TRANZEO
EMC LABS INC

EMC Test Report

FCCID: QRF-GNADX2NT4

Wireless Mesh Router

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: 81

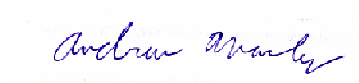
Type of test: Testing of electromagnetic disturbances characteristics

Date the EUT was received: June 14th, 2009

Date of test: June 15th, 2009 to July 6th, 2009

Report No.: 072809.1

Pitt Meadows, 7 July, 2009



EMC Manager: Andrew Marles EMC Engineer: Andrei Moldavanov

Revision History

Table of Contents

1.0 General Information

1.1 EUT Description

Product Name	Wireless Mesh Router
Company Name	Tranzeo Wireless Technologies Inc
FCC ID	QRF-GNADX2NT4
Model No.	EN500, EN505
Radio	IEEE 802.11a/b/g
Frequency Range	2400-2483.5 MHz; 5725-5850 MHz
Number of Channels	11 at 2.4GHz, 5 at 5.8 GHz
Channel Bandwidth	5, 10, and 20 MHz
Transmit Rate	54 Mbps maximum bit rate specification
Type of Modulation	2.4 GHz-DSSS, OFDM; 5.8GHz-OFDM
Antenna Type	External
Antenna Gain	2400-2483.5 MHz - 12 dBi max; 5725-5850 MHz - 32 dBi max
Product Software Revision	ENROUTETAI_20090415_05_00_0269
Test Software	Mikrotik; RS EMC32
Power Adapter	AC adapter, model PA1020-180i
	Input: 100-240V 50-60Hz, 0.4 A
	Output: DC 18 V, 1.1 A 20W max

Product samples tested:

Manufacturer	Model No.	Serial No.
Tranzeo Wireless	EN500	EN500-Eng1
Tranzeo Wireless	EN505	EN505-Eng1

Frequency of each channel:

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

5.8 GHz Frequency Band	
Channel	**Frequency,MHz**
Channel 149	5745
Channel 153	5765
Channel 157	5785
Channel 161	5805
Channel 165	5825

The EN500 and EN505 models have identical hardware platform and firmware implementation. The only difference in its name for marketing reasons.

The model mentioned above is fitted with two standard Type N connectors for use with an external antenna for each radio.

As an IEEE 802.11a/b/g compliant wireless bridge, this device includes a 2.4 and 5.8 GHz receive function as well as a 2.4 and 5.8 GHz digital modulation transmit function. There are no user serviceable parts inside the unit. It is factory sealed in a one-time use manner and inaccessible to the end user.

The tests were performed on production sample models 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 mesh router designed specifically for wireless mesh networks. The device has two radios, an 802.11a/b/g mesh backhaul radio and an access point radio for 802.11a/b/g client devices. It uses two external antennas, one for each radio. The transceivers operate in the frequency bands 2400-2483.5 and 5725-5850 MHz. The device transmits digital network data. The unit is mounted in fixed point-to-point installations. The device can be used to create either a stand alone or an internet extension network.

The type of RF modulation is DSSS and OFDM. Both DSSS and OFDM are used at 2.4 GHz while at 5.8 GHz only the OFDM is used. The device can transmit data at a bit rate of 11 Mbps in DSSS mode and 54 Mbps in OFDM mode or a real-world data rate of approximately 6.3 and 28.7 Mbps, respectively. The device's standard compliance ensures that it can communicate with any 802.11a/b/g network. An access point radio for secure communications uses WEP/WPA/WPA2 (PSK w/TKIP, EAP-TLS, EAP-PEAP TLS, EAP-PEAP MSChap/v2, EAP-TTLS) algorithms, whereas a mesh radio uses AES128 encryption and MAC address filtering.

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 EN500 model fitted with an external antenna was tested.

The device fitted with two standard Type N connectors was tested with the highest gain antenna of each type. Data is presented for the worst case configuration.

The EUT was mounted to a custom metallic stand to best represent a typical user installation. The EUT was connected to the host PC so that it could be cycled through the various test modes and channels.

The EUT was tested in the following modes:

- **Standby/Receive mode:** In this mode the EUT beacons at the lowest possible rate while searching for a client with which to establish communication.
- **Data transfer mode:** In this mode the EUT is exercised with commercially available bandwidth test software. A link is established between two PCs through the unit and an access point and data is transmitted at the highest possible rate.
- **Beaconing Mode:** In this mode the EUT is set to transmit network configuration beacons at the highest possible rate.

1.4 EUT Antennas

The EUT was tested with the following external antennas:

2.4 GHz Antennas	
TR-OD-24-7.5 SA24-90-9	7.5 dBi Vertical Omni 9 dBi Vertical Sector
TR-OD24-12	12 dBi Vertical Omni
5.8 GHz Antennas	
TR-HTQ-5.8-10 TR-HTQ-5.8-12 TR-58V-60-17 TR-5X-Ant-24 TR-GD58-26	10.5 dBi Vertical Omni 12 dBi Vertical Omni 17 dBi Vertical Sector 24 dBi Panel 26 dBi Grid Parabolic dish
TR-5.8-32Db-Ant	32 dBi Parabolic dish

1.5 EUT Modifications

No modifications were necessary for this unit to comply with FCC CFR 47 Part 15, Part 2, as well as with Industry Canada RSS-Gen, Issue 2, 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 No.	Cal Due Date
ETS-Lindgren	2165	Turntable	00043883	N/R
ETS-Lindgren	2175	Mast Motor	00077487	N/R
ETS-Lindgren	1030	Chamber	S2014X7LH	N/A
Sunol Sciences	JB3	Antenna	A042004	02-Nov-2008
Sunol Sciences	DRH-118	Antenna	A052804	02-Dec-2008
Com-Power	LI-115	LISN	241037	30-Oct-2008
Rohde & Schwarz	FSP40	Spectrum Analyzer	100184	24-Aug-2009
Rohde & Schwarz	NRP	Power Meter	100055	02-Aug-2009
Rohde & Schwarz	ESU40	EMI Receiver	100011	29-Mar-2009
Rohde & Schwarz	ESCI	EMI Receiver	100123	02-Nov-2008
TestEQUITY	140	Temperature chamber	140191	N/R

1.8 Test System Details

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

Manufacturer	Model	Description	Serial No.
Soyo	PW-930S	Laptop PC	6188
Pheenet	SW-05P	5 port switch	C0104260954
Tranzeo	POE-1	DC injection unit	n/a

Signal Cable Type	Signal Cable Description	Length
Cat 5 LAN	EUT to DC injection unit	50 m
Cat 5 LAN	DC injection unit to Ethernet switch	2 m
Cat 5 LAN	Populate 2nd Ethernet port	1 m

1.9 Test Results

The EUT complies with the FCC CFR 47 Part 15, Part 2, and Part 90, as well as with Industry Canada RSS-Gen, Issue 2, RSS-210 Issue 7, and RSS-111, Issue 3.

