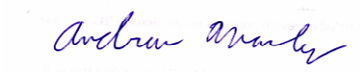
Tranzeo EMC Labs Inc.
19473 Fraser Way
Pitt Meadows, B.C.
V3Y 2V4

TR-6000
2.4 GHz Wireless Network Adapter
EMC Test Report

7 November 2005

Report Number: TRL071105.1

Bruce Balston, EMC Engineer



Andrew Marles, Technical Writer

Revision History

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1.0 General Information

1.1 EUT Description

Product Name	Wireless Access Point
Company Name	Tranzeo Wireless Technologies inc.
FCC ID	QRF-24DTS-CM9
Model No.	TR-6015; TR-6019
Frequency Range	2400-2483.5 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 2.4 GHz AP Build 19
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:

Manufacterer	Model No.	Serial No.
Tranzeo Wireless	TR-6015	TR-6000-CM9-EUT1
Tranzeo Wireless	TR-6019	TR-6000-CM9-EUT2
Tranzeo Wireless	TR-6000-N	TR-6000-CM9-EUT3

Frequency of each channel:

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

Three products, the TR-6015, TR-6019 and TR-6000-N are a product family. They are functionally identical except for the following:

1) The TR-6015 is fitted with a 15 dBi gain Antenna.
2) The TR-6019 is fitted with a 19 dBi gain Antenna.
3) The TR-6000-N is fitted with a standard Type N antenna connector.

As an IEEE 802.11b compliant wireless bridge, this device includes a 2.4 GHz receive function and a 2.4 GHz 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-6000 series is a wireless network bridge designed specifically for outdoor applications. The device provides a bridge between IEEE802.3 wired Ethernet LANs and IEEE802.11a compliant wireless networks. It uses an external antenna coupled with a 802.11a transceiver to connect to remote wireless clients. The transceiver is connected to N-female and operates in the frequency band 2400-2483.5 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 or, typically for broadband internet access.

The type of RF modulation is DSSS. The device can transmit data at a bit rate of 11 Mbps or a real-world data rate of approximately 4 Mbps. 64/128 bit Wired Equivalent Protection (WEP) algorithm is used for secure communications. The device's standard compliance ensures that it can communicate with any 802.11b network.

The firmware used with the device prevents the use of channels outside the 2400-2483.5 MHz band.

The TR-6000 series product (including the TR-6015 and TR-6019 and TR-6000-N) is used exclusively in a professionally installed, fixed point-to-point environment.

1.3 EUT Testing Configuration

Three products, the TR-6015, TR-6019 and TR-6000-N are a product family. Extensive prescanning for individual tests was performed to determine worst case. Data is presented for worst case measurements only.

The EUT is 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 is connected to the EUT via 1 meter of coaxial shielded cable. The 2nd Ethernet port is populated with 1m of cable.

The EUT was tested in the following modes:

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

2) 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 a transmit rate of 4 Mbps is specified reflecting the worst case data rate of the unit.

1.4 EUT Modifications

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

1.5 Test Facilities

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

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

FCC registration number: 960532
Industry Canada Number: 5238A

1.6 Test Equipment

Manufacturerer	Model	Description	Serial Number	Cal Due Date
Hewlett Packard	85650A	Quasi Peak Adapter	2043A00187	13-Aug-06
Hewlett Packard	8566B	Spectrum Analyzer	2637A04169	7-Feb-06
Hewlett Packard	85685A	Preselector	3010A1095	7-Feb-06
Sunol Sciences	SM46C	Turntable	051204-2	N/R
Sunol Sciences	Custom	Mast Motor	TREML0001	N/R
Sunol Sciences	JB3	Antenna	A042004	05-May-06
Sunol Sciences	DRH-118	Antenna	A052804	02-Jun-06
FCC	FCC-LISN-50-25-2	LISN	105	02-Jun-06
Wavetek	8501	Power Meter	45-00218	27-Jul-06
Wavetek	17266	Power Detector	1509315	27-Jul-06
Hewlett Packard	11970A	Harmonic Mixer	2332A00886	N/R
Hewlett Packard	11975A	Amplifier	2517A00949	N/R
Rohde & Schwarz	FSP40	Spectrum Analyzer	100184	24-Aug-2006
Rohde & Schwarz	NRP	Power Meter	100055	02-Aug-2006

1.7 Test System Details

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

Manufacturer	Model	Description	S/N
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	50m
Cat 5 LAN	DC Block to Ethernet switch	2m
Cat 5 LAN	Populate 2nd Eth port	1m

1.8 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 30MHz 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

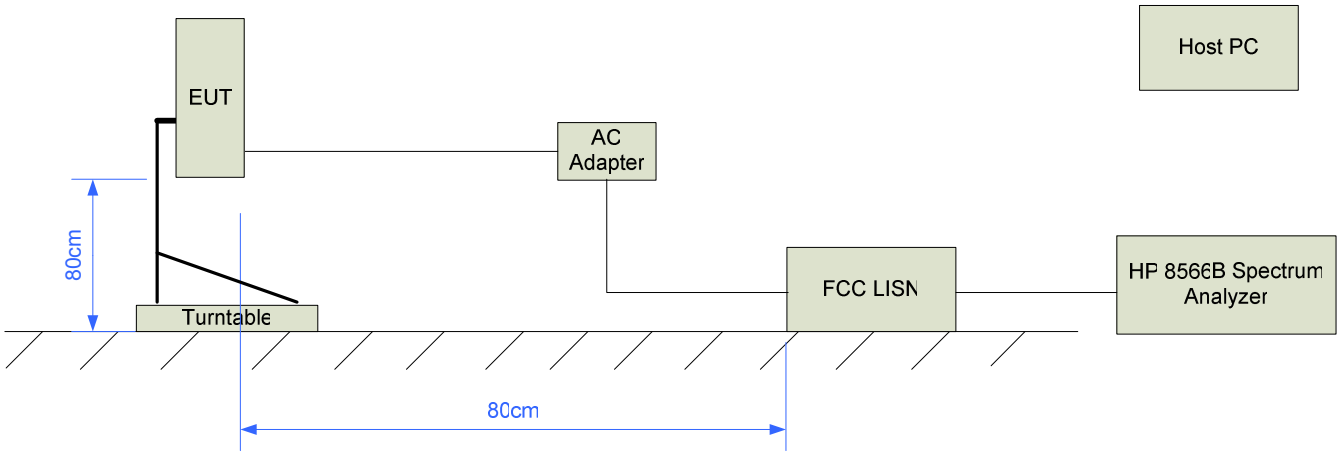
requency (MHz)	**Maximum Level (dBuV) Quasi-Peak**	**Maximum Level (dBuV) Average**
0.15-0.50	66-56 (Log Delta)	56-46 (Log Delta)
0.50-5.00	56	46
5.00-30.0	60	50

2.3 Test Setup

Both samples were scanned in all modes. Testing was performed over the frequency range of 0.15 MHz to 30 MHz. Only worst case data is shown below.

