EMC
TEST REPORT

Report No. : EME-021561
Model No. : WB1500SH
Issued Date : Jan. 23, 2003

Applicant : AboCom Systems, Inc.
300 1F, No. 21, R&D Rd. II, SBIP, Hsin-Chu,
Taiwan

Test By : Intertek Testing Services Taiwan Ltd.
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Table of Contents

Summary of Tests

802.11b Wireless Short PC Card with high power
Model: WB1500SH
FCC ID: MQ4WB1K5SH

Test	Reference	Results
Minimum 6dB Bandwidth test	15.247(a)(2)	Complies
Maximum Output Power test	15.247(b)	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 with high power
Model No.	: WB1500SH
FCC ID.	: MQ4WB1K5SH
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	: CCK (11Mps, 5.5Mbps), DQPSK (2Mbps), DBPSK (1Mbps)
Power Supply	: 5Vdc from PC
Power Cord	: N/A
Sample Received	: Oct. 24, 2002
Test Date(s)	: Oct. 29, 2002 to Nov. 1, 2002

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The 802.11b Wireless Short PC Card lets user take full advantage of user's PC's mobility with access to real-time information and online services anytime and anywhere.

The EUT meets special requirements for full modular approval on FCC Public Notice DA 00-1407 and the device is only for OEM integrator, please refer the test result in this report.

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

The EUT can be equipped with four kinds of antenna. The tests are based on the module with antenna separated. And the combinations are listed as below:

Item	Type of EUT	Definition in this report
1	Module with dipole antenna (with ground, a set of two antennas, 15cm & 12cm, white and black color)	WB1500SH (with antenna A)
2	Module with dipole antenna (without ground, a set of two antennas, 15cm & 12cm, white and black color)	WB1500SH (with antenna A1)
3	Module with dipole antenna (the same as item 2, the only difference is manufacturer)	WB1500SH (with antenna A2)
4	Module with dipole antenna (with ground, single antenna)	WB1500SH (with antenna B)

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

We only measured the Maximum Output Power test, Radiated Spurious test and Band-edge test for antenna A and antenna B and recorded the measurements in this report individually for each antenna.

1.3 Antenna description

The description of four kinds of antennas lists as below:

For antenna A, A1& A2:

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 : 2dBi
Antenna Type : Dipole antenna
Connector Type : MMCX Connector

For antenna B:

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 : 1.8dBi
Antenna Type : Dipole antenna
Connector Type : MMCX Connector

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook	HP	XE_3	TW20705468	FCC DoC Approved
Printer	HP	C2642A	TH86K1N2ZB	FCC DoC Approved
Modem	Dynalink	V1456VQE	00V230A00051494	FCC DoC Approved

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section §15.205、§15.207、§15.209、§15.247 and ANSI C63.4/1992.

The AC power conducted emissions was invested over the frequency range from 0.15MHz 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 Notebook and turn on the power, then run the test program “Prism test Utility” under Window OS.

The EUT was continuously transmit during the test.

2.4 Test equipment

Equipment	Brand	Frequency range	Model No.	Series No.	Last 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
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	100186	Oct. 9, 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, 2002
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:	23	℃
Relative Humidity:	58	%
Atmospheric Pressure	1023	hPa

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 100kHz, the video bandwidth set at 100kHz, 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	2142	10.421	＞500kHz
Middle	2437	10.220	＞500kHz
High	2462	10.220	＞500kHz

4. Maximum Output Power test

4.1 Operating environment

Temperature:	22	℃
Relative Humidity:	60	%
Atmospheric Pressure	1023	hPa

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	2142	1	18.69	19.69	93.111	1
Middle	2437	1	17.21	18.21	66.222	1
Highest	2462	1	16.35	17.35	54.325	1

