Electromagnetic Compatibility Test Report

Tests Performed on a BRK Brands

Smoke Detector, Model Onelink SA520

Radiometrics Document RP-5549

ACCREDITED
Certification # 1495.01

Product Detail:
FCC ID: M7U5201L
Equipment type: 902-928 MHz Transceiver

Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C
FCC Part 15 CFR Title 47: 2004
Industry Canada RSS-210, Issue 5 as required for Category I Equipment

This report concerns: Original Grant for Certification
FCC Part 15.249
RSS-210 section 6.2.2 (m2)

Tests Performed For:	*Test Facility:*
BRK Brands 3901 Liberty St Aurora, IL 60504-8122	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772 e-mail: info@radiomet.com

Test Date(s): (Month-Day-Year)
April 18 and 22, 2005

Document RP-5549 Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	April 25, 2005			

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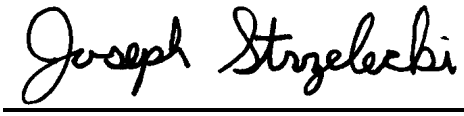
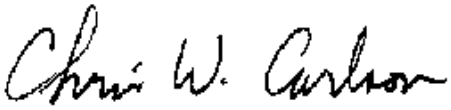
1 ADMINISTRATIVE DATA

Equipment Under Test: A BRK Brands, Smoke Detector Model: Onelink SA520 Serial Number: none This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) April 8, 2005	*Test Date(s): (Month-Day-Year)* April 18 and 22, 2005
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* The tests were not witnessed by BRK Brands.
Radiometrics' Personnel Responsible for Test:  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*Test Report Approved By*  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Smoke Detector, Model Onelink SA520, manufactured by BRK Brands. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions (Includes Band edges)	30-9300 MHz	RSS-210 & FCC Part 15	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	RSS-210 & FCC Part 15	Pass

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Smoke Detector, Model Onelink SA520, manufactured by BRK Brands. The EUT was in good working condition during the tests, with no known defects. This is a line of RF-interconnected smoke, CO, and combination smoke/CO alarms.

3.1.1 FCC Section 15.203 & RSS-210 Section 5.5 Antenna Requirements

The Antenna is permanently installed inside the EUT. The antenna is a trace on the circuit board.

3.2 Related Submittals

BRK Brands is submitting another similar product as FCC ID: M7U5001L.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. The EUT was tested as a stand-alone device.

Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Smoke Detector	E	BRK Brands	Onelink SA520	none

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	AC Cord	#1 Power input	No
1	1.8	DC Interconnect cable	#1	No

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2004	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2001	2001	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 5	2001	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
IC RSS-212 Issue 1	1998	Test Methods For Radio Equipment

The test procedures used are in accordance with the Industry Canada RSS-212 and ANSI document C63.4-2001, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of facilities located in Romeoville, Illinois used during the tests:

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures approximately 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number 31040/SIT 1300F2. The FCC test site Registration Number is 90897. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/07/04
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/07/04
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 mo	11/17/03
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/13/04
ANT-42	EMCO	Bicon Antenna	3104C	9512-4713	25-300MHz	24 Mo.	12/02/03
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	06/15/04
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	04/08/05
PRE-01	Hewlett Packard	Preselector	85685A	2510A00143	20 Hz-2GHz	12 Mo.	01/20/05
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	11/11/04
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	01/04/05
REC-08	Hewlett Packard	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	12 Mo.	05/26/04
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 Mo.	01/28/04

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

10.1 AC Conducted Emissions; Section 15.207

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

Broadband conducted emissions may exceed the following limits by no more than 13 dB. An emission is defined as broadband if the average detector amplitude is 6 dB or more under the quasi-peak detector amplitude.

FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

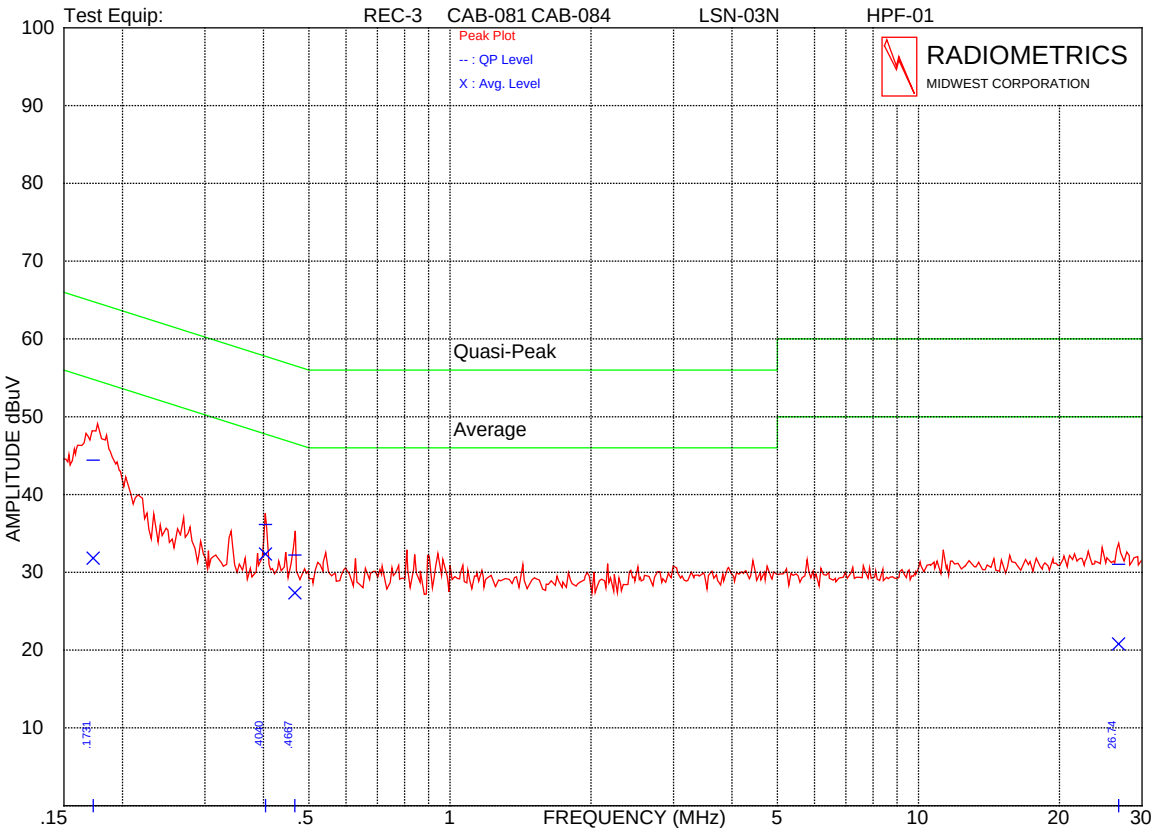
The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the EUT, after testing all modes of operation.

Test Date : April 18, 2005
The Amplitude is the final corrected value with cable and LISN Loss.

Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Neutral	0.17	44.42	64.81	31.81	54.81
AC Neutral	0.40	36.16	57.77	32.36	47.77
AC Neutral	0.47	32.22	56.57	27.35	46.57
AC Neutral	26.75	31.03	60.00	20.79	50.00
AC Hot	0.17	46.22	64.72	30.68	54.72
AC Hot	0.26	34.53	61.52	28.37	51.52
AC Hot	0.40	36.10	57.77	31.65	47.77
AC Hot	29.18	31.30	60.00	21.01	50.00
AC Hot	0.95	N/A	56.00	24.37	46.00

The above are the worst case results with three frequencies test for each EUT
* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

Judgment: Passed by 15.4 dB


Test Equip: REC-3 CAB-081 CAB-084 LSN-03N HPF-01
Peak Plot
-- : QP Level
X : Avg. Level
RADIOMETRICS
MIDWEST CORPORATION
Quasi-Peak
Average
AMPLITUDE dBuV
100
90
80
70
60
50
40
30
20
10
.15
.5
1
FREQUENCY (MHz)
5
10
20
30
.1731
.4080
.4667
26.74
COMPANY : BRK Brands
LEAD TESTED : AC Neutral
NOTES :
FCC 15 & EN55022 Class B Conducted Emission Test; Mains Port Disturbances.
MODEL : SA520
S/N : FCC #2
DATE :04-18-2005
TIME :16:37
Tested By: JRS
RP-5549 | 0554704