The unit was exercised using bandwidth test software at a rate of 4 Mbps representing the worst case data rate. Testing was performed using channels 1, 6 and 11. Only data from the worst case TR-6019 is shown below.

2.3.1 Test Setup Block Diagram



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

2.4 Test Results

2.4.1 Test Data

EUT - Line

Frequency (MHz)	Reading (dBµV)	Correction (dB)	Corr Reading (dBµV)	Limit (dBµV)	Margin (dBµV)	Polarity	Reading type	Result
0.151	56.6	2.0	58.6	65.9	-7.3	Line	QP	PASS
0.154	62.4	2.0	64.4	65.8	-1.4	Line	Peak	PASS
0.167	19.7	2.0	21.7	55.1	-33.4	Line	Ave	PASS
0.171	62.4	2.0	64.4	64.9	-0.5	Line	Peak	PASS
0.172	56.6	2.0	58.6	64.9	-6.3	Line	QP	PASS
0.173	23.2	2.0	25.2	54.8	-29.6	Line	Ave	PASS
0.199	61.8	1.0	62.8	63.7	-0.9	Line	QP	PASS
0.199	61.9	1.0	62.9	63.7	-0.8	Line	QP	PASS
0.200	25.6	2.0	27.6	53.6	-26.0	Line	Ave	PASS
0.235	55.7	2.0	57.7	62.3	-4.6	Line	QP	PASS
0.235	60.0	2.0	62.0	62.3	-0.3	Line	Peak	PASS
0.238	22.4	2.0	24.4	52.2	-27.8	Line	Ave	PASS
0.390	45.6	2.0	47.6	48.1	-0.5	Line	QP	PASS
0.390	51.4	2.0	53.4	58.1	-4.7	Line	Peak	PASS
0.403	9.4	2.0	11.4	47.8	-36.4	Line	Ave	PASS
0.493	44.8	2.0	46.8	56.1	-9.3	Line	QP	PASS
0.495	10.5	2.0	12.5	46.1	-33.6	Line	Ave	PASS
0.499	51.0	2.0	53.0	56.0	-3.0	Line	Peak	PASS
0.593	-3.4	2.0	-1.4	46.0	-47.4	Line	Ave	PASS
0.695	0.1	2.0	2.1	46.0	-43.9	Line	Ave	PASS
0.987	-16.4	2.0	-14.4	46.0	-60.4	Line	Ave	PASS

EUT – Neutral

Frequency (MHz)	Reading (dBµV)	Correction (dB)	Corr Reading (dBµV)	Limit (dBµV)	Margin (dBµV)	Polarity	Reading type	Result
0.158	61.2	2.0	63.2	65.6	7.6	Neutral	QP	Black
0.166	9.9	2.0	11.9	55.2	-43.3	Neutral	Ave	Black
0.178	59.6	2.0	61.6	64.6	7.0	Neutral	QP	Black
0.189	-60.0	2.0	-58.0	54.1	-112.1	Neutral	Ave	Black
0.206	57.2	2.0	59.2	63.4	5.8	Neutral	QP	Black
0.212	17.9	2.0	19.9	53.1	-33.2	Neutral	Ave	Black
0.222	55.1	2.0	57.1	62.8	4.3	Neutral	QP	Black
0.237	11.9	2.0	13.9	52.2	-38.3	Neutral	Ave	Black
0.244	15.3	2.0	17.3	52.0	-34.7	Neutral	Ave	Black
0.252	55.0	2.0	57.0	61.7	5.3	Neutral	QP	Black
0.321	13.4	2.0	15.4	49.7	-34.3	Neutral	Ave	Black
0.327	50.0	2.0	52.0	59.5	2.5	Neutral	QP	Black
0.402	47.1	2.0	49.1	57.8	1.3	Neutral	QP	Black
0.408	10.9	2.0	12.9	47.7	-34.8	Neutral	Ave	Black
0.497	47.1	2.0	49.1	56.1	3.0	Neutral	QP	Black
0.498	11.0	2.0	13.0	46.0	-33.0	Neutral	Ave	Black
0.542	13.2	2.0	15.2	46.0	-30.8	Neutral	Ave	Black
0.549	45.4	2.0	47.4	56.0	1.4	Neutral	QP	Black
1.994	49.1	2.0	51.1	56.0	5.1	Neutral	QP	Black
2.007	-60.0	2.0	-58.0	46.0	-104.0	Neutral	Ave	Black
3.000	-60.0	2.0	-58.0	46.0	-104.0	Neutral	Ave	Black
3.001	49.6	2.0	51.6	56.0	5.6	Neutral	QP	Black
3.994	-60.0	2.0	-58.0	46.0	-104.0	Neutral	Ave	Black
4.001	50.3	2.0	52.3	56.0	6.3	Neutral	QP	Black
5.004	46.3	2.0	48.3	60.0	-1.7	Neutral	QP	Black
5.009	-60.0	2.0	-58.0	50.0	-108.0	Neutral	Ave	Black
6.001	44.6	2.0	46.6	60.0	-3.4	Neutral	QP	Black
7.018	41.9	2.0	43.9	60.0	-6.1	Neutral	QP	Black
8.000	41.4	2.0	43.4	60.0	-6.6	Neutral	QP	Black
8.987	36.1	2.0	38.1	60.0	-11.9	Neutral	QP	Black
10.013	34.5	2.0	36.5	60.0	-13.5	Neutral	QP	Black
15.002	32.8	2.0	34.8	60.0	-15.2	Neutral	QP	Black
23.647	13.6	2.0	15.6	60.0	-34.4	Neutral	QP	Black

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 one 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

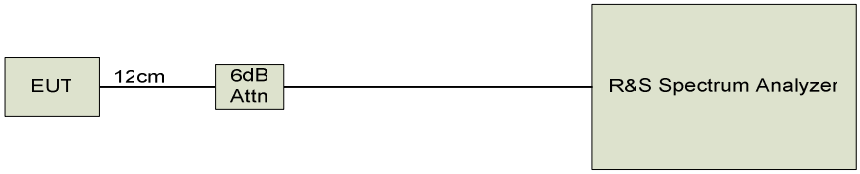
When used exclusively for fixed, point-to-point operations in the 2400-2483.5 MHz band, the intentional radiator may employ transmitting antennas with directional gain greater than 6 dBi by reducing the maximum output power by 1 dB for every 3 dB of antenna gain beyond 6 dBi. Therefore, with a 24 dBi antenna the maximum conducted output power of the transmitter shall be no greater than 24 dBm.

3.3 Test Setup

This test is performed with a modified unit. The antenna is removed and the intentional transmitter fitted with a modified production cable. The only modification to the cable is the addition of an appropriate connector that allows a direct connection to measurement equipment. The output of the EUT is connected directly to the power meter through an attenuator. Prescans using standby (beaconing) mode and data transfer mode were performed. The worst case measurements from standby mode are shown below.

This test is performed on channels 1, 6 and 11.