2.0 Conducted Emissions

2.1 Test Standard

FCC Part 15, Subpart C, Section 15.207a.

| a) Except as shown in Paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges. |

2.2 Test Limits

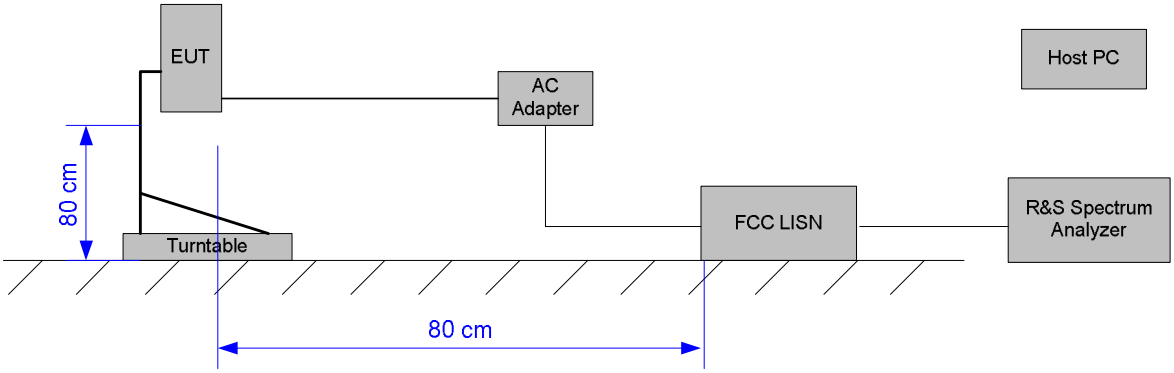
Frequency (MHz)	Maximum Level (dBuV) Quasi-Peak	Maximum Level (dBuV) Average
0.15-0.50	66-56 (Log Delta)	56-46 (Log Delta)
0.50-5.00	56	46
5.00-30.0	60	50

2.3 Test Setup

The EN500 model was tested. The access point and backhaul radios were exercised using data transmission mode at the highest possible transmit rate. The test is performed at low, middle and high channels and in 5, 10, and 20 MHz bandwidths for 2.4 and 5.8 GHz frequency band. The OFDM and DSSS modulation types were tested where applicable. Only worst case data is shown below.

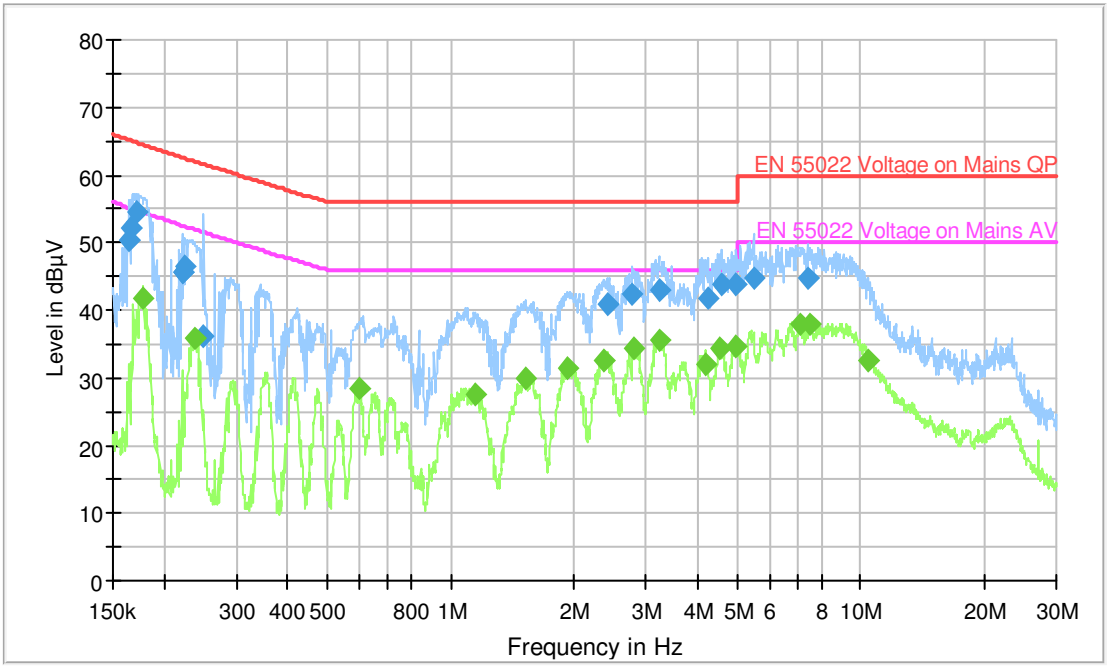
Note: For testing purposes only, to ensure worst case performance in all testing configurations, the radio is configured to transmit at the maximum possible RF power.

2.3.1 Test Setup Block Diagram



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

2.4 Test Results



2.4.1 Test Data Peak Detector

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.164440	50.5	1000.00	9.000	On	L1	-0.2	14.7	65.2
0.166091	52.2	1000.00	9.000	On	L1	-0.2	12.9	65.1
0.171486	54.6	1000.00	9.000	On	L1	-0.2	10.2	64.8
0.221461	45.6	1000.00	9.000	On	L1	-0.1	17.0	62.6
0.223238	45.6	1000.00	9.000	On	L1	-0.1	16.9	62.5
0.225479	46.4	1000.00	9.000	On	L1	-0.1	16.0	62.4
0.250166	36.1	1000.00	9.000	On	L1	-0.1	25.5	61.6
2.401534	41.0	1000.00	9.000	On	L1	-0.1	15.0	56.0
2.778641	42.4	1000.00	9.000	On	L1	-0.1	13.6	56.0
3.221394	43.1	1000.00	9.000	On	L1	-0.1	12.9	56.0
4.235666	41.7	1000.00	9.000	On	L1	-0.1	14.3	56.0
4.597251	43.9	1000.00	9.000	On	L1	-0.1	12.1	56.0
4.979745	44.0	1000.00	9.000	On	L1	-0.1	12.0	56.0
5.459116	44.9	1000.00	9.000	On	L1	-0.1	15.1	60.0
7.396325	44.9	1000.00	9.000	On	L1	-0.2	15.1	60.0

2.4.2 Test Data Average Detector

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.177057	41.8	1000.00	9.000	On	L1	-0.2	12.7	54.5
0.237028	35.9	1000.00	9.000	On	L1	-0.1	16.1	52.0
0.596605	28.5	1000.00	9.000	On	L1	0.0	17.5	46.0
1.153546	27.6	1000.00	9.000	On	L1	0.0	18.4	46.0
1.519779	30.1	1000.00	9.000	On	L1	0.0	15.9	46.0
1.935418	31.4	1000.00	9.000	On	L1	0.0	14.6	46.0
2.349329	32.6	1000.00	9.000	On	L1	-0.1	13.4	46.0
2.800937	34.3	1000.00	9.000	On	L1	-0.1	11.7	46.0
3.221394	35.4	1000.00	9.000	On	L1	-0.1	10.6	46.0
4.176838	32.0	1000.00	9.000	On	L1	-0.1	14.0	46.0
4.551553	34.4	1000.00	9.000	On	L1	-0.1	11.6	46.0
4.979745	34.7	1000.00	9.000	On	L1	-0.1	11.3	46.0
7.106595	38.0	1000.00	9.000	On	L1	-0.2	12.0	50.0
7.485526	37.8	1000.00	9.000	On	L1	-0.2	12.2	50.0
10.450373	32.6	1000.00	9.000	On	L1	-0.3	17.4	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.