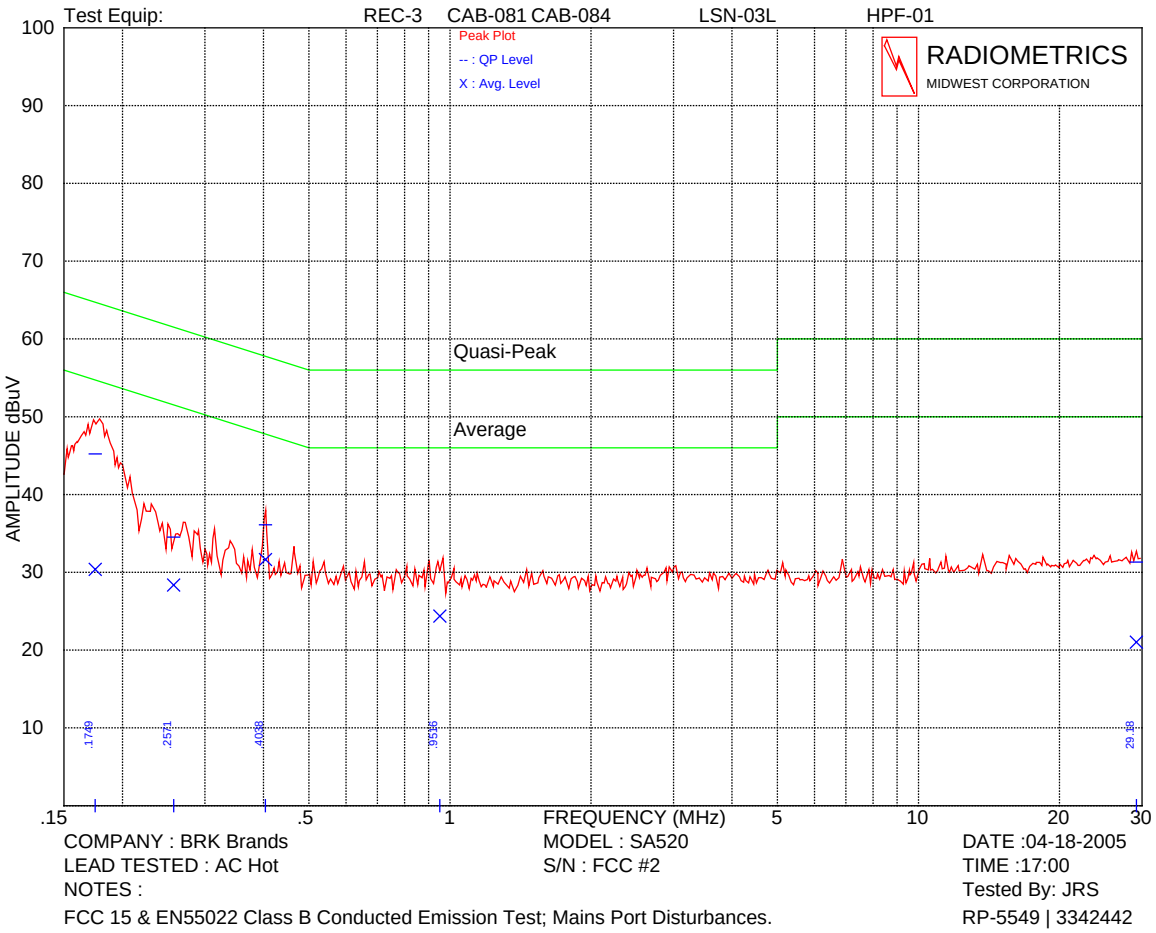
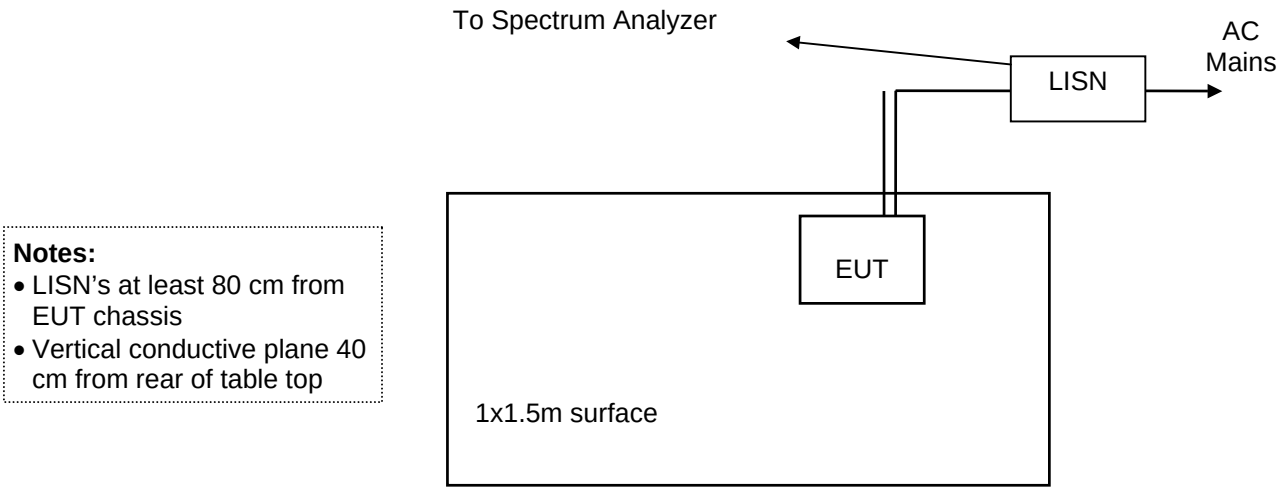


