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Amended FCC Test Report

(Contains R073108-02-02F)

Company:	Worth Data 623 Swift St. Santa Cruz, CA 95060
Contact:	Steve Luzovich
Product:	B5001, B5002 Base Station
FCC ID: IC ID:	JWSB5001 4724A-B5001
Test Report No:	073108-02-02G
APPROVED BY:	Nic Johnson Test Engineer
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1.0 Summary of test results

1.1 Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARDS: FCC Part 15, Subpart C			
Standard Section	**Test Type and Limit**	**Result**	**Remark**
15.203 RSS-Gen	Unique Antenna Requirement	Pass	Reverse polarity SMA
15.207 RSS-Gen	Conducted Emissions	Pass	Meets the requirement of the limit.
15.209 RSS-Gen	Radiated Emissions	Pass	Meets the requirement of the limit.
15.247(a)(1) RSS-210 Issue 6	Minimum Bandwidth, Limit: Max. 500kHz Limit Min. 250kHz	Pass	Meets the requirement of the limit.
15.247(b) RSS-210 Issue 6	Maximum Peak Output Power, Limit: Max. 23.9dBm	Pass	Meets the requirement of the limit.
15.247(c) RSS-210 Issue 6	Transmitter Radiated Emissions, Limit: Table 15.209	Pass	Meets the requirement of the limit.
15.247(c) RSS-210 Issue 6	Band Edge Measurement, Limit: 20dB less than the peak value of fundamental frequency	Pass	Meets the requirement of the limit.
15.247(a) RSS-210 Issue 6	Number of hopping channels	Pass	Meets the requirement from the standard.
15.247(a) RSS-210 Issue 6	Frequency hopping channel spacing	Pass	Meets the requirement from the standard.

1.2 Test Methods

1.2.1 Conducted AC Emissions

The EUT was powered by 120VAC/60Hz. Compliance to 47 CFR Part 15.207 was tested in accordance with the methods of ANSI/IEEE C63.4: 2003. Measurements were made on both conductors. There was no ground connection on the power plug.

1.2.2 Radiated Emissions

Compliance to 47 CFR Parts 15.209 and 15.247 was tested in accordance with the methods of ANSI/IEEE C63.4: 2003 and FCC Public Notice DA 00-705, March 30, 2000. Several configurations were examined and the results presented represent a worst-case scenario. The EUT was placed on a wooden table approximately 80cm high and centered on a 4m diameter turntable. The table was rotated to find the angles of maximum emissions and the receiving antenna was moved from 1m to 4m in *both vertical and horizontal positi*ons. All measurements were taken at a distance of 3m from the EUT for Part 15.209 intentional radiator measurements, and 3m for 15.247 measurements of the fundamental frequency in the 902MHz to 928MHz band and subsequent harmonics.

2.0 Description

2.1 Equipment under test

EUT Received Date: 22 September 2008
EUT Tested Dates: 22 - 24, 29 September 2008

22, 23 January 2009: (RF emissions from 1GHz to 10GHz, peak power and bandwidth).

PRODUCT	B5001, B5002 Base Station
MODULATION TYPE	QFSK
POWER SUPPLY	Worth Data Model 17UT-05-3000 Input: 100V-240VAC, 0.6A Output: 5.0V, 3.0A DC
RADIO TECHNOLOGY	Half-duplex RF Link
TRANSFER RATE	152.34 kb/sec maximum data rate
FREQUENCY RANGE	902.971 – 926.277MHz
NUMBER OF CHANNELS	32
MAX OUTPUT POWER	22.82dBm (660.693mW) The EUT has no provisions for changing power output
ANTENNA TYPE	Whip
ASSOCIATED DEVICES	7001 RF Terminal

NOTE:
1. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.
2. The B5001 does not include Ethernet connectivity, where as the B5002 does. The unit tested was a B5002 with an Ethernet cable attached and bundles 40cm below the table-top for emissions testing.

2.2 Laboratory description

All testing was performed at the NCEE Lincoln facility Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of 45 ± 4%
Temperature of 20 ± 3° Celsius

2.3 Description of test modes

The EUT was tested at the frequencies below:

Channel	Frequency
1	902.971
16	915.000
32	926.277

2.4 Applied standards

The EUT uses digital modulation and operates between 902 MHz and 928 MHz. It has no AC mains connection. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)
FCC Part 15, Subpart C (15.209)
RSS-210, Issue 7
RSS-GEN

All test items have been performed and recorded as per the above.

The unit is classified as a class "A" product as it is for use in a commercial environment. It was however tested to class "B" limits, as they are more stringent, and compliance with the class "A" limits are therefore implied.

2.5 Description of support units

None

2.6 Configuration of system under test

This EUT was set to transmit in a worse-case scenario with modulation on. The manufacturer modified the unit to transmit continuously on a selected frequency.

All data in this report was measured with the unit operating continuously. In normal operation, the EUT cannot have a duty cycle larger than 50% because it operates in half-duplex.

3.0 Test equipment used

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE
Rohde & Schwarz Test Receiver	ESIB26	100037	9 June 2008
EMCO Biconilog Antenna	3142B	1647	8 Feb 2008
EMCO Horn Antenna	3115	6416	5 Feb 2008
Rohde & Schwarz LISN	ESH3-Z5	100023	6 Feb 2008
Hewlett Packard Power Meter	4378	100307	20 Jan 2009
Hewlett Packard Power Sensor	8481A	2702A63981	20 Jan 2009
Rohde & Schwarz Preamp*	TS-PR18	082001/003	6 Dec 2008
Trilithic High Pass Filter*	6HC330	23042	6 Dec 2008

*Used for radiated measurements above 3GHz

4.0 Detailed results

4.1 Unique antenna requirement

4.1.1 Standard applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

4.1.2 Antenna description

The antenna is a reverse polarity SMA whip antenna and not easily replaced by the user.

4.2 Radiated emissions

4.2.1 Limits for radiated emissions measurements

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH (μV/m)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 * log * Emission level (μV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

4.2.2 Test procedures

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.

d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for peak and average measurements at frequencies above 1GHz. The video bandwidth for peak measurements was 3MHz and 10Hz for average measurements

4.2.3 Deviations from test standard

No deviation.