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 appropriate antenna port of the EUT.

The EN500 model was tested The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 5, 10, and 20 MHz bandwidths for 2.4 and 5.8 GHz frequency band. Power is measured using the channel power measurement feature of the spectrum analyzer. Only worst case data is shown below.

3.3.1 Test Setup Block Diagram

3.4 Test Results

3.4.1 2.4 GHz frequency band

Channel	Frequency,(MHz	Bandwidth, MHz	Measurement (dBm)	Limit (dBm)	Result
1	2412	5	17.50	30	PASS
		10	17.20		PASS
		20	17.92		PASS
6	2437		21.45		PASS
11	2462		17.74		PASS

3.4.2 5.8 GHz frequency band

Channel	Frequency,(MHz	Bandwidth, MHz	Measurement (dBm)	Limit (dBm)	Result
149	5745	5	21.75	30	PASS
150	5750	10	21.82		PASS
149	5745	20	22.00		PASS
157	5785		21.53		PASS
165	5825		21.61		PASS

4.0 Radiated Emissions, General Requirements

4.1 Test Standard

FCC Part 15, Subpart C, Section 15.209, Radiated Emission Limits, General Requirements.

15.209(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

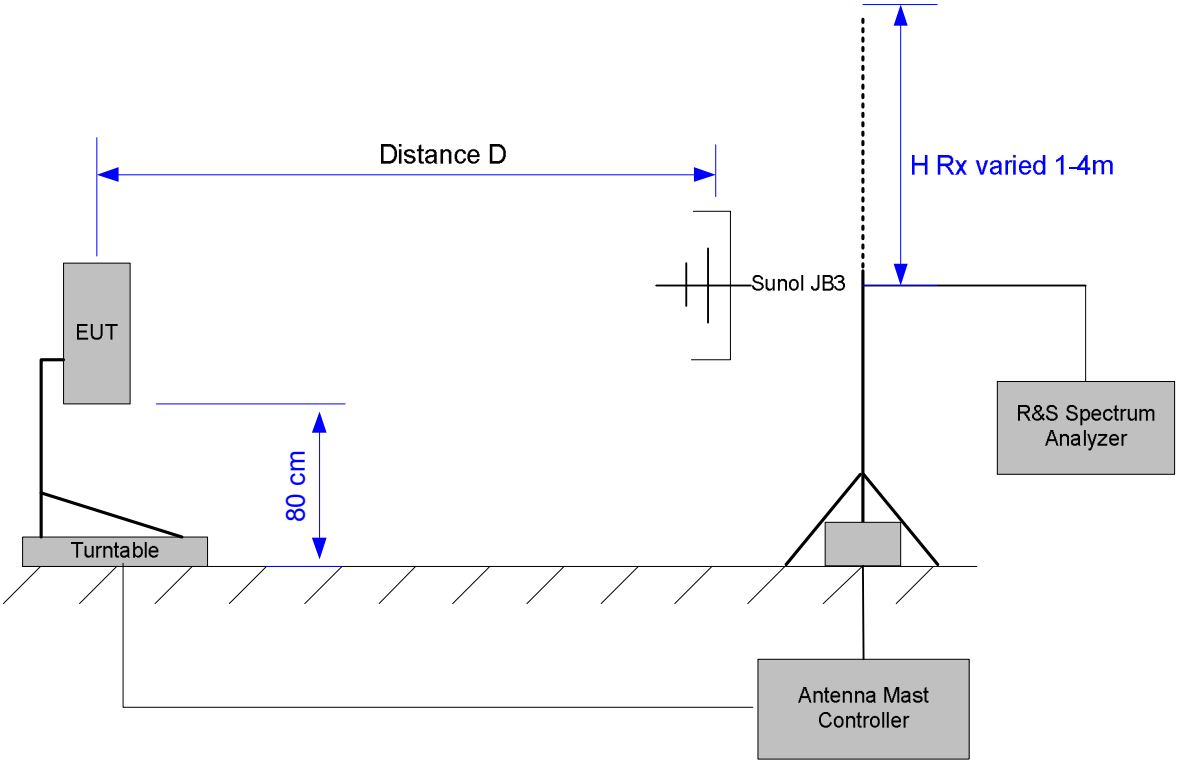
Frequency (MHz)	Maximum Field Strength (uV/m @ 3m)	Maximum Field Strength (dBuV/m @ 3m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-1000	500	54.0

4.3 Test Setup

The EN500 model was tested The EUT was tested when the radios were exercised in 2.4 and 5.8 GHz bands using data transfer mode at the highest possible transmit rate. The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 5, 10, and 20 MHz. Only worst case data is shown below.

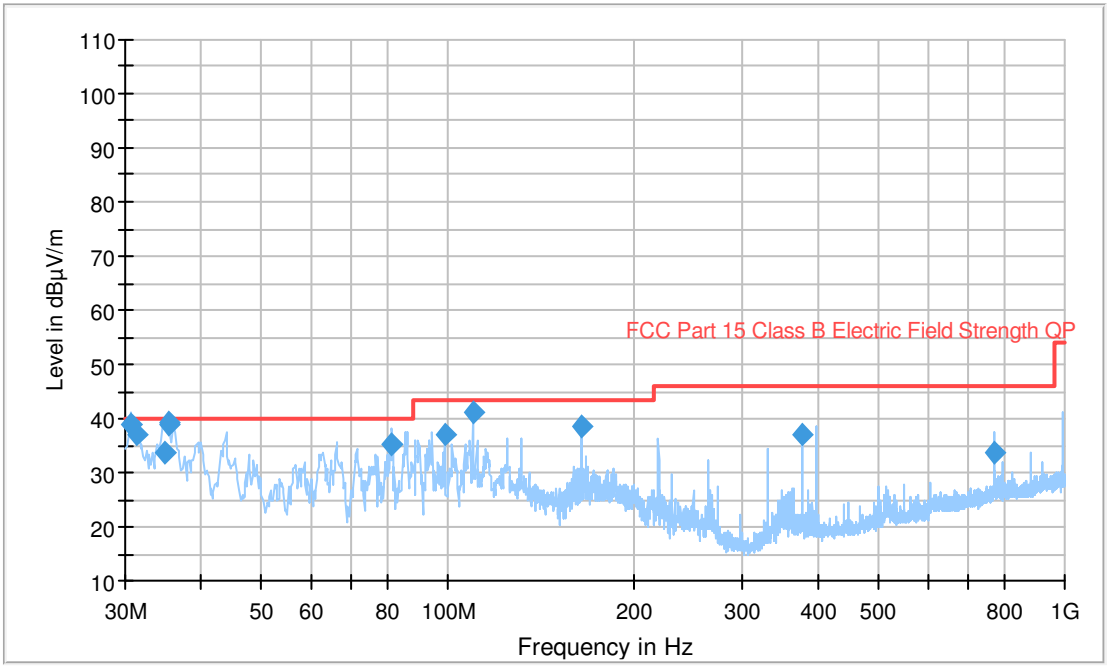
Note: For testing purposes only, to ensure worst case performance in all testing configurations, the radio is configured to transmit at the maximum possible RF power.

