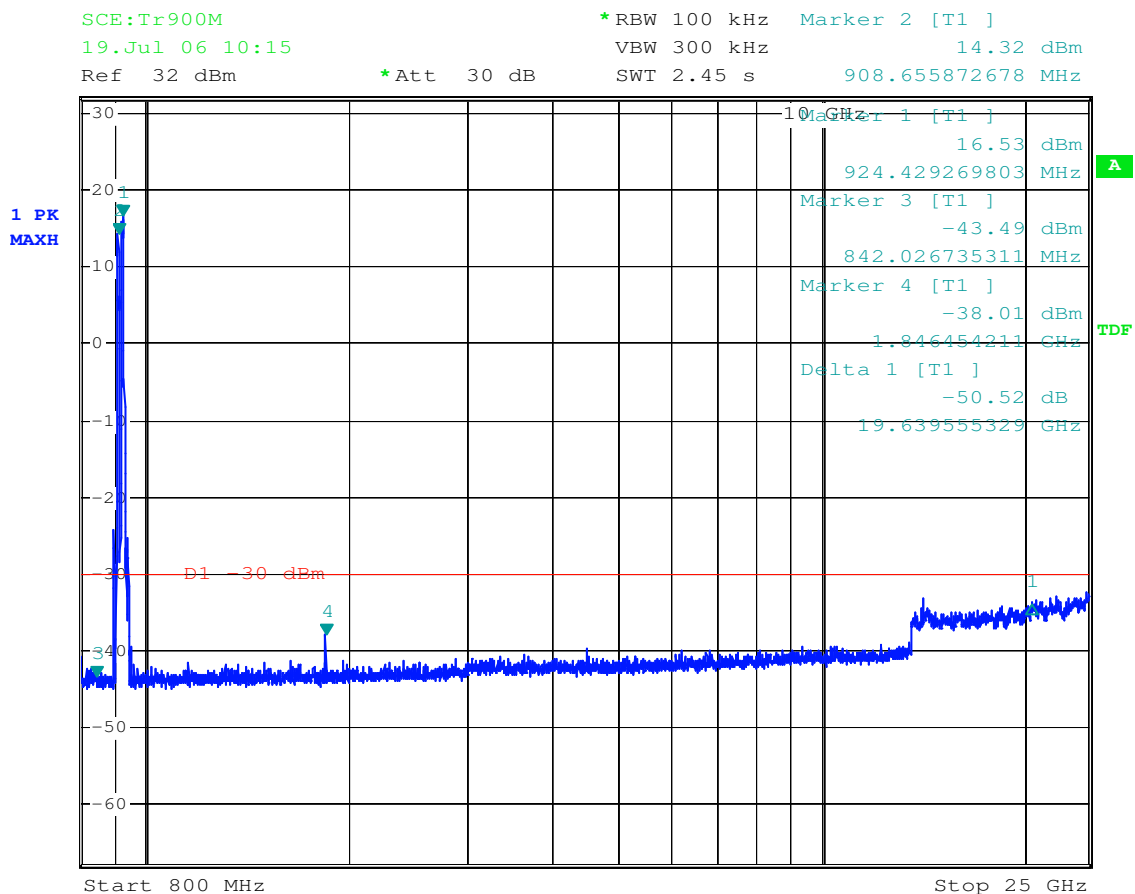


5.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



5.4 Test Results

5.4.1 Test Results 15.247-Harmonics -20 dBc



Conducted Spurious and Harmonics 5M/10M/20M B/G

Date: 19.JUL.2006 10:15:10

The above plot shows the worst case conducted output of the transmitter. 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. Only worst case data is shown.

Reading Type	Polarization	Frequency (MHz)	Level (dBuV/m @ 3m)	Margin (dB)
Peak	Horiz	1544.000	56.86	-17.14
Ave	Horiz	1544.000	49.16	-4.83
Peak	Vert	1544.000	51.79	-22.21
Ave	Vert	1544.000	44.09	-9.90

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.

1 (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)). 1

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

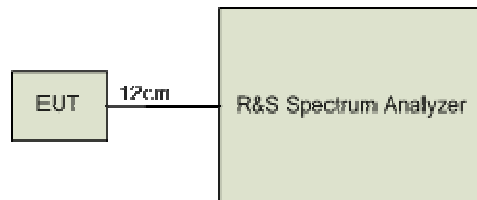
This test is performed conducted to ensure that the EUT complies with the 30 dBc limit. The measurement equipment is connected directly to the antenna port of the EUT.

The test is performed at low and high channels where applicable. The test is performed using both OFDM and DSSS modulation in 5, 10 and 20 Mhz bandwidths.

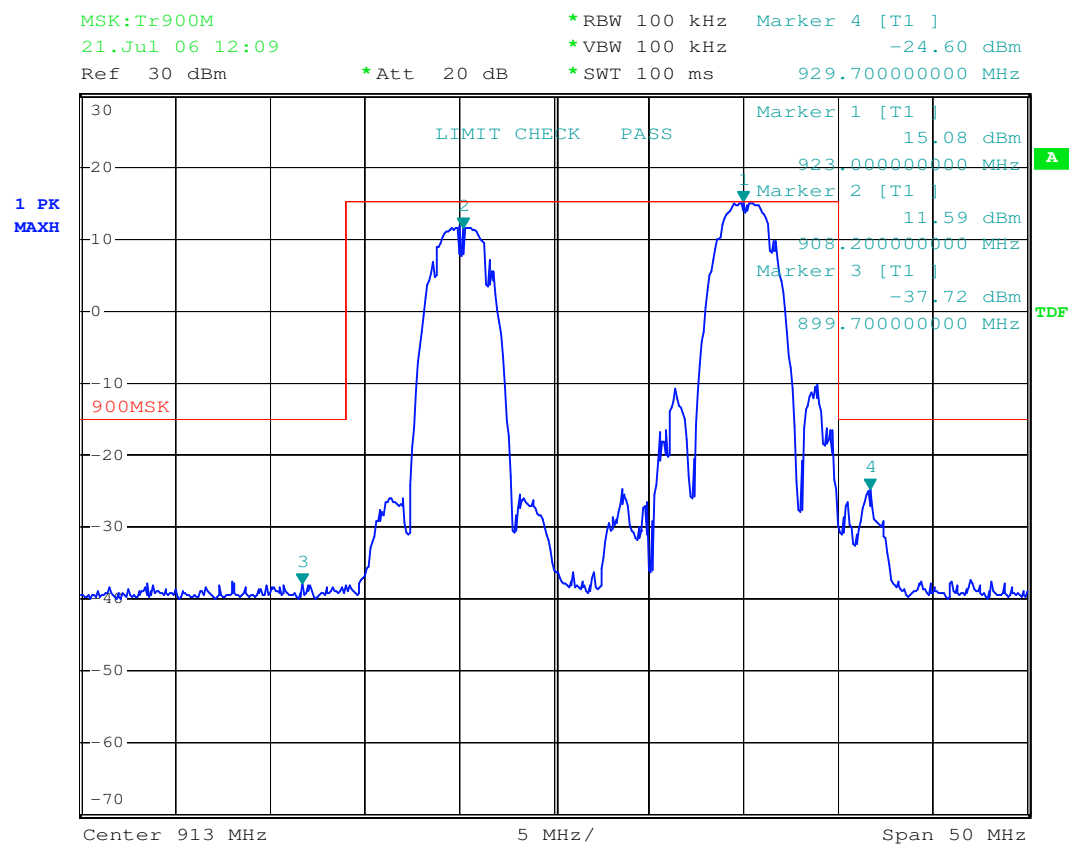
Please note that in the following plots the EUT is not transmitting on two channels simultaneously.