4.2.4 Test setup

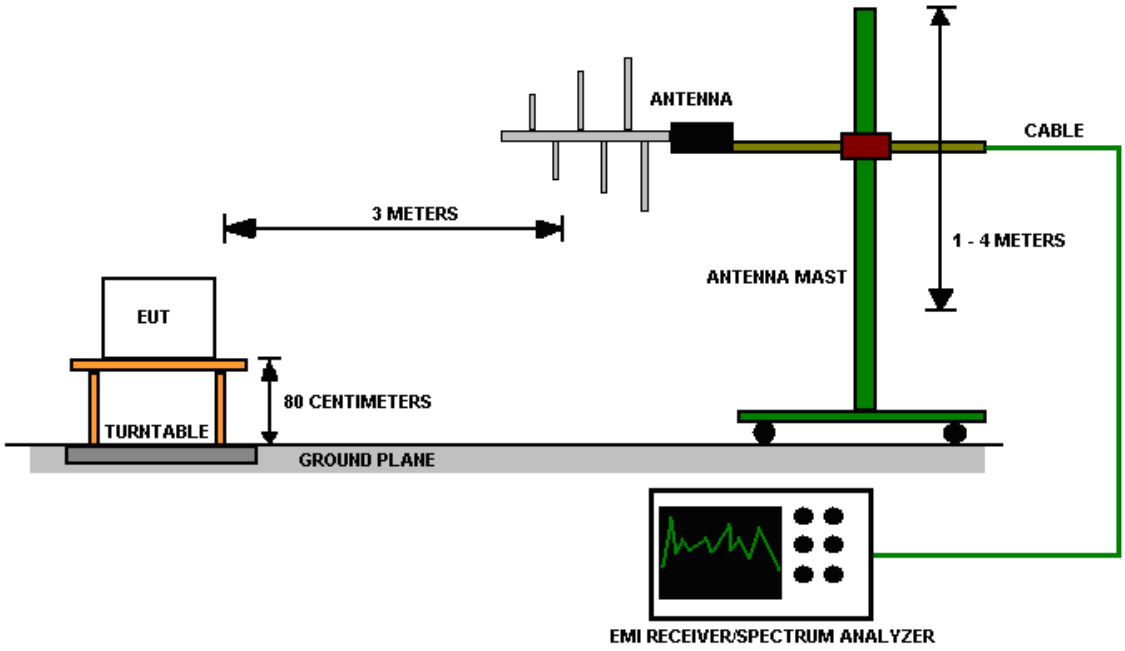


Figure 1 - Radiated Emissions Test Setup

For the actual test configuration, please refer to Appendix A for photographs of the test configuration.

4.2.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

4.2.6 Test results

EUT	5001 Base Station	MODE	Channel 1, Transmit
INPUT POWER	5VDC AC-DC power converter	FREQUENCY RANGE	30MHz – 1GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Quasi-peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dBµV/m	dBµV/m	dB	cm	deg.	
46.20	36.21	40.00	3.79	100	83	VERT
107.82	31.17	44.00	12.83	99	346	VERT
109.44	34.97	44.00	9.03	100	297	VERT
639.24	21.59	46.00	24.41	100	161	VERT
663.00	29.35	46.00	16.65	146	218	VERT
665.10	30.06	46.00	15.94	100	153	VERT
666.60	24.06	46.00	21.94	100	210	VERT
729.24	34.86	46.00	11.14	113	217	HORI
902.64	99.09	NA*	NA*	109	113	VERT
902.94	121.42	NA*	NA*	100	29	VERT
912.66	42.99	46.00	3.0	115	36	VERT
927.78	51.08	NA*	NA*	100	111	VERT
934.08	39.85	46.00	6.15	109	107	VERT
940.20	45.42	46.00	0.58	100	115	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. *Radiated limits do not apply within the 902MHz to 928MHz band.
6. ** Radiated emissions outside of the 902MHz to 928MHz band must be at least 20dB below the highest emission

EUT	5001 Base Station	MODE	Channel 16, Transmit
INPUT POWER	5VDC AC-DC power converter	FREQUENCY RANGE	30MHz – 1GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Quasi-peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dBµV/m	dBµV/m	dB	cm	deg.	
45.84	33.69	40.00	6.31	99	157	VERT
45.9	34.99	40.00	5.01	100	177	VERT
915.06	120.06	NA*	NA*	185	322	VERT
915.18	105.88	NA*	NA*	99	30	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. *Radiated limits do not apply within the 902MHz to 928MHz band.
6. ** Radiated emissions outside of the 902MHz to 928MHz band must be at least 20dB below the highest emission

EUT	5001 Base Station	MODE	Channel 32, Transmit
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	30MHz – 1GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Quasi-peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Po..
MHz	dBµV/m	dBµV/m	dB	cm	deg.	
45.720000	36.69	40.00	3.31	98.0	197	VERT
45.960000	36.98	40.00	3.02	101.0	199	VERT
926.340000	121.68	NA*	NA*	185.0	247	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. *Radiated limits do not apply within the 902MHz to 928MHz band.
6. **All emissions outside of the 902MHZ to 928MHZ bands are required to be 20dB below the highest emission

EUT	5001 Base Station	MODE	Receive
INPUT POWER	5VDC, AC-DC Converter	FREQUENCY RANGE	30MHz – 1GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Quasi-peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dBµV/m	dBµV/m	dB	cm	deg.	
44.16	34.05	40.00	5.9	149	282	VERT
44.70	33.76	40.00	6.2	100	236	VERT
235.56	23.55	46.00	22.4	185	35	HORI
319.08	26.34	46.00	19.7	102	86	HORI
465.78	32.59	46.00	13.4	106	205	VERT
731.22	26.04	46.00	20.0	99	35	VERT
914.22	24.50	46.00	21.5	388	0	HORI

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. *Radiated limits do not apply within the 902MHz to 928MHz band.
6. ** Radiated emissions outside of the 902MHz to 928MHz band must be at least 20dB below the highest emission