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.348400	39.1	1000.00	100.000	100.0	V	72.0	17.1	0.90	40.00
35.353440	39.0	1000.00	100.000	100.0	V	118.0	17.0	1.00	40.00
30.623387	38.8	1000.00	100.000	100.0	V	340.0	20.6	1.20	40.00
109.981520	41.1	1000.00	100.000	100.0	V	119.0	13.3	2.40	43.50
31.399520	37.0	1000.00	100.000	100.0	V	340.0	19.9	3.00	40.00
81.193920	35.2	1000.00	100.000	100.0	V	82.0	8.9	4.80	40.00
164.984640	38.6	1000.00	100.000	100.0	V	140.0	13.3	4.90	43.50
34.847680	33.8	1000.00	100.000	100.0	V	70.0	17.4	6.20	40.00
98.978480	37.0	1000.00	100.000	100.0	V	90.0	11.1	6.50	43.50
374.989360	37.2	1000.00	100.000	210.0	V	270.0	16.6	8.80	46.00
769.985440	33.7	1000.00	100.000	100.0	H	273.0	23.3	12.30	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.

15.247(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

- Fundamental Limit = 30 dBm
- Harmonics and Spurious Emissions = 20 dBc
- Restricted Band Emissions = Average 54 dBuV, Peak 74dBuV

5.3 Test Setup – Spurious Emissions

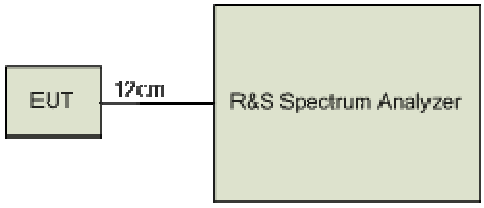
Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels. Conducted scans are used to determine compliance with the 20 dBc limit for emissions outside of the operational frequency band.

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.

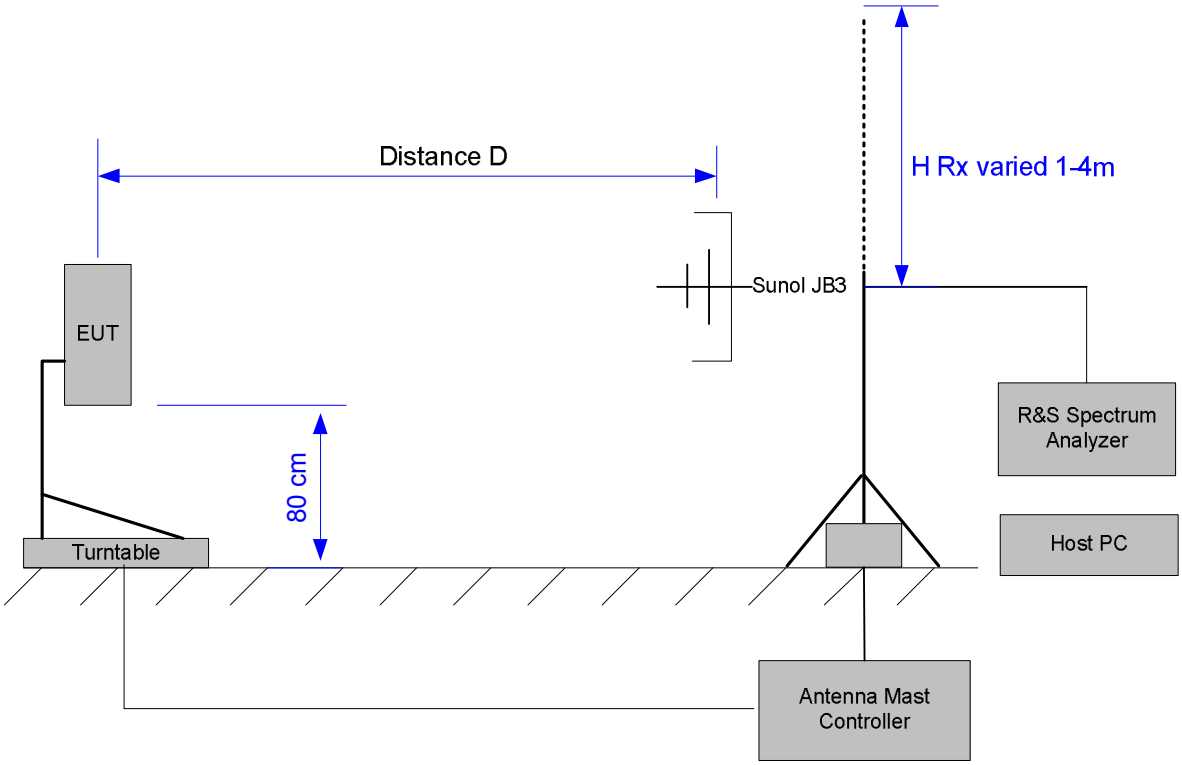
The EN500 model was tested Each EUT's radio was exercised using data transfer mode at the highest possible transmit rate. Testing was performed on low, middle and high channels in the 2.4 and 5.8 GHz frequency band. All combinations of the modulation schemes were tested. Only worst case data is shown below.