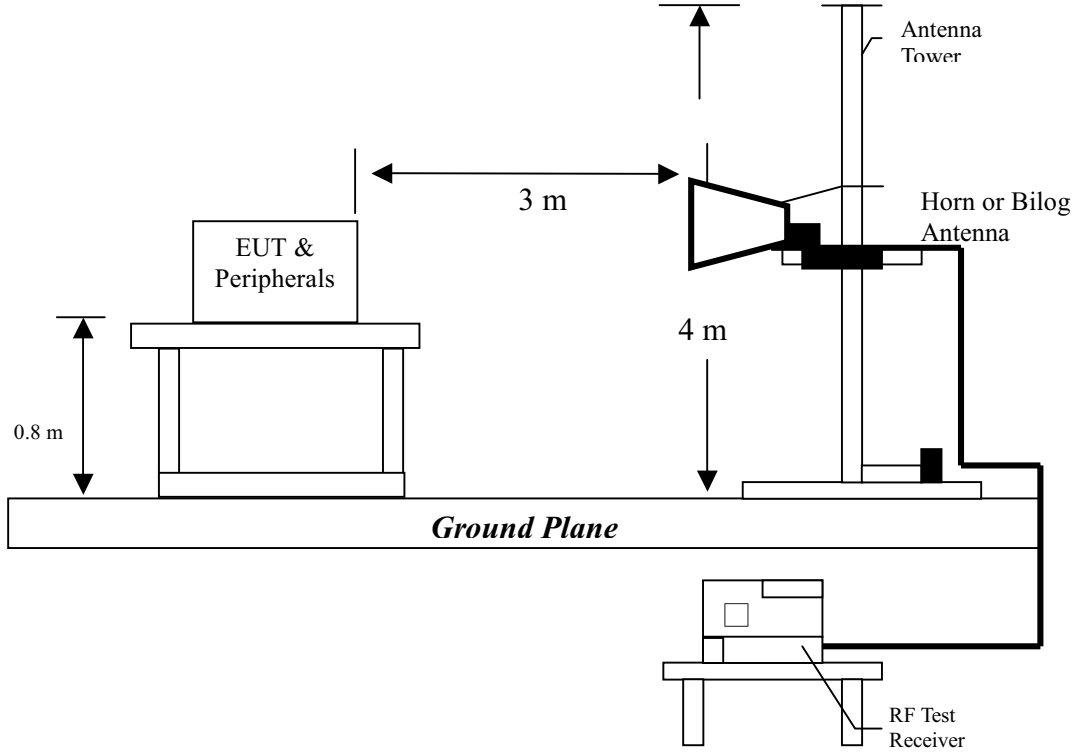
5. Radiated Emission test

5.1 Operating environment

Temperature:	23	℃
Relative Humidity:	58	%
Atmospheric Pressure	1023	hPa

5.2 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.

5.3 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.
Expanded uncertainty (k=2) of conducted emission measurement is ±2.02 dB.

5.4 Radiated spurious emission test data

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

EUT : WB1500SH (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 Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
132.80000	QP	V	13.36	20.54	33.90	43.50	-9.60
198.80000	QP	V	12.03	27.47	39.50	43.50	-4.00
332.60000	QP	V	15.30	13.30	28.60	46.00	-17.40
365.60000	QP	V	15.83	15.37	31.20	46.00	-14.80
398.60000	QP	V	16.67	22.73	39.40	46.00	-6.60
532.50000	QP	V	19.46	14.54	34.00	46.00	-12.00
132.80000	QP	H	13.36	23.04	36.40	43.50	-7.10
165.80000	QP	H	14.92	20.68	35.60	43.50	-7.90
196.80000	QP	H	12.03	28.07	40.10	43.50	-3.40
299.70000	QP	H	14.39	20.91	35.30	46.00	-10.70
400.50000	QP	H	16.96	25.14	42.10	46.00	-3.90
532.50000	QP	H	19.46	17.14	36.60	46.00	-9.40

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

EUT : WB1500SH (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 Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
132.80000	QP	V	13.36	19.04	32.40	43.50	-11.10
198.80000	QP	V	12.03	26.37	38.40	43.50	-5.10
332.60000	QP	V	15.30	14.10	29.40	46.00	-16.60
365.60000	QP	V	15.83	14.97	30.80	46.00	-15.20
398.60000	QP	V	16.67	20.43	37.10	46.00	-8.90
532.50000	QP	V	19.46	15.54	35.00	46.00	-11.00
132.80000	QP	H	13.36	22.04	35.40	43.50	-8.10
165.80000	QP	H	14.92	18.28	33.20	43.50	-10.30
196.80000	QP	H	12.03	27.07	39.10	43.50	-4.40
299.70000	QP	H	14.39	20.81	35.20	46.00	-10.80
400.50000	QP	H	16.96	25.04	42.00	46.00	-4.00
532.50000	QP	H	19.46	16.64	36.10	46.00	-9.90