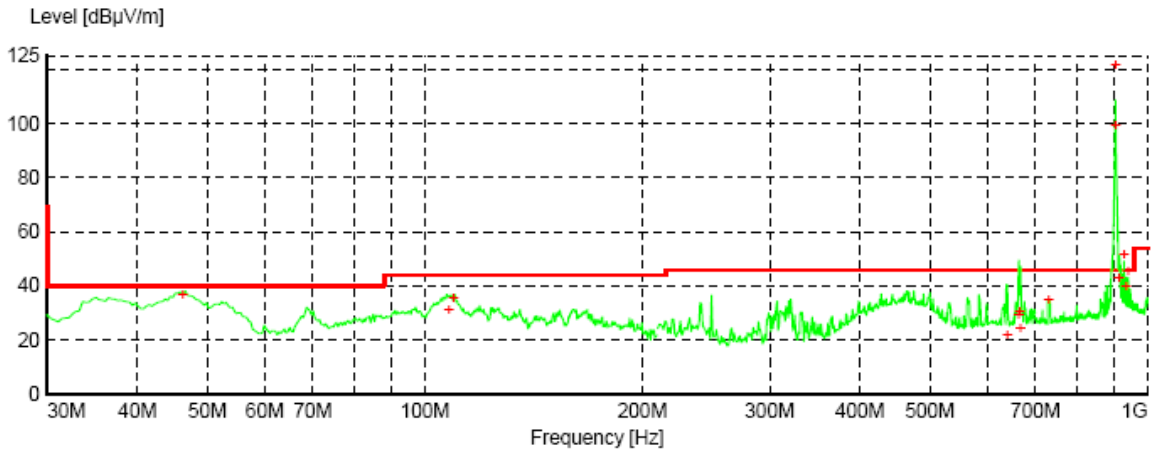


Figure 2 - Channel 1, Radiated Emissions Plot

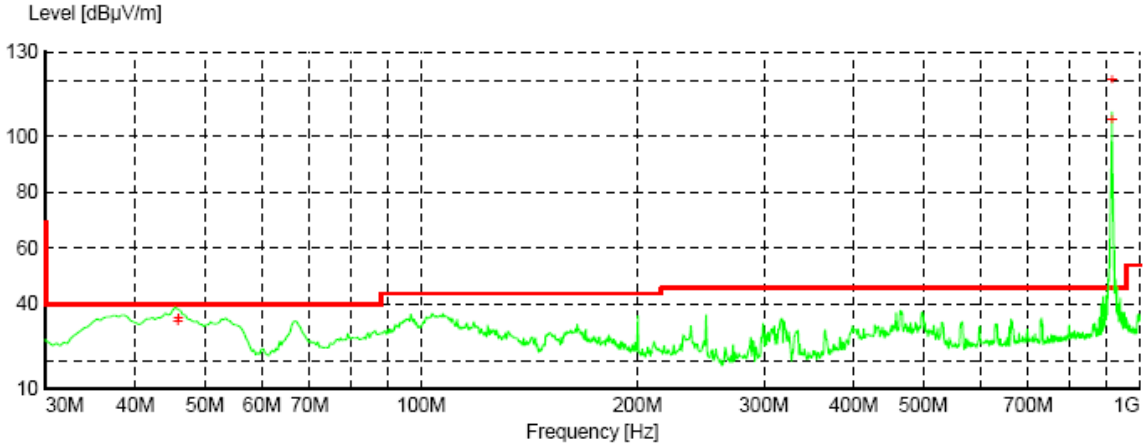


Figure 3 - Channel 16, Radiated Emissions Plot

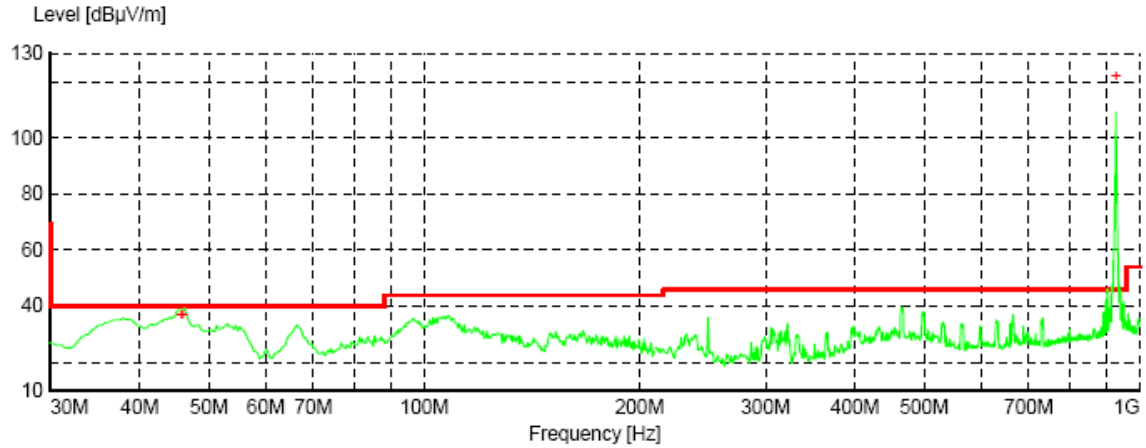


Figure 4 - Channel 32, Radiated Emissions Plot

EUT	5001 Base Station	MODE	Channel 1
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	1GHz – 10GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Po.**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm**	**deg.**	
Average						
1806	76.23	101.42**	25.19	191	118	VERT
2709	53.88	54.00	0.12	208	84	VERT
3612	50.77	54.00	3.23	220	300	VERT
4515	52.23	54.00	1.77	198	56	VERT
6182.5	50.74	54.00	3.26	185	299	VERT
Peak						
1806	80.82	101.42**	20.60	191	118	VERT
2709	58.00	74.00	16.00	208	84	VERT
3612	58.12	74.00	15.88	220	300	VERT
4515	61.12	74.00	12.88	198	56	VERT
6182.5	63.70	74.00	10.30	185	299	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. **All emissions outside of the 902MHZ to 928MHZ bands are required to be 20dB below the highest emission if they are not in a restricted band.

EUT	5001 Base Station	MODE	Channel 16
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	1GHz – 10GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	Njohnson

Frequency	Level	Limit	Margin	Height	Angle	Po..
MHz	dBµV/m	dBµV/m	dB	cm	deg.	
Average						
1829.0	74.14	100.06**	25.92	198	110	VERT
2745.0	52.98	54.00	1.02	198	121	VERT
3660.0	51.24	54.00	2.76	202	66	VERT
4575.0	49.12	54.00	4.88	211	261	VERT
5490.5	50.46	54.00	3.54	202	198	VERT
Peak						
1829.0	79.11	100.06**	20.95	198	110	VERT
2745.0	58.38	74.00	15.62	198	121	VERT
3660.0	60.05	74.00	13.95	202	66	VERT
4575.0	61.87	74.00	12.13	211	261	VERT
5490.5	62.62	74.00	11.38	202	198	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. **All emissions outside of the 902MHZ to 928MHZ bands are required to be 20dB below the highest emission if they are not in a restricted band.