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)



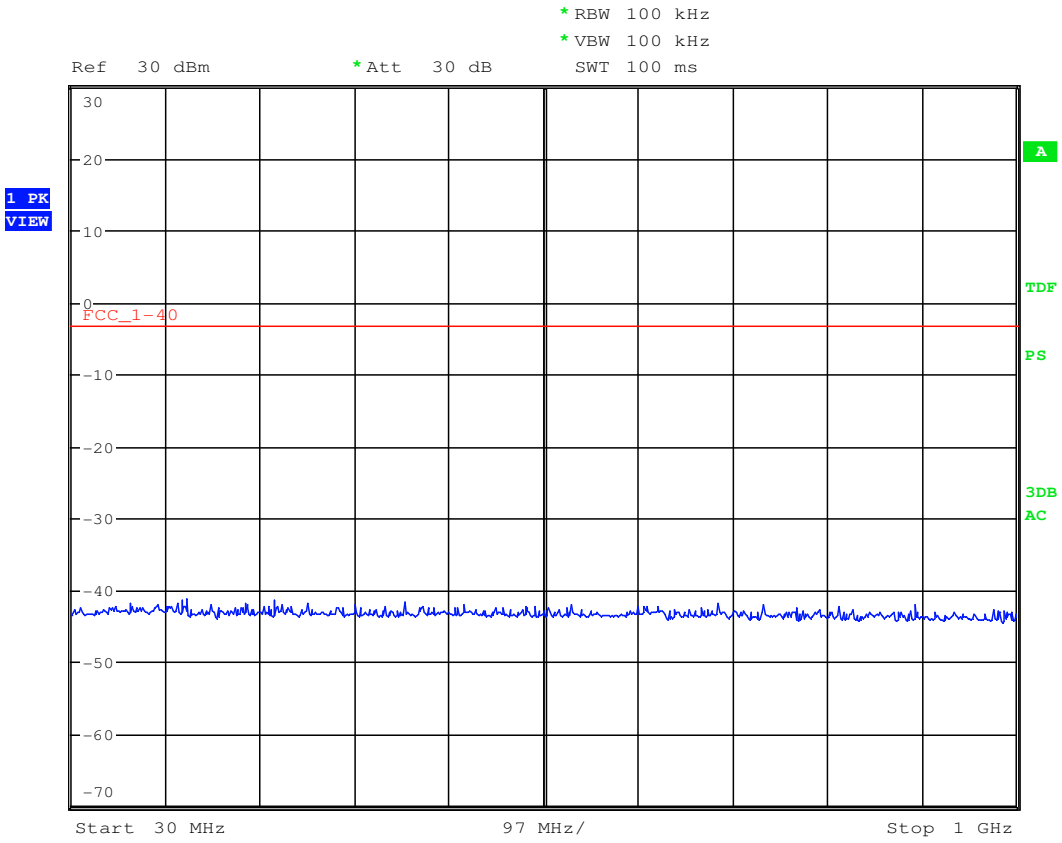
5.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



5.4 Test Results

5.4.1 Harmonics – 20 dBc

30MHz – 1GHz band



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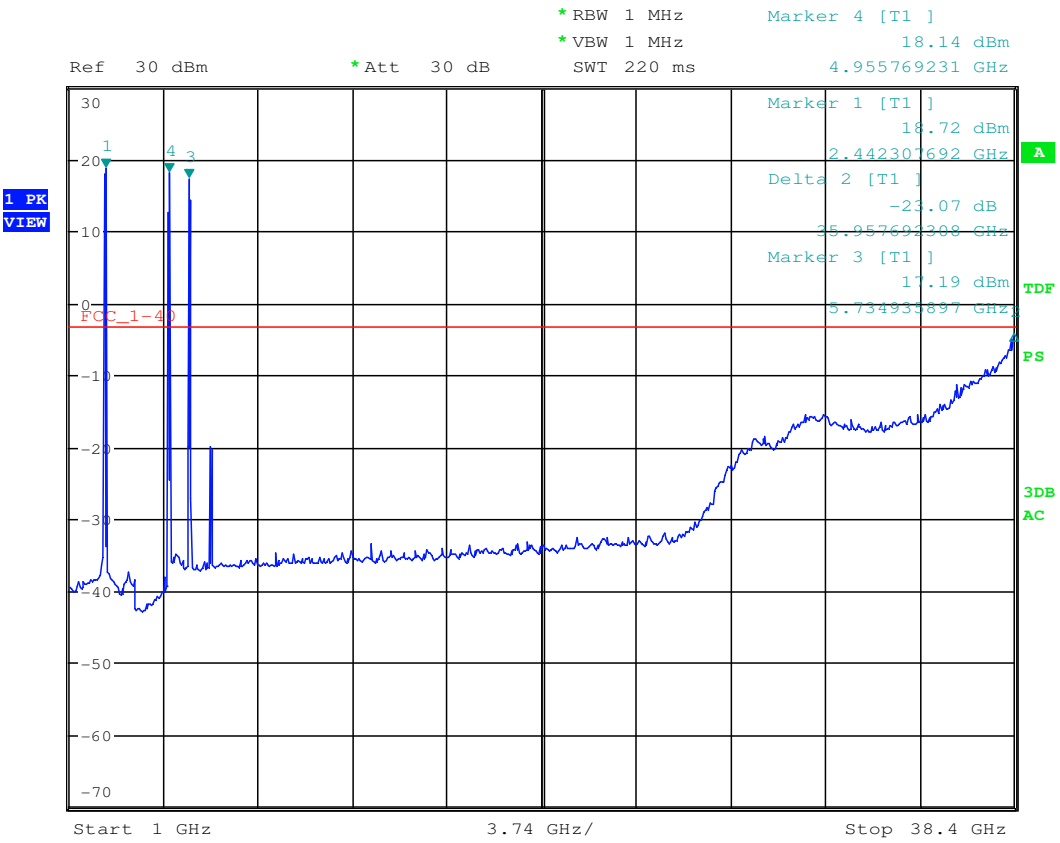
1GHz – 40GHz band