3.3.1 Test Setup Block Diagram



3.4 Test Results

Channel	Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
1	2412	22.94	24	PASS
6	2437	22.40	24	PASS
11	2462	22.94	24	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.

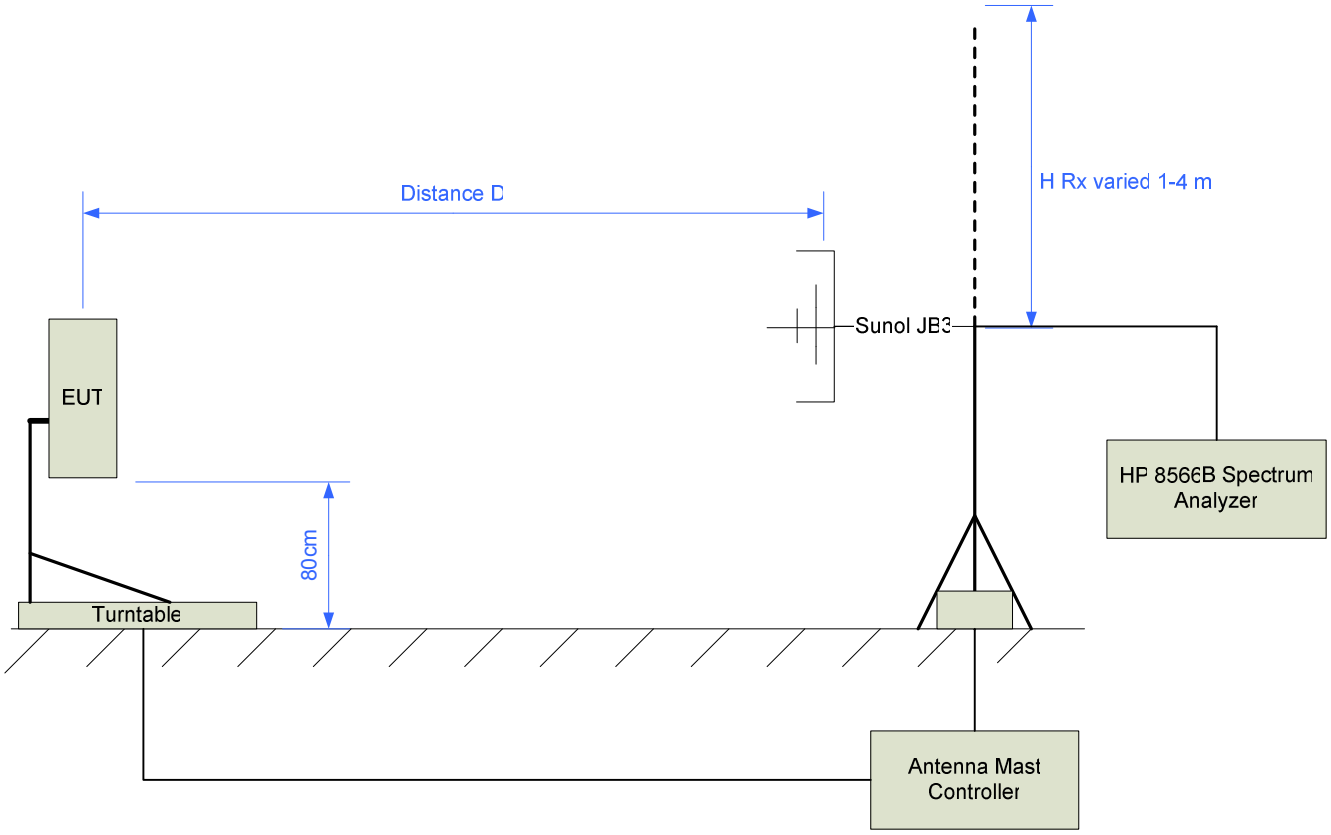
4.2 Test Limits

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

Both units, the TR-6015 and TR-6019 were tested. The TR-6000-N was tested with all antennas. Each unit was tested in both horizontal and vertical orientations. The EUT was exercised with bandwidth test software at a rate of 4 Mbps reflecting the worst case data-rate. Testing was performed on channels 1, 6 and 11. The TR-6019 was determined to be worst case. The 2nd Ethernet port is populated with 1m of cable. Only worst case data is shown below.

4.3.1 Test Setup Block Diagram



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

4.4 Test Results

Frequency (MHz)	Meter (dBuV)	Correction (dBuV)	Corr Reading (dBuV)	Limit (dBuV)	Margin (dB)	Polarization	Rtype	Result
51.300	23.5	9.3	32.8	40.0	-7.2	Vert	Peak	PASS
55.760	25.1	8.6	33.7	40.0	-6.3	Vert	Peak	PASS
118.850	19.2	15.0	34.2	43.5	-9.3	Vert	Peak	PASS
248.064	20.4	14.4	34.8	46.0	-11.2	Vert	Peak	PASS
372.117	14.5	18.0	32.5	46.0	-13.5	Vert	Peak	PASS
425.220	13.5	19.9	33.4	46.0	-12.6	Horiz	Peak	PASS
434.190	15.6	19.9	35.5	46.0	-10.5	Horiz	Peak	PASS
496.162	18.1	21.3	39.4	46.0	-6.6	Vert	Peak	PASS
525.220	11.4	21.4	32.8	46.0	-13.2	Horiz	Peak	PASS
558.186	14.6	21.9	36.5	46.0	-9.5	Vert	Peak	PASS
682.221	11.6	24.5	36.1	46.0	-9.9	Horiz	Peak	PASS
744.261	16.5	25.5	42.0	46.0	-4.0	Horiz	Peak	PASS
800.440	11.7	26.7	38.4	46.0	-7.6	Horiz	Peak	PASS
806.270	11.7	26.9	38.6	46.0	-7.4	Horiz	Peak	PASS
992.340	10.5	29.7	40.2	54.0	-13.8	Horiz	Peak	PASS

5.0 Harmonic and Spurious Emissions

5.1 Test Standard

FCC CFR 47, Part 15, Subpart B 15.247d

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

5.2 Test Limits

2400-2483.5 MHz limits:
Fundamental Limit = 137 dBuV
Harmonics and Spurious Emissions = 20 dBc
Restricted Band Emissions = AVG 54 dBuV, PK 74dBuV

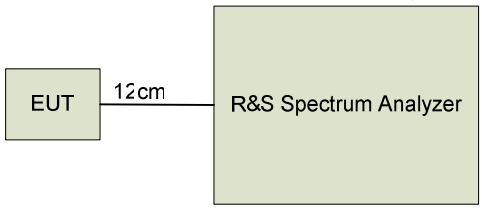
5.3 Test Setup – Spurious Emissions

This test is performed with a modified unit. The antenna is removed and the intentional transmitter fitted with a modified production cable. The only modification to the cable is the addition of an appropriate connector that allows a direct connection to measurement equipment. The output of the EUT is connected directly to the spectrum analyzer. The unit is exercised with bandwidth test software at a rate of 4 MBps reflecting the maximum possible transmit rate. This test is performed on channels 1, 6, and 11.

