

EMC Test Report

FCCID: QRF-CU901GZ0
900 MHz Wireless Network Adapter
Tranzeo Wireless Technologies Inc.

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

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



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

Order number: 84

Type of test: Testing of electromagnetic disturbances characteristics

Date the EUT was received: August 6th, 2009

Date of test: August 7th, 2009 to August 12th, 2009

Report No.: 081309.1

Pitt Meadows, 13 August, 2009

A handwritten signature in blue ink that appears to read "Andrew Marles".

EMC Manager: Andrew Marles

A handwritten signature in blue ink that appears to read "Andrei Moldavanov".

EMC Engineer: Andrei Moldavanov

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-CU901GZ0 |
| Model No. | TR-902-N,TR-902-8,TR-902-11,TR-SL9-8, TR-SL9-N |
| 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: 13 dBi MAX |
| Product Software Revision | TR6-4.0.3Rt |
| Test Software | Bandwidth test software |
| Operator Channel Selection | By software |
| Power Adapter | Model: PA1024-3DU |
| | Input: 100-240V ~50-60 Hz |
| | Output: 18V 1.1A 20W Max |

Product samples tested:

| Manufacturer | Model No. | Serial No. |
|------------------|-----------|------------|
| Tranzeo Wireless | TR-902-N | PH-ENGR1 |

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-902-8 and TR-SL9-8 are fitted with an integrated 900 MHz 8 dBi patch antenna, the TR-902-11 is fitted with an integrated 900 MHz 11 dBi patch antenna. The TR-902-N and TR-SL9-N are fitted with a standard N type connector and are 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 model to demonstrate compliance with FCC Part 15, Subpart B, and Subpart C, as well as Industry Canada RSS-210 Issue 7 for digitally modulated devices.

1.2 Operational Description

The device is a wireless network bridge designed specifically for outdoor/indoor applications. The device provides a bridge between IEEE802.3 wired Ethernet LANs and IEEE 802.11b/g compliant wireless networks. It uses an external antenna 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 in fixed point-to-point installations. It is mounted on the exterior/interior 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 6 and 24 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-902-N unit was 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.

Test procedures followed those in ANSI C63.4 as required by 47 CFR Part 15 Subpart A Section 15.31(a)(3)

1.4 EUT Antennas

The TR-902-N was tested with the following external antennas:

| Tranzeo Part Number | Antenna Type |
|---------------------|-------------------|
| TR-OD900-12 | Omni |
| TR-900H-120-12 | Horizontal Sector |
| TR-900V-120-13 | Vertical Sector |

1.5 EUT Modifications

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

1.6 Test Facilities

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

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

FCC registration number: 960532
Industry Canada Number: 5238A

1.7 Test Equipment

| Manufacturer | Model | Description | Serial Number | Cal Due Date |
|-----------------|----------|-------------------------|---------------|--------------|
| Rohde & Schwarz | ESU 40 | EMI Test Reciever | 10011 | 29-Mar-09 |
| Rohde & Schwarz | SMJ 100A | Vector Signal Generator | 100645 | 12-Mar-09 |
| ETS-Lindgren | 2165 | Turntable | 00043883 | N/R |
| ETS-Lindgren | 2175 | Mast Motor | 00077487 | N/R |
| Sunol Sciences | JB3 | Antenna | A042004 | 05-May-09 |
| Sunol Sciences | DRH-118 | Antenna | A052804 | 02-Jun-09 |
| Com-Power | LI-115 | LISN | 241037 | 30-Jan-09 |
| Agilent | 8648C | Signal Generator | 3623A03622 | 28-Feb-09 |
| ETS Lindgren | 2090 | Multi-Device Controller | 00058942 | 07-Dec-09 |

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 7.

2.0 Conducted Emissions

2.1 Test Standard

FCC Part 15, Subpart C, Section 15.207a.

| a) Except as shown in Paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 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. |

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 |

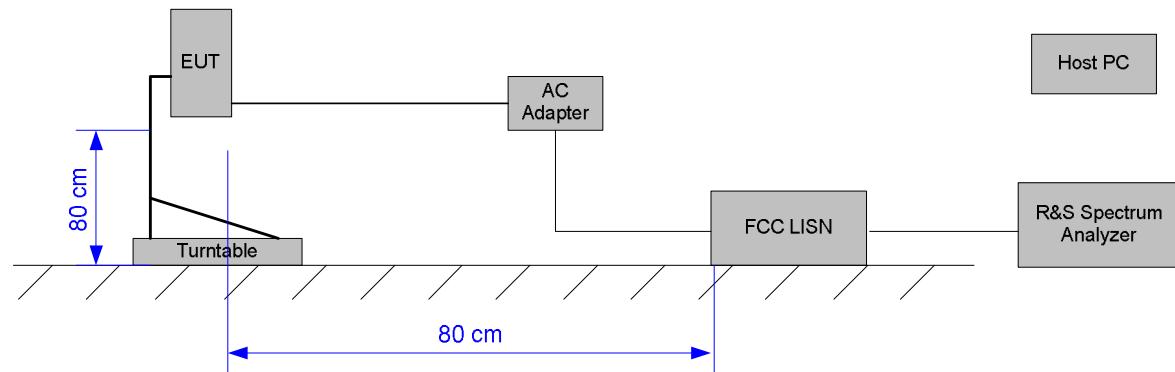
2.3 Test Setup

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

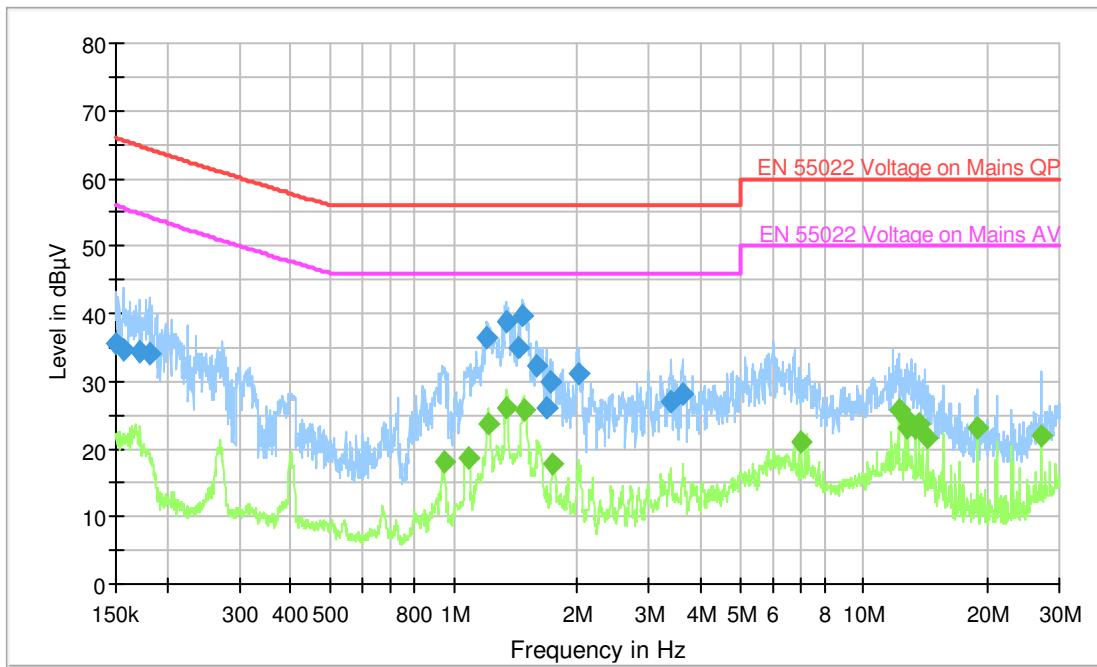


Note: The unused LISN terminal is terminated with a 50 ohms terminator.

2.4 Test Results

2.4.1 Test Data

EUT – Neutral-b Mode (Ch Freq: 915 MHz)



Quasi-Peak Detector

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 1.471963 | 39.8 | 1000.00 | 9.000 | On | L1 | 0.0 | 16.2 | 56.0 |
| 1.345394 | 39.0 | 1000.00 | 9.000 | On | L1 | 0.0 | 17.0 | 56.0 |
| 1.205382 | 36.5 | 1000.00 | 9.000 | On | L1 | 0.0 | 19.5 | 56.0 |
| 1.445731 | 35.0 | 1000.00 | 9.000 | On | L1 | 0.0 | 21.0 | 56.0 |
| 1.597620 | 32.2 | 1000.00 | 9.000 | On | L1 | 0.0 | 23.8 | 56.0 |
| 2.010303 | 31.1 | 1000.00 | 9.000 | On | L1 | 0.0 | 24.9 | 56.0 |
| 1.727089 | 30.0 | 1000.00 | 9.000 | On | L1 | 0.0 | 26.0 | 56.0 |
| 3.609973 | 28.1 | 1000.00 | 9.000 | On | L1 | -0.1 | 27.9 | 56.0 |
| 3.399948 | 27.0 | 1000.00 | 9.000 | On | L1 | -0.1 | 29.0 | 56.0 |
| 1.686173 | 26.1 | 1000.00 | 9.000 | On | L1 | 0.0 | 29.9 | 56.0 |
| 1.676096 | 26.0 | 1000.00 | 9.000 | On | L1 | 0.0 | 30.0 | 56.0 |
| 0.180630 | 34.1 | 1000.00 | 9.000 | On | L1 | -0.2 | 30.2 | 64.3 |
| 0.171829 | 34.4 | 1000.00 | 9.000 | On | L1 | -0.2 | 30.4 | 64.8 |
| 0.150000 | 35.5 | 1000.00 | 9.000 | On | L1 | -0.3 | 30.5 | 66.0 |
| 0.157368 | 34.8 | 1000.00 | 9.000 | On | L1 | -0.2 | 30.8 | 65.6 |

Note: All data points are corrected for insertion loss.

Average Detector

| Frequency (MHz) | Average (dB μ V) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) |
|-----------------|----------------------|-----------------|-----------------|--------|------|------------|-------------|--------------------|
| 1.350781 | 26.1 | 1000.00 | 9.000 | On | L1 | 0.0 | 19.9 | 46.0 |
| 1.480813 | 25.9 | 1000.00 | 9.000 | On | L1 | 0.0 | 20.1 | 46.0 |
| 1.210209 | 23.8 | 1000.00 | 9.000 | On | L1 | 0.0 | 22.2 | 46.0 |
| 12.139783 | 25.9 | 1000.00 | 9.000 | On | L1 | -0.4 | 24.1 | 50.0 |
| 12.685301 | 24.7 | 1000.00 | 9.000 | On | L1 | -0.4 | 25.3 | 50.0 |
| 13.604138 | 23.8 | 1000.00 | 9.000 | On | L1 | -0.4 | 26.2 | 50.0 |
| 12.812663 | 23.2 | 1000.00 | 9.000 | On | L1 | -0.4 | 26.8 | 50.0 |
| 13.361695 | 23.2 | 1000.00 | 9.000 | On | L1 | -0.4 | 26.8 | 50.0 |
| 18.916687 | 23.0 | 1000.00 | 9.000 | On | L1 | -0.5 | 27.0 | 50.0 |
| 1.086434 | 18.6 | 1000.00 | 9.000 | On | L1 | 0.0 | 27.4 | 46.0 |
| 0.944632 | 18.1 | 1000.00 | 9.000 | On | L1 | 0.0 | 27.9 | 46.0 |
| 27.158306 | 21.9 | 1000.00 | 9.000 | On | L1 | -0.8 | 28.1 | 50.0 |
| 1.740947 | 17.8 | 1000.00 | 9.000 | On | L1 | 0.0 | 28.2 | 46.0 |
| 14.272378 | 21.6 | 1000.00 | 9.000 | On | L1 | -0.4 | 28.4 | 50.0 |
| 7.035953 | 21.1 | 1000.00 | 9.000 | On | L1 | -0.2 | 28.9 | 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 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 | 22.92 | 30 | PASS |
| 913 | 21.16 | 30 | PASS |
| 923 | 21.63 | 30 | PASS |

| Mode DSSS/ Channel BW = 10MHz | | | |
|-------------------------------|------------------|-------|--------|
| Frequency(MHz) | Measurement(dBm) | Limit | Result |
| 910 | 24.96 | 30 | PASS |
| 920 | 24.23 | 30 | PASS |

| Mode OFDM/ Channel BW = 5MHz | | | |
|------------------------------|------------------|-------|--------|
| Frequency(MHz) | Measurement(dBm) | Limit | Result |
| 908 | 22.89 | 30 | PASS |
| 913 | 21.35 | 30 | PASS |
| 923 | 21.78 | 30 | PASS |

| Mode OFDM/ Channel BW = 10MHz | | | |
|-------------------------------|------------------|-------|--------|
| Frequency(MHz) | Measurement(dBm) | Limit | Result |
| 910 | 24.56 | 30 | PASS |
| 920 | 24.76 | 30 | PASS |

| Channel BW = 20MHz | | | | |
|--------------------|------|------------------|-------|--------|
| Frequency(MHz) | Mode | Measurement(dBm) | Limit | Result |
| 915 | DSSS | 25.59 | 30 | PASS |
| | OFDM | 25.31 | 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