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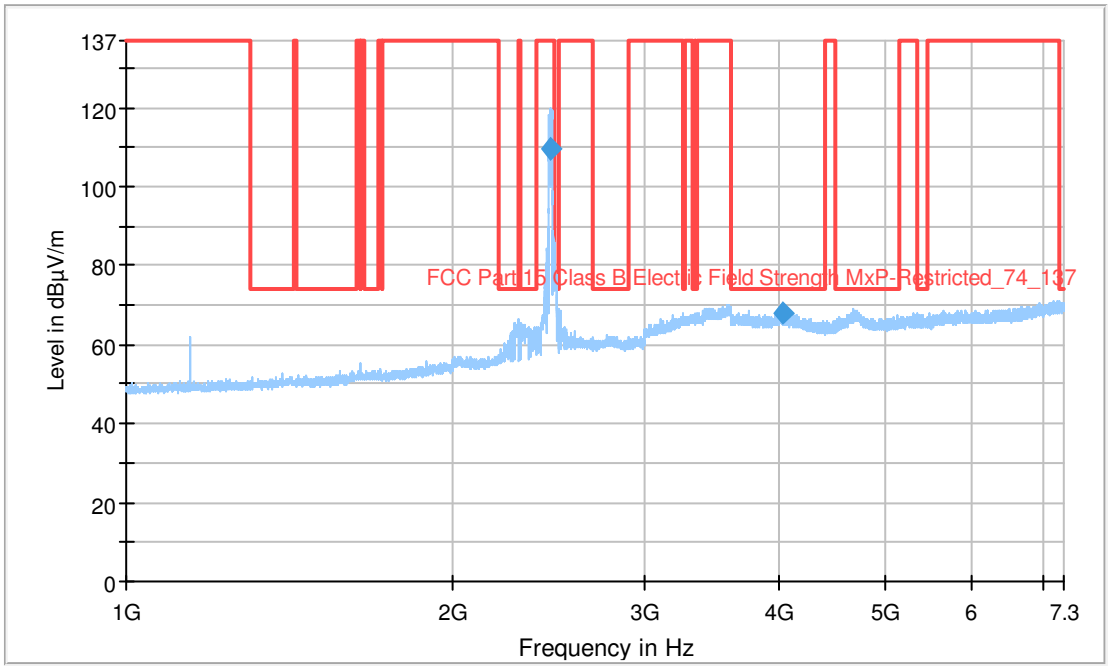
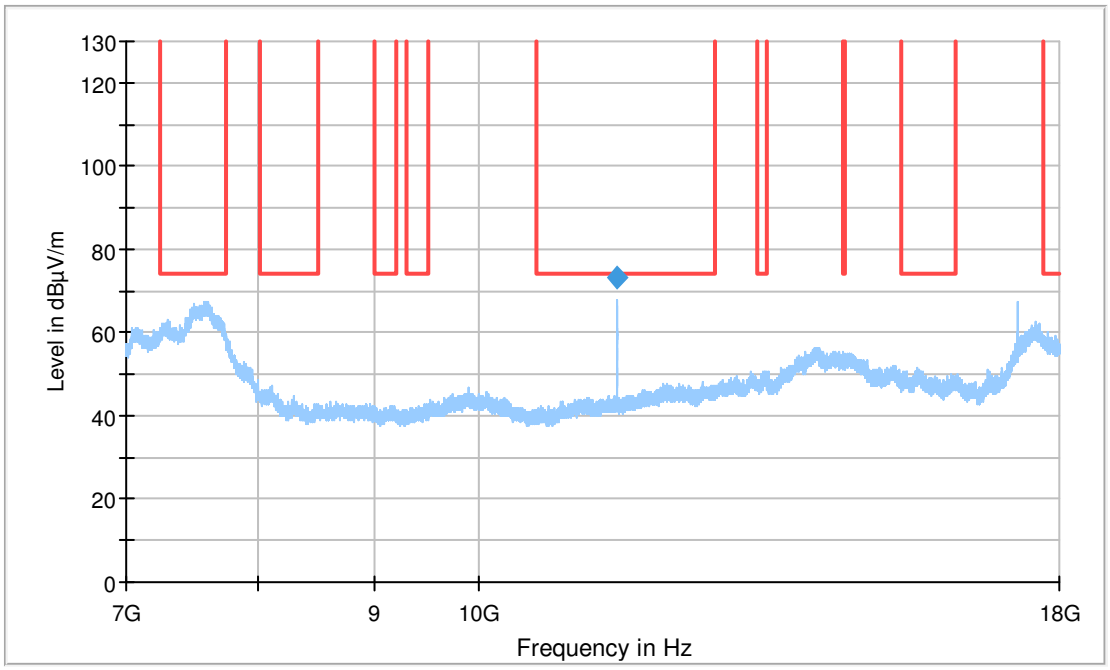
The above plot shows the worst case conducted output of the transmitter. It should be noted that the EUT is not transmitting on two or more channels simultaneously. However, the unit is cycled through low, mid and high channels, 5,10, and 20 MHz bandwidths, and all modulation types. All conducted harmonics are at least 20 dBc.

5.4.2 Restricted Bands



Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2456.40000	109.7	1000.000	138.0	V	202.0	32.2	27.3	137.0
4023.60000	68.0	1000.000	108.0	H	308.0	38.3	6.0	74.0



Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
11494.40000	73.0	1000.000	135.0	V	180.0	12.9	1.0	74.0

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

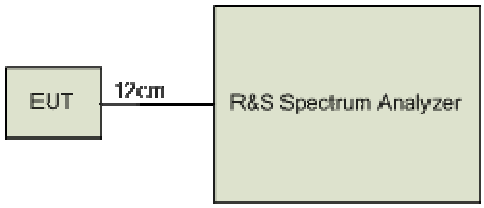
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the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

6.3 Test Setup

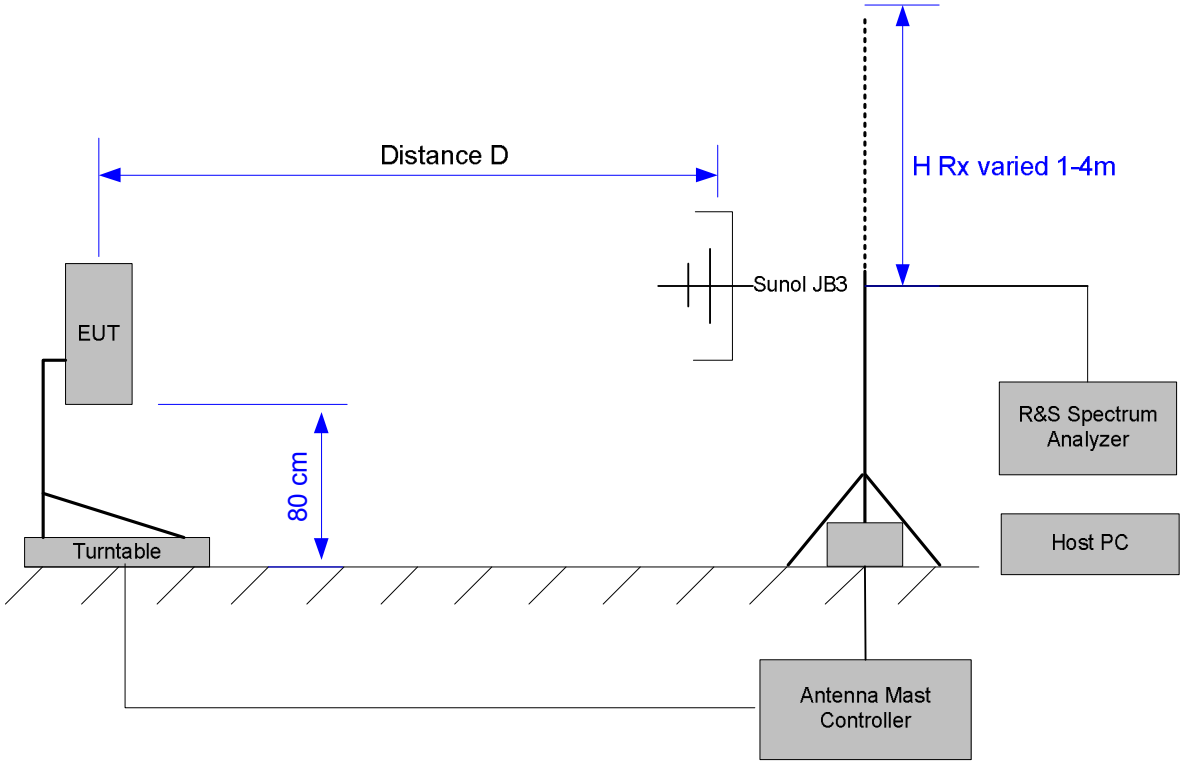
Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels.