Figure 1. Conducted Emissions Test Setup



10.2 Radiated Emissions (All Bands)

This section contains the results for the fundamental emissions, as well as spurious, harmonics and band edge tests. The tests were performed from 30 to 9300 MHz. The low end of the band edge was tested with the EUT at the lowest channel. The high end of the band edge was tested with the EUT on the highest channel.

From 30 to 1000 MHz, an Anritsu Spectrum analyzer and a pre-amplifier with a 10 dB attenuator connected to the input were used. The emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 2 to 9.3 GHz, an HP8566B spectrum analyzer was used with a Celeritek uWave amplifier. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). Below 2 GHz an external preselector was used with the 8566B Analyzer.

Radiated emission measurements are performed with linearly polarized broadband antennas. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

Final radiated emissions measurements were performed in the Anechoic chamber E at a test distance of 3 meters. The entire frequency range from 30 to 9300 MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. All tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

Since the EUT is wall or ceiling mounted, it was tested in two orientations. It tested in an upright configuration and flat on the table during the tests.

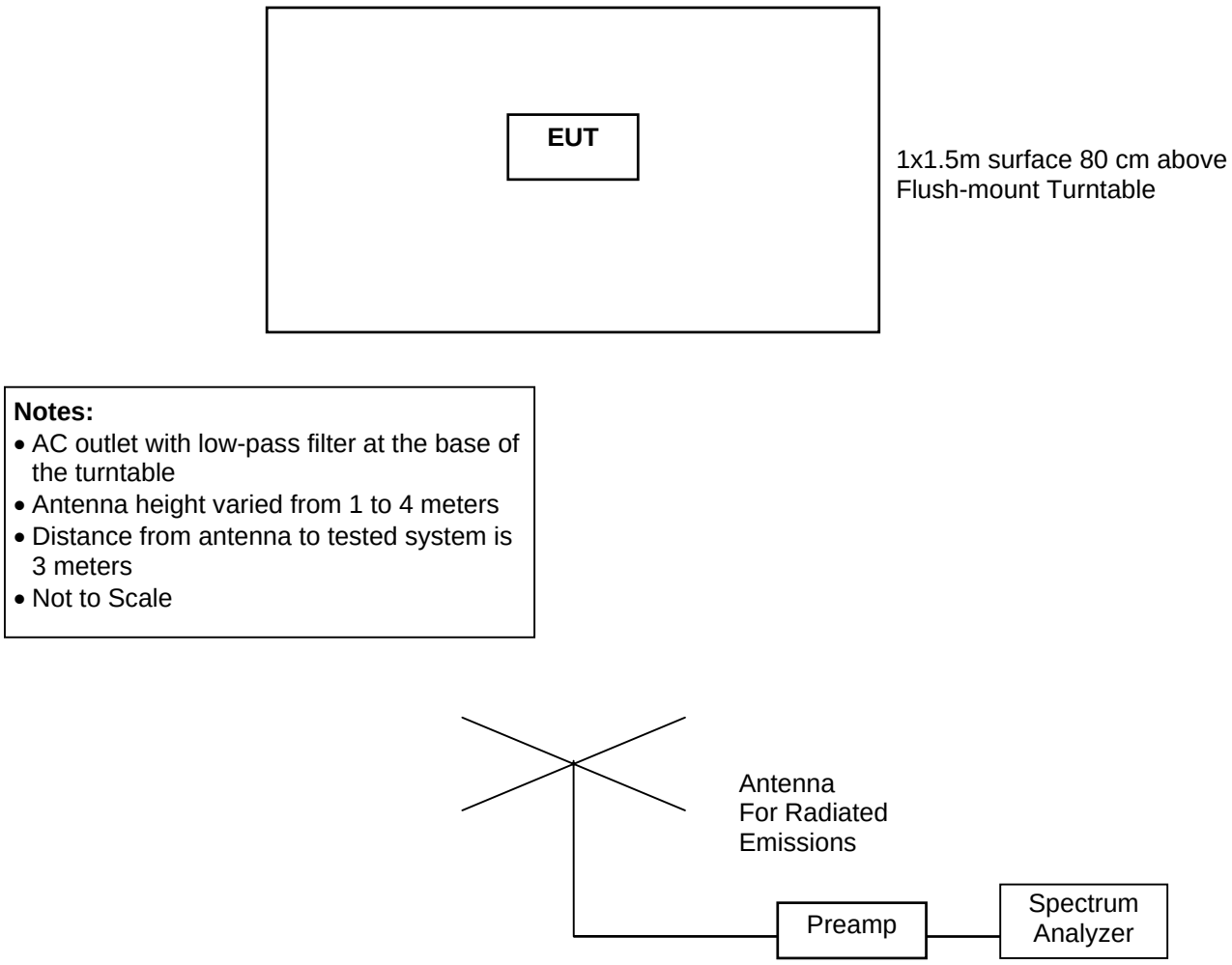
10.2.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Figure 2. Drawing of Radiated Emissions Setup



