



EMC TEST REPORT

Report No. : EME-020856

Model No. : WB1500S

Issued Date : Sep. 30, 2002

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Project Engineer

Kaysi Chen

Reviewed By

Elton Chen



Table of Contents

Summary of Tests	4
1. General information	5
1.1 Identification of the EUT	5
1.2 Additional information about the EUT	5
1.3 Antenna description	6
1.4 Peripherals equipment.....	6
2. Test specifications	7
2.1 Test standard	7
2.2 Operation mode.....	7
2.4 Test equipment	8
3. Minimum 6dB Bandwidth test.....	9
3.1 Operating environment	9
3.2 Test setup & procedure	9
3.3 Measured data of Minimum 6dB Bandwidth test results.....	9
4. Maximum Output Power test	10
4.1 Operating environment	10
4.2 Test setup & procedure	10
4.3 Measured data of Maximum Output Power test results.....	10
5. RF Antenna Conducted Spurious test.....	11
5.1 Operating environment	11
5.2 Test setup & procedure	11
5.3 Measured data of the highest RF Antenna Conducted Spurious test result.....	11
6. Radiated Emission test.....	12
6.1 Operating environment	12
6.2 Test setup & procedure	12
6.3 Emission limits.....	13
6.4 Radiated spurious emission test data	14
6.4.1 Measurement results: frequencies equal to or less than 1 GHz	14
6.4.2 Measurement results: frequency above 1GHz	20
7. Power Spectrum Density test	32
7.1 Operating environment	32
7.2 Test setup & procedure	32



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 3 of 37

7.3 Measured data of Power Spectrum Density test results.....	32
8. Emission on the band edge §FCC 15.247(C)	33
9. Power Line Conducted Emission test §FCC 15.207.....	34
9.1 Operating environment	34
9.2 Test setup & procedure	34
9.3 Power Line Conducted Emission test data.....	35



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 4 of 37

Summary of Tests

802.11b Wireless Short PC Card-Model: WB1500S

FCC ID: MQ4WB1K5S

Test	Reference	Results
Minimum 6dB Bandwidth test	15.247(a)(2)	Complies
Maximum Output Power test	15.247(b)	Complies
RF Antenna Conducted Spurious test	15.247(c)	Complies
Radiated Spurious Emission test	15.205, 15.209	Complies
Power Spectrum Density test	15.247(d)	Complies
Power Line Conducted Emission test	15.207	Complies



1. General information

1.1 Identification of the EUT

Manufacturer	: AboCom System, Inc.
Product	: 802.11b Wireless Short PC Card
Model No.	: WB1500S
FCC ID.	: MQ4WB1K5S
Frequency Range	: 2412MHz to 2462MHz
Channel Number	: 11
Frequency of Each Channel	: 2412MHz, 2417MHz, 2422MHz, 2427MHz, 2432MHz, 2437MHz, 2442MHz, 2447MHz, 2452MHz, 2457MHz, 2462MHz
Type of Modulation	: BPSK, QPSK, CCK
Power Supply	: 5Vdc from PC
Power Cord	: N/A
Sample Received	: July 30, 2002
Test Date(s)	: Aug. 1, 2002 to Sep. 26, 2002

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The EUT lets user take full advantage of user's PC's mobility with access to real-time information and online services anytime and anywhere. Plus, with the network installation's simplicity and flexibility, user can eliminate the needs to pull cable through walls and ceilings and allow the network to go where wires cannot go.

For more detail features, please refer to User's manual as file name "Installation guide.pdf"



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 6 of 37

The EUT, applied for module approval, can be equipped with two set of antenna. The tests are based on the module with antenna separated. And the two combinations are listed as below:

Type of EUT

Definition in this report

Module with dipole antenna (with ground) WB1500S (with antenna A)

Module with dipole antenna (without ground) WB1500S (with antenna B)

(please refer to External photo as file name "External photo.pdf)

We only measured the Radiated Spurious test for two sets of antenna and recorded the measurements in this report individually for each antenna.

1.3 Antenna description

The descriptions for these two sets of antenna are the same and listed as below:

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain : 2.35dBi

Antenna Type : Dipole Antenna

Connector Type : MMCX

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
PC	N/A	N/A	N/A	FCC DoC Approved
Printer	HP	C2642A	TH86K1N2ZB	FCC DoC Approved
Modem	Dynalink	V1456VQE	00V230A00051494	FCC DoC Approved

Remark: The PC is provided by client.



2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section §15.207 、 §15.209 、 §15.247 and ANSI C63.4/1992.