The EN500 model was tested The test is performed at low and high channels. Compliance in the 5725-5850 MHz band is established through conducted measurements. Compliance with the 15.209 restricted band requirements of the 2400-2483.5 MHz band is established through radiated measurements. Data is presented for the worst case configuration.

6.3.1 Test Setup Block Diagram – Conducted Measurements

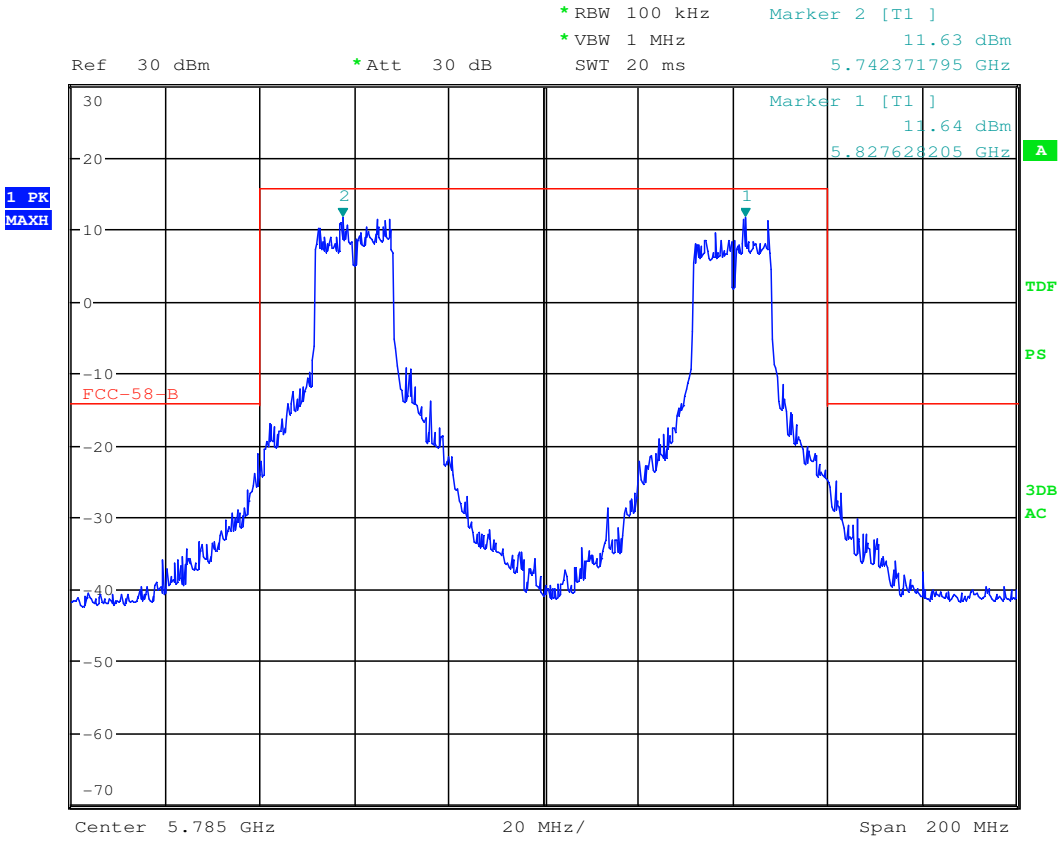


6.3.2 Test Setup Block Diagram – Radiated Measurements



6.4 Test Results

6.4.1 5725-5850 MHz, Conducted Measurements



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Freq (MHz)	Transmit Power (dBm)	Hi Reading (dBm)	Low Reading (dBm)	Delta	Limit (dBc)	Margin (dB)	Result
5745	default	11.63	-21.26	-32.89	-20	-12.89	PASS
5825	default	11.64	-23.89	-35.53	-20	-15.53	PASS

All emissions outside of the 5725-5850 MHz frequency band are attenuated by at least 20 dB.

6.4.2 2400-2483.5 MHz, Radiated Measurements

This measurement is performed using the peak-delta method. The delta is measured using bandwidth settings of RBW, VBW = 100 KHz. This delta is then subtracted from the peak radiated power which is measured using settings of RBW, VBW = 1 MHz. Only the worst case data is shown below.

Freq (MHz)	Transmit Power (dBm)	Peak 1M/1M (dBuV/m@3m)	Delta 100k/100k (dB)	BE Reading (dBuV/m@ 3m)	Limit (dBuV/m@ 3m)	Margin	Result
2412	default	109.6	38.67	70.93	74	3.07	PASS
2462	default	109.62	38.16	71.46	74	2.54	PASS

Thus, 20 dBc attenuation and compliance with the 15.209 restricted band requirements for the 2400-2483.5 MHz band is confirmed

7.0 Occupied Bandwidth

7.1 Test Standard

FCC CFR47, Part 15, Subpart B 15.247a.

15.247(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

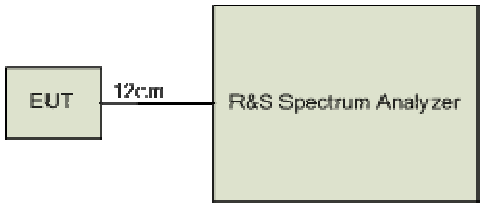
The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3 Test Setup

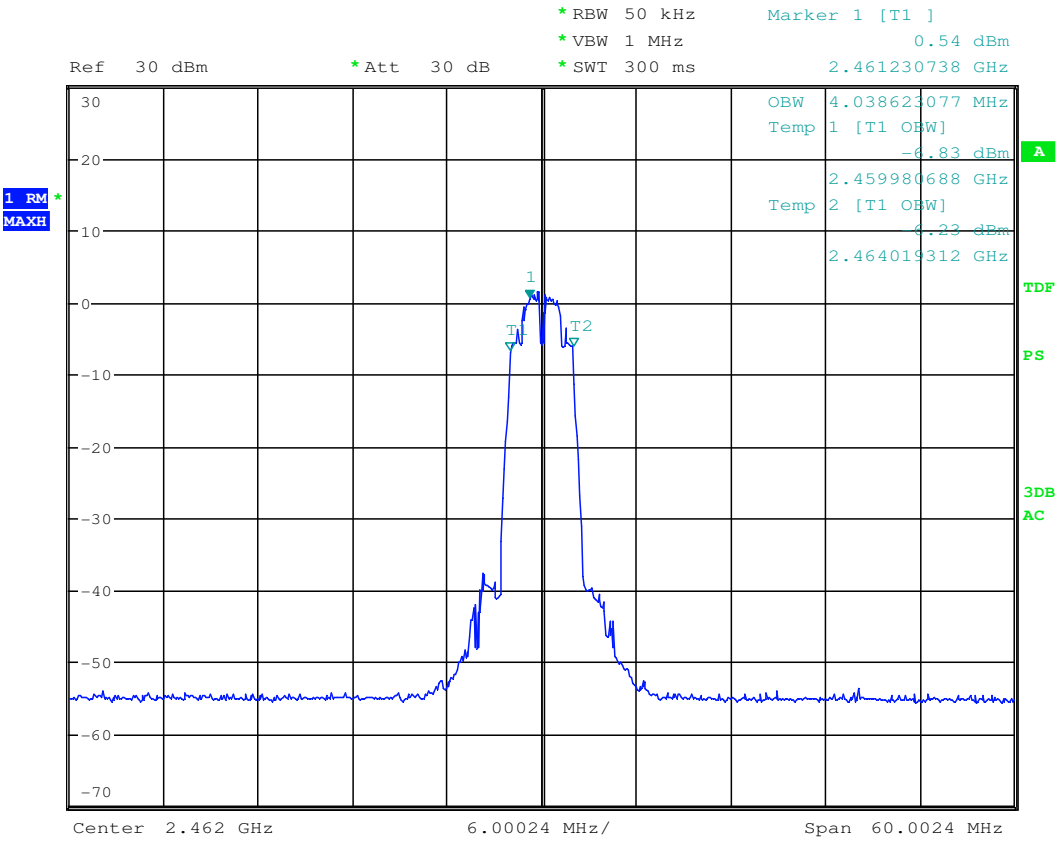
This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