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

The radiated spurious emissions at

Frequency(MHz)	Margin
196.80000	-2.11

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

EUT : WB1500SH (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 Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
132.80000	QP	V	13.36	17.84	31.20	43.50	-12.30
198.80000	QP	V	12.03	25.57	37.60	43.50	-5.90
332.60000	QP	V	15.30	15.10	30.40	46.00	-15.60
365.60000	QP	V	15.83	13.97	29.80	46.00	-16.20
398.60000	QP	V	16.67	20.03	36.70	46.00	-9.30
532.50000	QP	V	19.46	14.54	34.00	46.00	-12.00
132.80000	QP	H	13.36	21.34	34.70	43.50	-8.80
165.80000	QP	H	14.92	17.48	32.40	43.50	-11.10
196.80000	QP	H	12.03	28.67	40.70	43.50	-2.80
299.70000	QP	H	14.39	21.61	36.00	46.00	-10.00
400.50000	QP	H	16.96	24.24	41.20	46.00	-4.80
532.50000	QP	H	19.46	18.34	37.80	46.00	-8.20

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

The radiated spurious emissions at

Frequency(MHz)	Margin
582.90000	-2.50
198.80000	-2.00

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

EUT : WB1500SH (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 Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
132.80000	QP	V	13.36	20.24	33.60	43.50	-9.90
198.80000	QP	V	12.03	24.77	36.80	43.50	-6.70
365.60000	QP	V	15.83	15.07	30.90	46.00	-15.10
400.50000	QP	V	16.96	21.14	38.10	46.00	-7.90
532.80000	QP	V	19.46	19.04	38.50	46.00	-7.50
582.90000	QP	V	20.65	22.85	43.50	46.00	-2.50
198.80000	QP	H	12.03	29.47	41.50	43.50	-2.00
266.70000	QP	H	13.32	26.28	39.60	46.00	-6.40
332.60000	QP	H	15.30	21.40	36.70	46.00	-9.30
398.60000	QP	H	16.67	23.33	40.00	46.00	-6.00
530.50000	QP	H	19.46	19.94	39.40	46.00	-6.60
623.60000	QP	H	21.31	20.09	41.40	46.00	-4.60

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

The radiated spurious emissions at

Frequency(MHz)	Margin
198.80000	-2.80

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

EUT : WB1500SH (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 Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
132.80000	QP	V	13.36	19.04	32.40	43.50	-11.10
198.80000	QP	V	12.03	23.67	35.70	43.50	-7.80
365.60000	QP	V	15.83	15.67	31.50	46.00	-14.50
400.50000	QP	V	16.96	21.64	38.60	46.00	-7.40
532.80000	QP	V	19.46	18.04	37.50	46.00	-8.50
582.90000	QP	V	20.65	21.45	42.10	46.00	-3.90
198.80000	QP	H	12.03	28.67	40.70	43.50	-2.80
266.70000	QP	H	13.32	25.78	39.10	46.00	-6.90
332.60000	QP	H	15.30	19.80	35.10	46.00	-10.90
398.60000	QP	H	16.67	23.53	40.20	46.00	-5.80
530.50000	QP	H	19.46	20.84	40.30	46.00	-5.70
623.60000	QP	H	21.31	19.69	41.00	46.00	-5.00

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

EUT : WB1500SH (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 Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
132.80000	QP	V	13.36	20.34	33.70	43.50	-9.80
198.80000	QP	V	12.03	22.07	34.10	43.50	-9.40
365.60000	QP	V	15.83	16.77	32.60	46.00	-13.40
400.50000	QP	V	16.96	22.24	39.20	46.00	-6.80
532.80000	QP	V	19.46	16.54	36.00	46.00	-10.00
582.90000	QP	V	20.65	21.05	41.70	46.00	-4.30
198.80000	QP	H	12.03	28.07	40.10	43.50	-3.40
266.70000	QP	H	13.32	26.88	40.20	46.00	-5.80
332.60000	QP	H	15.30	21.50	36.80	46.00	-9.20
398.60000	QP	H	16.67	25.23	41.90	46.00	-4.10
530.50000	QP	H	19.46	22.54	42.00	46.00	-4.00
623.60000	QP	H	21.31	20.29	41.60	46.00	-4.40