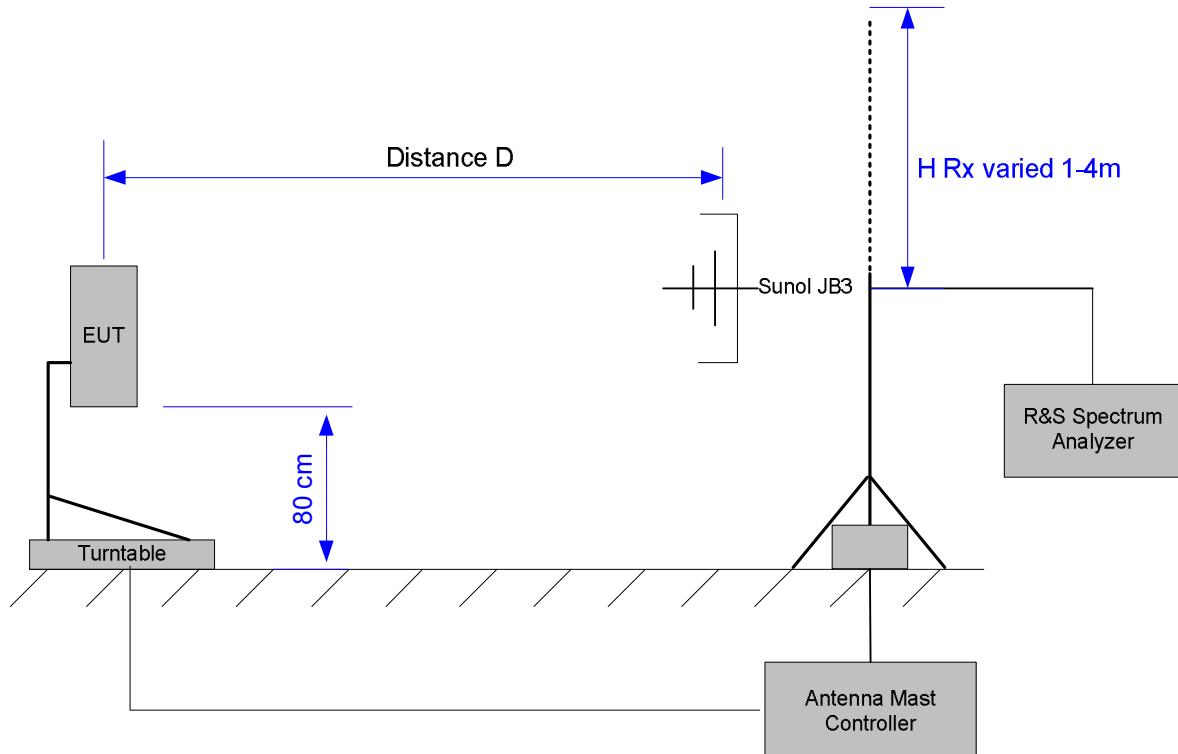
| Frequency (MHz) | Maximum Field Strength (uV/m @ 3m) | Maximum Field Strength (dBuV/m @ 3m) |
|-----------------|------------------------------------|--------------------------------------|
| 30-88 | 100 | 40.0 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46.0 |
| 960-1000 | 500 | 54.0 |

4.3 Test Setup

The EUT was exercised using data transfer 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.

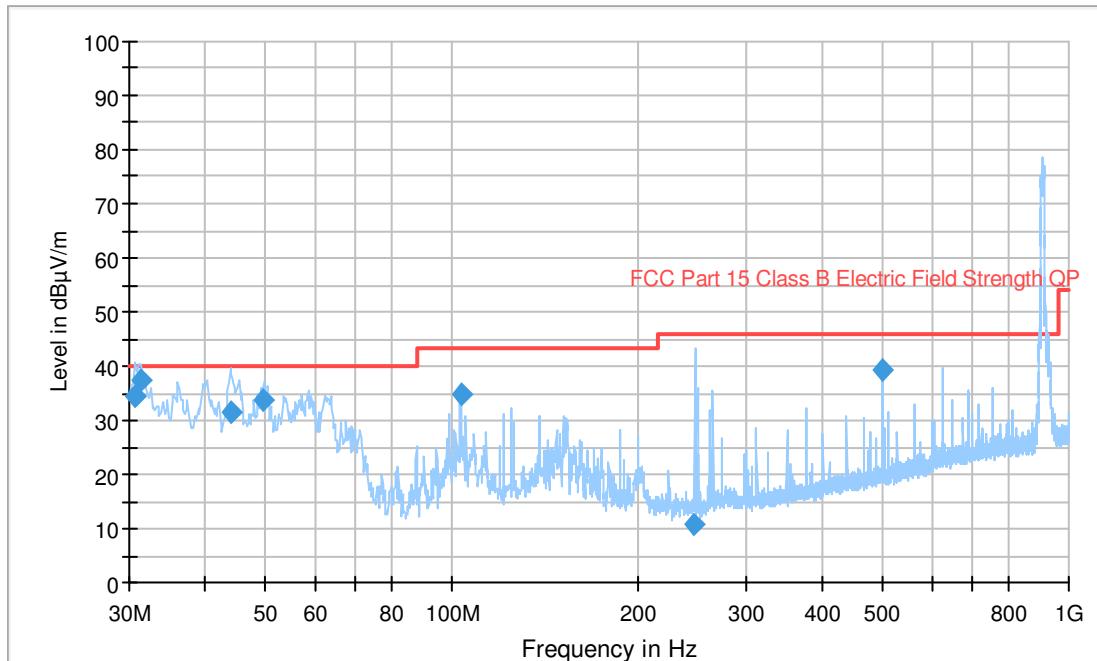
4.3.1 Test Setup Block Diagram



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 13 dBi Vertical Sector antenna



| Frequency (MHz) | QuasiPeak (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|--------------------|-----------------|-----------------|---------------------|----------|--------------------------|------------|-------------|----------------|
| 30.734240 | 34.6 | 1000.00 | 100.000 | 100.0 | V | 228.0 | 20.5 | 5.40 | 40.00 |
| 31.415600 | 37.2 | 1000.00 | 100.000 | 100.0 | V | 156.0 | 19.9 | 2.80 | 40.00 |
| 43.947040 | 31.3 | 1000.00 | 100.000 | 100.0 | V | 250.0 | 11.2 | 8.70 | 40.00 |
| 49.608240 | 33.6 | 1000.00 | 100.000 | 100.0 | V | 220.0 | 8.8 | 6.40 | 40.00 |
| 103.498880 | 35.0 | 1000.00 | 100.000 | 100.0 | V | 189.0 | 12.2 | 8.50 | 43.50 |
| 247.723600 | 10.7 | 1000.00 | 100.000 | 170.0 | V | 153.0 | 13.4 | 35.30 | 46.00 |
| 500.012560 | 39.2 | 1000.00 | 100.000 | 100.0 | V | 340.0 | 19.1 | 6.80 | 46.00 |

Note: All data points are corrected for insertion loss.

5.0 Harmonic and Spurious Emissions

5.1 Test Standard

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

| (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). |

5.2 Test Limits

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

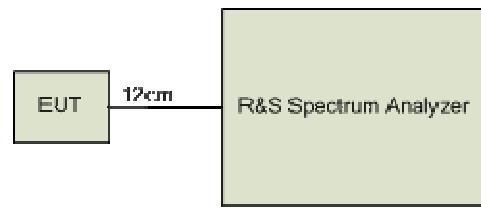
Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels. Conducted scans are used to determine compliance with the 30 dBc limit for emissions outside of the operational frequency band.

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.

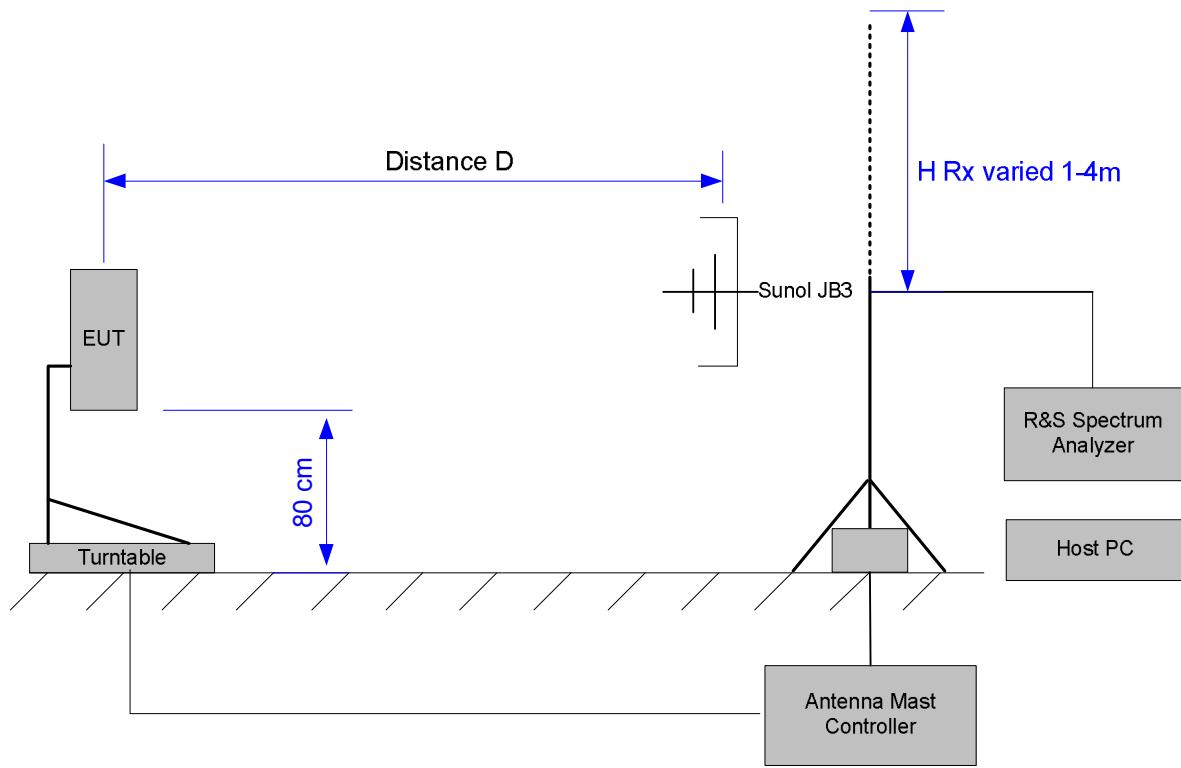
The TR-902-N was tested with all external antennas. The EUT was exercised using data transfer mode at the highest possible transmit rate. Testing was performed on low, middle and high channels in 20 MHz, 10MHz and 5MHz bandwidths for both DSSS and OFDM modes.