6.3.1 Test Setup Block Diagram

Conducted Setup

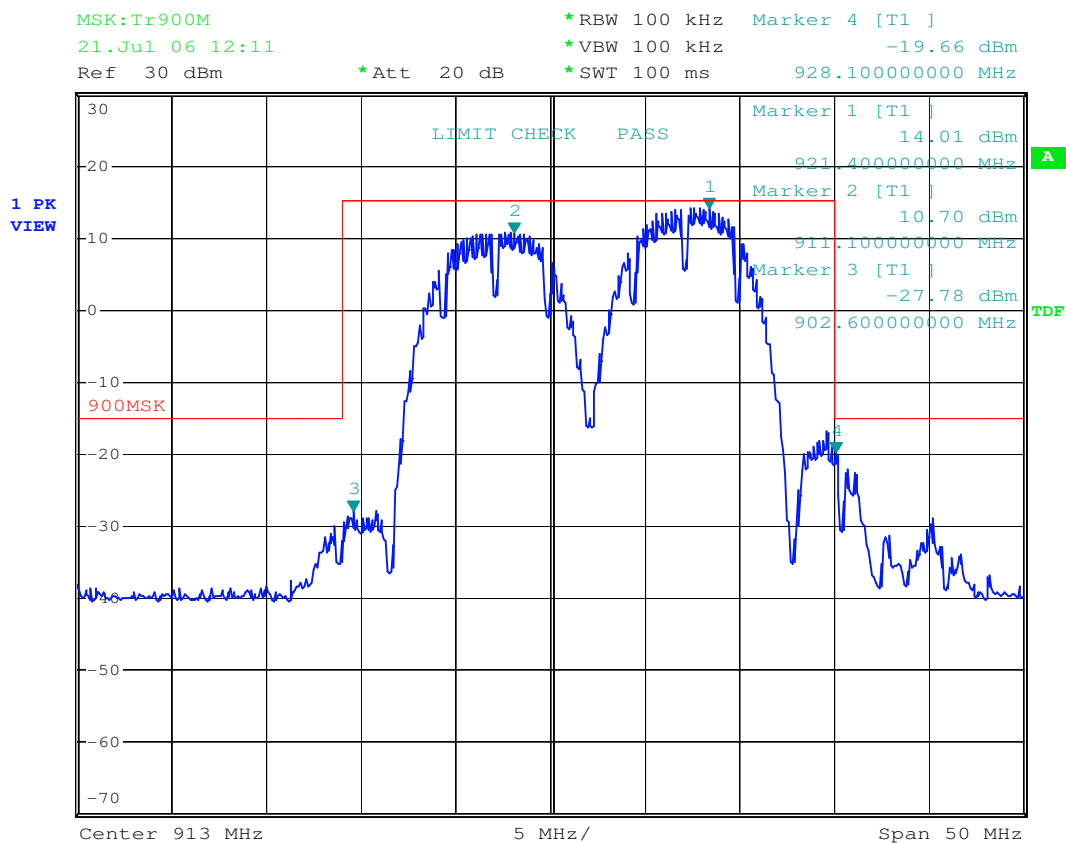


6.4 Test Results



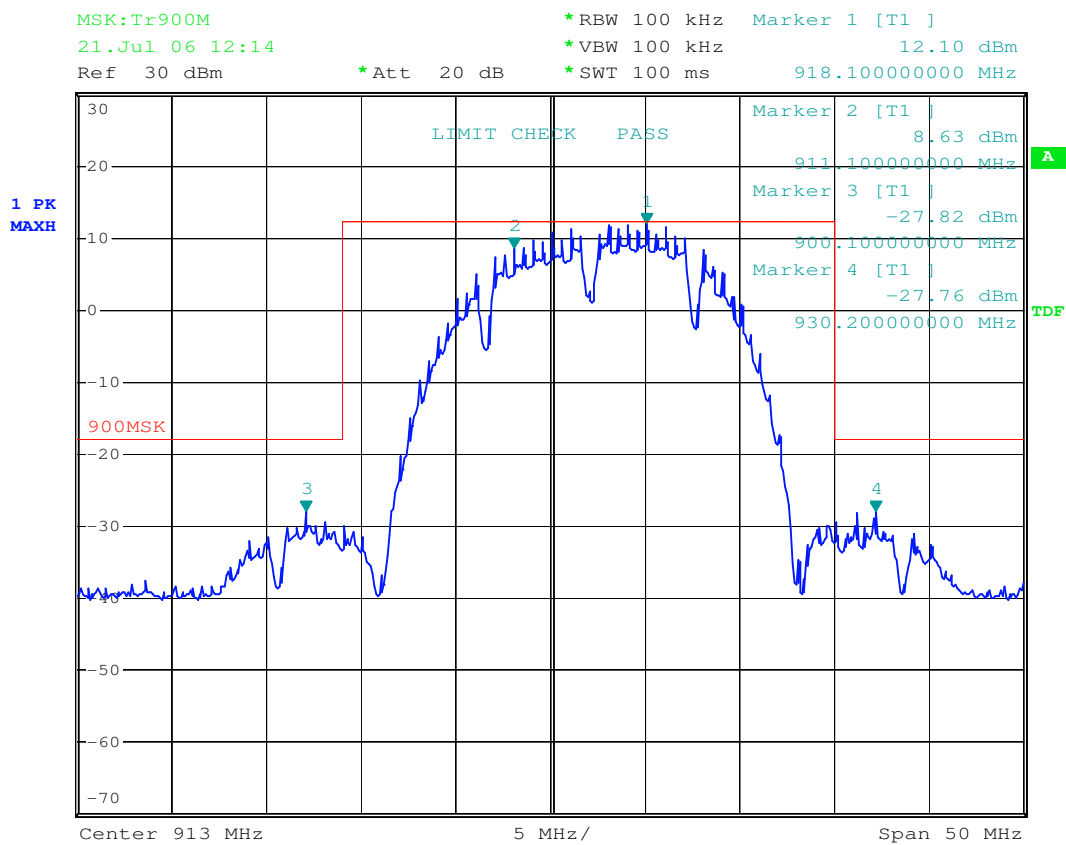
CE Emission Mask 902-928M 30dBc

Date: 21.JUL.2006 12:09:00



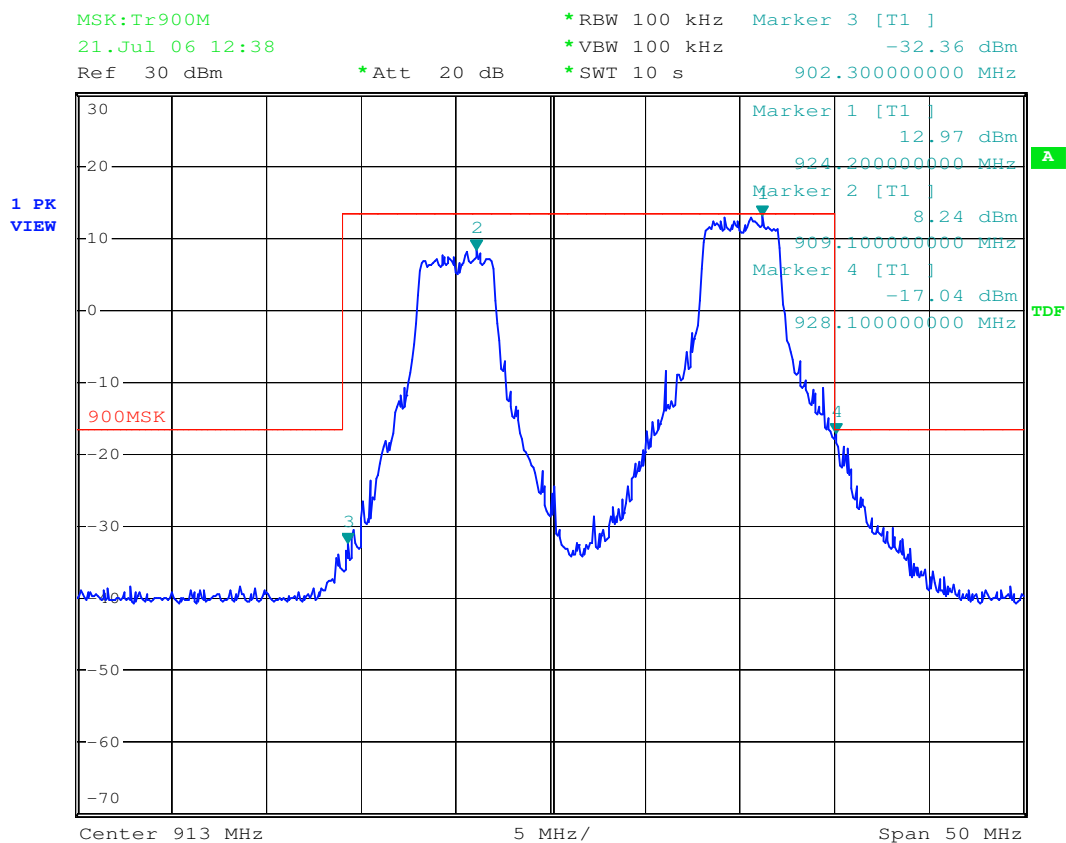
CE Emission Mask 902-928M 30dBc

Date: 21.JUL.2006 12:11:47



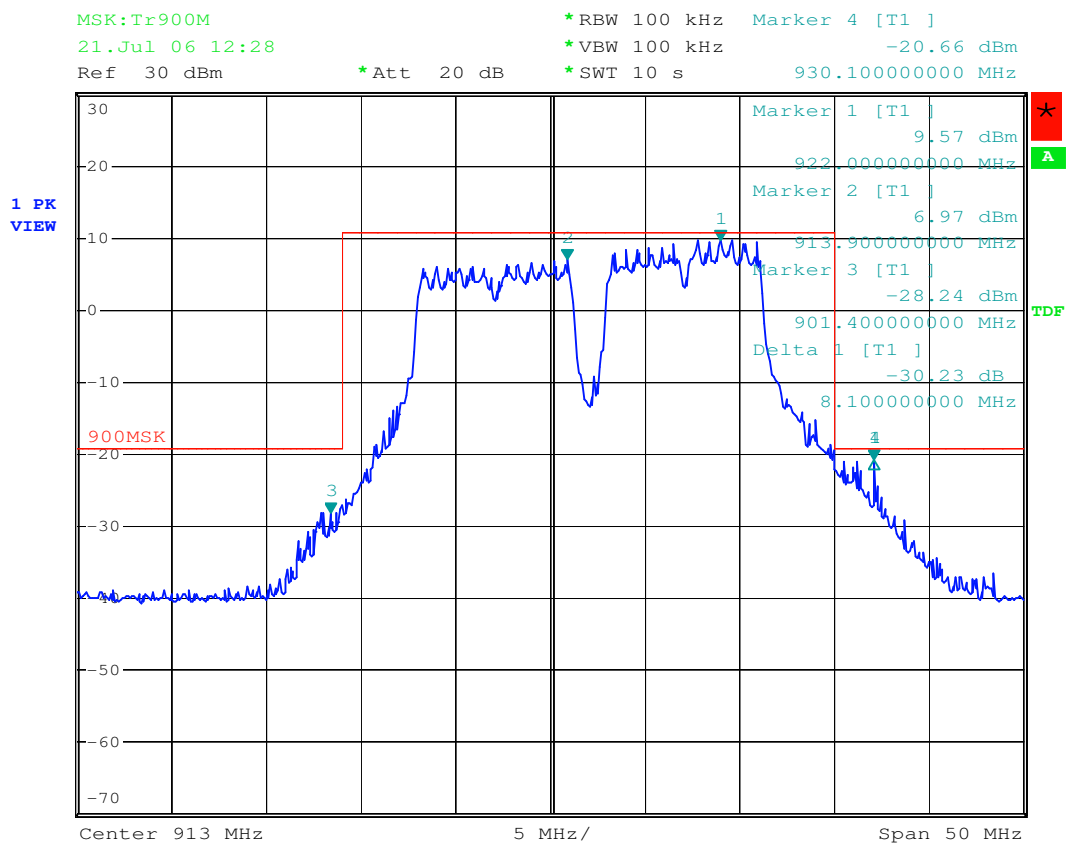