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

6.4.2 Measurement results: frequency above 1GHz

The radiated spurious emissions at

Frequency(MHz)	Margin
7236	-1.32

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

EUT : WB1500SH (with antenna A)
Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	V	0	29.36	15.42	44.78	74	-29.22
2038	AV	V	0	29.36	4.27	33.63	54	-20.37
4076	PK	V	31.88	34.59	40.77	43.48	74	-30.52
4076	AV	V	31.88	34.59	28.42	31.13	54	-22.87
6114	PK	V	33.42	37.74	38.31	42.63	74	-31.37
6114	AV	V	33.42	37.74	27.99	32.31	54	-21.69
8152	PK	V	34.92	40.05	42.08	47.21	74	-26.79
8152	AV	V	34.92	40.05	33.61	38.74	54	-15.26
10190	PK	V	36.03	41.99	-	-	74	-
10190	AV	V	36.03	41.99	-	-	54	-
4824	PK	V	32.496	35.47	42.73	45.704	74	-28.296
4824	AV	V	32.496	35.47	29.04	32.014	54	-21.986
7236	PK	V	34.32	38.42	59.55	63.65	74	-10.35
7236	AV	V	34.32	38.42	48.58	52.68	54	-1.32
9648	PK	V	35.808	41.35	44.01	49.552	74	-24.448
9648	AV	V	35.808	41.35	36.3	41.842	54	-12.158
12060	PK	V	35.4	43.38	-	-	74	-
12060	AV	V	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna A)
Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	H	0	29.36	15.56	44.92	74	-29.08
2038	AV	H	0	29.36	3.54	32.9	54	-21.1
4076	PK	H	31.88	34.59	40.21	42.92	74	-31.08
4076	AV	H	31.88	34.59	27.67	30.38	54	-23.62
6114	PK	H	33.42	37.74	38.78	43.1	74	-30.9
6114	AV	H	33.42	37.74	29.19	33.51	54	-20.49
8152	PK	H	34.92	40.05	42.79	47.92	74	-26.08
8152	AV	H	34.92	40.05	35.55	40.68	54	-13.32
10190	PK	H	36.03	41.99	-	-	74	-
10190	AV	H	36.03	41.99	-	-	54	-
4824	PK	H	32.496	35.47	40.89	43.864	74	-30.136
4824	AV	H	32.496	35.47	27.81	30.784	54	-23.216
7236	PK	H	34.32	38.42	51.89	55.99	74	-18.01
7236	AV	H	34.32	38.42	41.02	45.12	54	-8.88
9648	PK	H	35.808	41.35	43.83	49.372	74	-24.628
9648	AV	H	35.808	41.35	37.47	43.012	54	-10.988
12060	PK	H	35.4	43.38	-	-	74	-
12060	AV	H	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna A)
Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	V	0	29.36	17.32	46.68	74	-27.32
2063	AV	V	0	29.36	4.56	33.92	54	-20.08
4126	PK	V	31.88	34.59	38.56	41.27	74	-32.73
4126	AV	V	31.88	34.59	26.78	29.49	54	-24.51
6189	PK	V	33.42	37.74	39.17	43.49	74	-30.51
6189	AV	V	33.42	37.74	30.46	34.78	54	-19.22
8252	PK	V	35.031	39.97	39.77	44.709	74	-29.291
8252	AV	V	35.031	39.97	31.25	36.189	54	-17.811
10315	PK	V	35.967	42.06	-	-	74	-
10315	AV	V	35.967	42.06	-	-	54	-
4874	PK	V	32.496	35.47	-	-	74	-
4874	AV	V	32.496	35.47	-	-	54	-
7311	PK	V	34.32	38.42	57.01	61.11	74	-12.89
7311	AV	V	34.32	38.42	46.47	50.57	54	-3.43
9748	PK	V	35.808	41.35	41.26	46.802	74	-27.198
9748	AV	V	35.808	41.35	30.9	36.442	54	-17.558
12185	PK	V	35.4	43.38	-	-	74	-
12185	AV	V	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna A)
Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	H	0	29.36	15.66	45.02	74	-28.98
2063	AV	H	0	29.36	3.79	33.15	54	-20.85
4126	PK	H	31.88	34.59	38.27	40.98	74	-33.02
4126	AV	H	31.88	34.59	26.59	29.3	54	-24.7
6189	PK	H	33.42	37.74	39.85	44.17	74	-29.83
6189	AV	H	33.42	37.74	32.03	36.35	54	-17.65
8252	PK	H	35.031	39.97	41.78	46.719	74	-27.281
8252	AV	H	35.031	39.97	34.67	39.609	54	-14.391
10315	PK	H	35.967	42.06	-	-	74	-
10315	AV	H	35.967	42.06	-	-	54	-
4874	PK	H	32.496	35.47	-	-	74	-
4874	AV	H	32.496	35.47	-	-	54	-
7311	PK	H	34.32	38.42	50.91	55.01	74	-18.99
7311	AV	H	34.32	38.42	39.83	43.93	54	-10.07
9748	PK	H	35.808	41.35	42.97	48.512	74	-25.488
9748	AV	H	35.808	41.35	34.96	40.502	54	-13.498
12185	PK	H	35.4	43.38	-	-	74	-
12185	AV	H	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna A)
Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	V	0	29.36	15.23	44.59	74	-29.41
2088	AV	V	0	29.36	4.43	33.79	54	-20.21
4176	PK	V	31.88	34.59	35.41	38.12	74	-35.88
4176	AV	V	31.88	34.59	26.15	28.86	54	-25.14
6264	PK	V	33.57	37.74	41.55	45.72	74	-28.28
6264	AV	V	33.57	37.74	29.83	34	54	-20
8352	PK	V	35.031	39.97	45.04	49.979	74	-24.021
8352	AV	V	35.031	39.97	32.12	37.059	54	-16.941
10440	PK	V	35.904	42.21	-	-	74	-
10440	AV	V	35.904	42.21	-	-	54	-
4924	PK	V	32.496	35.47	40.84	43.814	74	-30.186
4924	AV	V	32.496	35.47	28.01	30.984	54	-23.016
7386	PK	V	34.32	38.42	55.86	59.96	74	-14.04
7386	AV	V	34.32	38.42	43.12	47.22	54	-6.78
9848	PK	V	35.919	41.55	40.22	45.851	74	-28.149
9848	AV	V	35.919	41.55	30.81	36.441	54	-17.559
12310	PK	V	35.315	43.75	-	-	74	-
12310	AV	V	35.315	43.75	-	-	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.