EUT	5001 Base Station	MODE	Channel 32
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	1GHz – 10GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	Njohnson

Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Po.**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm**	**deg.**	
Average						
1852.5	73.88	100.68**	26.80	121	118	VERT
2779.0	53.72	54.00	0.28	99	114	VERT
3705.5	52.17	54.00	1.83	127	122	VERT
4631.5	50.23	54.00	3.77	122	100	VERT
Peak						
1852.5	80.56	100.68**	20.12	121	118	VERT
2779.0	60.50	74.00	13.5	99	114	VERT
3705.5	59.90	74.00	14.1	127	122	VERT
4631.5	60.10	74.00	13.9	122	100	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. **All emissions outside of the 902MHZ to 928MHZ bands are required to be 20dB below the highest emission if they are not in a restricted band.

EUT	5001 Base Station	MODE	Receive
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	1GHz – 10GHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	Njohnson

Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Po.**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm**	**deg.**	
Average						
5088.0	44.72	54.00	9.3	200	343	HORI
6175.5	50.91	54.00	3.1	152	96	VERT
Peak						
5088.0	58.70	74.00	-4.7	200	343	HORI
6175.5	64.59	74.00	-10.6	152	96	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. **All emissions outside of the 902MHZ to 928MHZ bands are required to be 20dB below the highest emission if they are not in a restricted band.

4.3 Bandwidth

4.3.1 Limits of bandwidth measurements

The 20dB bandwidth of the signal must be less than 0.50MHz and greater than 0.25MHz for systems using fewer than 50 hop frequencies.

4.3.2 Test procedures

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10 kHz RBW and 10 MHz VBW. The 20 dB bandwidth is defined as the bandwidth of which is higher than peak power minus 20dB.
The 99% occupied is defined as the bandwidth at which 99% of the signal

power is found. This corresponds to 20dB down from the maximum power level. The maximum power was measured with the largest resolution bandwidth possible (10MHz) and this value was recorded. The signal was then captured with a 100kHz resolution bandwidth and the frequencies where the measurements were 20dB below the maximum power were marked. The bandwidth between these frequencies was recorded as the 99% occupied bandwidth.

It was found for this particular EUT, that the 20dB and 99% bandwidths were identical, so only the 20dB bandwidth is displayed in this report.

4.3.3 Deviations from test standard

No deviation.

4.3.4 Test setup

4.3.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

4.3.6 Test results

EUT	5001 Base Station	MODE	Channel 1, 16, 32
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	902.971 – 926.277MHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BW (kHz)	20dB Limit Max (kHz)	RESULT
1	902.971	378.76	500.00	PASS
16	915.000	362.72	500.00	PASS
32	926.277	380.76	500.00	PASS

REMARKS:

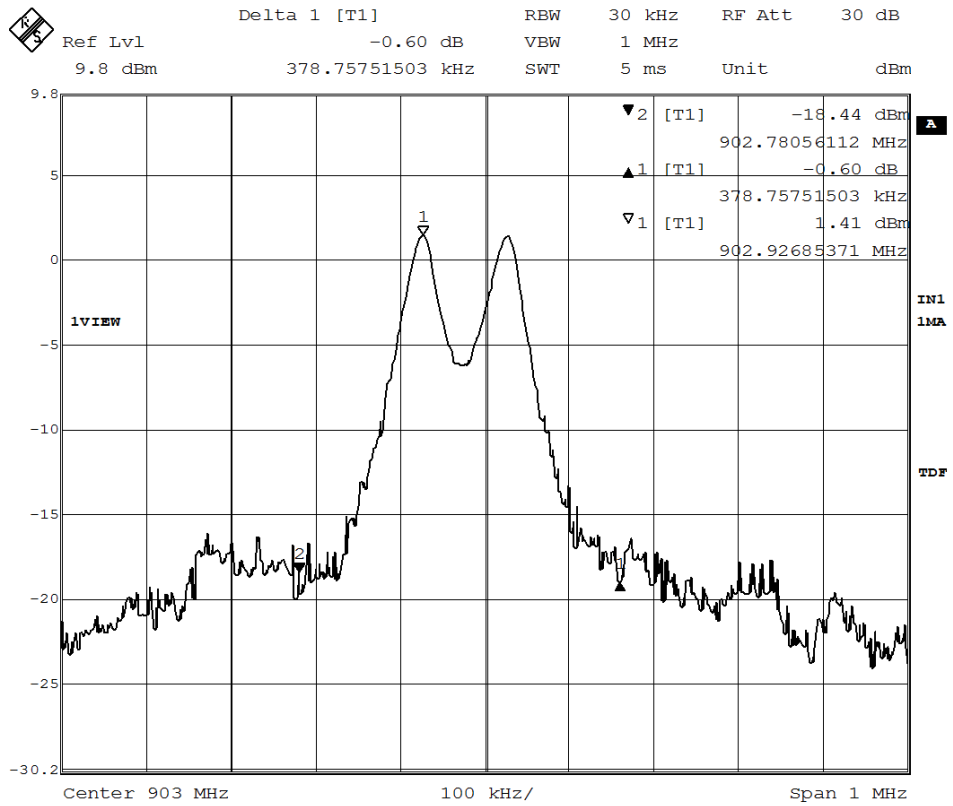


Figure 5 - Channel 1, 20dB Bandwidth

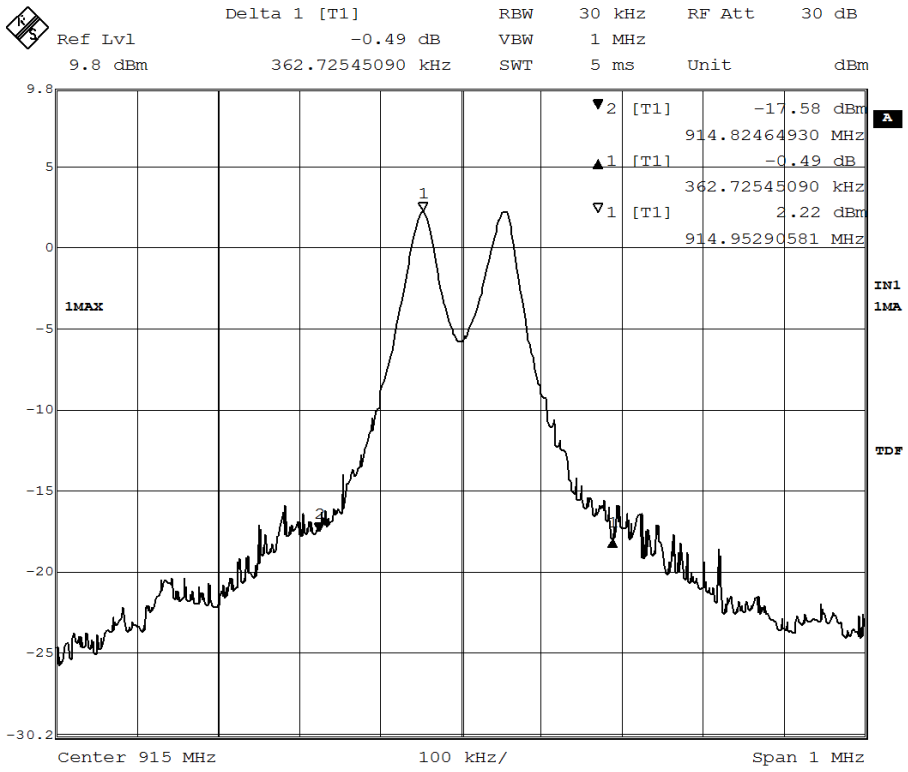


Figure 6 - Channel 16, 20dB Bandwidth

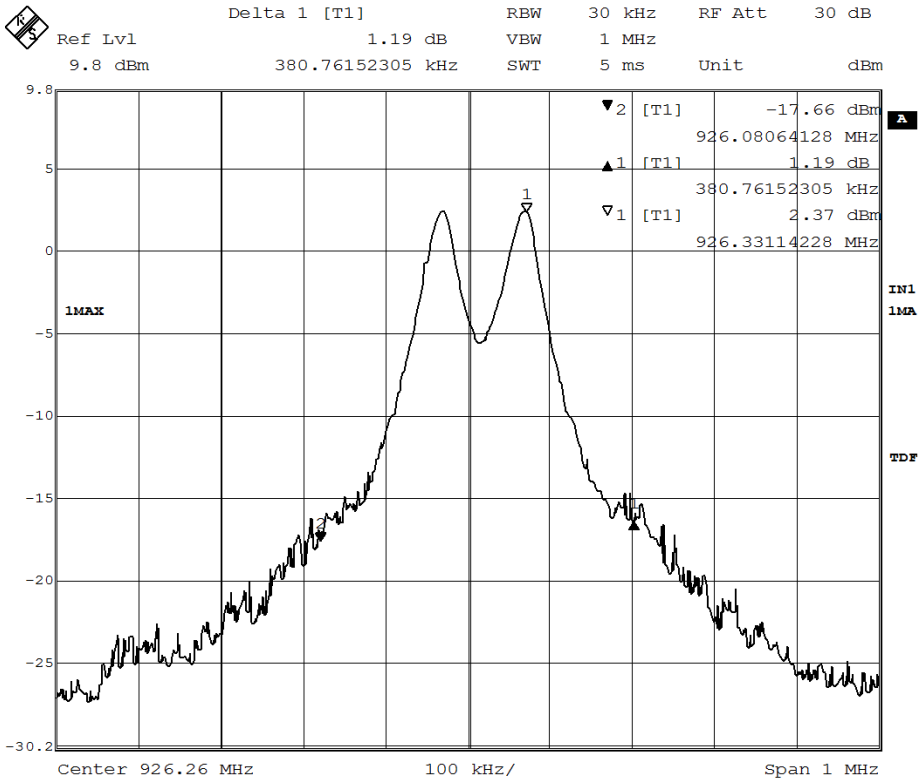


Figure 7 - Channel 32, 20dB Bandwidth

4.4 Maximum peak output power

4.4.1 Limits of power measurements

The maximum peak output power allowed is 30dBm (1000mW).

4.4.2 Test procedures

1. The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable.

2. The resolution bandwidth was set to 10MHz and the video bandwidth was set to 10MHz to capture the maximum amount of signal. The analyzer used a peak detector in max hold mode. This represented the maximum output power.

4.4.3 Deviations from test standard

No deviation.

4.4.4 Test setup

The RF output of the EUT was connected to a power sensor with the appropriate attenuation. Power readings were taken from a power meter.

4.4.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

4.4.6 Test results

EUT	5001 Base Station	MODE	Channel 1, 16, 32
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	902.971 – 926.277MHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Maximum peak output power

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	RESULT
1	902.971	20.93	30	PASS
16	915.000	21.51	30	PASS
32	926.277	22.82	30	PASS

REMARKS:
None

4.5 Bandedges

4.5.1 Limits of bandedge measurements

For emissions outside of the allowed band of operation (902MHz – 928MHz), the emission level needs to be 20dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

4.5.2 Test procedures

The EUT was tested in the same method as described in section *4.2 - Radiated emissions*. The EUT was oriented as to produce the maximum emission levels. The resolution bandwidth was set to 120kHz and the EMI receiver was used to scan from the bandedge to the fundamental frequency with a quasi-peak detector. The highest emissions level beyond the bandedge was measured and recorded. If the out of band emissions do not fall within a restricted band from 15.205, then it is required that the out of band emission be 20dB below that of the fundamental emission level. If the out of band emission falls with a restricted band from 15.205, then it is required that the emission be below the limits from 15.209.

4.5.3 Deviations from test standard

No deviation.

4.5.4 Test setup

See Section 4.4

4.5.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

4.5.6 Test results

EUT	5001 Base Station	MODE	Channel 1, 32
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	902.971 – 926.277MHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Highest Out of Band Emissions

CHANNEL	Band edge /Measurement Frequency (MHz)	Highest out of band level dBm	Highest in band level dBµV/m	Delta	Limit (dBc)	Result
0 (902.971MHZ)	901.95	-10.54	21.47	32.01	20.00	PASS
32(926.277MHz)	928.05	-17.59	40.28		20.00	PASS

NOTE:
EUT was tested as described in section 4.2. All measurements above were taken from section 4.2. The highest out of band measurement was maximized in a 5MHz frequency band, so the frequency may be slightly within the frequency band, but represents a worse-case scenario for all out of band measurements. The plots on the following page shows the peak measurements in green and quasi-peak in red.