CE Emission Mask 902-928M 30dBc

Date: 21.JUL.2006 12:14:13



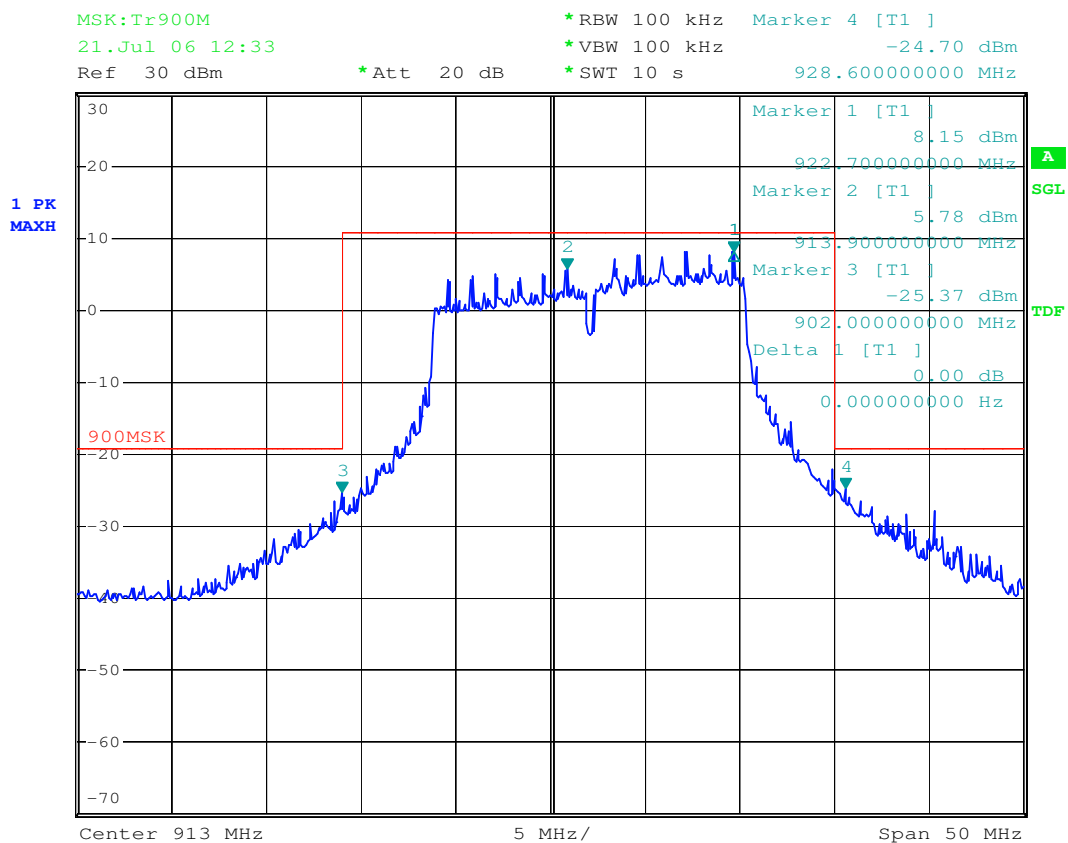
CE Emission Mask 902-928M 30dBc

Date: 21.JUL.2006 12:38:31



CE Emission Mask 902-928M 30dBc

Date: 21.JUL.2006 12:28:44



CE Emission Mask 902-928M 30dBc

Date: 21.JUL.2006 12:33:09

7.0 Occupied Bandwidth

7.1 Test Standard

FCC CFR47, Part 15, Subpart B 15.247a.