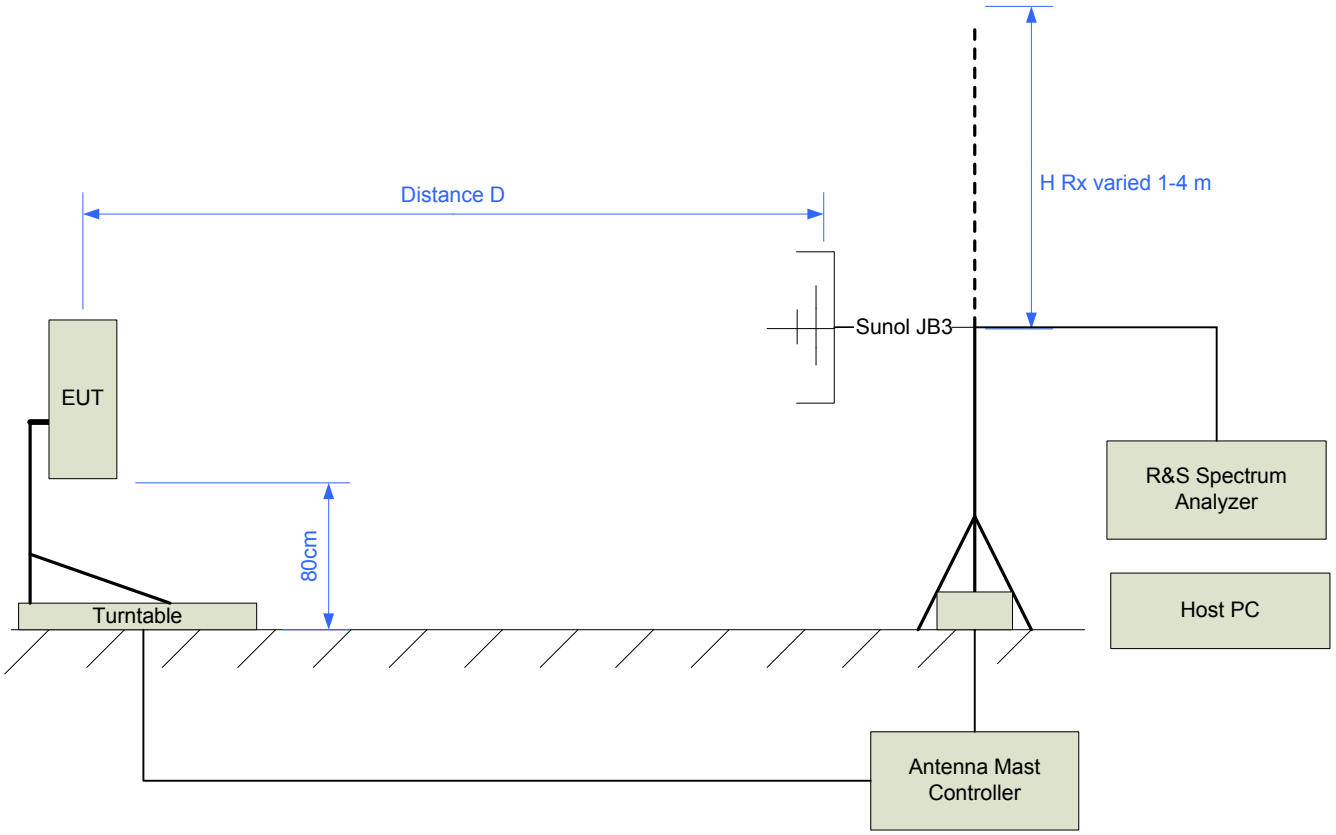
In addition to conducted measurements, extensive radiated pre-testing above 2 GHz is performed. The measurement antenna is scanned around all sides of the EUT to identify signals of interest. Additional measurements at an appropriate measurement distance are performed to ensure that emissions were at maximum. The TR-6000 with the 24 dBi antenna was determined to be worst case.

The antenna is connected to the EUT via 1 meter of coaxial shielded cable.

5.3.1 Test Setup Block Diagram – Conducted Measurements (Harmonics)

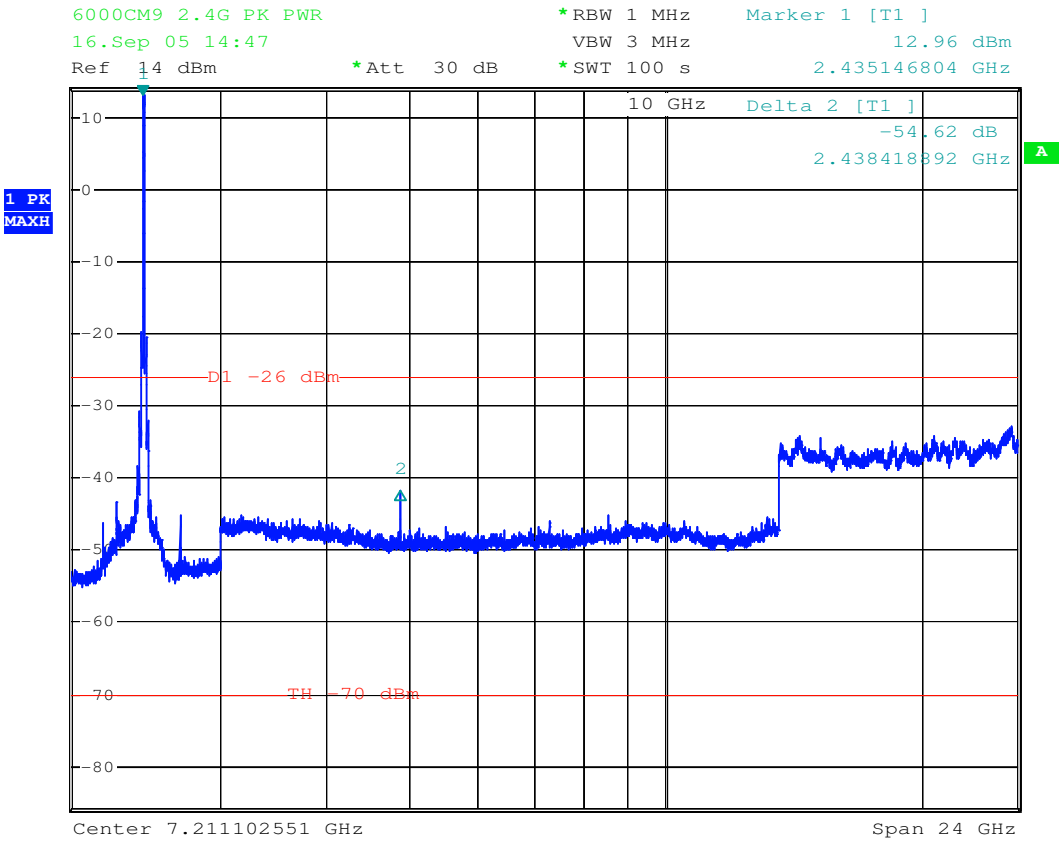


5.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



5.4 Test Results

5.4.1 Test Results 15.247–Harmonics -20 dBc



The above plot shows the worst case conducted output of the transmitter (channel 6). All conducted harmonics are at least -20 dBc

5.4.3 Test Results 15.247– Restricted Bands (Spurious Emissions)

The following data is taken from frequencies identified during radiated pre-testing at 1m. Data presented below was taken at a measurement distance of 3m. Only worst case data is shown.