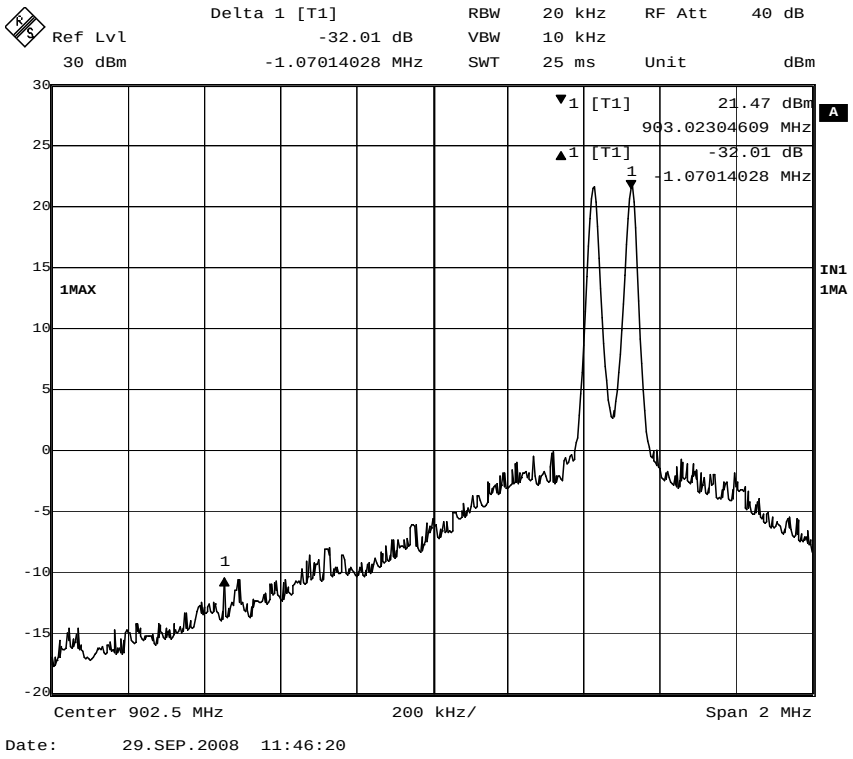


Figure 8 – Channel 1, Bandedge Measurements

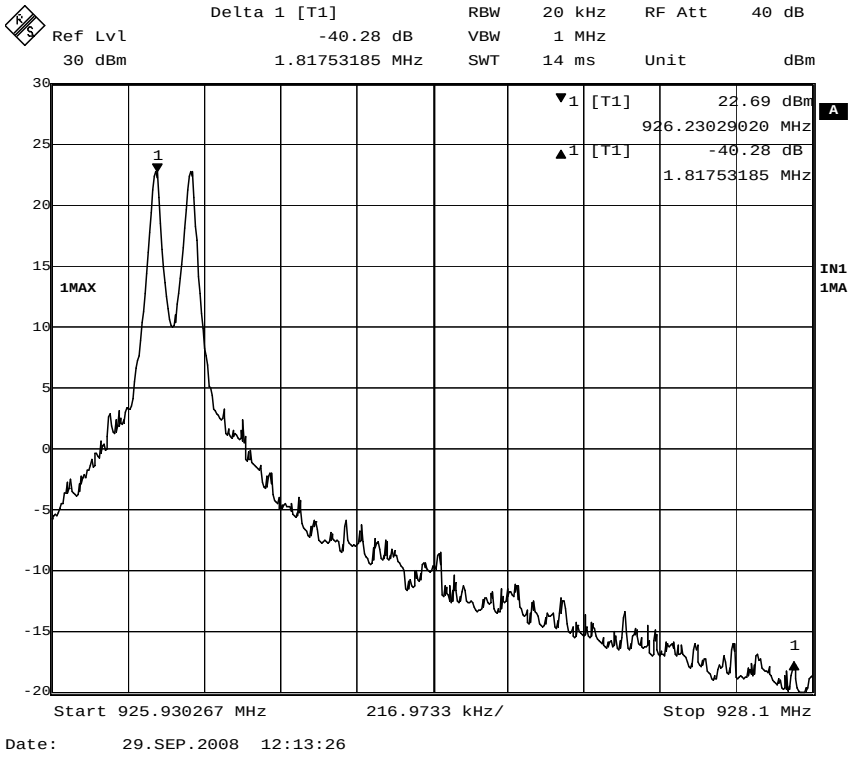


Figure 9 - Channel 32, Bandedge Measurements

4.6 Number of hopping frequencies

4.6.1 Hopping frequency measurements

For frequency hopping systems with a 20dB bandwidth greater than 250kHz, the system shall use at least 25 hopping channels.

4.6.2 Test procedures

The transmitter output was connected directly to the spectrum analyzer. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using 100 kHz RBW and 300 kHz VBW. The spectrum analyzer was set in max hold mode and held until all hopping channels were captured.

4.6.3 Deviations from test standard

No deviation.

4.6.4 Test setup

See Section 4.4

4.6.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

4.6.6 Test results

EUT	5001 Base Station	MODE	Hopping
INPUT POWER	3.7VDC, Internal Battery	FREQUENCY RANGE	902.971 – 926.277MHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Number of frequency hopping channels

CHANNELS	MINIMUM
26	25

NOTE:
The EUT is capable of transmitting on 32 channels, there are six pseudo randomly ordered hopping sequences selectable. Each hopping sequence uses 26 of the 32 channels. The operational description provides this information.