The AC power conducted emissions was invested over the frequency range from 0.45MHz to 30MHz using a receiver bandwidth of 9kHz. (15.207 paragraph)

Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading recorded also on the report.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

The EUT setup configurations please refer to the photo of test configuration in item.

2.2 Operation mode

Plug the EUT into PC and turn on the power, then run the test program “Prism test Utility” under Window OS.

The EUT was continuously transmit during the test.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 8 of 37

2.4 Test equipment

Equipment	Brand	Frequency range	Model No.	Series No.	Cal.Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	825788/014	May 24, 2002
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	825428/005	June 10, 2002
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	100137	July 10, 2002
Horn Antenna	EMCO	1GHz~18GHz	3115	9906-5890	Sep. 19, 2002
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	159	June 20, 2002
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	3111	June 20, 2002
Turn Table	HDGmbH	N/A	DS 420S	420/669/01	N/A
Antenna Tower	HDGmbH	N/A	MA 240	240/573	N/A
Microwave Amplifier	Agilent	2GHz~26.5GHz	8348A	3111A00567	Dec. 20, 2001
RF Power Meter	Boonton	10kHz~100GHz	4231A	79401	May 22, 2002
Power Sensor	Boonton	30MHz~8GHz	51011-EMC	32482	May 25, 2002

Note:

1. The calibration interval of the above instruments is 12 months.



3. Minimum 6dB Bandwidth test

3.1 Operating environment

Temperature: 20 °C
Relative Humidity: 58 %

3.2 Test setup & procedure

The minimum 6dB bandwidth per FCC §15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 1MHz, the video bandwidth set at 3MHz, and the SPAN>>RBW. The test was performed at 3 channels (lowest, middle and highest channel). The minimum 6-dB modulation bandwidth is in the following Table.

See Minimum 6dB Bandwidth plot as file name “Minimum 6dB Bandwidth plot.pdf”

3.3 Measured data of Minimum 6dB Bandwidth test results

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
Low	2413.40	11.20	> 500kHz
Middle	2438.40	11.20	> 500kHz
High	2463.40	11.30	> 500kHz



4. Maximum Output Power test

4.1 Operating environment

Temperature: 22 °C
Relative Humidity: 60 %

4.2 Test setup & procedure

The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to power meter via power sensor. Power was read directly and cable loss correction (1dB) was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel).

4.3 Measured data of Maximum Output Power test results

Channel	Frequency (MHz)	C.B.L. (dB)	Reading (dBm)	Power Output		Limit (W)
				(dBm)	(mW)	
Lowest	2412	1	10.15	11.15	13.03	1
Middle	2437	1	10.56	11.56	14.32	1
Highest	2462	1	10.25	11.25	13.33	1



5. RF Antenna Conducted Spurious test

5.1 Operating environment

Temperature: 20 °C
Relative Humidity: 58 %

5.2 Test setup & procedure

The measurements were performed from 30MHz to 25GHz RF antenna conducted per FCC 15.247 (c) was measured from the EUT antenna port using a 50ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz.

Harmonics and spurious noise must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The table below is the results from the highest emission for each channel within the authorized band. This table was used to determine the spurious limits for each channel.

See RF Antenna Conducted plot as file name “RF Antenna Conducted plot.pdf”

5.3 Measured data of the highest RF Antenna Conducted Spurious test result

Channel	Max Spurious level at Frequency (MHz)	Spurious Emission level (dBm)	Limit (dB)
Low	2400.00	-38.06	-23.71
Middle	4873.74	-48.39	-23.16
High	4918.84	-50.71	-23.51

Note: 1. Limit = peak power output (in 100kHz RBW) – 20dB
2. All the other emissions were very low the limit.