Frequency (GHz)	Corr Reading (dBuV)	Limit (dBuV)	Margin (dB)	Polarization	Rtype	Result
2.1269	56.1	74.0	-17.9	Vert	Peak	PASS
2.1398	52.4	74.0	-21.6	Vert	Peak	PASS
2.1474	55.0	74.0	-19.0	Vert	Peak	PASS
2.1521	49.5	74.0	-24.5	Vert	Peak	PASS
2.2457	45.1	74.0	-29.0	Vert	Peak	PASS
2.3673	49.2	74.0	-24.8	Vert	Peak	PASS
2.3699	50.9	74.0	-23.1	Vert	Peak	PASS
2.4575	57.8	74.0	-16.2	Vert	Peak	PASS
2.6459	51.1	74.0	-22.9	Vert	Peak	PASS
2.6685	43.5	74.0	-30.5	Vert	Peak	PASS
2.9041	44.8	74.0	-29.2	Vert	Peak	PASS
3.1892	46.1	74.0	-27.9	Vert	Peak	PASS
8.6242	45.5	74.0	-28.5	Vert	Peak	PASS
10.7819	46.3	74.0	-27.7	Vert	Peak	PASS

Please note Peak-Avg duty cycle delta is **34.96 dB**, therefore only peak data is shown.

6.0 Band Edge

6.1 Test Standard

FCC CFR 47, Part 15, Subpart B 15.247d

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

6.2 Test Limits

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

6.3 Test Setup

This test was performed radiated on all units and with all antennas. The TR-6000N with the 24 dBi grid antenna was found to be worst case. Only worst case measurements are shown below.

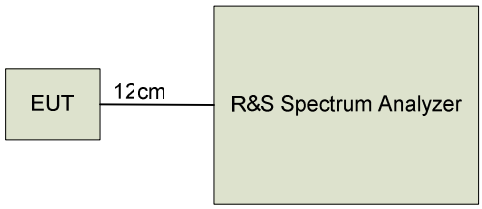
The EUT is exercised with bandwidth test software at a rate of 4 MBps reflecting the worst case transmit rate.

The antenna is connected to the EUT via 1 meter of coaxial shielded cable.

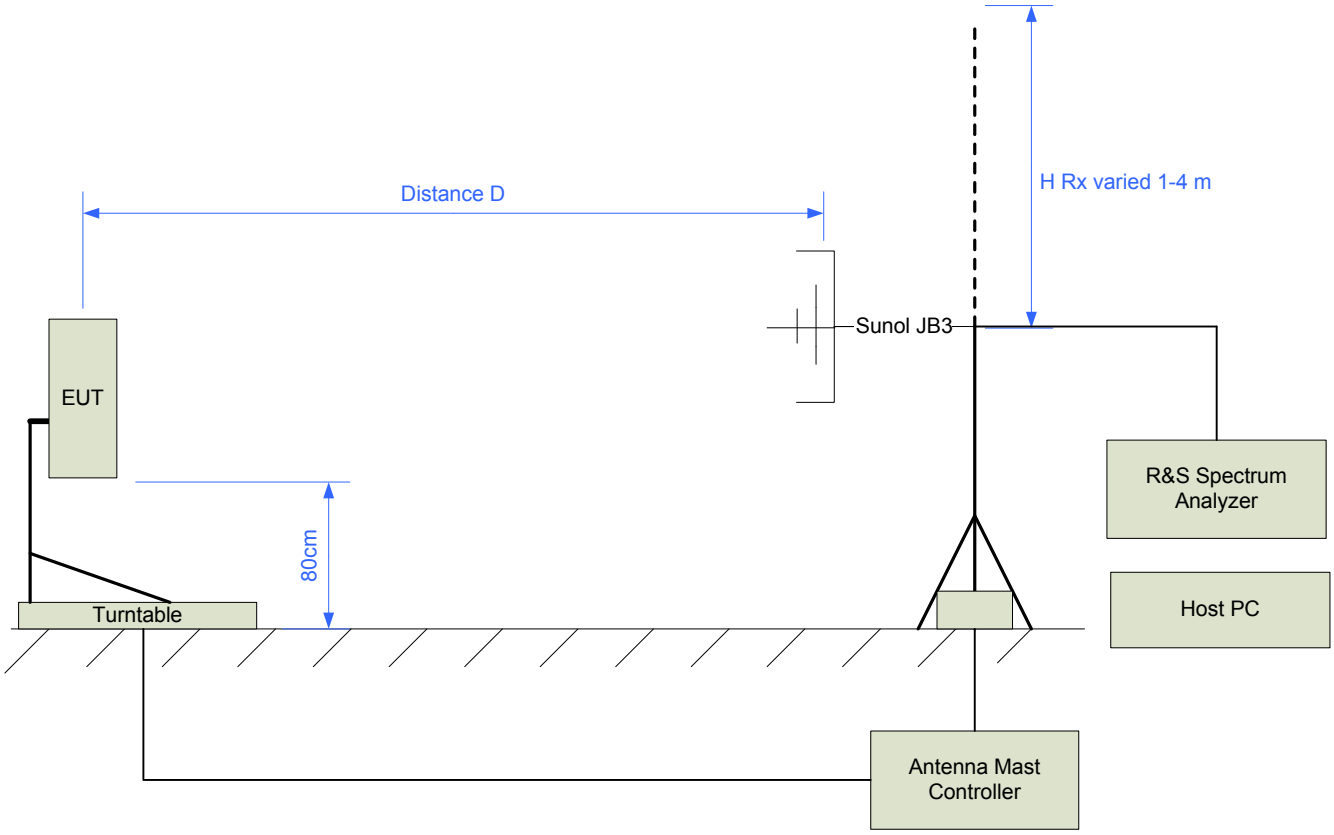
This test is performed on channels 1, and 11.