EUT : WB1500SH (with antenna A)
Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	H	0	29.36	14.63	43.99	74	-30.01
2088	AV	H	0	29.36	3.81	33.17	54	-20.83
4176	PK	H	31.88	34.59	39.65	42.36	74	-31.64
4176	AV	H	31.88	34.59	26.32	29.03	54	-24.97
6264	PK	H	33.57	37.74	41.92	46.09	74	-27.91
6264	AV	H	33.57	37.74	30.11	34.28	54	-19.72
8352	PK	H	35.031	39.97	45.88	50.819	74	-23.181
8352	AV	H	35.031	39.97	33.96	38.899	54	-15.101
10440	PK	H	35.904	42.21	-	-	74	-
10440	AV	H	35.904	42.21	-	-	54	-
4924	PK	H	32.496	35.47	-	-	74	-
4924	AV	H	32.496	35.47	-	-	54	-
7386	PK	H	34.32	38.42	46.09	50.19	74	-23.81
7386	AV	H	34.32	38.42	35.89	39.99	54	-14.01
9848	PK	H	35.919	41.55	44.01	49.641	74	-24.359
9848	AV	H	35.919	41.55	32.98	38.611	54	-15.389
12310	PK	H	35.315	43.75	-	-	74	-
12310	AV	H	35.315	43.75	-	-	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.