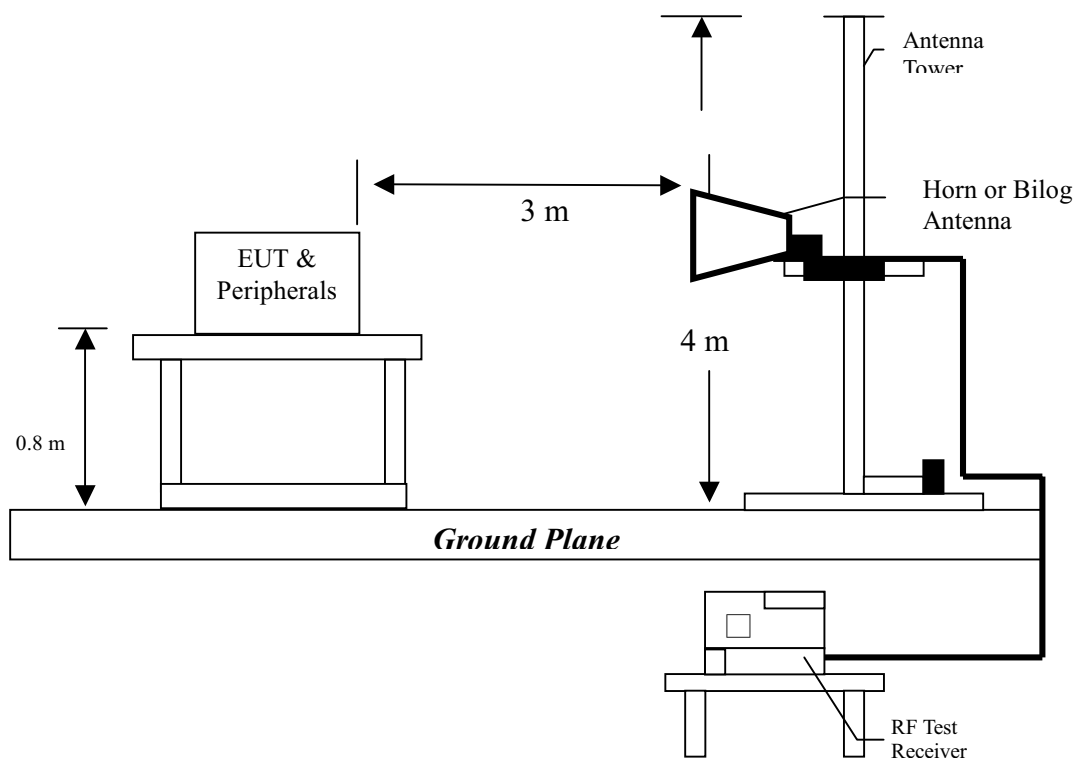
6. Radiated Emission test

6.1 Operating environment

Temperature: 20 °C
Relative Humidity: 58 %

6.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.



6.3 Emission limits

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81.

Expanded uncertainty (k=2) of radiated emission measurement is ± 3.078 dB.



6.4 Radiated spurious emission test data

6.4.1 Measurement results: frequencies equal to or less than 1 GHz

The radiated spurious emissions at

Frequency(MHz)	Margin
220.00000	-1.10

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna A)

Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
176.00000	QP	V	10.97	17.73	28.70	43.50	-14.80
220.00000	QP	V	13.82	27.28	41.10	46.00	-4.90
264.00000	QP	V	14.77	18.83	33.60	46.00	-12.40
308.00000	QP	V	15.91	15.29	31.20	46.00	-14.80
396.00000	QP	V	19.53	9.17	28.70	46.00	-17.30
748.00000	QP	V	25.27	5.43	30.70	46.00	-15.30
176.00000	QP	H	10.97	26.53	37.50	43.50	-6.00
220.00000	QP	H	13.82	31.08	44.90	46.00	-1.10
264.00000	QP	H	14.77	20.03	34.80	46.00	-11.20
308.00000	QP	H	15.91	21.99	37.90	46.00	-8.10
396.00000	QP	H	19.53	5.67	25.20	46.00	-20.80
748.00000	QP	H	25.27	5.33	30.60	46.00	-15.40

Remark:

1. Corrected Level = Reading Level + Correction Factor

2. Correction Factor = Antenna Factor + Cable Loss

3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 15 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
220.00000	-1.70

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna A)

Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
176.00000	QP	V	10.97	14.13	25.10	43.50	-18.40
220.00000	QP	V	13.82	26.30	40.12	46.00	-5.88
264.00000	QP	V	14.77	17.84	32.61	46.00	-13.39
308.00000	QP	V	15.91	14.09	30.00	46.00	-16.00
396.00000	QP	V	19.53	8.97	28.50	46.00	-17.50
748.00000	QP	V	25.27	5.73	31.00	46.00	-15.00
176.00000	QP	H	10.97	25.13	36.10	43.50	-7.40
220.00000	QP	H	13.82	30.48	44.30	46.00	-1.70
264.00000	QP	H	14.77	19.03	33.80	46.00	-12.20
308.00000	QP	H	15.91	20.19	36.10	46.00	-9.90
396.00000	QP	H	19.53	5.37	24.90	46.00	-21.10
748.00000	QP	H	25.27	6.28	31.55	46.00	-14.45

Remark:

1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 16 of 37

EUT : WB1500S (with antenna A)

Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
176.00000	QP	V	10.97	13.73	24.70	43.50	-18.80
220.00000	QP	V	13.82	27.78	41.60	46.00	-4.40
264.00000	QP	V	14.77	18.83	33.60	46.00	-12.40
308.00000	QP	V	15.91	15.29	31.20	46.00	-14.80
396.00000	QP	V	19.53	7.37	26.90	46.00	-19.10
748.00000	QP	V	25.27	7.53	32.80	46.00	-13.20
176.00000	QP	H	10.97	24.03	35.00	43.50	-8.50
220.00000	QP	H	13.82	27.48	41.30	46.00	-4.70
264.00000	QP	H	14.77	18.13	32.90	46.00	-13.10
308.00000	QP	H	15.91	19.79	35.70	46.00	-10.30
396.00000	QP	H	19.53	4.07	23.60	46.00	-22.40
748.00000	QP	H	25.27	7.43	32.70	46.00	-13.30

Remark:

1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 17 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
220.00000	-2.30

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna B)

Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
176.00000	QP	V	10.97	18.83	29.80	43.50	-13.70
220.00000	QP	V	13.82	28.98	42.80	46.00	-3.20
264.00000	QP	V	14.77	17.63	32.40	46.00	-13.60
308.00000	QP	V	15.91	16.99	32.90	46.00	-13.10
396.00000	QP	V	19.53	9.47	29.00	46.00	-17.00
748.00000	QP	V	25.27	5.83	31.10	46.00	-14.90
176.00000	QP	H	10.97	25.83	36.80	43.50	-6.70
220.00000	QP	H	13.82	29.88	43.70	46.00	-2.30
264.00000	QP	H	14.77	20.63	35.40	46.00	-10.60
308.00000	QP	H	15.91	20.49	36.40	46.00	-9.60
396.00000	QP	H	19.53	7.37	26.90	46.00	-19.10
748.00000	QP	H	25.27	6.23	31.50	46.00	-14.50

Remark:

1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 18 of 37

EUT : WB1500S (with antenna B)

Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
176.00000	QP	V	10.97	13.73	24.70	43.50	-18.80
220.00000	QP	V	13.82	27.78	41.60	46.00	-4.40
264.00000	QP	V	14.77	16.83	31.60	46.00	-14.40
308.00000	QP	V	15.91	13.89	29.80	46.00	-16.20
396.00000	QP	V	19.53	10.87	30.40	46.00	-15.60
748.00000	QP	V	25.27	5.23	30.50	46.00	-15.50
176.00000	QP	H	10.97	24.73	35.70	43.50	-7.80
220.00000	QP	H	13.82	27.78	41.60	46.00	-4.40
264.00000	QP	H	14.77	17.73	32.50	46.00	-13.50
308.00000	QP	H	15.91	18.19	34.10	46.00	-11.90
396.00000	QP	H	19.53	5.27	24.80	46.00	-21.20
748.00000	QP	H	25.27	7.33	32.60	46.00	-13.40

Remark:

1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 19 of 37

EUT : WB1500S (with antenna B)

Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
176.00000	QP	V	10.97	14.13	25.10	43.50	-18.40
220.00000	QP	V	13.82	26.18	40.00	46.00	-6.00
264.00000	QP	V	14.77	17.83	32.60	46.00	-13.40
308.00000	QP	V	15.91	16.59	32.50	46.00	-13.50
396.00000	QP	V	19.53	8.27	27.80	46.00	-18.20
748.00000	QP	V	25.27	8.13	33.40	46.00	-12.60
176.00000	QP	H	10.97	23.73	34.70	43.50	-8.80
220.00000	QP	H	13.82	26.78	40.60	46.00	-5.40
264.00000	QP	H	14.77	17.73	32.50	46.00	-13.50
308.00000	QP	H	15.91	17.99	33.90	46.00	-12.10
396.00000	QP	H	19.53	4.57	24.10	46.00	-21.90
748.00000	QP	H	25.27	5.53	30.80	46.00	-15.20

Remark:

1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



6.4.2 Measurement results: frequency above 1GHz

EUT : WB1500S (with antenna A)

Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	V	0	29.36	20.34	49.7	74	-24.3
2038	AV	V	0	29.36	15.52	44.88	54	-9.12
4076	PK	V	28.02	34.59	41.05	47.62	74	-26.38
4076	AV	V	28.02	34.59	30.24	36.81	54	-17.19
6114	PK	V	28.02	37.74	40.91	50.63	74	-23.37
6114	AV	V	28.02	37.74	29.45	39.17	54	-14.83
8152	PK	V	28.02	40.05	-	-	74	-
8152	AV	V	28.02	40.05	-	-	54	-
4824	PK	V	28.02	35.47	42.13	49.58	74	-24.42
4824	AV	V	28.02	35.47	30.44	37.89	54	-16.11
7236	PK	V	28.02	38.42	40	50.4	74	-23.6
7236	AV	V	28.02	38.42	28.21	38.61	54	-15.39
9648	PK	V	28.02	41.35	-	-	74	-
9648	AV	V	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 21 of 37

EUT : WB1500S (with antenna A)

Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	H	0	29.36	21.19	50.55	74	-23.45
2038	AV	H	0	29.36	16.02	45.38	54	-8.62
4076	PK	H	28.02	34.59	39.66	46.23	74	-27.77
4076	AV	H	28.02	34.59	27.41	33.98	54	-20.02
6114	PK	H	28.02	37.74	-	-	74	-
6114	AV	H	28.02	37.74	-	-	54	-
8152	PK	H	28.02	40.05	-	-	74	-
8152	AV	H	28.02	40.05	-	-	54	-
4824	PK	H	28.02	35.47	42.11	49.56	74	-24.44
4824	AV	H	28.02	35.47	30.45	37.9	54	-16.1
7236	PK	H	28.02	38.42	-	-	74	-
7236	AV	H	28.02	38.42	-	-	54	-
9648	PK	H	28.02	41.35	-	-	74	-
9648	AV	H	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 22 of 37

EUT : WB1500S (with antenna A)

Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	V	0	29.36	22.83	52.19	74	-21.81
2063	AV	V	0	29.36	18.44	47.8	54	-6.2
4126	PK	V	28.02	34.59	42.51	49.08	74	-24.92
4126	AV	V	28.02	34.59	29.07	35.64	54	-18.36
6189	PK	V	28.02	37.74	40.29	50.01	74	-23.99
6189	AV	V	28.02	37.74	28.45	38.17	54	-15.83
8252	PK	V	28.02	39.97	-	-	74	-
8252	AV	V	28.02	39.97	-	-	54	-
4874	PK	V	28.02	35.47	36.98	44.43	74	-29.57
4874	AV	V	28.02	35.47	27.6	35.05	54	-18.95
7311	PK	V	28.02	38.42	45.67	56.07	74	-17.93
7311	AV	V	28.02	38.42	33.95	44.35	54	-9.65
9748	PK	V	28.02	41.35	-	-	74	-
9748	AV	V	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 23 of 37

EUT : WB1500S (with antenna A)

Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	H	0	29.36	22.04	51.4	74	-22.6
2063	AV	H	0	29.36	17.21	46.57	54	-7.43
4126	PK	H	28.02	34.59	40.12	46.69	74	-27.31
4126	AV	H	28.02	34.59	33.52	40.09	54	-13.91
6189	PK	H	28.02	37.74	42.55	52.27	74	-21.73
6189	AV	H	28.02	37.74	30.21	39.93	54	-14.07
8252	PK	H	28.02	39.97	-	-	74	-
8252	AV	H	28.02	39.97	-	-	54	-
4874	PK	H	28.02	35.47	40.61	48.06	74	-25.94
4874	AV	H	28.02	35.47	29.25	36.7	54	-17.3
7311	PK	H	28.02	38.42	-	-	74	-
7311	AV	H	28.02	38.42	-	-	54	-
9748	PK	H	28.02	41.35	-	-	74	-
9748	AV	H	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 24 of 37

EUT : WB1500S (with antenna A)

Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	V	0	29.36	23.41	52.77	74	-21.23
2088	AV	V	0	29.36	17.66	47.02	54	-6.98
4176	PK	V	28.02	34.59	40.75	47.32	74	-26.68
4176	AV	V	28.02	34.59	31.61	38.18	54	-15.82
6264	PK	V	28.02	37.74	41.77	51.49	74	-22.51
6264	AV	V	28.02	37.74	29.77	39.49	54	-14.51
8352	PK	V	28.02	39.97	-	-	74	-
8352	AV	V	28.02	39.97	-	-	54	-
4924	PK	V	28.02	35.47	35.74	43.19	74	-30.81
4924	AV	V	28.02	35.47	26.88	34.33	54	-19.67
7386	PK	V	28.02	38.42	46.95	57.35	74	-16.65
7386	AV	V	28.02	38.42	34.25	44.65	54	-9.35
9848	PK	V	28.02	41.55	-	-	74	-
9848	AV	V	28.02	41.55	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 25 of 37