6.3.1 Test Setup Block Diagram

Conducted Setup



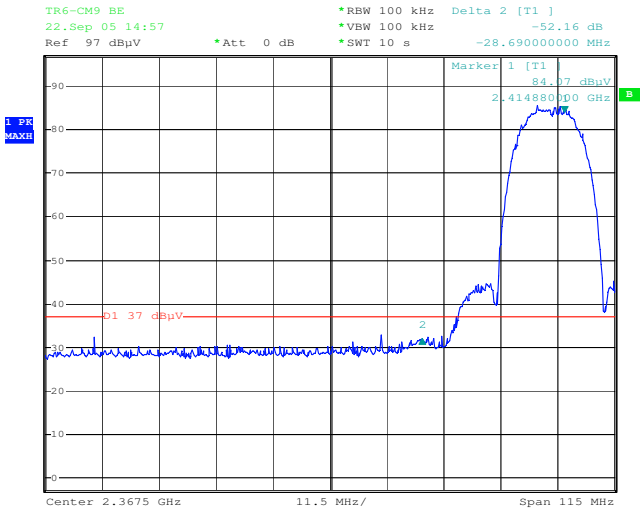
Radiated Setup

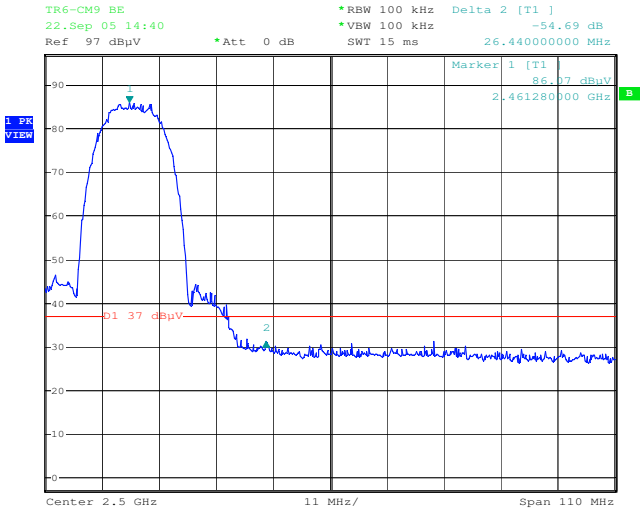


Radiated measurements are performed at a distance of 3 meters.

6.4 Test Results

This measurement is performed using the delta method. The conducted delta is measured using bandwidth settings of RBW, VBW = 100 KHz. This delta is then subtracted from the peak radiated power which is measured using settings of RBW,VBW = 1 MHz.





Test result, Channel 1

Hi Reading (dBuV)	Lo Reading (dBuV)	Delta (dB)	Peak Rdg RBW,VBW = 1 MHz (dBuV)	Low Rdg RBW,VBW = 1MHz (dBuV)	Limit (dBuV)	Margin	Result
84.07	31.91	-52.16	126.62	74.46	74.0	-0.5	PASS

Average Value (dBuV)	Limit (dBuV)	Margin	Result
39.5	54.0	-14.5	Pass

Test result, Channel 11

Hi Reading (dBuV)	Lo Reading (dBuV)	Delta (dB)	Peak Rdg RBW,VBW = 1 MHz (dBuV)	Low Rdg RBW,VBW = 1MHz (dBuV)	Limit (dBuV)	Margin	Result
86.07	31.38	-54.69	127.65	72.96	74.0	-1.0	PASS

Average Value (dBuV)	Limit (dBuV)	Margin	Result
38.0	54.0	-16.0	PASS

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

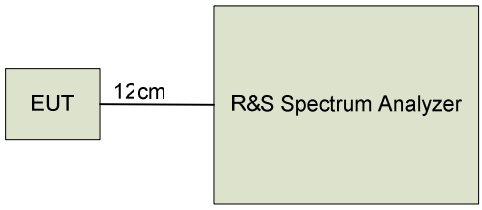
The minimum 6dB bandwidth shall be at least 500 kHz.

7.3 Test Setup

This test is performed with a modified unit. The antenna is removed and the intentional transmitter was fitted with a modified production cable. The only modification to the cable is the addition of an appropriate connector that allows a direct connection to the measurement equipment. The output of the EUT is connected directly to the spectrum analyzer through an attenuator. The unit is exercised with bandwidth test software at a rate of 4 MBps reflecting the worst case transmit rate.

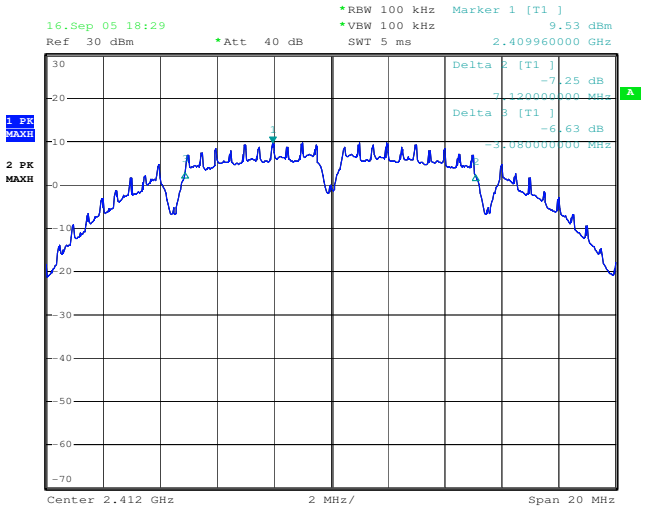
This test was performed on channels 1, 6 and 11.

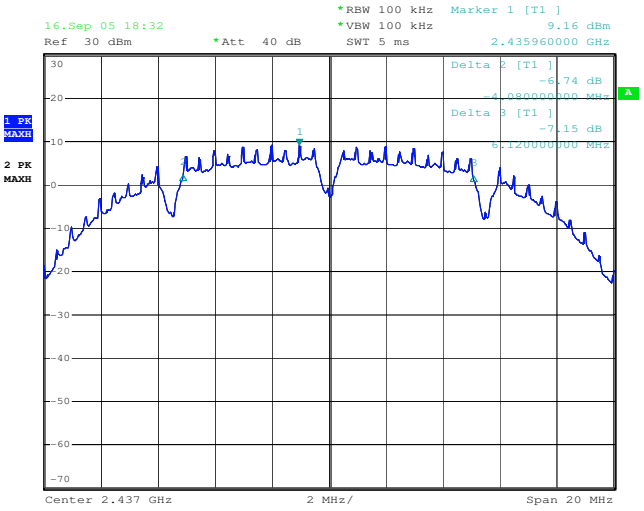
7.3.1 Test Setup Block Diagram

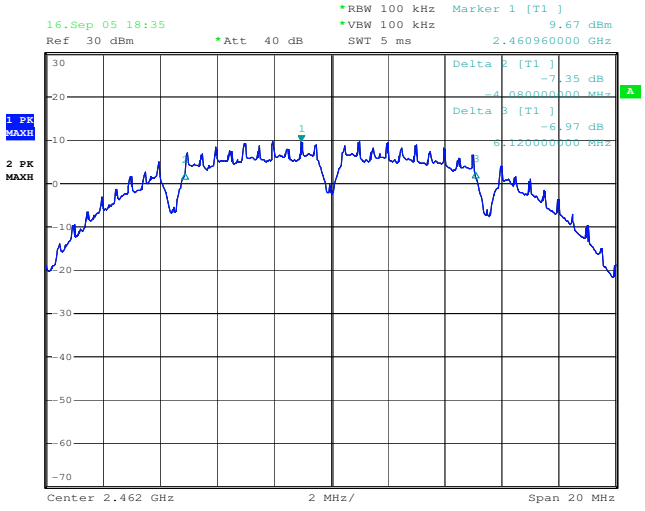


7.4 Test Results

6 dB Occupied Bandwidth







	Delta Low (MHz)	Delta High (MHz)	Occupied Bandwidth (MHz)	Result
CH 1	3.08	7.12	**10.20**	PASS
Ch 7	4.08	6.12	**10.20**	PASS
Ch 15	4.08	6.12	**10.20**	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