EUT : WB1500SH (with antenna B)
Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	V	0	29.36	17.55	46.91	74	-27.09
2038	AV	V	0	29.36	6.01	35.37	54	-18.63
4076	PK	V	31.88	34.59	35.11	37.82	74	-36.18
4076	AV	V	31.88	34.59	26.79	29.5	54	-24.5
6114	PK	V	33.42	37.74	39.08	43.4	74	-30.6
6114	AV	V	33.42	37.74	28.46	32.78	54	-21.22
8152	PK	V	34.92	40.05	45.31	50.44	74	-23.56
8152	AV	V	34.92	40.05	33.64	38.77	54	-15.23
10190	PK	V	36.03	41.99	-	-	74	-
10190	AV	V	36.03	41.99	-	-	54	-
4824	PK	V	32.496	35.47	42.54	45.514	74	-28.486
4824	AV	V	32.496	35.47	29.63	32.604	54	-21.396
7236	PK	V	34.32	38.42	56.01	60.11	74	-13.89
7236	AV	V	34.32	38.42	45.59	49.69	54	-4.31
9648	PK	V	35.808	41.35	44.76	50.302	74	-23.698
9648	AV	V	35.808	41.35	35.15	40.692	54	-13.308
12060	PK	V	35.4	43.38	-	-	74	-
12060	AV	V	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna B)
Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2038	PK	H	0	29.36	15.21	44.57	74	-29.43
2038	AV	H	0	29.36	3.95	33.31	54	-20.69
4076	PK	H	31.88	34.59	38.99	41.7	74	-32.3
4076	AV	H	31.88	34.59	27.09	29.8	54	-24.2
6114	PK	H	33.42	37.74	41.39	45.71	74	-28.29
6114	AV	H	33.42	37.74	30.57	34.89	54	-19.11
8152	PK	H	34.92	40.05	46.66	51.79	74	-22.21
8152	AV	H	34.92	40.05	35.01	40.14	54	-13.86
10190	PK	H	36.03	41.99	-	-	74	-
10190	AV	H	36.03	41.99	-	-	54	-
4824	PK	H	32.496	35.47	39.65	42.624	74	-31.376
4824	AV	H	32.496	35.47	28.1	31.074	54	-22.926
7236	PK	H	34.32	38.42	49.44	53.54	74	-20.46
7236	AV	H	34.32	38.42	38.7	42.8	54	-11.2
9648	PK	H	35.808	41.35	48.21	53.752	74	-20.248
9648	AV	H	35.808	41.35	36.39	41.932	54	-12.068
12060	PK	H	35.4	43.38	-	-	74	-
12060	AV	H	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna B)
Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	V	0	29.36	16.11	45.47	74	-28.53
2063	AV	V	0	29.36	5.32	34.68	54	-19.32
4126	PK	V	31.88	34.59	37.45	40.16	74	-33.84
4126	AV	V	31.88	34.59	25.58	28.29	54	-25.71
6189	PK	V	33.42	37.74	38.66	42.98	74	-31.02
6189	AV	V	33.42	37.74	29.15	33.47	54	-20.53
8252	PK	V	35.031	39.97	40.23	45.169	74	-28.831
8252	AV	V	35.031	39.97	30.22	35.159	54	-18.841
10315	PK	V	35.967	42.06	-	-	74	-
10315	AV	V	35.967	42.06	-	-	54	-
4874	PK	V	32.496	35.47	41.65	44.624	74	-29.376
4874	AV	V	32.496	35.47	28.74	31.714	54	-22.286
7311	PK	V	34.32	38.42	55.82	59.92	74	-14.08
7311	AV	V	34.32	38.42	43.97	48.07	54	-5.93
9748	PK	V	35.808	41.35	42.71	48.252	74	-25.748
9748	AV	V	35.808	41.35	31.85	37.392	54	-16.608
12185	PK	V	35.4	43.38	-	-	74	-
12185	AV	V	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna B)
Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2063	PK	H	0	29.36	14.26	43.62	74	-30.38
2063	AV	H	0	29.36	4.95	34.31	54	-19.69
4126	PK	H	31.88	34.59	37.61	40.32	74	-33.68
4126	AV	H	31.88	34.59	25.49	28.2	54	-25.8
6189	PK	H	33.42	37.74	40.2	44.52	74	-29.48
6189	AV	H	33.42	37.74	31.71	36.03	54	-17.97
8252	PK	H	35.031	39.97	40.96	45.899	74	-28.101
8252	AV	H	35.031	39.97	31.67	36.609	54	-17.391
10315	PK	H	35.967	42.06	-	-	74	-
10315	AV	H	35.967	42.06	-	-	54	-
4874	PK	H	32.496	35.47	38.75	41.724	74	-32.276
4874	AV	H	32.496	35.47	26.58	29.554	54	-24.446
7311	PK	H	34.32	38.42	48.66	52.76	74	-21.24
7311	AV	H	34.32	38.42	37.91	42.01	54	-11.99
9748	PK	H	35.808	41.35	41.24	46.782	74	-27.218
9748	AV	H	35.808	41.35	32.55	38.092	54	-15.908
12185	PK	H	35.4	43.38	-	-	74	-
12185	AV	H	35.4	43.38	-	-	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.