10.2.2 Radiated Emissions Test Results

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW

A Video Bandwidth of 100 Hz was used for Average measurements above 1 GHz.

Manufacturer	BRK Brands	Specification	FCC Part 15 Subpart C & RSS-210
Model	Onelink SA520	Test Date	April 18, 2005
Serial Number	none	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP		
Notes	No external preamp used for Fundamental and second harmonic		

Tx Freq Setting (MHz)	Ant ID	Ant Pol.	Emission Freq (MHz)	SAMR (dBuV)	Detector Func.	Ant. Factor (dB/m)	Amp & cable (dB)	Tot. FS (dBuV/m)	Limit (dBuV/m)	Margin Under limit (dB)
906.6	44	V	906.6	57.0	Peak	22.2	9.7	88.9	94.0	5.1
906.6	44	H	906.6	56.8	Peak	22.7	9.7	89.2	94.0	4.8
906.6	13	V	1813.2	14.0	Peak	26.7	3.7	44.4	74.0	29.6
906.6	13	H	1813.2	14.0	Peak	26.7	3.7	44.4	74.0	29.6
906.6	13	V	2719.8	31.1	Peak	29.3	-25.2	35.2	74.0	38.8
906.6	13	H	2719.8	32.4	Peak	29.3	-25.2	36.5	74.0	37.5
906.6	13	V	1813.2	6.5	Ave	26.7	3.7	36.9	54.0	17.1
906.6	13	H	1813.2	7.8	Ave	26.7	3.7	38.2	54.0	15.8
906.6	13	V	2719.8	25.6	Ave	29.3	-25.2	29.7	54.0	24.3
906.6	13	H	2719.8	25.9	Ave	29.3	-25.2	30.0	54.0	24.0
906.6	44	V	902.0	29.2	QP	22.2	-10.3	41.1	46.0	4.9
906.6	44	H	902.0	32.0	QP	22.5	-10.3	44.2	46.0	1.8
913.3	44	V	913.3	54.9	Peak	22.6	9.7	87.2	94.0	6.8
913.3	44	H	913.3	55.3	Peak	23.0	9.7	88.0	94.0	6.0
913.3	13	V	1826.6	14.0	Peak	26.6	3.7	44.3	74.0	29.7
913.3	13	H	1826.6	14.0	Peak	29.2	3.7	46.9	74.0	27.1
913.3	13	V	2739.9	31.2	Peak	29.2	-25.1	35.3	74.0	38.7
913.3	13	H	2739.9	33.1	Peak	29.2	-25.1	37.2	74.0	36.8
913.3	13	V	1826.6	8.1	Ave	26.6	3.7	38.4	54.0	15.6
913.3	13	H	1826.6	7.9	Ave	29.2	3.7	40.8	54.0	13.2
913.3	13	V	2739.9	31.6	Ave	29.2	-25.1	35.7	54.0	18.3
913.3	13	H	2739.9	30.5	Ave	29.2	-25.1	34.6	54.0	19.4
922.9	44	V	922.9	54.3	Peak	22.7	9.7	86.7	94.0	7.3
922.9	44	H	922.9	54.9	Peak	22.9	9.7	87.5	94.0	6.5
922.9	13	V	1845.8	14.0	Peak	26.8	-21.4	19.4	74.0	54.6
922.9	13	H	1845.8	14.0	Peak	26.8	-21.4	19.4	74.0	54.6
922.9	13	V	2768.7	32.2	Peak	29.4	-25.1	36.5	74.0	37.5
922.9	13	H	2768.7	33.2	Peak	29.4	-25.1	37.5	74.0	36.5
922.9	13	V	1845.8	6.7	Ave	26.8	-21.4	12.1	54.0	41.9
922.9	13	H	1845.8	7.6	Ave	26.8	-21.4	13.0	54.0	41.0
922.9	13	V	2768.7	25.8	Ave	29.4	-25.1	30.1	54.0	23.9
922.9	13	H	2768.7	26.2	Ave	29.4	-25.1	30.5	54.0	23.5
922.9	44	V	928.0	27.1	QP	22.8	-10.3	39.6	46.0	6.4
922.9	44	H	928.0	30.2	QP	22.6	-10.3	42.5	46.0	3.5