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)

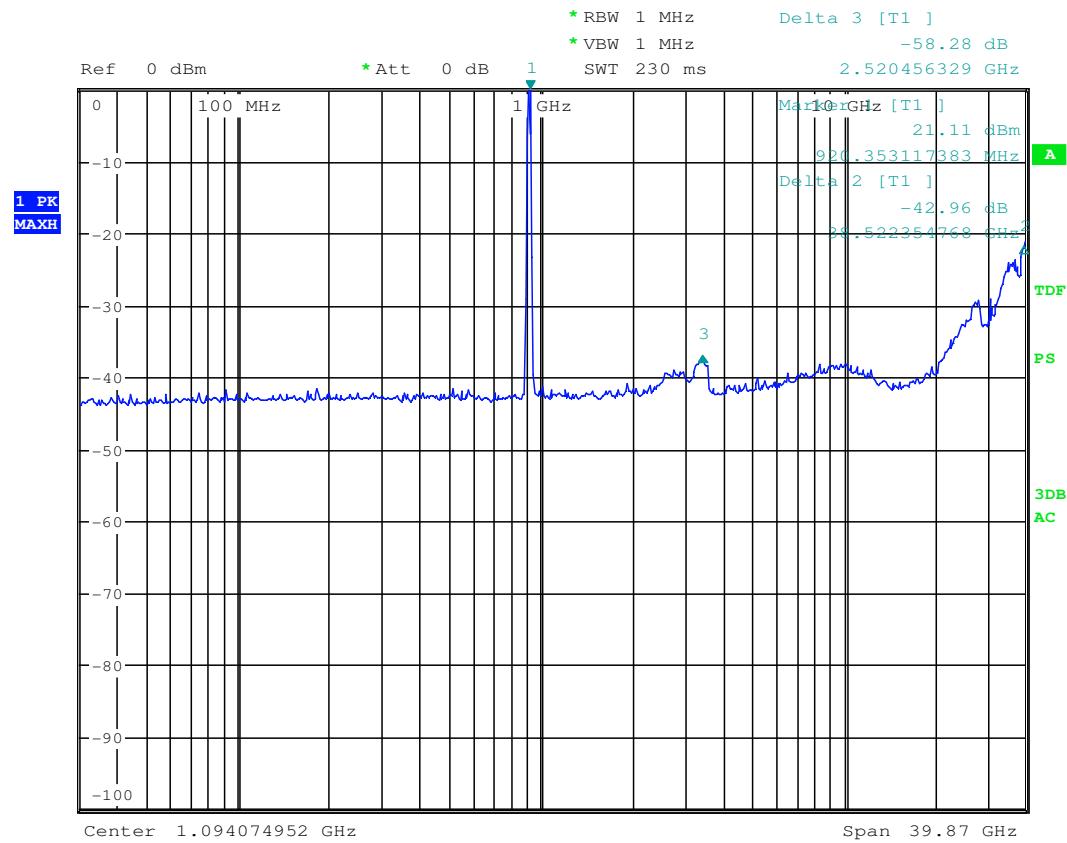


5.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



5.4 Test Results

5.4.1 Test Results 15.247-Harmonics -20 dBc



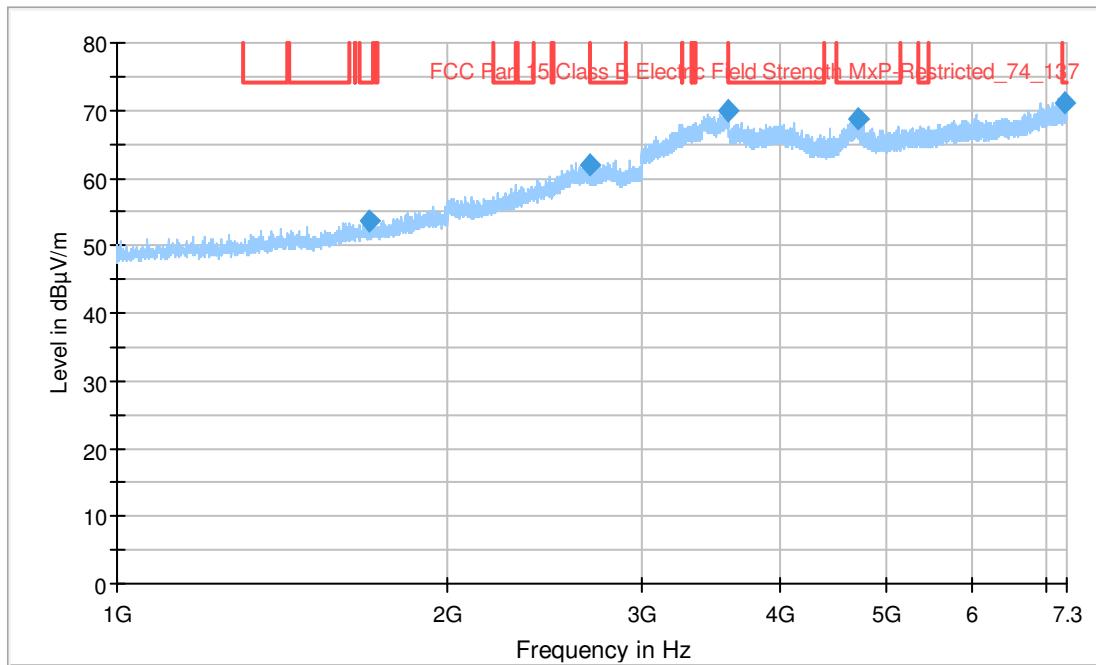
Date: 31.AUG.2009 14:10:25

The above plot shows the conducted output of the transmitter. There are no conducted harmonics within the 20 dBc limit.

5.4.2 Test Results 15.247– Restricted Bands (Spurious Emissions)

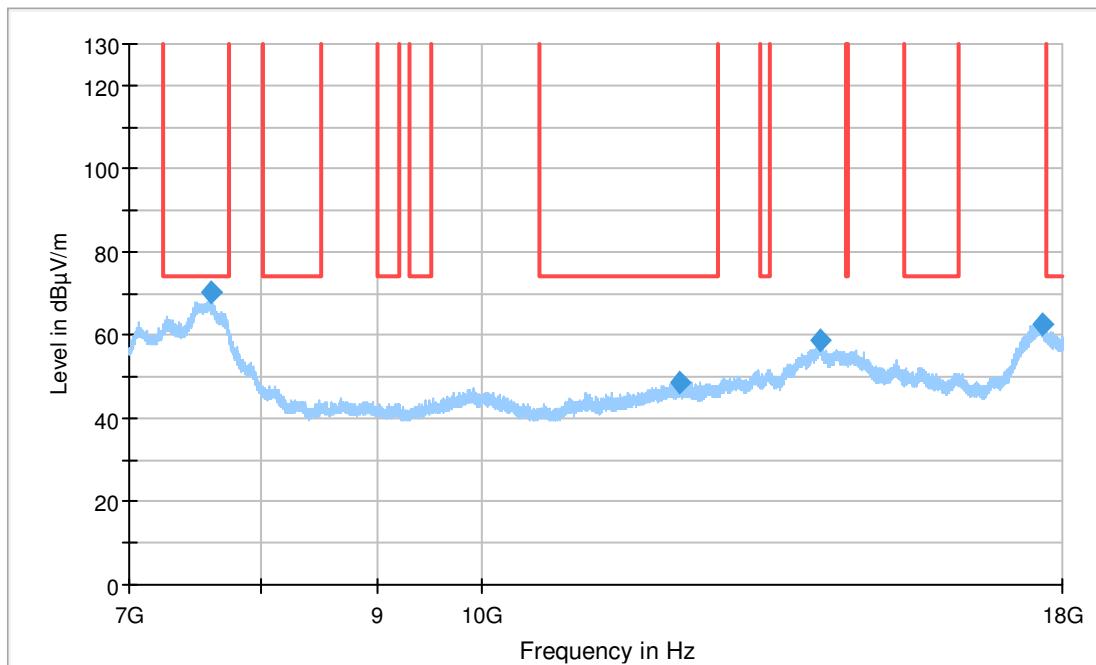
Data presented below was taken at a measurement distance of 3 m. Data is presented for the worst case configuration, being 20 MHz bandwidth in OFDM mode at channel 1 (915 MHz).

Peak detector



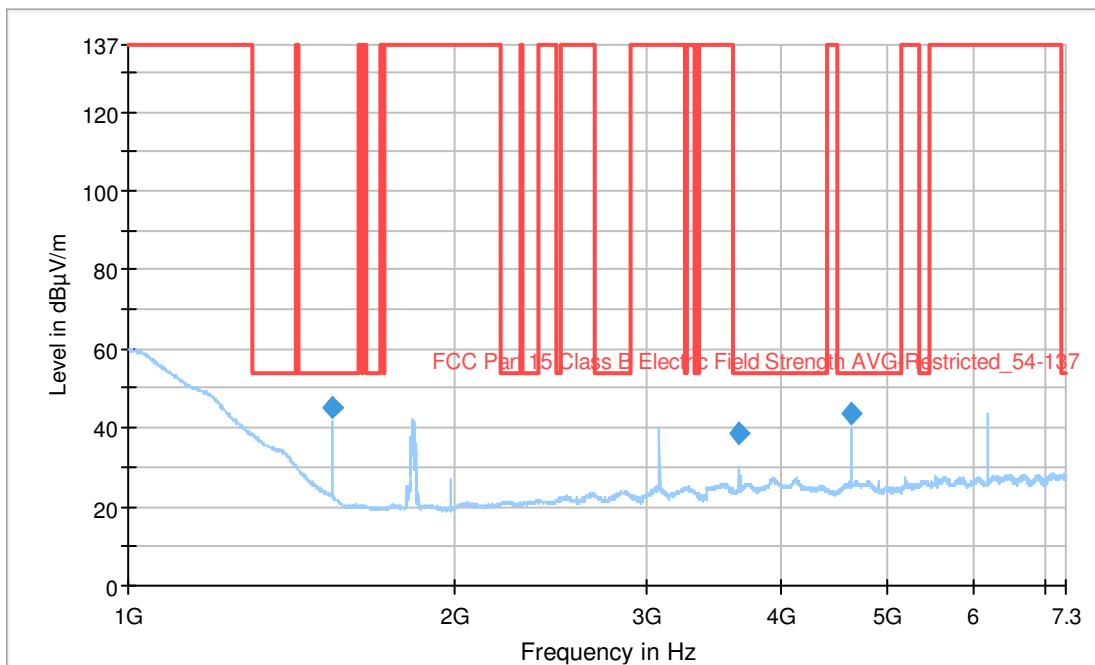
| Frequency (MHz) | MaxPeak (dBμV/m) | Bandwidth (kHz) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-----------------|---------------------|----------|--------------------------|------------|-------------|----------------|
| 1698.40000 | 53.7 | 1000.000 | 215.0 | V | 245.0 | 28.4 | 20.4 | 74.0 |
| 2694.80000 | 61.9 | 1000.000 | 209.0 | V | 173.0 | 33.0 | 12.1 | 74.0 |
| 3600.00000 | 69.8 | 1000.000 | 140.0 | H | 171.0 | 37.4 | 4.2 | 74.0 |
| 4725.60000 | 68.8 | 1000.000 | 215.0 | H | 46.0 | 38.9 | 5.2 | 74.0 |
| 7266.40000 | 71.2 | 1000.000 | 149.0 | H | 340.0 | 41.9 | 2.8 | 74.0 |