EUT : WB1500SH (with antenna B)
Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	V	0	29.36	15.19	44.55	74	-29.45
2088	AV	V	0	29.36	4.22	33.58	54	-20.42
4176	PK	V	31.88	34.59	34.69	37.4	74	-36.6
4176	AV	V	31.88	34.59	25.76	28.47	54	-25.53
6264	PK	V	33.57	37.74	40.18	44.35	74	-29.65
6264	AV	V	33.57	37.74	30.29	34.46	54	-19.54
8352	PK	V	35.031	39.97	45.95	50.889	74	-23.111
8352	AV	V	35.031	39.97	33.19	38.129	54	-15.871
10440	PK	V	35.904	42.21	-	-	74	-
10440	AV	V	35.904	42.21	-	-	54	-
4924	PK	V	32.496	35.47	39.88	42.854	74	-31.146
4924	AV	V	32.496	35.47	28	30.974	54	-23.026
7386	PK	V	34.32	38.42	54.64	58.74	74	-15.26
7386	AV	V	34.32	38.42	44.75	48.85	54	-5.15
9848	PK	V	35.919	41.55	39.85	45.481	74	-28.519
9848	AV	V	35.919	41.55	28.14	33.771	54	-20.229
12310	PK	V	35.315	43.75	-	-	74	-
12310	AV	V	35.315	43.75	-	-	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.

EUT : WB1500SH (with antenna B)
Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
2088	PK	H	0	29.36	14.77	44.13	74	-29.87
2088	AV	H	0	29.36	3.95	33.31	54	-20.69
4176	PK	H	31.88	34.59	40.15	42.86	74	-31.14
4176	AV	H	31.88	34.59	29.59	32.3	54	-21.7
6264	PK	H	33.57	37.74	40.79	44.96	74	-29.04
6264	AV	H	33.57	37.74	29.66	33.83	54	-20.17
8352	PK	H	35.031	39.97	46.23	51.169	74	-22.831
8352	AV	H	35.031	39.97	34.28	39.219	54	-14.781
10440	PK	H	35.904	42.21	-	-	74	-
10440	AV	H	35.904	42.21	-	-	54	-
4924	PK	H	32.496	35.47	43.29	46.264	74	-27.736
4924	AV	H	32.496	35.47	32.51	35.484	54	-18.516
7386	PK	H	34.32	38.42	45.02	49.12	74	-24.88
7386	AV	H	34.32	38.42	34.27	38.37	54	-15.63
9848	PK	H	35.919	41.55	43.11	48.741	74	-25.259
9848	AV	H	35.919	41.55	32.06	37.691	54	-16.309
12310	PK	H	35.315	43.75	-	-	74	-
12310	AV	H	35.315	43.75	-	-	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.

6. Power Spectrum Density test

6.1 Operating environment

Temperature:	23	℃
Relative Humidity:	58	%
Atmospheric Pressure	1023	hPa

6.2 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 3kHz, a span of 1.5 MHz, and the sweep time set at 500 seconds. Power Density was read directly and cable loss (1dB) 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”

6.3 Measured data of Power Spectrum Density test results

Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
Low	2410.39	-7.56	8
Middle	2435.39	-8.80	8
High	2460.39	-10.60	8

7. 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.

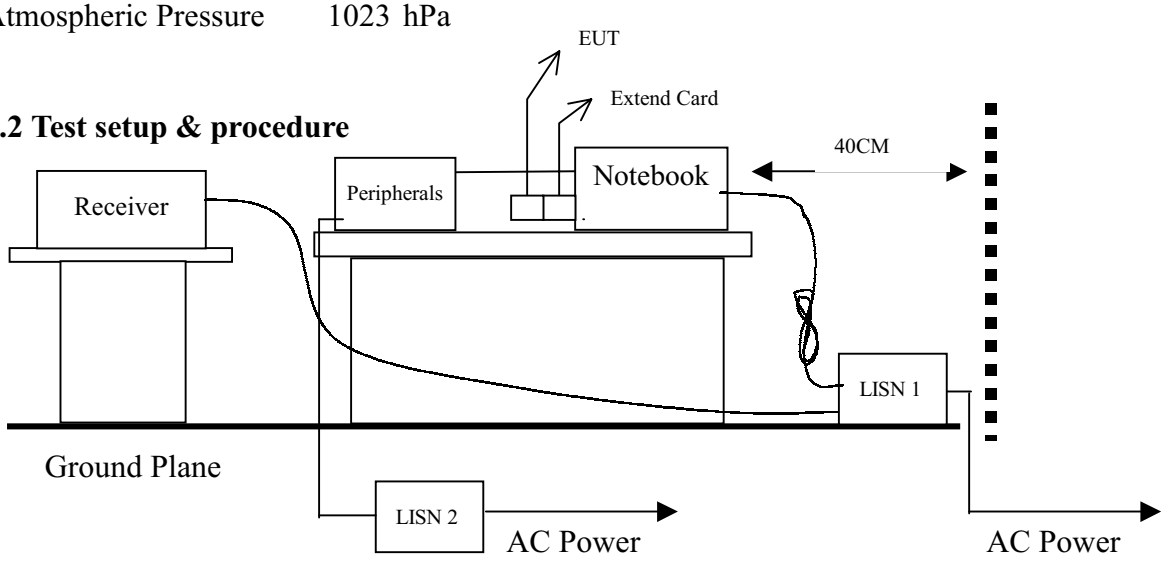
See band-edge plot as file name “Band-edge plot.pdf”.