1 (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. 1

7.2 Test Limits

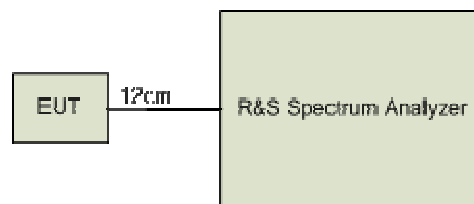
The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3 Test Setup

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

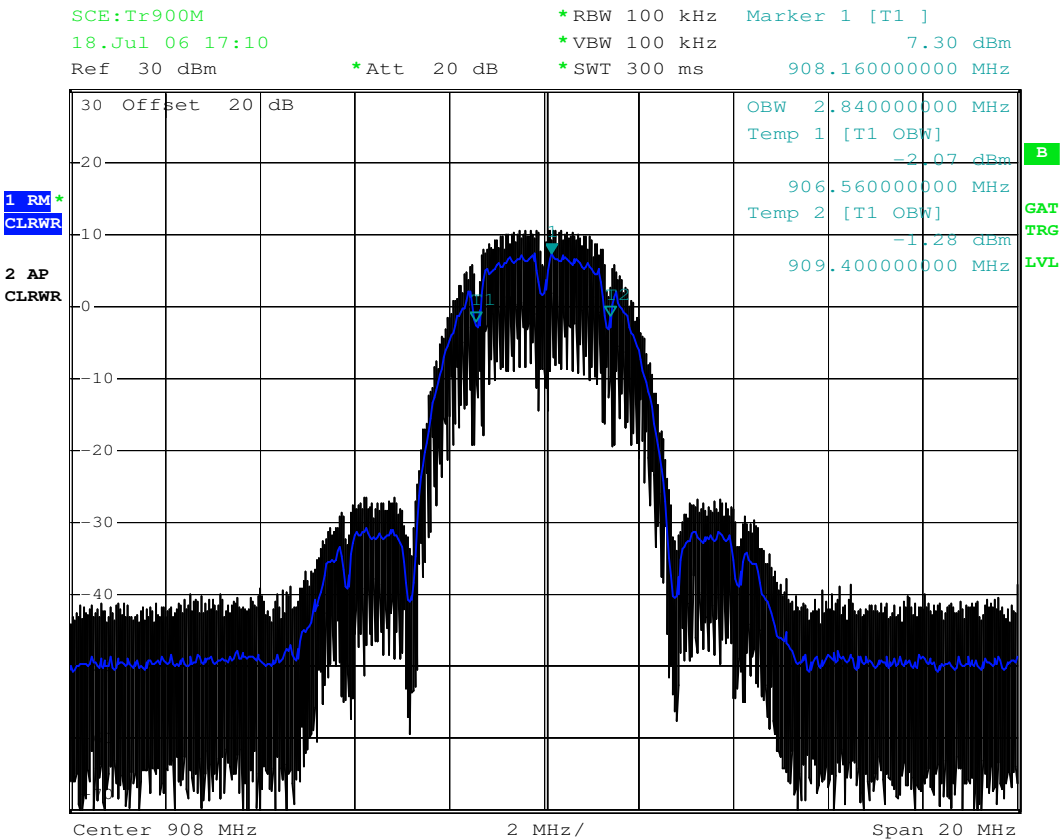
The test is performed at low, middle and high channels using both OFDM and DSSS modulation in 5, 10 and 20 Mhz bandwidths. Only worst case 5 Mhz bandwidth measurements are shown below.