Peak detector



| Frequency (MHz) | MaxPeak (dBμV/m) | Bandwidth (kHz) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-----------------|---------------------|----------|--------------------------|------------|-------------|----------------|
| 7603.600000 | 70.5 | 1000.000 | 156.0 | V | 221.0 | 34.5 | 3.5 | 74.0 |
| 12224.800000 | 48.4 | 1000.000 | 160.0 | V | 38.0 | 15.2 | 25.6 | 74.0 |
| 14085.600000 | 58.7 | 1000.000 | 100.0 | V | 54.0 | 25.0 | 78.3 | 137.0 |
| 17625.600000 | 62.7 | 1000.000 | 210.0 | V | 52.0 | 29.6 | 74.3 | 137.0 |

Average detector

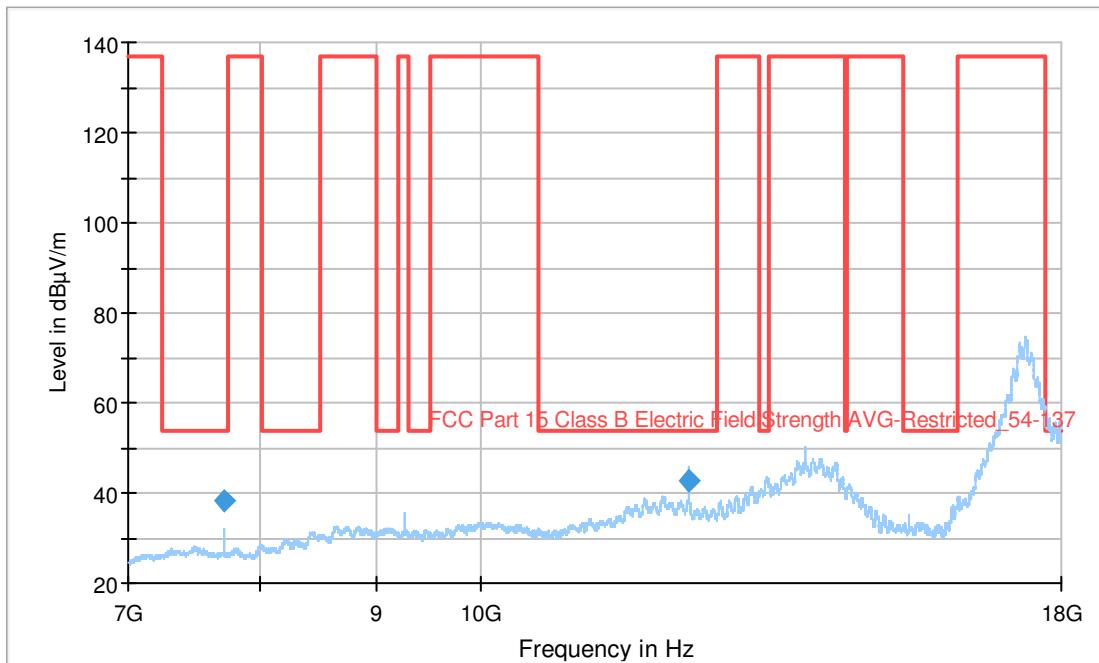


| Frequency (MHz) | Average (dB μ V/m) | Bandwidth (kHz) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Margin (dB) | Limit (dB μ V/m) |
|-----------------|------------------------|-----------------|---------------------|----------|--------------------------|------------|-------------|----------------------|
| 1544.00000 | 45.0 | 1000.000 | 100.0 | V | 0.0 | -7.2 | 9.0 | 54.0 |
| 3659.60000 | 38.5 | 1000.000 | 150.0 | H | 270.0 | -1.5 | 15.5 | 54.0 |
| 4632.00000 | 43.7 | 1000.000 | 219.0 | H | 209.0 | -1.6 | 10.3 | 54.0 |

Average detector

EMC32 Report

FCC HF-ESU40-part2_Chamber_AM_Average



| Frequency (MHz) | Average (dB μ V/m) | Bandwidth (kHz) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Margin (dB) | Limit (dB μ V/m) |
|-----------------|------------------------|-----------------|---------------------|----------|--------------------------|------------|-------------|----------------------|
| 7720.000000 | 38.4 | 1000.000 | 150.0 | V | 208.0 | 3.5 | 15.6 | 54.0 |
| 12352.000000 | 42.7 | 1000.000 | 150.0 | V | 180.0 | 17.1 | 11.3 | 54.0 |

6.0 Band Edge

6.1 Test Standard

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

| (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). |

6.2 Test Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 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).)

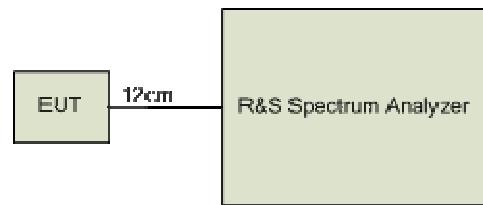
6.3 Test Setup

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

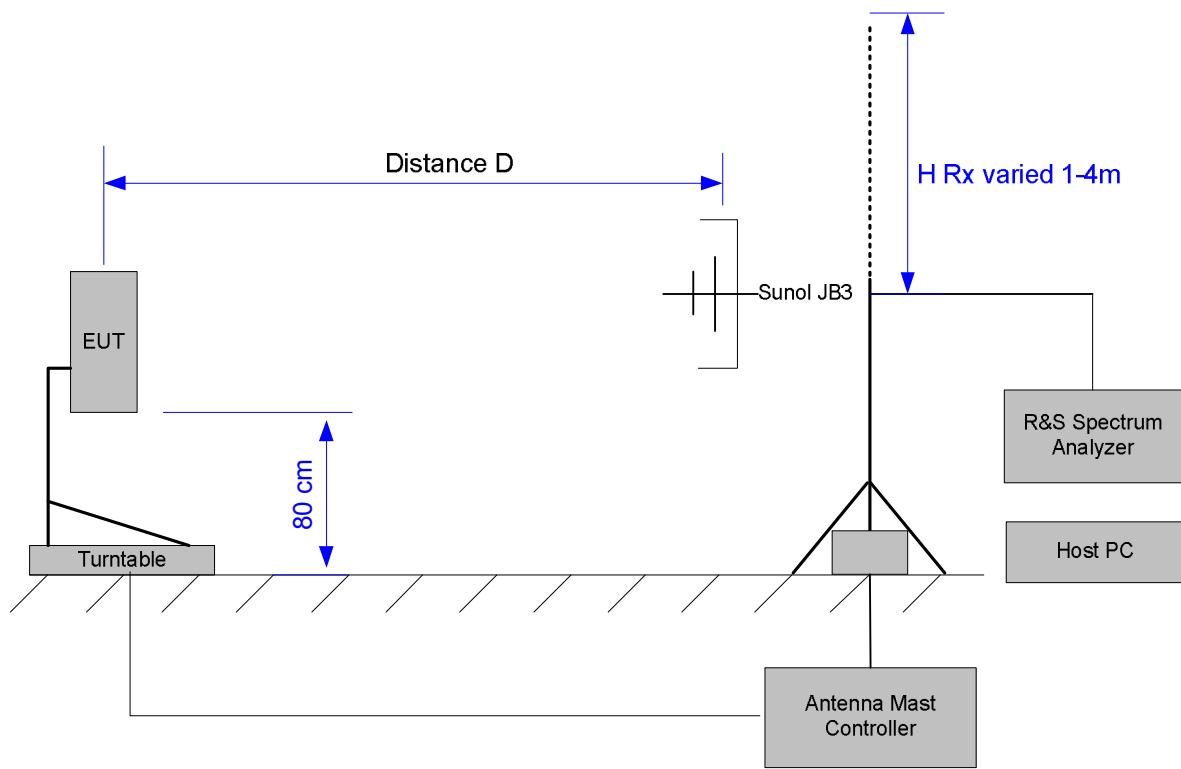
The test is performed at low and high channels. Compliance in the 902-928 MHz band is established through conducted measurements.

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)