The readings at 902 and 928 MHz are the band edge emissions.

The following emissions were from the unintentional radiator portion of the EUT.

Notes	Corr. Factors = Cable Loss – Preamp Gain No external preamp used for Fundamental and second harmonic

Freq. MHz	Meter Reading (dBuV)	Antenna Factor (dB)	Antenna Pol/ Type	Corr. Factors (dB)	Field Strength (dBuV/m) EUT	Field Strength (dBuV/m) Limit	Margin Under Limit (dB)
51.5	25.6 P	15.0	H/44	-17.3	23.2	40.0	16.8
145.3	32.0 P	6.7	H/44	-16.1	22.6	43.5	20.9
165.4	41.6 P	9.6	H/44	-16.0	35.2	43.5	8.3
167.1	38.7 Q	9.4	H/44	-16.0	32.2	43.5	11.3
168.9	37.9 P	9.1	H/44	-15.9	31.1	43.5	12.4
169.3	39.5 Q	9.1	H/44	-15.9	32.7	43.5	10.8
169.7	39.1 Q	9.0	H/44	-15.9	32.2	43.5	11.3
173.7	39.4 P	9.0	H/44	-15.9	32.5	43.5	11.0
178.3	36.0 P	9.4	H/44	-15.9	29.5	43.5	14.0
184.3	36.5 P	9.9	H/44	-15.8	30.6	43.5	12.9
185.6	35.2 P	10.0	H/44	-15.8	29.4	43.5	14.1
194.0	33.5 P	10.4	H/44	-15.7	28.1	43.5	15.4
239.5	26.7 P	12.7	H/44	-15.4	24.0	46.0	22.0
37.2	29.5 Q	15.6	V/44	-17.6	27.5	40.0	12.5
37.4	26.9 Q	15.6	V/44	-17.6	24.9	40.0	15.1
41.9	34.5 P	16.2	V/44	-17.5	33.2	40.0	6.8
46.2	27.5 Q	16.3	V/44	-17.4	26.4	40.0	13.6
46.3	33.5 P	16.2	V/44	-17.4	32.3	40.0	7.7
77.6	35.1 Q	7.2	V/44	-16.9	25.4	40.0	14.6
128.3	32.4 Q	10.3	V/44	-16.3	26.4	43.5	17.1
144.5	35.6 P	6.7	V/44	-16.1	26.2	43.5	17.3
161.2	38.7 Q	12.8	V/44	-16.0	35.4	43.5	8.1
162.6	38.8 Q	12.7	V/44	-16.0	35.5	43.5	8.0
173.9	33.4 P	10.5	V/44	-15.9	28.0	43.5	15.5
176.8	26.9 P	10.3	V/44	-15.9	21.3	43.5	22.2
232.5	26.0 P	12.1	V/44	-15.4	22.6	46.0	23.4

Judgment: Passed by 1.8 dB
No emissions were detected above 3 GHz.