7.3.1 Test Setup Block Diagram



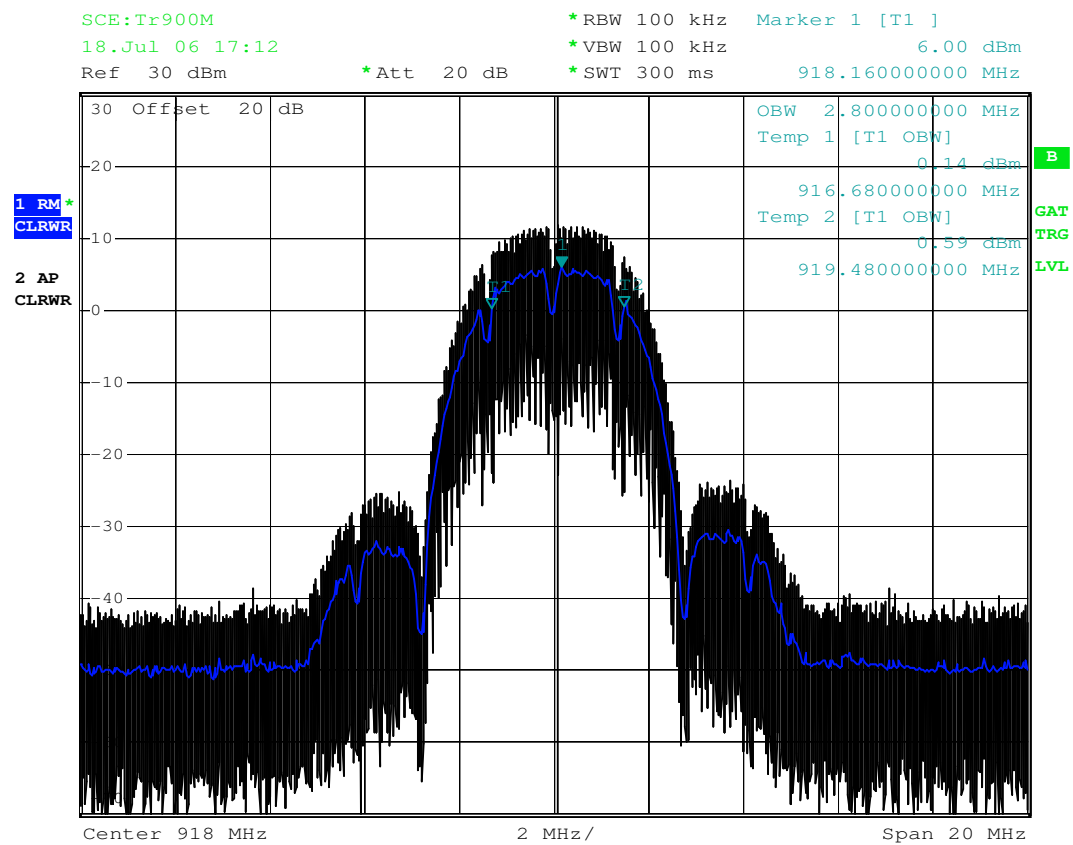
7.4 Test Results

6 dB Occupied Bandwidth



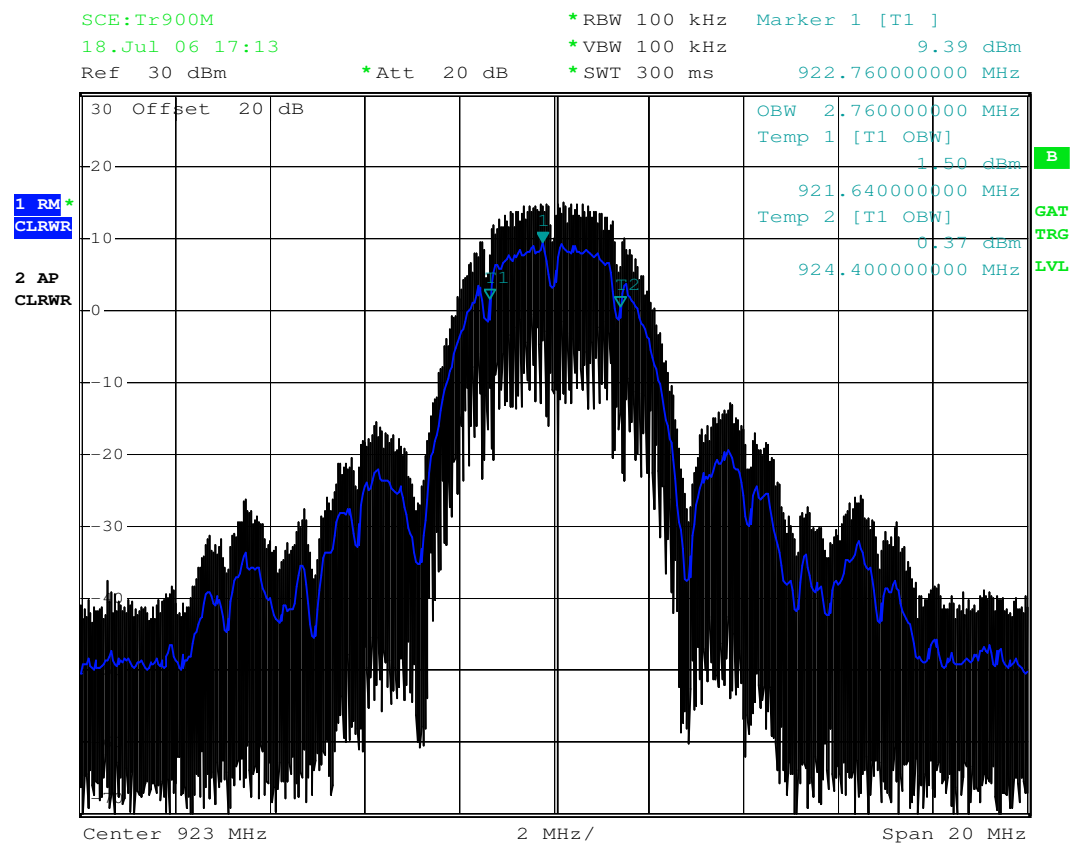
Conducted Occupied Bandwidth

Date: 18.JUL.2006 17:10:47



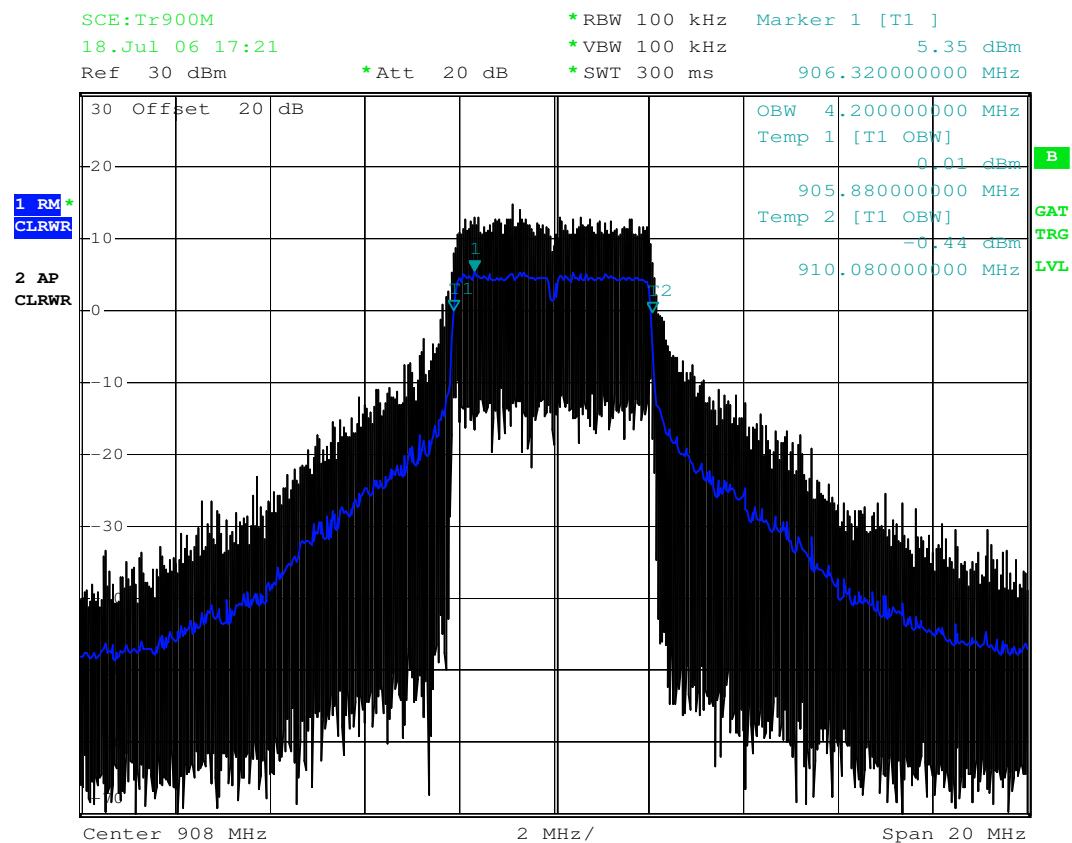
Conducted Occupied Bandwidth

Date: 18.JUL.2006 17:12:32



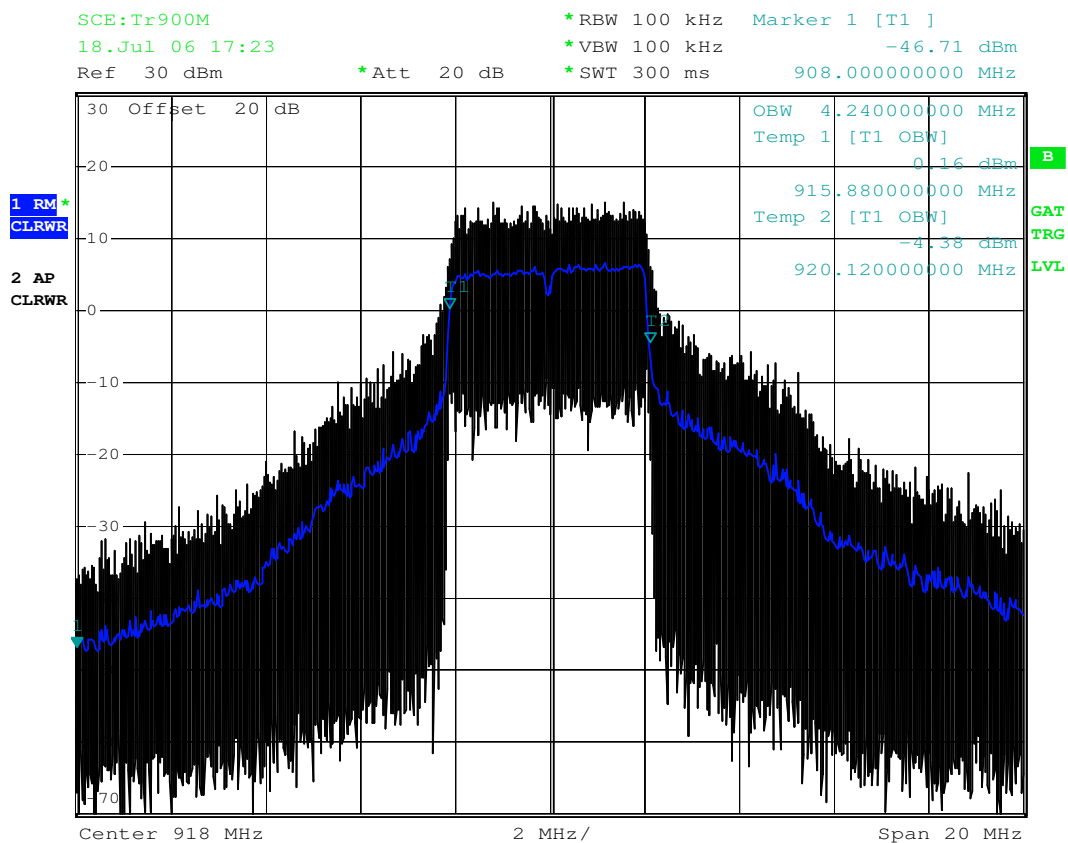
Conducted Occupied Bandwidth

Date: 18.JUL.2006 17:13:43



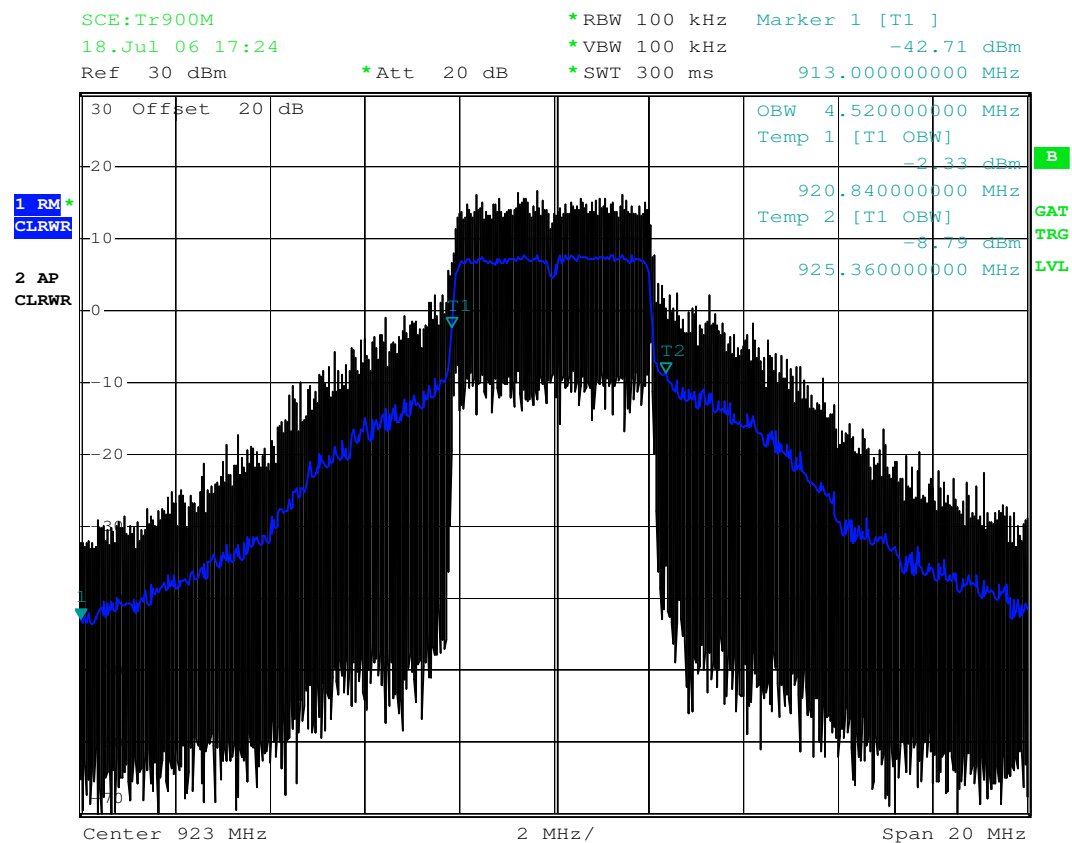
Conducted Occupied Bandwidth

Date: 18.JUL.2006 17:21:51



Conducted Occupied Bandwidth