The EN500 model was tested The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 5, 10, and 20 MHz bandwidths for 2.4 and 5.8 GHz frequency band. Only the worst case is shown.

7.3.1 Test Setup Block Diagram

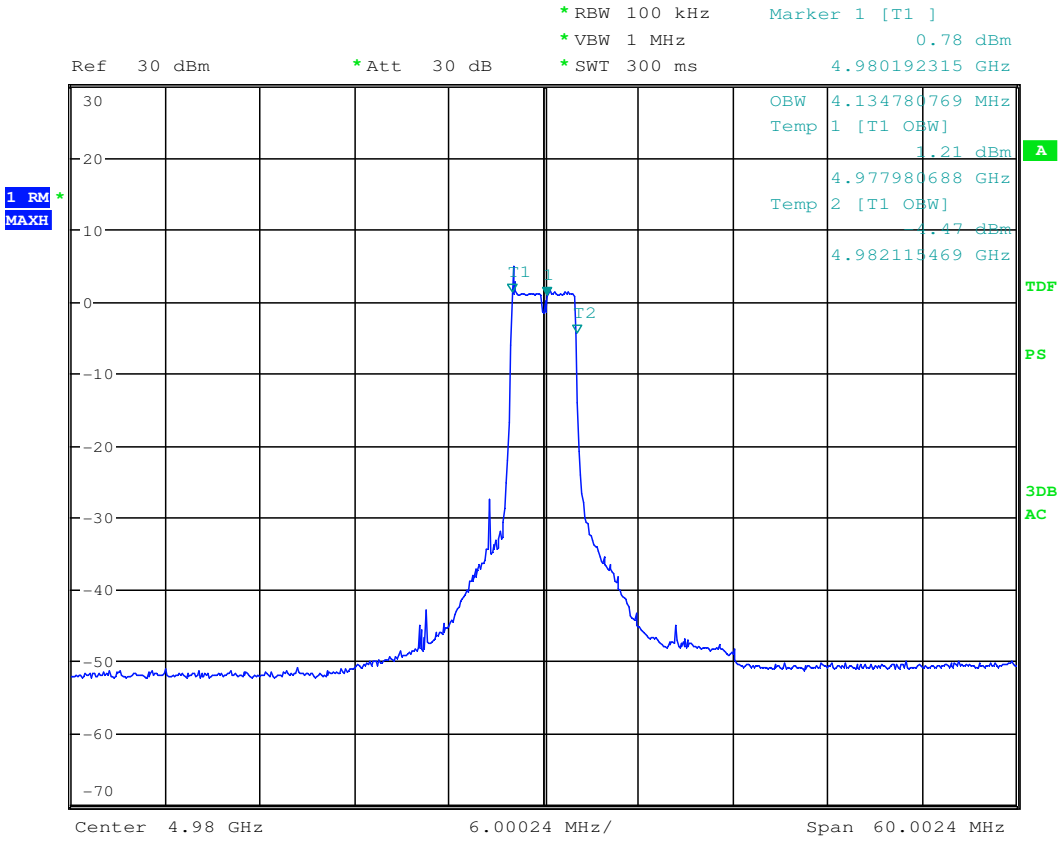


Test Results, 6 dB Occupied Bandwidth at 2.4 GHz Frequency band



Date: 26.JUN.2009 18:19:57

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



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7.3.2 Data Table – Occupied Bandwidth

Channel	Frequency, MHz	Bandwidth, MHz	Occupied Bandwidth, MHz	Limit	Result
165	5825	5	4.19	0.5	PASS
157	5785	10	8.270		
149	5745	20	16.539		
11	2462	5	4.039		
6	2437	10	8.17		
1	2462	20	16.31		

8.0 Power Spectral Density

8.1 Test Standard

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

15.247(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

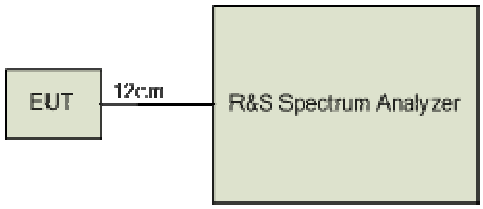
The transmitted power density shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3 Test Setup

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

The EN500 model was tested The test is performed at low, middle and high channels using both OFDM and DSSS modulations where applicable and in 5, 10, and 20 MHz bandwidths for 2.4 and 5.8 GHz frequency band.

8.4 Test Setup Block Diagram



8.5 Test Results

Frequency, MHz	Bandwidth, MHz	PSD in 3 KHz, dBm	Limit, dBm	Result
2429.907	20	-9.19	8	PASS
2411.878	5	-6.68		
2435.876		-3.05		
5744.673		-2.99		
5785.653	10	-3.56		
5825.159	20	-4.24		

9.0 RF Exposure Evaluation

9.1 Test Standard

FCC CFR47, Part 1, 1307 (b), 1310
FCC CFR47, Part 2, Subpart J 1091

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*

9.2 EUT Operating Condition

The maximum antenna gain is 12 dBi at 2.4 GHz and 32 dBi at 5.8 GHz.

9.3 RF exposure evaluation distance calculation

2.4GHz radio with 12 dBi antenna

Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
2412	17.92	12	8.8
2437	21.45	12	13.3
2462	17.74	12	8.6

5.8 GHz radio with 32 dBi antenna

Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
5745	22.00	32	141.2
5785	21.53	32	144.8
5825	21.61	32	135.2

As shown above, the minimum distance where the MPE limit is reached is 144.8 cm for the EUT.

10.0 Test Photos

10.1 Radiated emissions setup

10.2 Conducted emissions setup