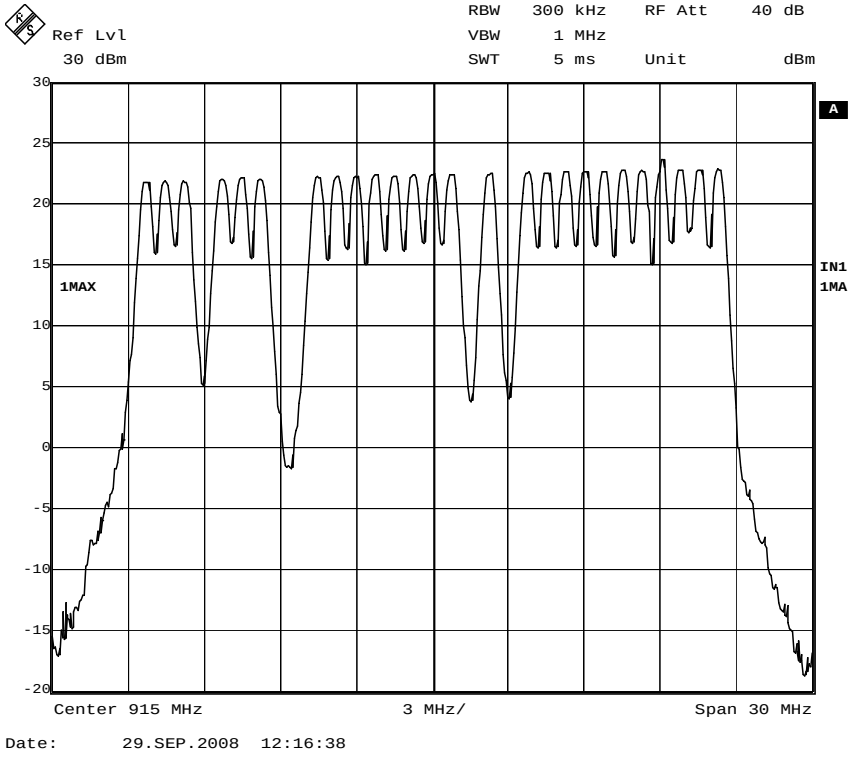


Figure 10 - Number of Hopping Frequencies

4.7 Time of occupancy

4.7.1 Requirements for time of occupancy

If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.7.2 Test procedures

The transmitter output was connected directly to the spectrum analyzer. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using 100 kHz RBW and 1 MHz VBW.

4.7.3 Deviations from test standard

No deviation.

4.7.4 Test setup

See Section 4.4

4.7.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

4.7.6 Test results

EUT	7001 RF Terminal	MODE	Channel 16
INPUT POWER	3.7VDC, Internal Battery	FREQUENCY RANGE	902.971 – 926.277MHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency hopping channel separation

CHANNEL	Time between hops (s)	Hop timing (ms)	Duty Cycle (Sec on/Sec off)	Duty Cycle Limit (Max)	RESULT
16	10.0	320	0.032	0.040	PASS

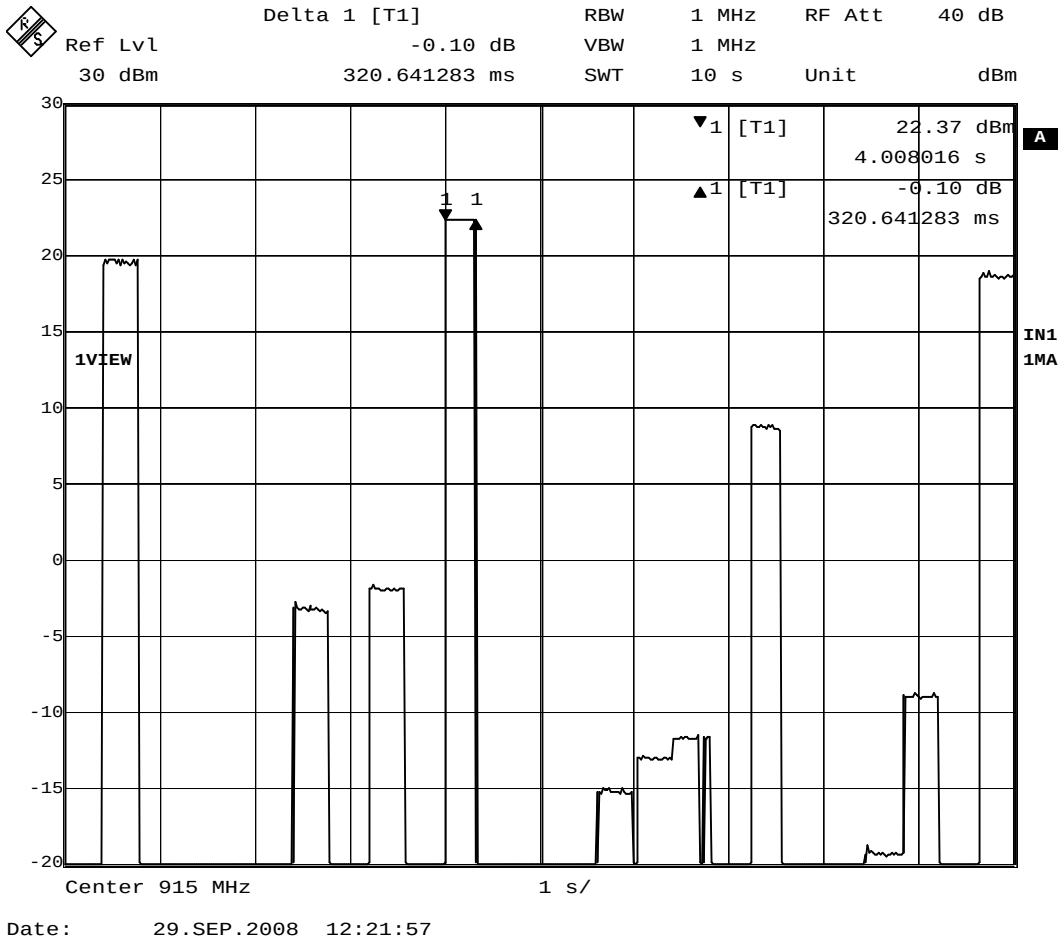


Figure 11 - Time of Occupancy

4.8 Carrier frequency separation

4.8.1 Requirements for carrier frequency separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

4.8.2 Test procedures

The transmitter output was connected directly to the spectrum analyzer. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using 100 kHz RBW and 1 MHz VBW.

4.8.3 Deviations from test standard

No deviation.