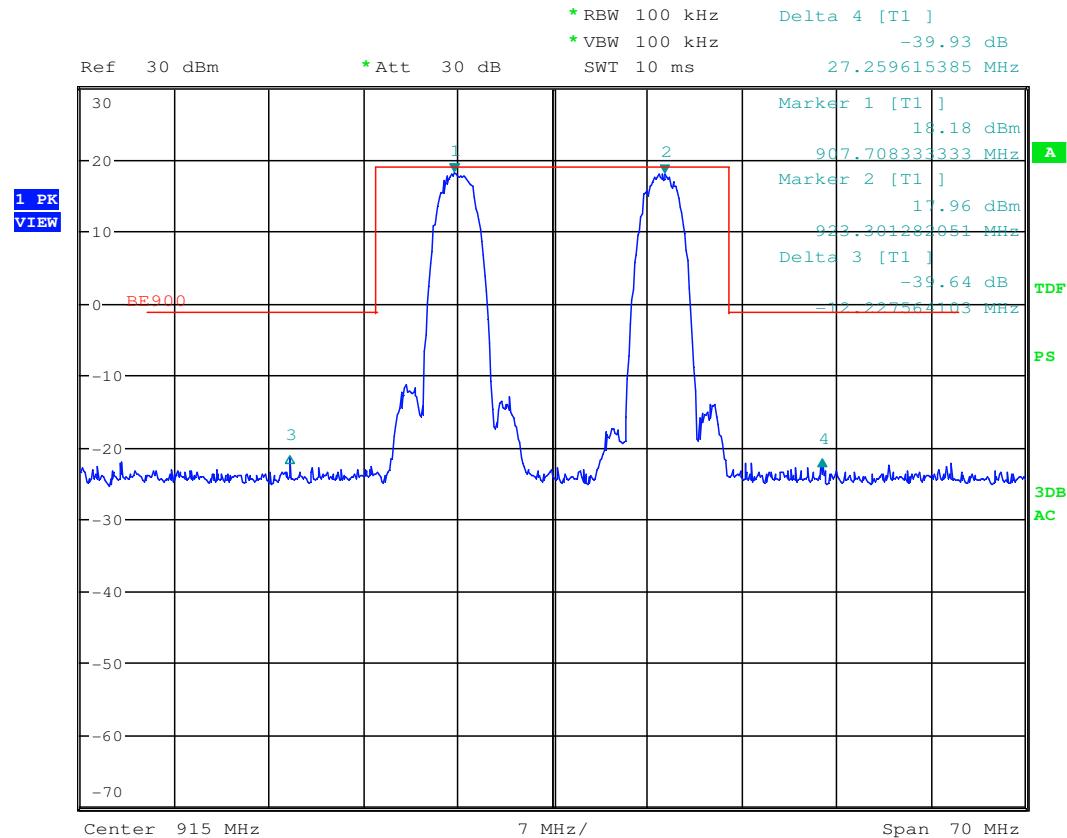


6.3.2 Test Setup Block Diagram – Radiated Measurements



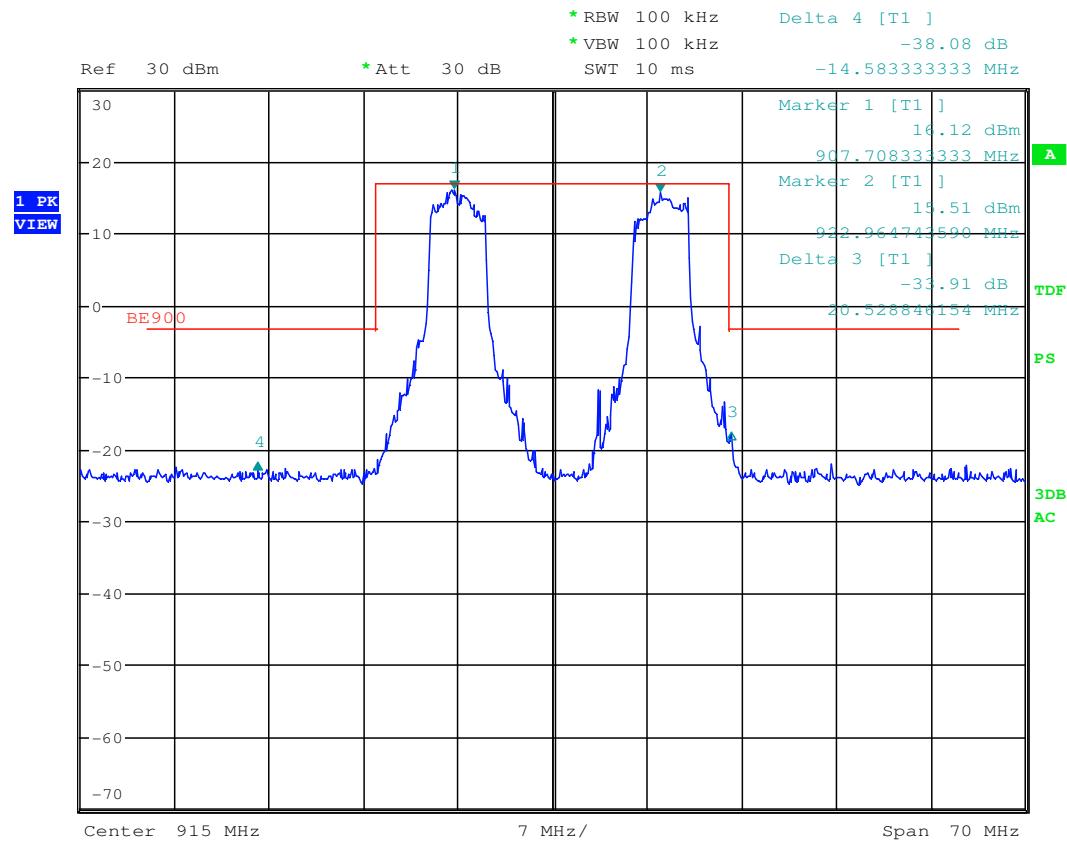
6.4 Test Results, 902-928 MHz, Conducted Measurements