Date: 18.JUL.2006 17:23:29



Conducted Occupied Bandwidth

Date: 18.JUL.2006 17:24:14

8.0 Power Spectral Density

8.1 Test Standard

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

1 (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. 1

8.2 Test Limits

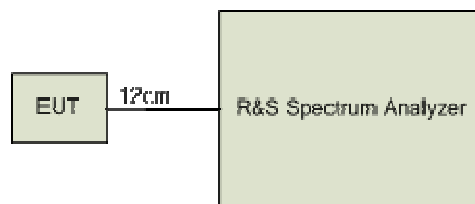
The transmitted power density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3 Test Setup

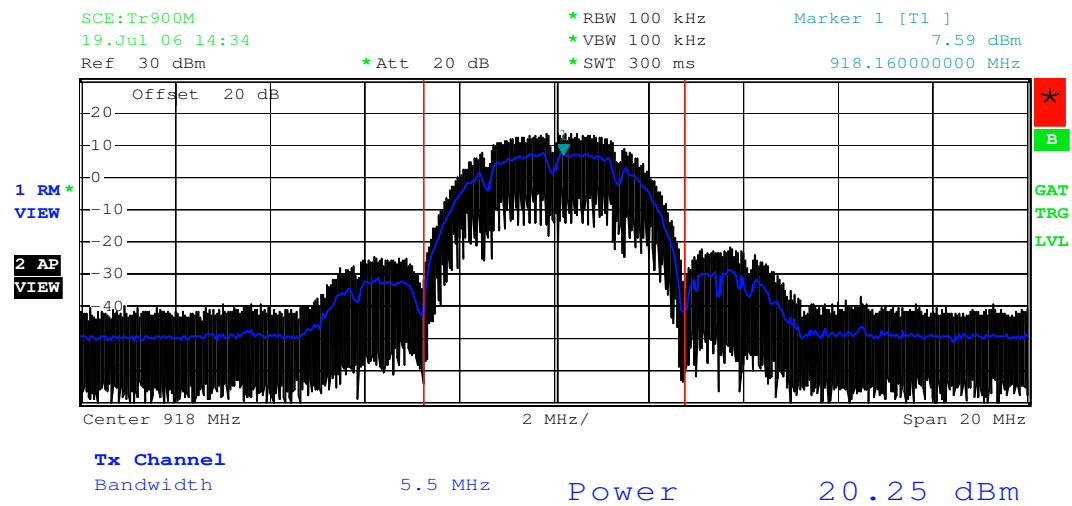
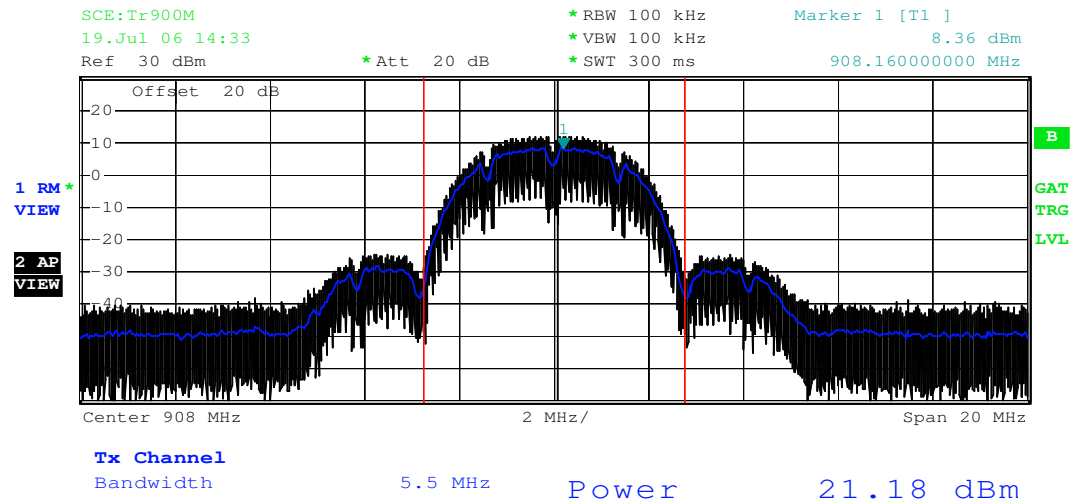
This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