EUT : WB1500S (with antenna A)

Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	H	0	29.36	21.41	50.77	74	-23.23
2088	AV	H	0	29.36	16.74	46.1	54	-7.9
4176	PK	H	28.02	34.59	41.61	48.18	74	-25.82
4176	AV	H	28.02	34.59	32.85	39.42	54	-14.58
6264	PK	H	28.02	37.74	40.31	50.03	74	-23.97
6264	AV	H	28.02	37.74	29.24	38.96	54	-15.04
8352	PK	H	28.02	39.97	-	-	74	-
8352	AV	H	28.02	39.97	-	-	54	-
4924	PK	H	28.02	35.47	39.88	47.33	74	-26.67
4924	AV	H	28.02	35.47	27.65	35.1	54	-18.9
7386	PK	H	28.02	38.42	-	-	74	-
7386	AV	H	28.02	38.42	-	-	54	-
9848	PK	H	28.02	41.55	-	-	74	-
9848	AV	H	28.02	41.55	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 26 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
2038	-1

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna B)

Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	V	0	29.36	29.02	58.38	74	-15.62
2038	AV	V	0	29.36	23.64	53	54	-1
4076	PK	V	28.02	34.59	43.65	50.22	74	-23.78
4076	AV	V	28.02	34.59	32.54	39.11	54	-14.89
6114	PK	V	28.02	37.74	40.11	49.83	74	-24.17
6114	AV	V	28.02	37.74	29.85	39.57	54	-14.43
8152	PK	V	28.02	40.05	-	-	74	-
8152	AV	V	28.02	40.05	-	-	54	-
4824	PK	V	28.02	35.47	43.56	51.01	74	-22.99
4824	AV	V	28.02	35.47	31.11	38.56	54	-15.44
7236	PK	V	28.02	38.42	43.7	54.1	74	-19.9
7236	AV	V	28.02	38.42	33.37	43.77	54	-10.23
9648	PK	V	28.02	41.35	-	-	74	-
9648	AV	V	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 27 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
2038	-1.44

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna B)

Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	H	0	29.36	29.55	58.91	74	-15.09
2038	AV	H	0	29.36	23.2	52.56	54	-1.44
4076	PK	H	28.02	34.59	41.66	48.23	74	-25.77
4076	AV	H	28.02	34.59	29.75	36.32	54	-17.68
6114	PK	H	28.02	37.74	-	-	74	-
6114	AV	H	28.02	37.74	-	-	54	-
8152	PK	H	28.02	40.05	-	-	74	-
8152	AV	H	28.02	40.05	-	-	54	-
4824	PK	H	28.02	35.47	41.55	49	74	-25
4824	AV	H	28.02	35.47	30.12	37.57	54	-16.43
7236	PK	H	28.02	38.42	45.97	56.37	74	-17.63
7236	AV	H	28.02	38.42	32.67	43.07	54	-10.93
9648	PK	H	28.02	41.35	-	-	74	-
9648	AV	H	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp

2. Correction Factor = Antenna Factor + Cable Loss

3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 28 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
2063	-1.94

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna B)

Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	V	0	29.36	29.59	58.95	74	-15.05
2063	AV	V	0	29.36	22.7	52.06	54	-1.94
4126	PK	V	28.02	34.59	42.23	48.8	74	-25.2
4126	AV	V	28.02	34.59	31.98	38.55	54	-15.45
6189	PK	V	28.02	37.74	41.83	51.55	74	-22.45
6189	AV	V	28.02	37.74	28.77	38.49	54	-15.51
8252	PK	V	28.02	39.97	-	-	74	-
8252	AV	V	28.02	39.97	-	-	54	-
4874	PK	V	28.02	35.47	42.22	49.67	74	-24.33
4874	AV	V	28.02	35.47	31.67	39.12	54	-14.88
7311	PK	V	28.02	38.42	41.88	52.28	74	-21.72
7311	AV	V	28.02	38.42	33.25	43.65	54	-10.35
9748	PK	V	28.02	41.35	-	-	74	-
9748	AV	V	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 29 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
2063	-0.49

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna B)

Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	H	0	29.36	29.83	59.19	74	-14.81
2063	AV	H	0	29.36	24.15	53.51	54	-0.49
4126	PK	H	28.02	34.59	41.41	47.98	74	-26.02
4126	AV	H	28.02	34.59	30.45	37.02	54	-16.98
6189	PK	H	28.02	37.74	40.95	50.67	74	-23.33
6189	AV	H	28.02	37.74	28.43	38.15	54	-15.85
8252	PK	H	28.02	39.97	-	-	74	-
8252	AV	H	28.02	39.97	-	-	54	-
4874	PK	H	28.02	35.47	42.01	49.46	74	-24.54
4874	AV	H	28.02	35.47	32.88	40.33	54	-13.67
7311	PK	H	28.02	38.42	45.11	55.51	74	-18.49
7311	AV	H	28.02	38.42	32.15	42.55	54	-11.45
9748	PK	H	28.02	41.35	-	-	74	-
9748	AV	H	28.02	41.35	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp

2. Correction Factor = Antenna Factor + Cable Loss

3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 30 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
2088	-1.63

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna B)

Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	V	0	29.36	30.45	59.81	74	-14.19
2088	AV	V	0	29.36	23.01	52.37	54	-1.63
4176	PK	V	28.02	34.59	41.66	48.23	74	-25.77
4176	AV	V	28.02	34.59	30.85	37.42	54	-16.58
6264	PK	V	28.02	37.74	40.95	50.67	74	-23.33
6264	AV	V	28.02	37.74	29.51	39.23	54	-14.77
8352	PK	V	28.02	39.97	-	-	74	-
8352	AV	V	28.02	39.97	-	-	54	-
4924	PK	V	28.02	35.47	41.63	49.08	74	-24.92
4924	AV	V	28.02	35.47	30.44	37.89	54	-16.11
7386	PK	V	28.02	38.42	42.91	53.31	74	-20.69
7386	AV	V	28.02	38.42	30.87	41.27	54	-12.73
9848	PK	V	28.02	41.55	-	-	74	-
9848	AV	V	28.02	41.55	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 31 of 37

The radiated spurious emissions at

Frequency(MHz)	Margin
2088	-1.93

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : WB1500S (with antenna B)

Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	H	0	29.36	30.44	59.8	74	-14.2
2088	AV	H	0	29.36	22.71	52.07	54	-1.93
4176	PK	H	28.02	34.59	40.75	47.32	74	-26.68
4176	AV	H	28.02	34.59	29.84	36.41	54	-17.59
6264	PK	H	28.02	37.74	41.75	51.47	74	-22.53
6264	AV	H	28.02	37.74	30.23	39.95	54	-14.05
8352	PK	H	28.02	39.97	-	-	74	-
8352	AV	H	28.02	39.97	-	-	54	-
4924	PK	H	28.02	35.47	41.25	48.7	74	-25.3
4924	AV	H	28.02	35.47	30.55	38	54	-16
7386	PK	H	28.02	38.42	44.87	55.27	74	-18.73
7386	AV	H	28.02	38.42	33.94	44.34	54	-9.66
9848	PK	H	28.02	41.55	-	-	74	-
9848	AV	H	28.02	41.55	-	-	54	-

Remark:

1. Corrected Level = Reading Level + Correction Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.



7. Power Spectrum Density test

7.1 Operating environment

Temperature: 22 °C
Relative Humidity: 59 %

7.2 Test setup & procedure

The power spectrum density per FCC § 15.247(d) was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 30kHz, a span of 1.5 MHz, and the sweep time set at 500 seconds. Power Density was read directly and cable loss (1dB)/external attenuator (3dB) correction was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel). The Power Spectral Density measured result is in the following table.

See Power Spectrum Density plot as file name “Power Spectrum Density plot.pdf”

7.3 Measured data of Power Spectrum Density test results

Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
Low	2413.115	-14.49	8
Middle	2438.115	-14.19	8
High	2463.115	-14.53	8



8. Emission on the band edge §FCC 15.247(C)

In any 100kHz 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.