6.4.1 5MHz Bandwidth, DSSS

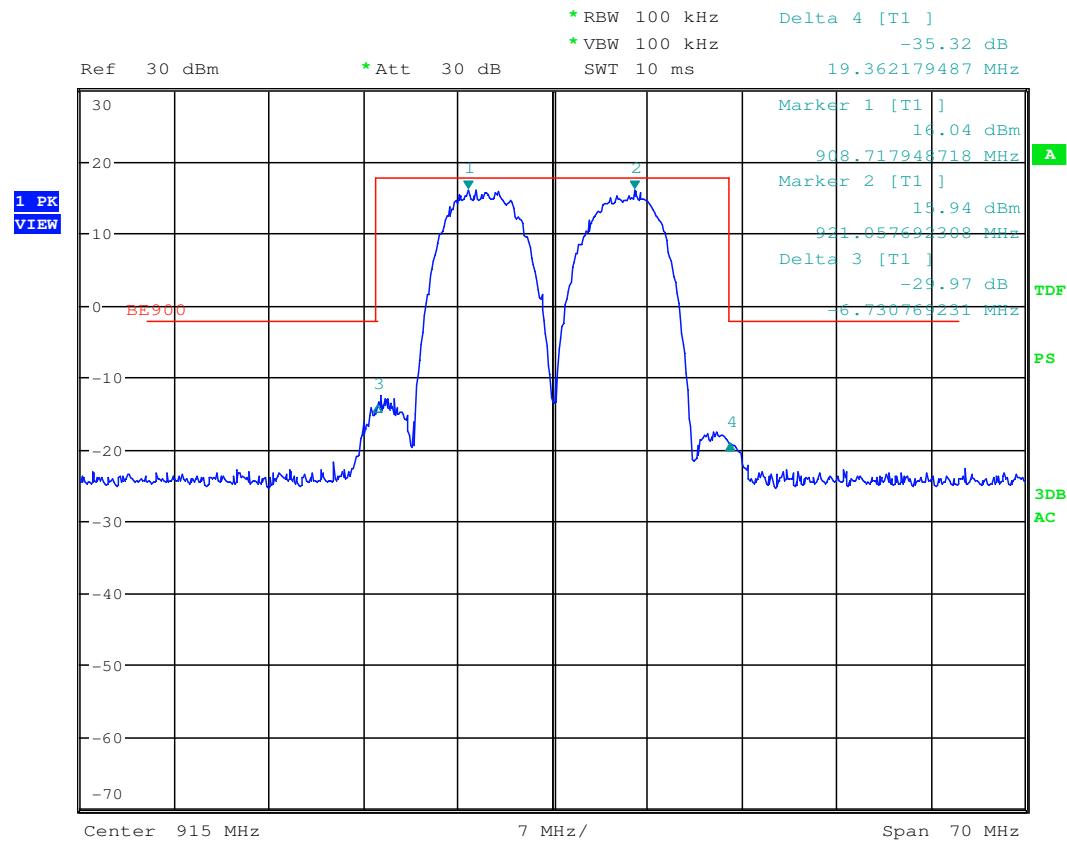


Date: 7.AUG.2009 13:44:35

6.4.2 5MHz Bandwidth, OFDM

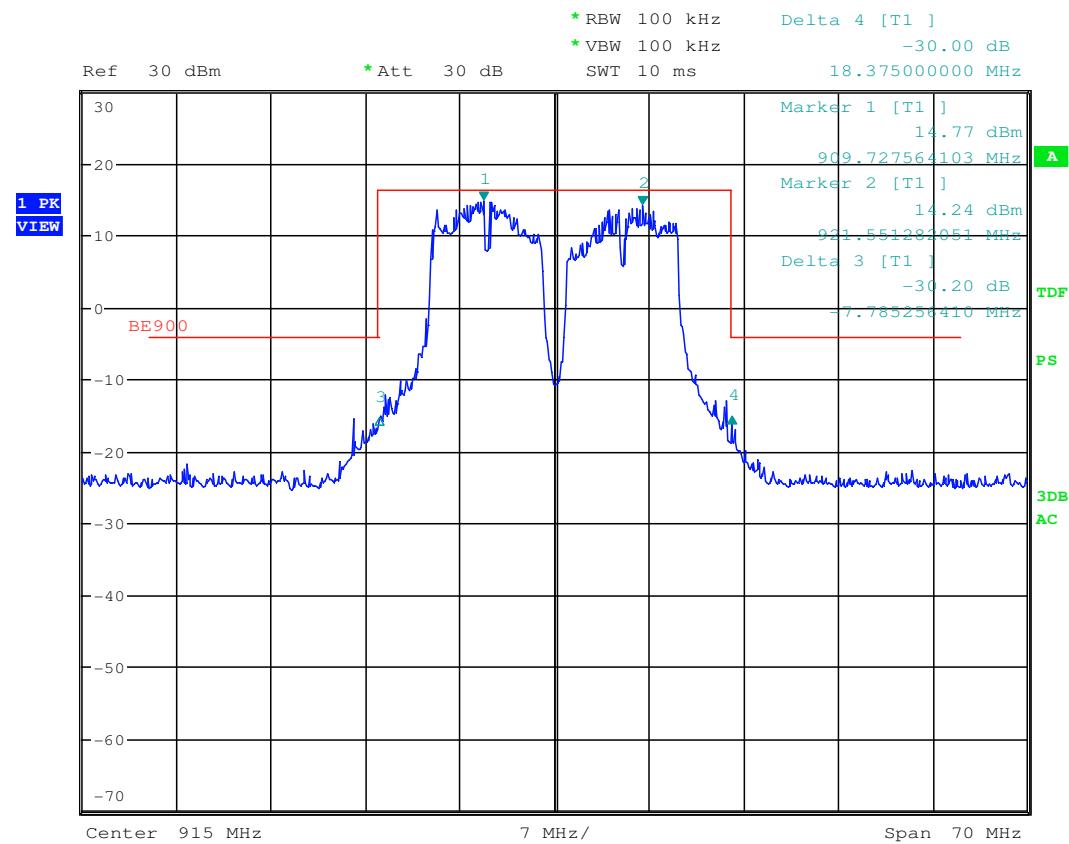


6.4.3 10MHz Bandwidth, DSSS



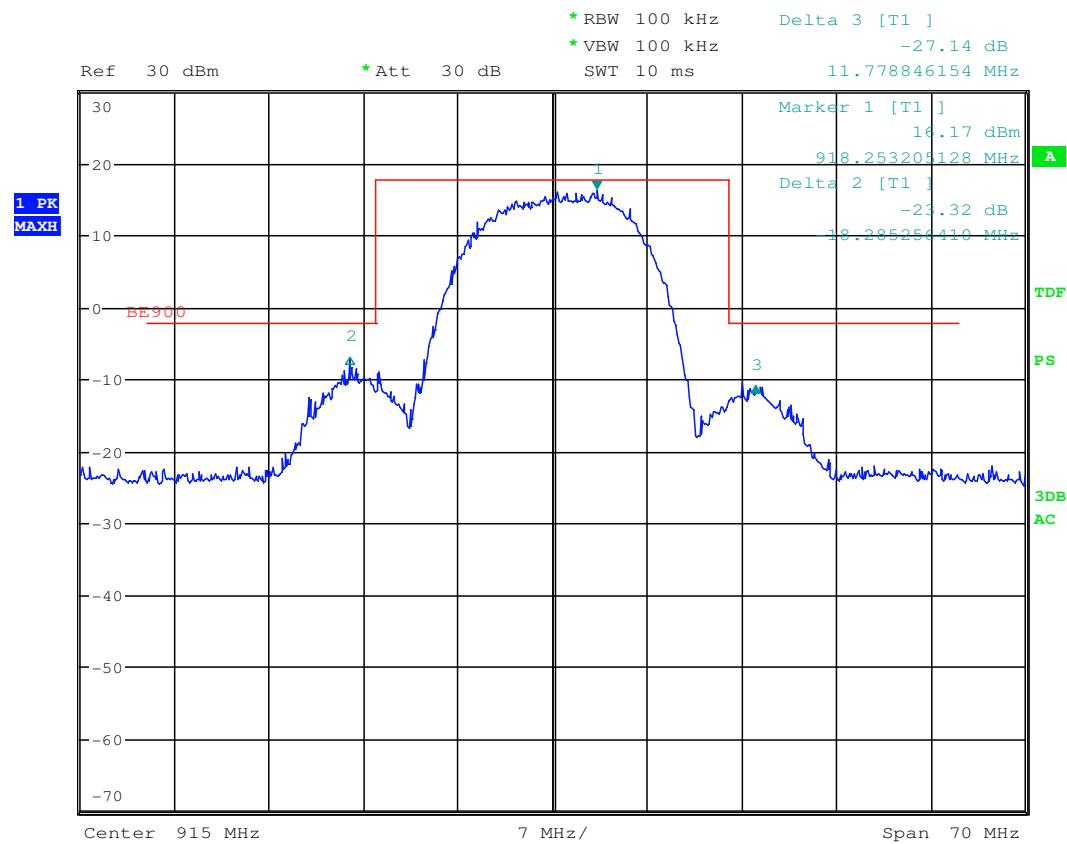
Date: 7.AUG.2009 13:40:50

6.4.4 10MHz Bandwidth, OFDM



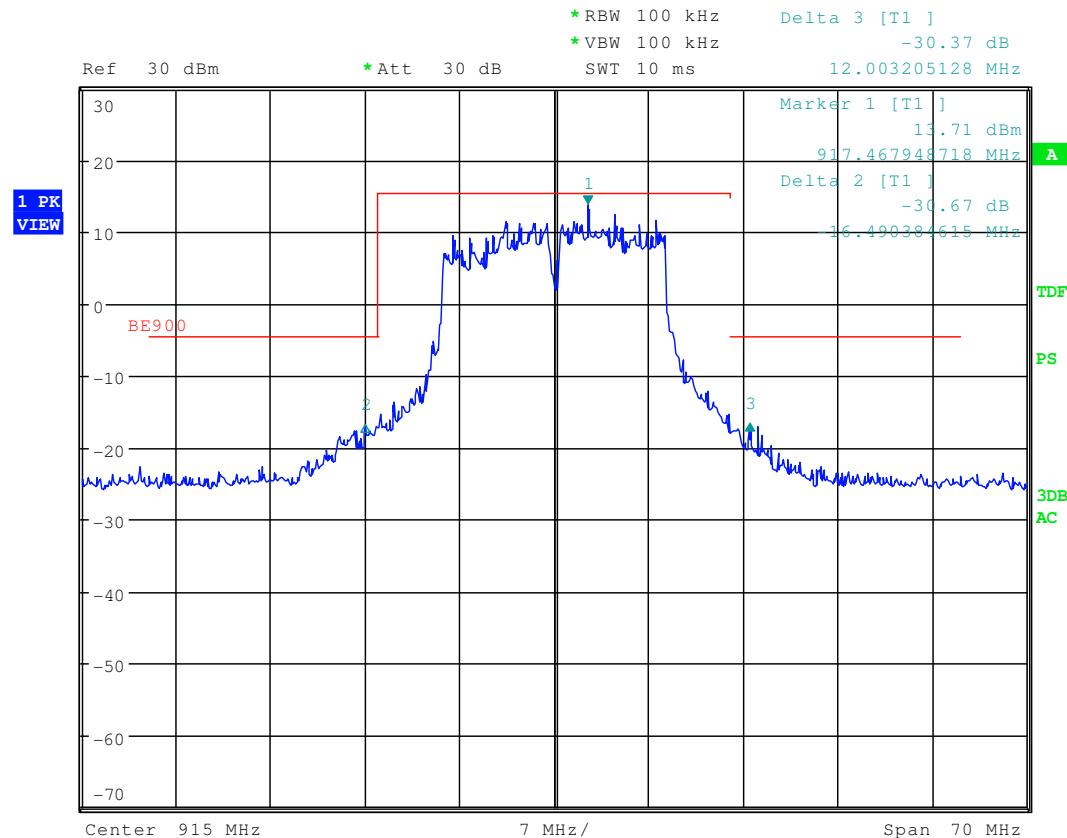
Date: 7.AUG.2009 13:53:45

6.4.5 20MHz Bandwidth, DSSS



Date: 7.AUG.2009 13:36:21

6.4.6 20MHz Bandwidth, OFDM



All emissions outside the 902-928 MHz frequency band are attenuated by at least 20 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

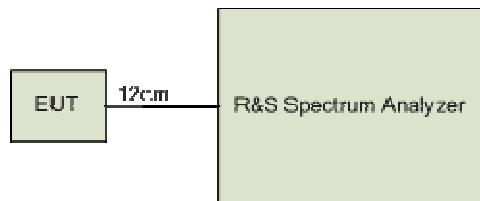
The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3 Test Setup

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

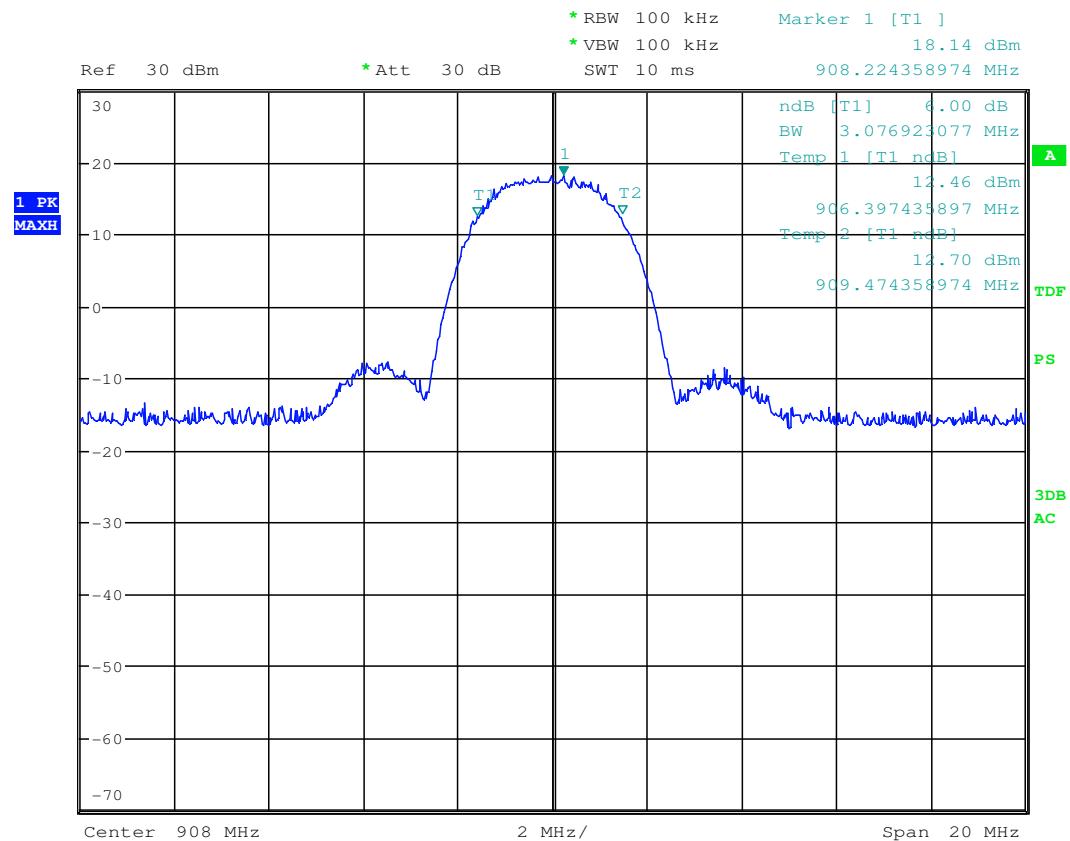
The test is performed at low, middle and high channels using both OFDM and DSSS modulations in 20 MHz, 10MHz and 5MHz bandwidths.