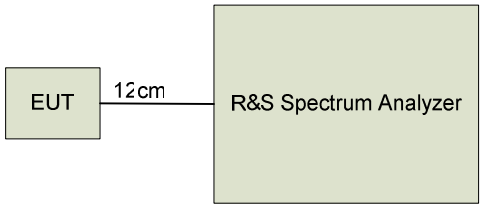
The transmitted power density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3 Test Setup

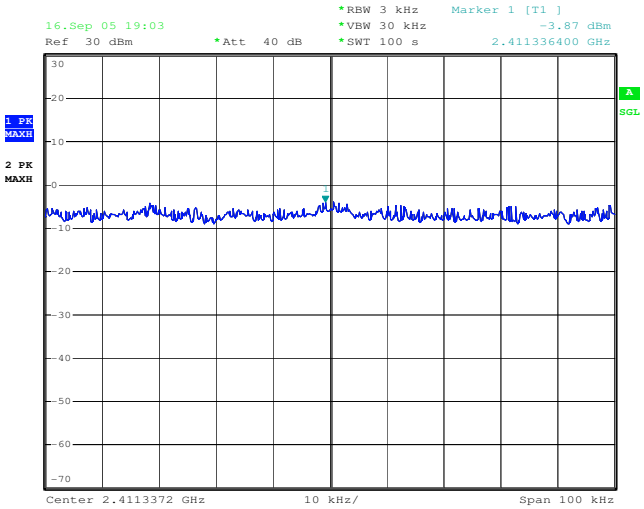
This test is performed with a modified unit. The antenna is removed and the intentional transmitter fitted with a modified production cable. The only modification to the cable is the addition of an appropriate connector that allows a direct connection to measurement equipment. The unit is exercised with bandwidth test software at a rate of 4 MBps reflecting the worst case transmit rate.

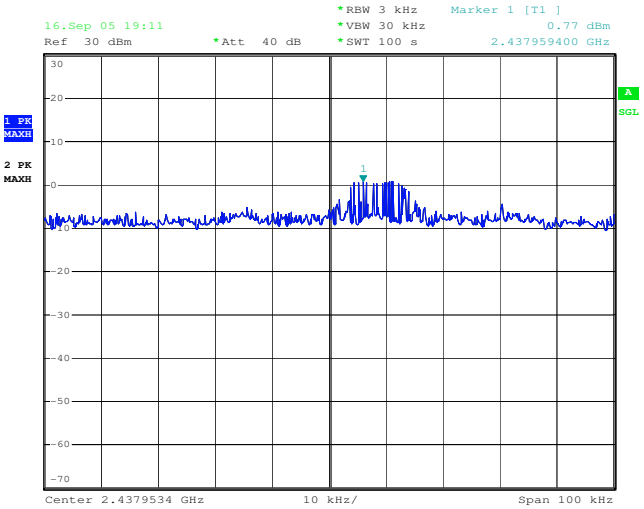
This test was performed on channels 1, 6 and 11.

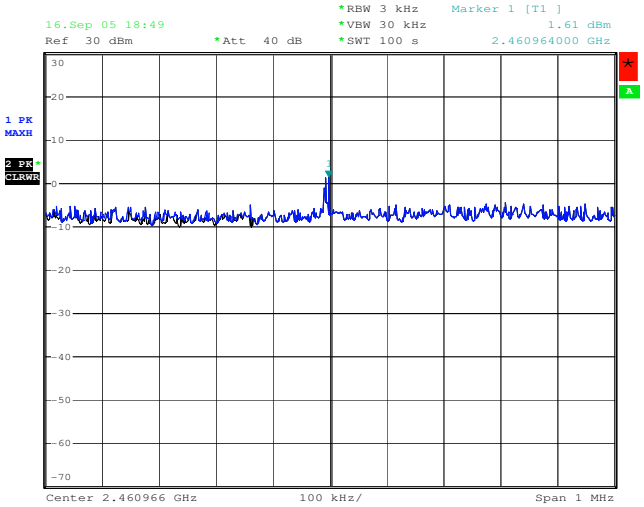
8.3.1 Test Setup Block Diagram



8.4 Test Results 15.247







Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
2411.3	-3.87	+8	PASS
2437.9	0.77	+8	PASS
2460.9	1.61	+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 Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 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 Friis Formula

Fries transmission formula: $Pd = (P_{out}*G)/(4*\pi*r^2)$ Where

Pd = power density in mW/cm^2
P_{out} = output power to antenna in mW.
G = gain of antenna in the direction of interest relative to an isotropic radiator.
R = the distance between the observation point and the center of the radiator in cm.

Pd is the limit of MPE, $1mW/cm^2$. If we know the maximum gain of the antenna and the total power input to the antenna we can calculate the distance r where the MPE limit is reached.

9.2 EUT Operating Condition

The maximum antenna gain is 24 dBi as stated by the manufacturer.

9.3 RF exposure evaluation distance calculation

EUT with 24 dBi antenna

Chan	Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
1	2412	22.94	24	62
6	2437	22.40	24	62
11	2462	22.94	24	62