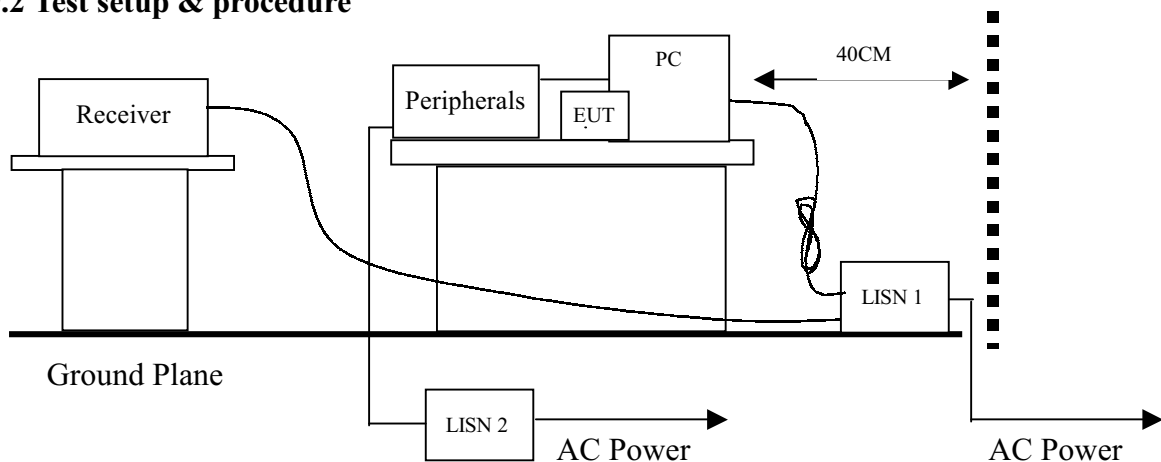
See band-edge plot as file name “Band-edge plot.pdf”.

9. Power Line Conducted Emission test §FCC 15.207

9.1 Operating environment

Temperature: 22 °C
Relative Humidity: 59 %

9.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/1992 on conducted measurement.

The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

See Power Line Conducted Emission plot as file name “Power Line Conducted Emission plot.pdf”.

Emission Limit

FCC Part 15 Paragraph 15.207		
Freq. (MHz)	Maximum RF Line Voltage	
	uV	dBuV
0.45 - 30	250	48.0



9.3 Power Line Conducted Emission test data

EUT : WB1500S

Test Condition : Tx at low channel

Power Line (circle)	Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Margin (dB) QP
LINE	0.61800	36.3	48.00	-11.70
LINE	0.79400	34.7	48.00	-13.30
LINE	0.97800	36.2	48.00	-11.80
LINE	1.77000	35.2	48.00	-12.80
LINE	2.60200	29.8	48.00	-18.20
LINE	26.77800	26.3	48.00	-21.70
NEUTRAL	0.65000	37.1	48.00	-10.90
NEUTRAL	0.96200	35.7	48.00	-12.30
NEUTRAL	1.77000	33.8	48.00	-14.20
NEUTRAL	2.60200	30.0	48.00	-18.00
NEUTRAL	8.75400	16.2	48.00	-31.80
NEUTRAL	26.85000	24.7	48.00	-23.30

Remark:

1. The reading value included cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81.

Expanded uncertainty (k=2) of conducted emission measurement is ± 2.6 dB.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 36 of 37

EUT : WB1500S

Test Condition : Tx at middle channel

Power Line (circle)	Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Margin (dB) QP
LINE	0.61800	36.2	48.00	-11.80
LINE	0.74600	34.8	48.00	-13.20
LINE	0.97800	36.8	48.00	-11.20
LINE	1.77000	34.9	48.00	-13.10
LINE	2.60200	30.2	48.00	-17.80
LINE	26.77800	26.4	48.00	-21.60
NEUTRAL	0.65000	37.7	48.00	-10.30
NEUTRAL	0.83400	35.9	48.00	-12.10
NEUTRAL	0.96200	35.8	48.00	-12.20
NEUTRAL	1.77000	33.5	48.00	-14.50
NEUTRAL	2.60200	30.0	48.00	-18.00
NEUTRAL	26.97800	26.9	48.00	-21.10

Remark:

1. The reading value included cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81.

Expanded uncertainty (k=2) of conducted emission measurement is ± 2.6 dB.



Intertek Testing Services

ETL SEMKO

FCC ID. : MQ4WB1K5S

Report No.: EME-020856

Page 37 of 37

EUT : WB1500S

Test Condition : Tx at high channel

Power Line (circle)	Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Margin (dB) QP
LINE	0.61800	36.2	48.00	-11.80
LINE	0.79400	35.9	48.00	-12.10
LINE	0.97800	37.1	48.00	-10.90
LINE	1.76200	33.7	48.00	-14.30
LINE	2.60200	30.2	48.00	-17.80
LINE	26.77800	26.6	48.00	-21.40
NEUTRAL	0.65000	37.3	48.00	-10.70
NEUTRAL	0.83400	36.3	48.00	-11.70
NEUTRAL	0.96200	35.3	48.00	-12.70
NEUTRAL	1.77000	33.6	48.00	-14.40
NEUTRAL	2.60200	30.0	48.00	-18.00
NEUTRAL	26.91400	26.3	48.00	-21.70

Remark:

1. The reading value included cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81.

Expanded uncertainty (k=2) of conducted emission measurement is ± 2.6 dB.