7.3.1 Test Setup Block Diagram

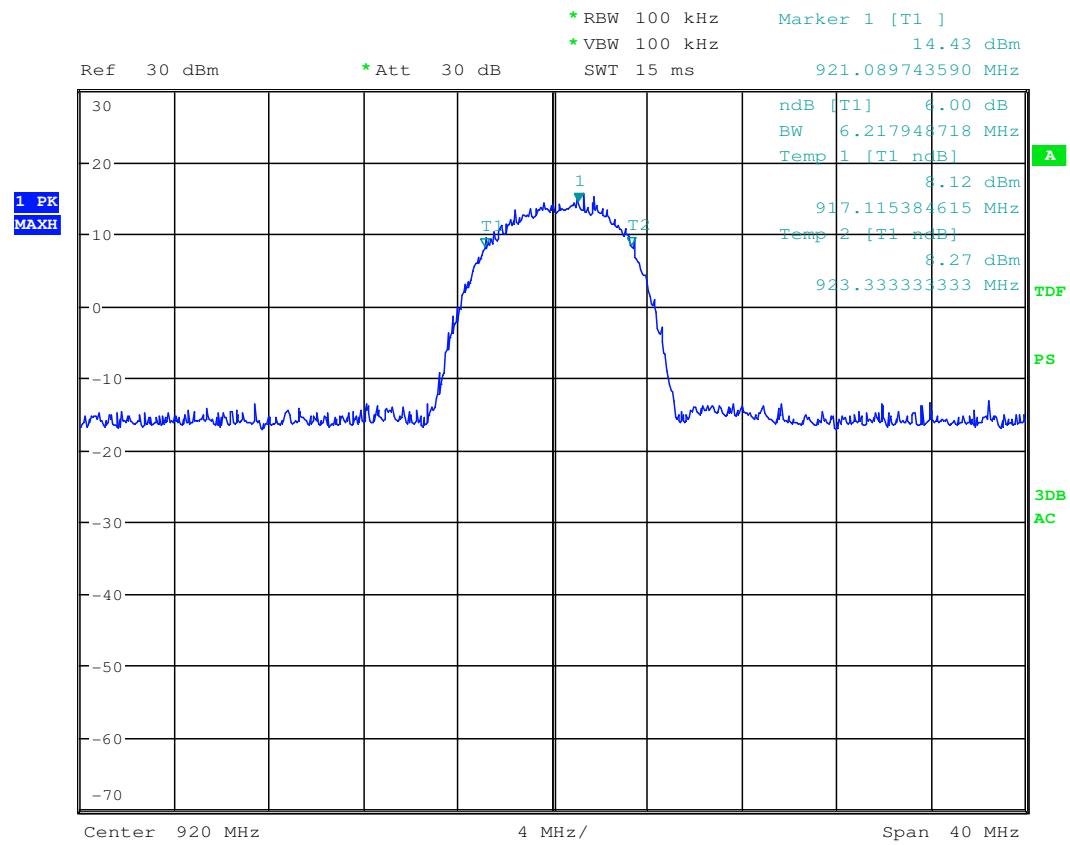


7.4 Test Results, 6 dB Occupied Bandwidth

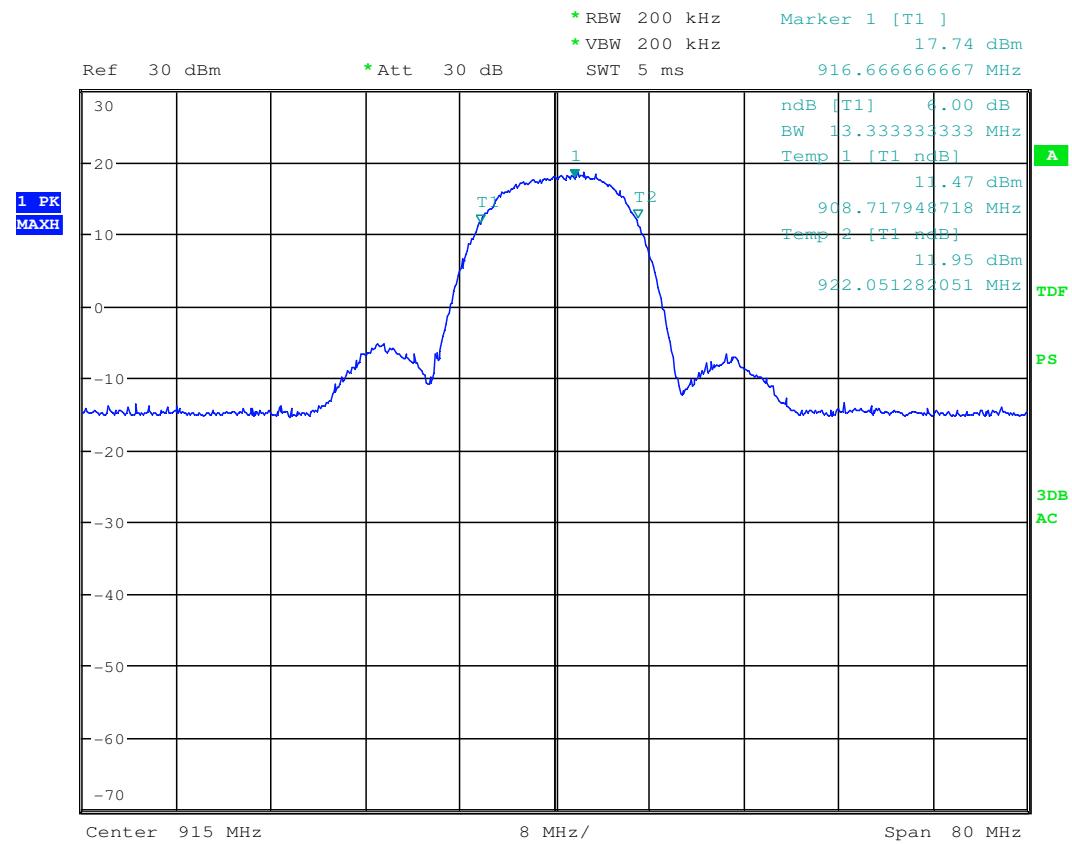
7.4.1 DSSS



Date: 6.AUG.2009 15:41:56

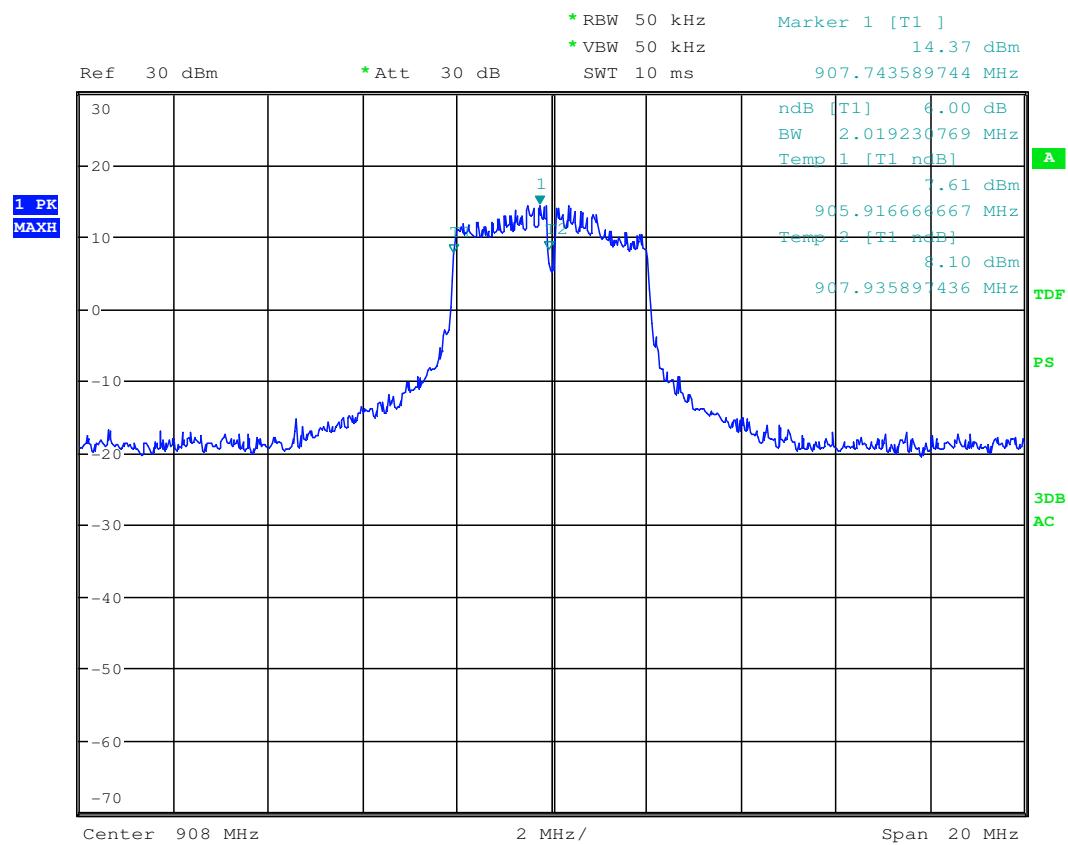


Date: 6.AUG.2009 15:47:49

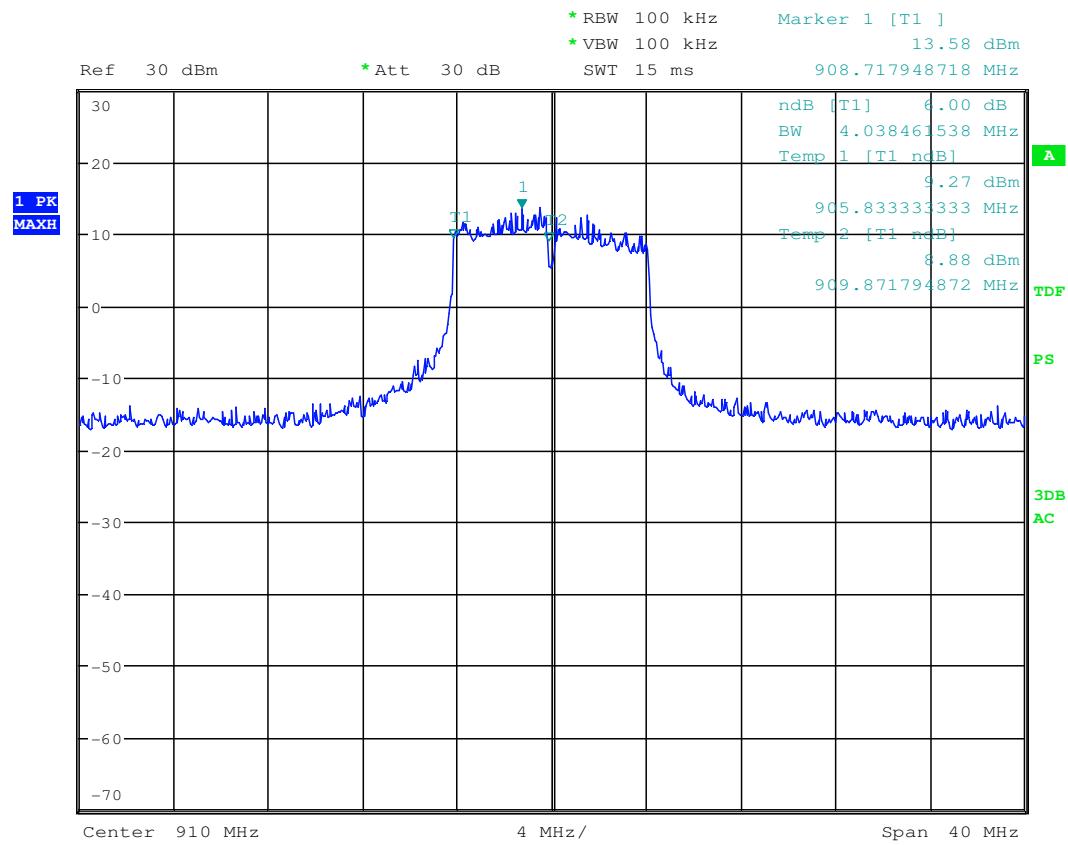


Date: 6.AUG.2009 15:30:12

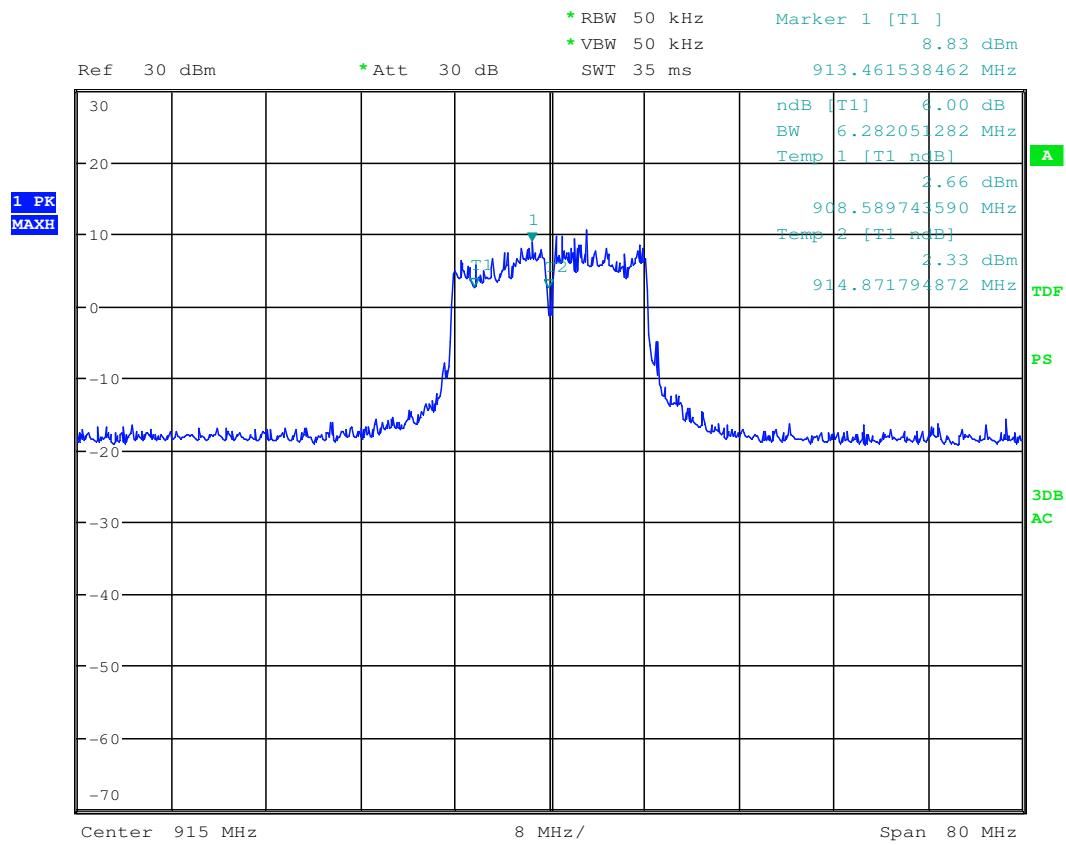
7.4.2 OFDM



Date: 6.AUG.2009 15:56:58



Date: 6.AUG.2009 15:54:21



Date: 6.AUG.2009 16:02:03

Data Table – Occupied Bandwidth

| Mode DSSS/ Channel BW = 5MHz | | | |
|-------------------------------------|--------------------------------|--------------|---------------|
| Frequency(MHz) | Occupied Bandwidth(MHz) | Limit | Result |
| 908 | 3.08 | 0.5 | PASS |
| 913 | 3.04 | 0.5 | PASS |
| 923 | 3.04 | 0.5 | PASS |

| Mode DSSS/ Channel BW = 10MHz | | | |
|--------------------------------------|--------------------------------|--------------|---------------|
| Frequency(MHz) | Occupied Bandwidth(MHz) | Limit | Result |
| 910 | 6.22 | 0.5 | PASS |
| 920 | 6.47 | 0.5 | PASS |

| Mode OFDM/ Channel BW = 5MHz | | | |
|-------------------------------------|--------------------------------|--------------|---------------|
| Frequency(MHz) | Occupied Bandwidth(MHz) | Limit | Result |
| 908 | 2.02 | 0.5 | PASS |
| 913 | 2.02 | 0.5 | PASS |
| 923 | 2.68 | 0.5 | PASS |

| Mode OFDM/ Channel BW = 10MHz | | | |
|--------------------------------------|--------------------------------|--------------|---------------|
| Frequency(MHz) | Occupied Bandwidth(MHz) | Limit | Result |
| 910 | 4.04 | 0.5 | PASS |
| 920 | 4.10 | 0.5 | PASS |

| Channel BW = 20MHz | | | | |
|---------------------------|-------------|--------------------------------|--------------|---------------|
| Frequency(MHz) | Mode | Occupied Bandwidth(MHz) | Limit | Result |
| 915 | DSSS | 13.33 | 0.5 | PASS |
| | OFDM | 12.56 | 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

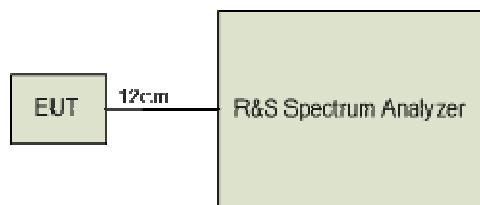
The transmitted power density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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 direct measurements done at 3 KHz RBW.