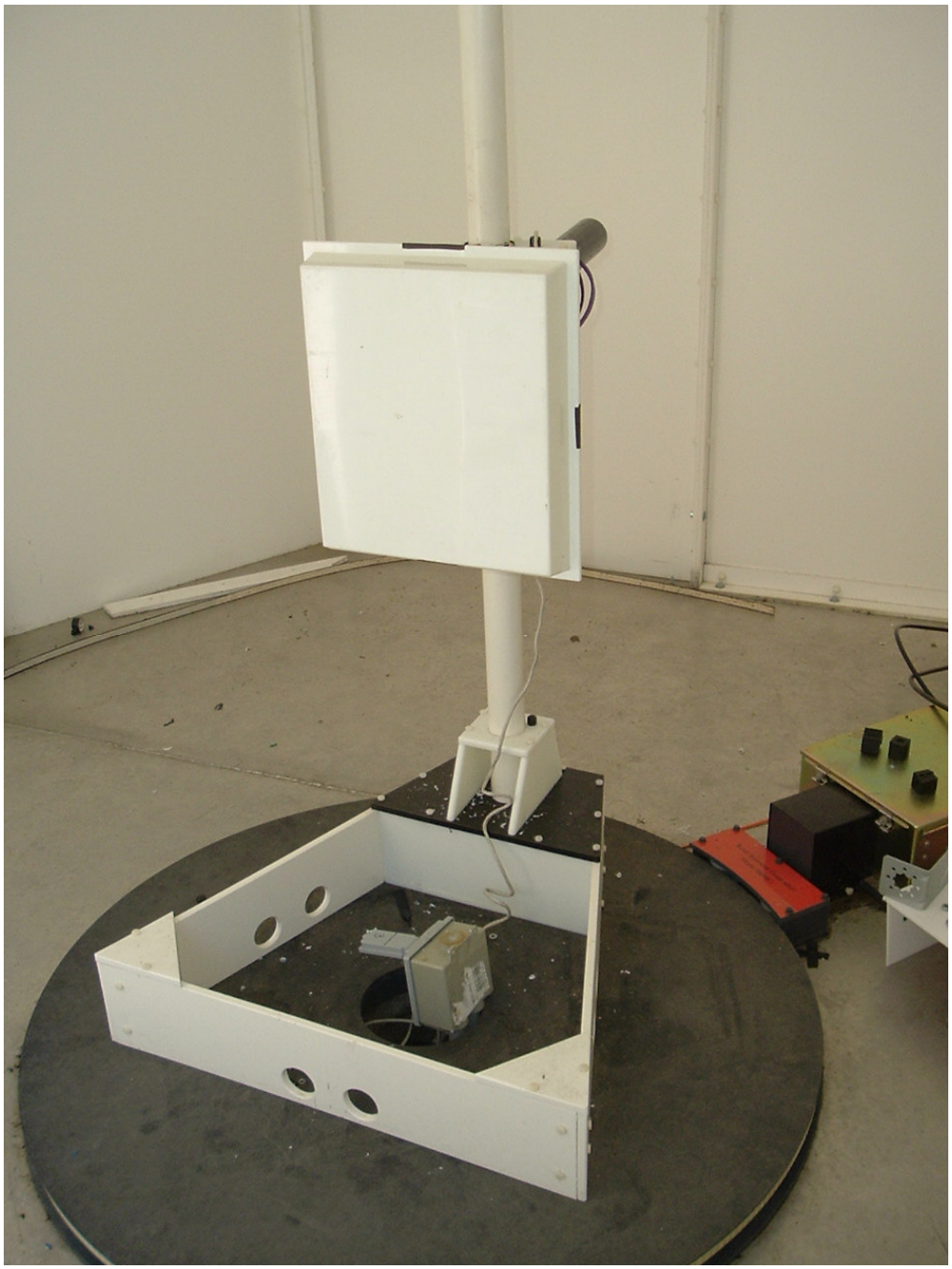
As shown above, the minimum distance where the MPE limit is reached is 62 cm for the EUT.

10.0 Test Photos

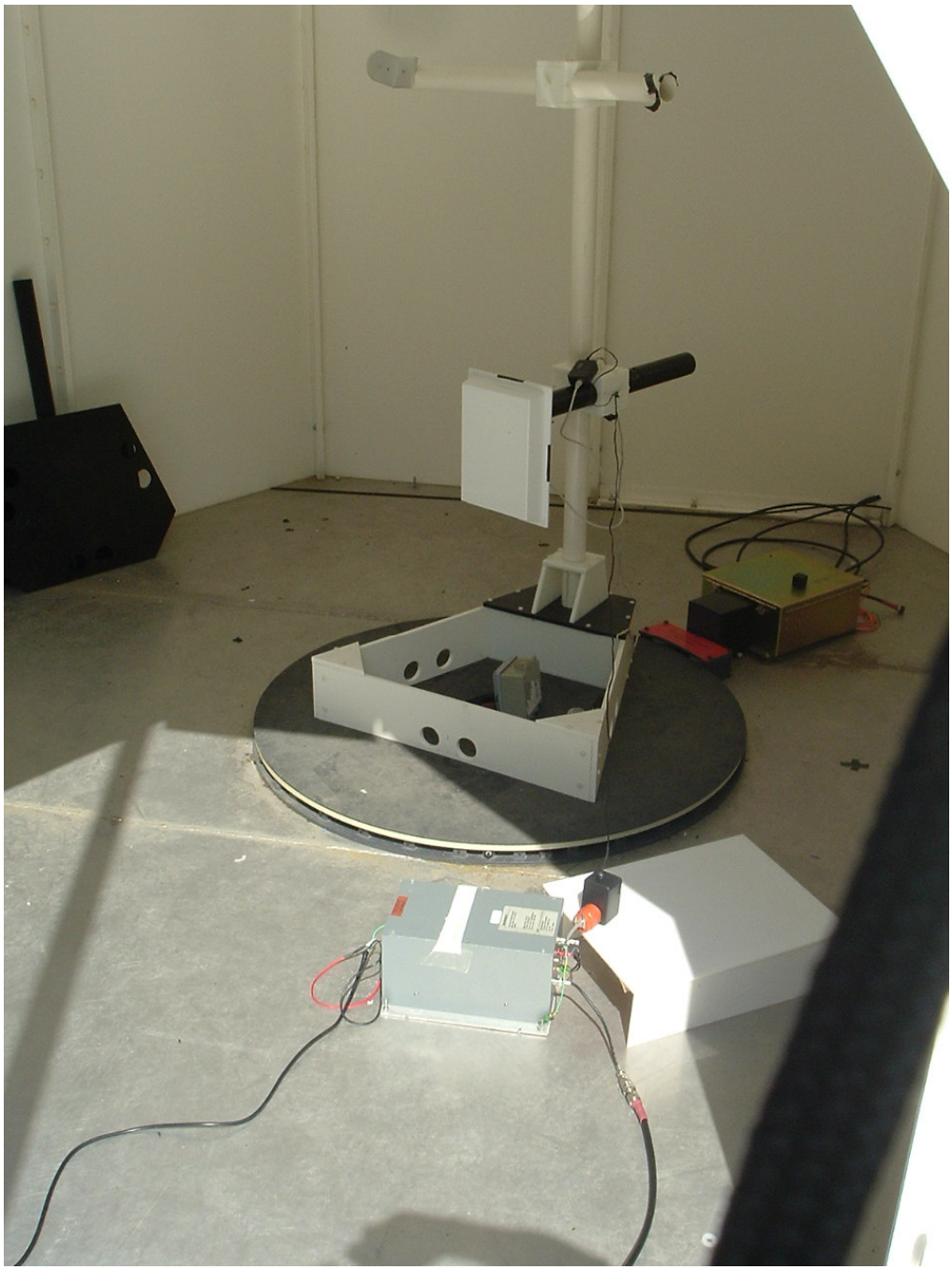
Radiated Emissions Test Setup – 12 dBi Dipole

Radiated Emissions Test Setup – 17 dBi Sector

Radiated Emissions Test Setup – 24 dBi Grid



Radiated Emissions Test Setup



Conducted Emissions Test Setup