8. Power Line Conducted Emission test §FCC 15.207

8.1 Operating environment

Temperature: 23 ℃
Relative Humidity: 58 %
Atmospheric Pressure 1023 hPa

8.2 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

Freq. (MHz)	Maximum RF Line Voltage			
	Class A (dB μ V)		Class B (dB μ V)	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56	56~46
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

8.3 Power Line Conducted Emission test data

(1) Line

EUT : WB1500SH

Test Condition : Tx at low channel

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	48.3	63.37	39.2	53.37	-15.07	-14.17
0.27000	43.9	61.12	35.2	51.12	-17.22	-15.92
0.40600	34.0	57.73	30.4	47.73	-23.73	-17.33
2.57400	31.9	56.00	28.6	46.00	-24.10	-17.40
3.45400	33.9	56.00	27.0	46.00	-22.10	-19.00
29.12600	25.5	60.00	17.2	50.00	-34.50	-32.80

(2) Neutral

EUT : WB1500SH

Test Condition : Tx at low channel

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	50.1	63.37	41.1	53.37	-13.27	-12.27
0.27000	46.2	61.12	36.4	51.12	-14.92	-14.72
0.40600	35.8	57.73	30.2	47.73	-21.93	-17.53
1.96600	30.5	56.00	28.0	46.00	-25.50	-18.00
3.11800	31.9	56.00	27.2	46.00	-24.10	-18.80
29.68600	25.6	60.00	17.4	50.00	-34.40	-32.60

Remark:

1. 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.

(1) Line

EUT : WB1500SH

Test Condition : Tx at middle channel

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	45.5	63.37	35.7	53.37	-17.87	-17.67
0.27000	40.0	61.12	31.9	51.12	-21.12	-19.22
0.40600	33.8	57.73	31.9	47.73	-23.93	-15.83
2.50200	22.1	56.00	16.2	46.00	-33.90	-29.80
3.59000	26.4	56.00	20.4	46.00	-29.60	-25.60
5.82200	16.5	60.00	12.5	50.00	-43.50	-37.50

(2) Neutral

EUT : WB1500SH

Test Condition : Tx at middle channel

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	46.1	63.37	36.3	53.37	-17.27	-17.07
0.27000	38.9	61.12	31.3	51.12	-22.22	-19.82
0.40600	34.7	57.73	31.6	47.73	-23.03	-16.13
0.54200	30.6	56.00	29.5	46.00	-25.40	-16.50
1.69400	29.6	56.00	28.1	46.00	-26.40	-17.90
2.98200	29.1	56.00	25.2	46.00	-26.90	-20.80

Remark:

1. 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.

(1) Line

EUT : WB1500SH

Test Condition : Tx at high channel

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	46.2	63.37	36.4	53.37	-17.17	-16.97
0.27000	40.3	61.12	32.0	51.12	-20.82	-19.12
0.40600	34.6	57.73	32.1	47.73	-23.13	-15.63
0.54200	31.0	56.00	30.1	46.00	-25.00	-15.90
1.69400	29.6	56.00	28.2	46.00	-26.40	-17.80
2.98200	28.9	56.00	25.0	46.00	-27.10	-21.00

(2) Neutral

EUT : WB1500SH

Test Condition : Tx at high channel

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	46.3	63.37	36.5	53.37	-17.07	-16.87
0.27000	39.0	61.12	31.3	51.12	-22.12	-19.82
0.40600	35.0	57.73	31.8	47.73	-22.73	-15.93
0.54200	30.6	56.00	29.5	46.00	-25.40	-16.50
1.96600	29.8	56.00	28.7	46.00	-26.20	-17.30
2.98200	29.1	56.00	25.0	46.00	-26.90	-21.00

Remark:

1. 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.