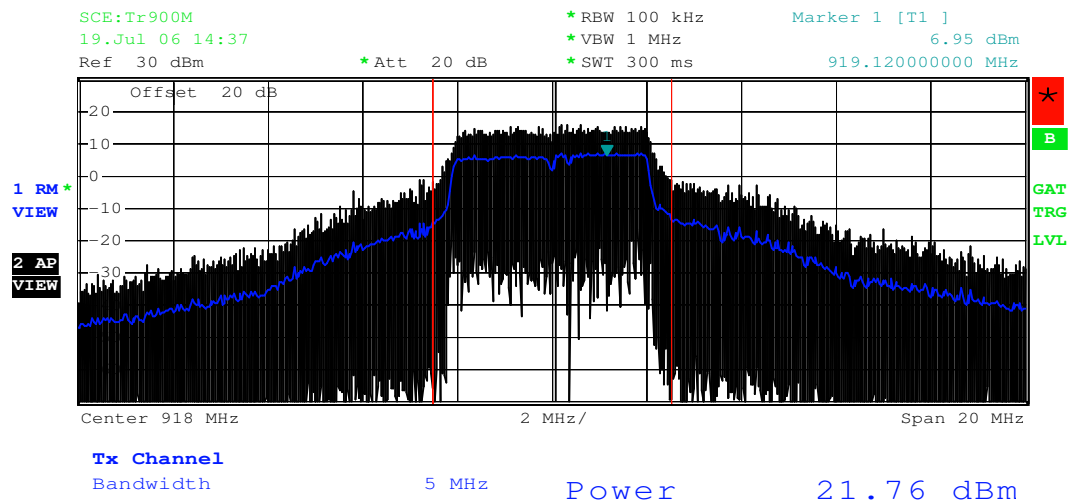
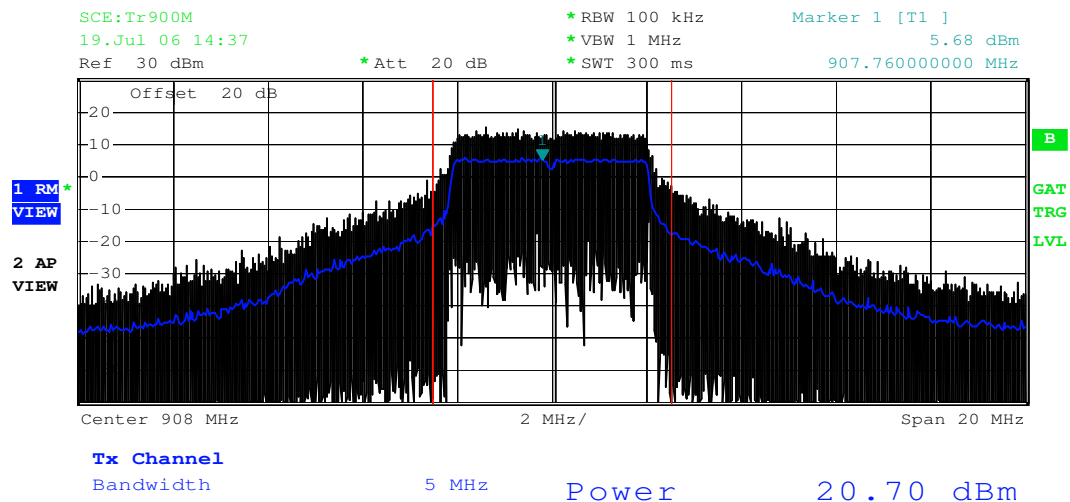
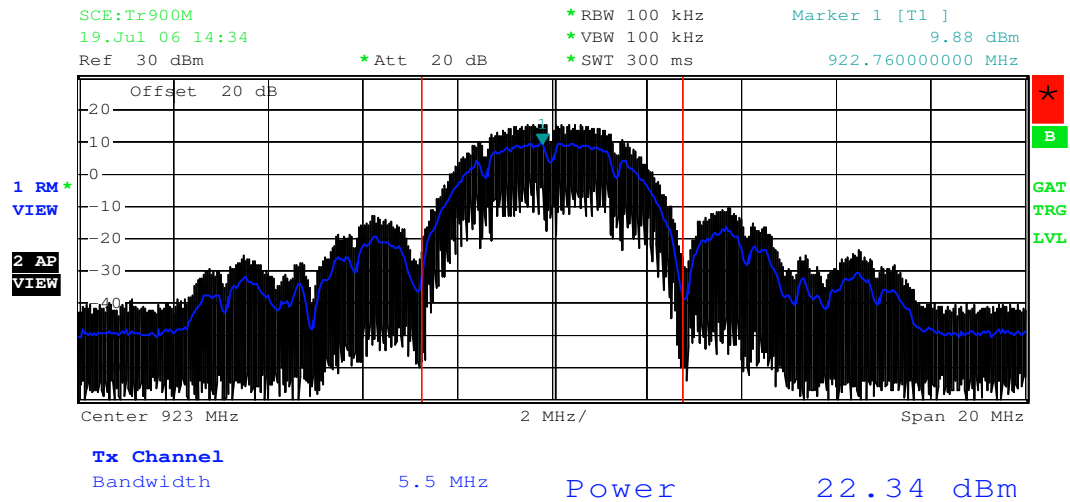
The test is performed at low, middle and high channels using both OFDM and DSSS modulation in 5, 10 and 20 Mhz bandwidths. Only worst case 5 Mhz bandwidth measurements are shown below.

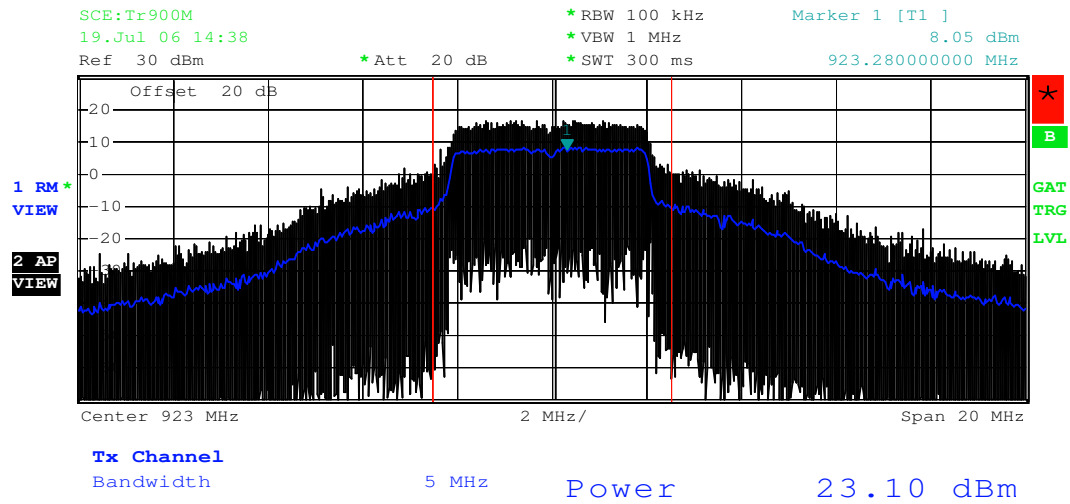
8.3.1 Test Setup Block Diagram



8.4 Test Results 15.247







Mode	Channel			
DSSS	5 Mhz			
Frequency (Mhz)	Measurement (dBm)	PSD in 3 KHz (dBm)	Limit	Result
908	8.36	-6.86	8	PASS
918	7.59	-7.63	8	PASS
923	9.88	-5.34	8	PASS

Mode	Channel			
OFDM	5 Mhz			
Frequency (Mhz)	Measurement (dBm)	PSD in 3 KHz (dBm)	Limit	Result
908	5.68	-9.54	8	PASS
918	6.95	-8.27	8	PASS
923	8.05	-7.17	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 as stated by the manufacturer. Please note that the following data is for worst case test purposes only. When installed correctly the firmware of the radio limits the output power of the radio to ensure compliance with required EIRP levels. In this case, with a 14 dBi antenna, the output power of the radio would normally be limited to 22 dBm.