Data Table – Power Spectral Density

| Frequency(MHz) | DHSS PSD in 3 KHz (dBm) | Limit | Result | |
|-------------------------|-------------------------|--------------------|--------|--------|
| 908 | 4.41 | 8 | PASS | |
| 913 | 3.91 | 8 | PASS | |
| 923 | 3.16 | 8 | PASS | |
| DHSS PSD in 3 KHz (dBm) | | | | |
| Frequency(MHz) | KHz (dBm) | Limit | Result | |
| 910 | 2.08 | 8 | PASS | |
| 920 | 1.42 | 8 | PASS | |
| OFDM PSD in 3 KHz (dBm) | | | | |
| Frequency(MHz) | 3 KHz (dBm) | Limit | Result | |
| 908 | 4.17 | 8 | PASS | |
| 913 | 1.73 | 8 | PASS | |
| 923 | 3.52 | 8 | PASS | |
| OFDM PSD in 3 KHz (dBm) | | | | |
| Frequency(MHz) | 3 KHz (dBm) | Limit | Result | |
| 910 | 1.79 | 8 | PASS | |
| 920 | -0.01 | 8 | PASS | |
| Frequency(MHz) | Mode | PSD in 3 KHz (dBm) | Limit | Result |
| 915 | DSSS | -2.66 | 8 | PASS |
| | OFDM | -5.00 | 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 13 dBi at 900 MHz.

9.2 RF exposure evaluation distance calculation

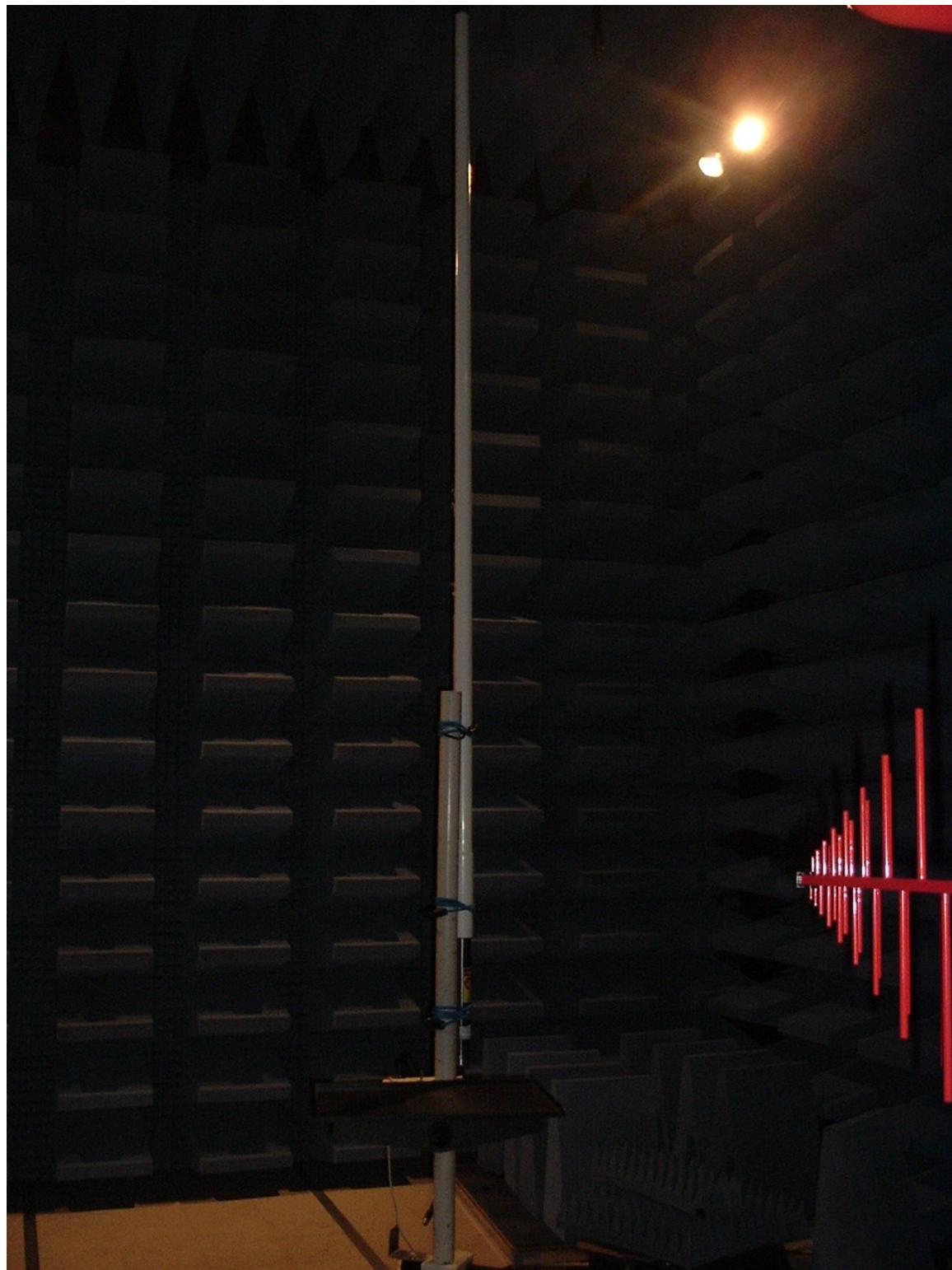
EUT with 13 dBi antenna

| Freq (MHz) | Output Power to Antenna (dBm) | Antenna Gain (dBi) | r (cm) |
|------------|-------------------------------|--------------------|--------|
| 908 | 25.0 | 13 | 27.7 |
| 910 | 24.81 | 13 | 28.6 |
| 913 | 23.94 | 13 | 18.8 |
| 915 | 25.58 | 13 | 30.7 |
| 920 | 23.89 | 13 | 27.8 |
| 923 | 26.0 | 13 | 19.7 |

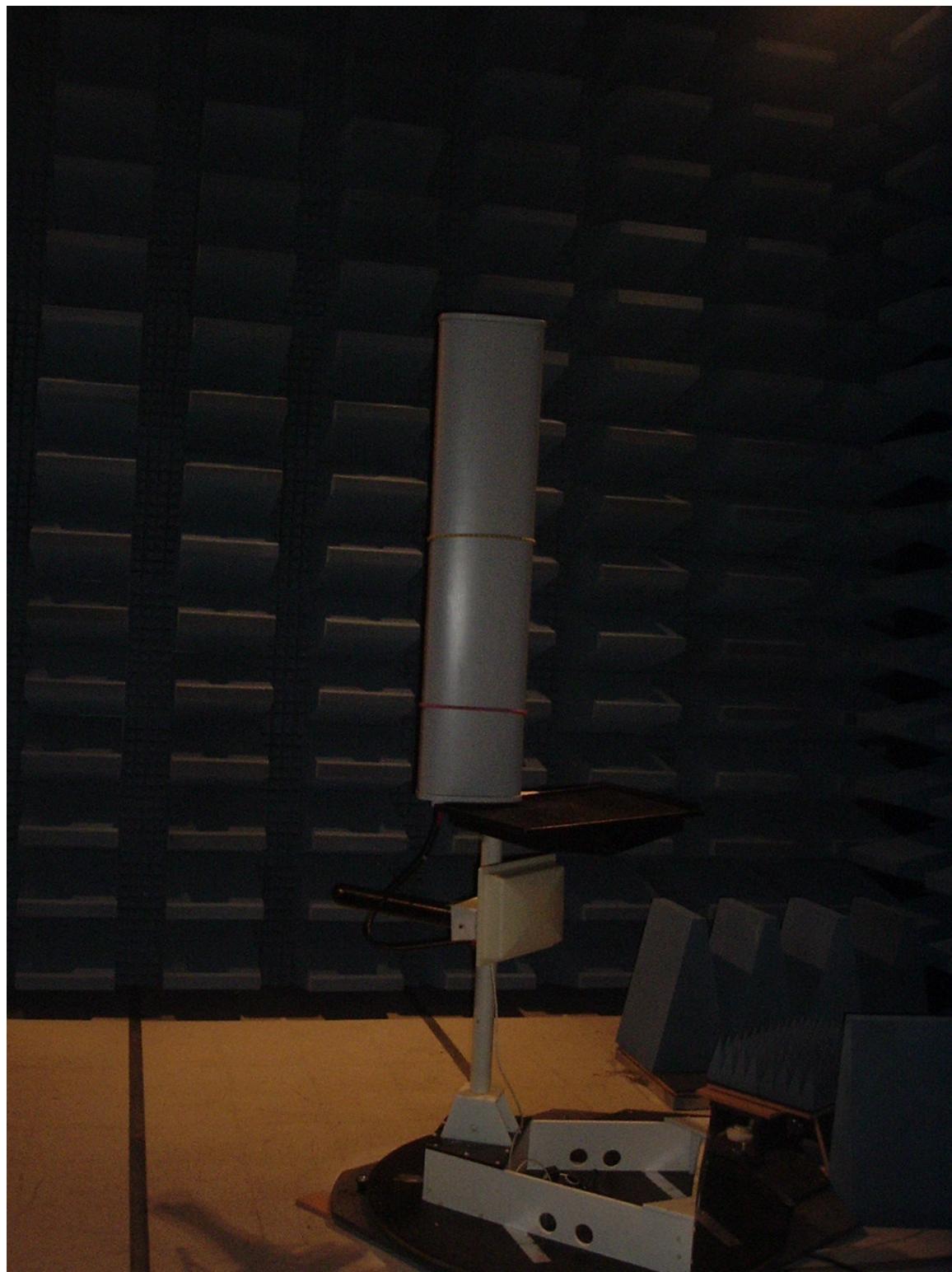
As shown above, the minimum distance where the MPE limit is reached is 30.7 cm for the EUT.

10.0 Test Photos

10.1 12 dBi Vertical Omni antenna



10.2 13 dBi Vertical Sector antenna



10.3 Conducted Emissions Setup