4.8.4 Test setup

4.8.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

4.8.6 Test results

EUT	B5001 Base	MODE	Hopping
INPUT POWER	3.7VDC, Internal Battery	FREQUENCY RANGE	902.971 – 926.277MHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency hopping channel separation

CHANNEL A-B	CHANNEL A FREQ. (MHz)	CHANNEL B FREQ. (MHz)	DELTA (kHz)	MINIMUM (kHz)	RESULT
0 - 1	902.955	903.712	757	380.76	PASS
1 – 2	903.712	904.464	752	380.76	PASS
2 – 3	904.464	905.215	751	380.76	PASS
3 – 4	905.215	905.964	749	380.76	PASS
4 – 5	905.964	906.717	753	380.76	PASS
6 - 7	906.717	907.475	758	380.76	PASS
7 – 8	907.475	908.969	752	380.76	PASS
8 – 9	908.969	909.731	762	380.76	PASS
9 – 10	909.731	910.484	753	380.76	PASS
10 – 11	910.484	911.230	746	380.76	PASS
11 - 12	911.230	911.979	749	380.76	PASS
12 – 13	911.979	912.734	755	380.76	PASS
13 – 14	912.734	913.487	753	380.76	PASS
14 - 15	913.487	914.241	754	380.76	PASS
15 – 16	914.241	914.989	748	380.76	PASS
16 – 17	914.989	915.742	753	380.76	PASS
17 – 18	915.742	916.496	754	380.76	PASS
18 – 19	916.496	917.249	753	380.76	PASS
19 – 20	917.249	917.996	747	380.76	PASS
20 – 21	917.996	918.750	754	380.76	PASS
21 – 22	918.750	919.500	750	380.76	PASS
22 – 23	919.500	920.250	750	380.76	PASS
23 – 24	920.250	920.997	747	380.76	PASS
24 – 25	920.997	921.751	754	380.76	PASS
25 - 26	921.751	922.504	753	380.76	PASS
26 – 27	922.504	923.258	754	380.76	PASS
27 - 28	923.258	924.005	747	380.76	PASS
28 – 29	924.005	924.765	760	380.76	PASS
29 - 30	924.765	925.512	747	380.76	PASS
30 - 31	925.512	926.265	753	380.76	PASS

4.9 Conducted AC Mains Emissions

4.9.1 Limits for conducted emissions measurements

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.9.2 Test Procedures

a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.

c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits could not be reported

4.9.3 Deviation from the test standard

No deviation

4.9.4 Test setup

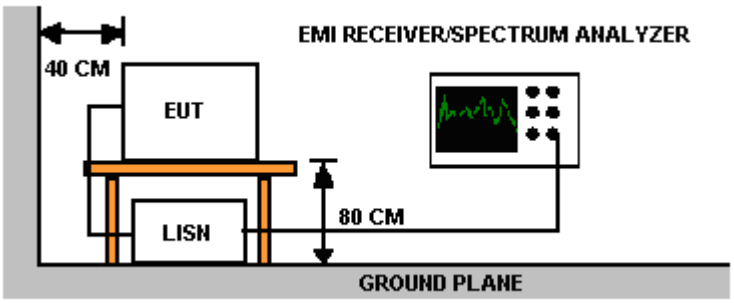


Figure 12 - Conducted Emissions Test Setup

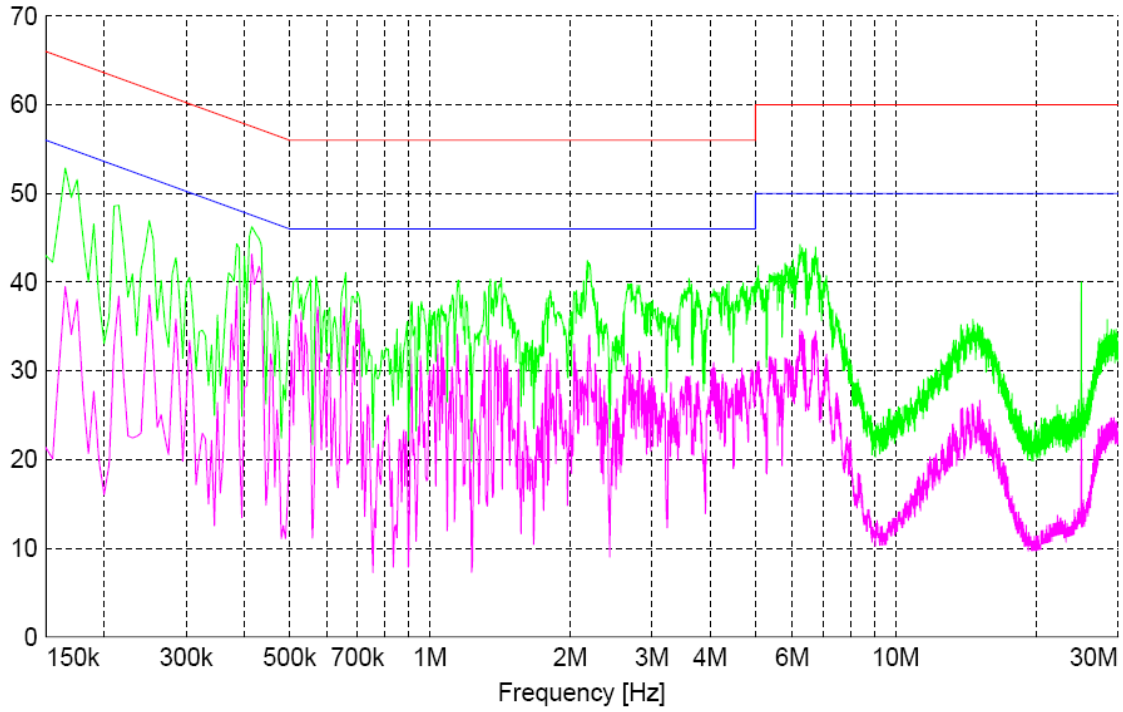
For actual test configuration, see photographs in Appendix A

4.9.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Latitude laptop PC via USB.

4.9.6 Test Results

EUT	5001 Base Station	MODE	Hopping
INPUT POWER	5VDC, AC-DC power converter	FREQUENCY RANGE	150kHz – 30MHz
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson



REMARKS:
1. Q.P. and AV. are abbreviations for quasi-peak and average respectively.
2. All emission levels were greater than 20dB below the limit.

Appendix A: Test Photos

Figure 13 - Radiated Emissions Test Setup

Figure 14 - Radiated Emissions Test Setup

Figure 15 - Conducted Emissions Test Setup

Figure 16 - Conducted Emissions Test Setup

Appendix B: Sample Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.

FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBμV/m

The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m

AV is calculated by the taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

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