9.2 RF exposure evaluation distance calculation

EUT with 14 dBi antenna

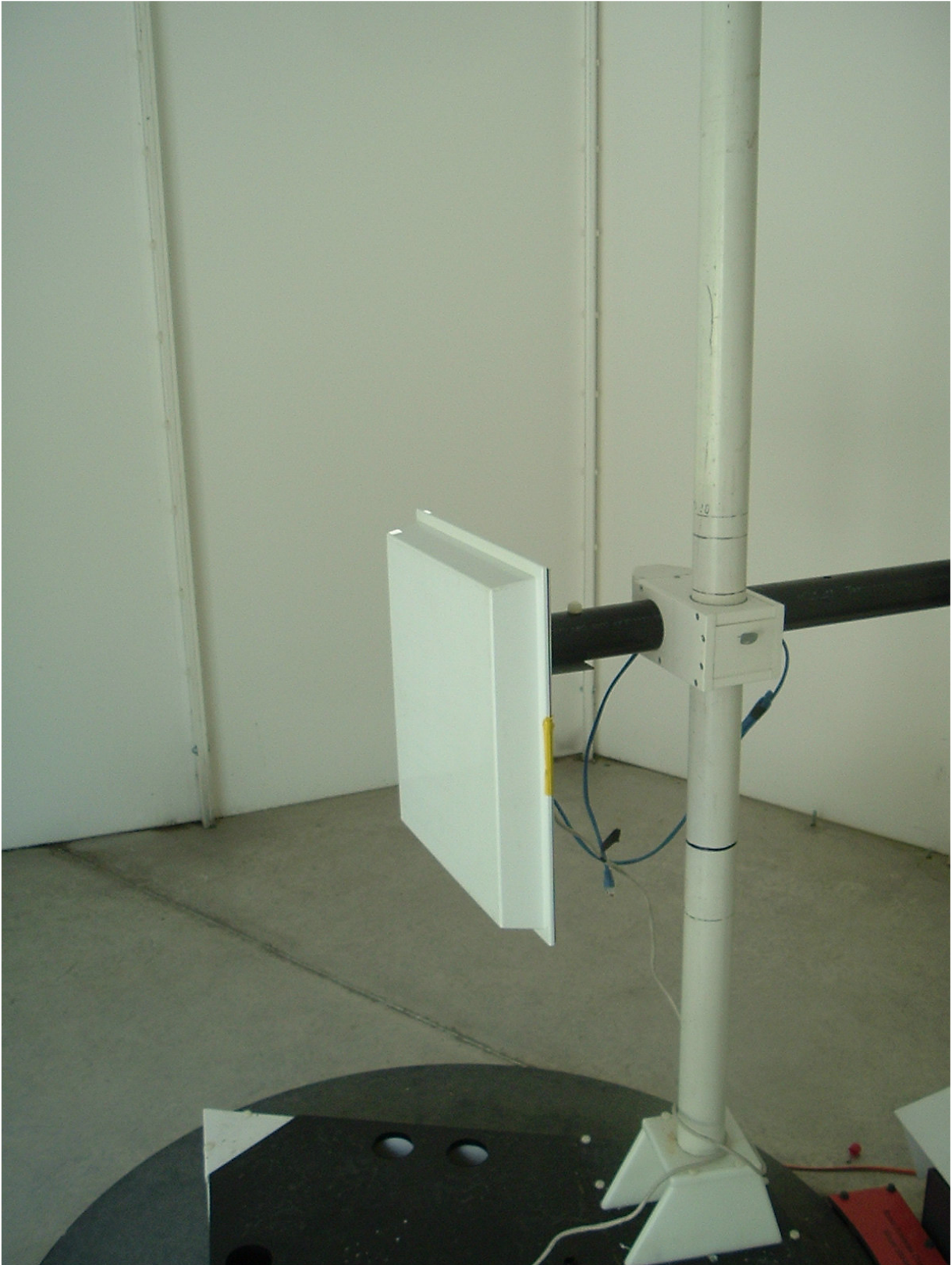
Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
908	20.70	14	20
918	21.76	14	22
923	23.1	14	28

As shown above, the minimum distance where the MPE limit is reached is 23 cm for the EUT.

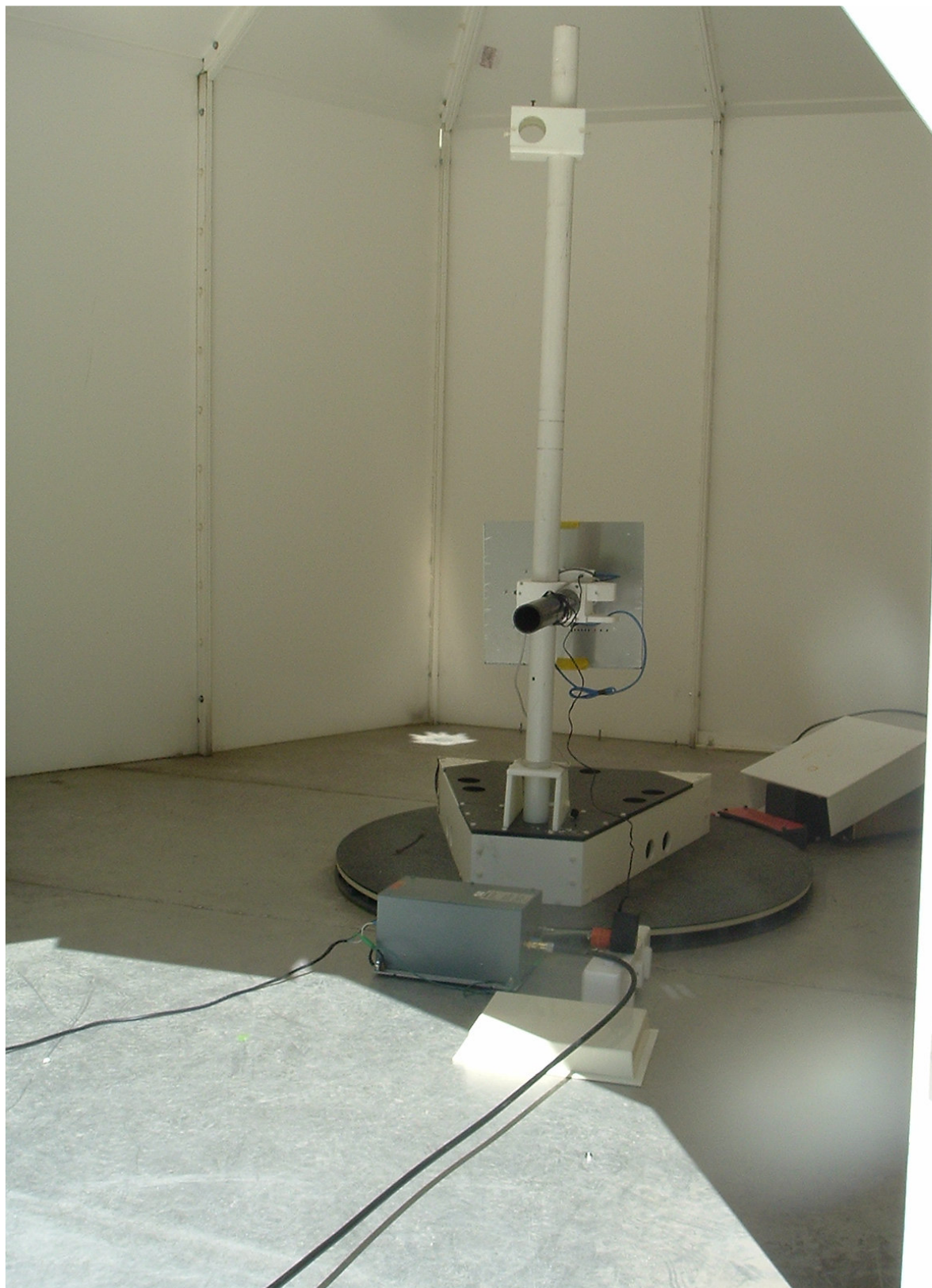
10.0 Test Photos







Radiated Emissions Test Setup.



Conducted Emissions Setup