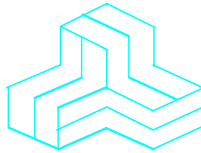


ENGINEERING TEST REPORT



Radio-Z Module
MODEL NO.: L-ZM2102

FCC ID: TOB-LZM2102

Applicant:

Logitech Inc. - Canada
2355 Skymark Avenue, Suite 200
Mississauga, ON
Canada L4W 4Y6

Tested in Accordance With

FCC Part 15, Subpart C, Section 15.249
Low Power Transmitters
Operating in the Frequency Band 902 - 928 MHz

Class II Permissive Change

UltraTech's File No.: LOG-003F15C249CIIPC

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: November 25, 2005



Report Prepared by: Dan Huynh

Tested by: Mr. Hung Trinh, EMC/RFI Technician

Issued Date: November 25, 2005

Test Dates: November 15, 2005

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050

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SL2-IN-E-1119R



00-034



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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.249
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	Class II Permissive Change for additional antennas.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	▪ Commercial, industrial or business environment ▪ Residential

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2005	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval
CISPR 22 +A1 EN 55022	2003-04-10 2004-10-14 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement
CISPR 16-2-3	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Radiated disturbance measurement

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Logitech Inc.
Address:	2355 Skymark Avenue, suite 200 Mississauga, ON L4W 4Y6 Canada L4W 4Y6
Contact Person:	Samuel Asare Phone #: 905-273-4571 EXT: 2443 Fax #: 905-273-9789 Email Address: Samuel_asare@logitech.com

MANUFACTURER	
Name:	Wanlida Group of Companies
Address:	No. 618, Jiahe Rd. Xiamen, Fujian, China
Contact Person:	Linden Lin Phone #: 86-592-5700999 Ext. 8618 Fax #: 86-592-5701337 Email Address: Linden@malata.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Logitech Inc. - Canada
Product Name:	Radio-Z Module
Model Name or Number:	L-ZM2102
Serial Number:	Test Sample
Type of Equipment:	Low Power Transceiver
Input Power Supply Type:	N/A
Primary User Functions of EUT:	Provide data communication link through air.

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile Base station (fixed use)
Intended Operating Environment:	Residential Commercial, light industry & heavy industry
Power Supply Requirement:	3.3 V
RF Output Power Rating:	92.65 dBμV/m Peak
Operating Frequency Range:	908.42 MHz
RF Output Impedance:	50 Ohms
20 dB Bandwidth:	69.94 kHz
Modulation Type:	FSK
Emission Designation:	F1D
Oscillator Frequencies:	32 MHz
Antenna Connector Type:	Integral
Antenna Description:	Antenna 1: Manufacturer: Wanlida Group of Companies Type: Rigid Wire Antenna Model: 202118-0000 Frequency Range: 908.42MHz Nominal Impedance: 50 Ohms Gain: 4dBi Antenna 2: Manufacturer: Wanlida Group of Companies Type: Inverted F Antenna Model: 202114-0000 Frequency Range: 908.42MHz Nominal Impedance: 50 Ohms Gain: 4dBi

2.4. LIST OF EUT'S PORTS

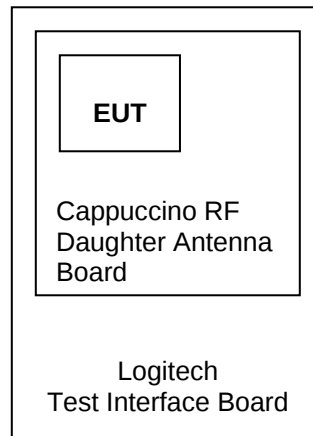
None.

2.5. ANCILLARY EQUIPMENT

None.

2.6. GENERAL TEST SETUP

EUT with Rigid Wire Antenna



EUT with Inverted F Antenna

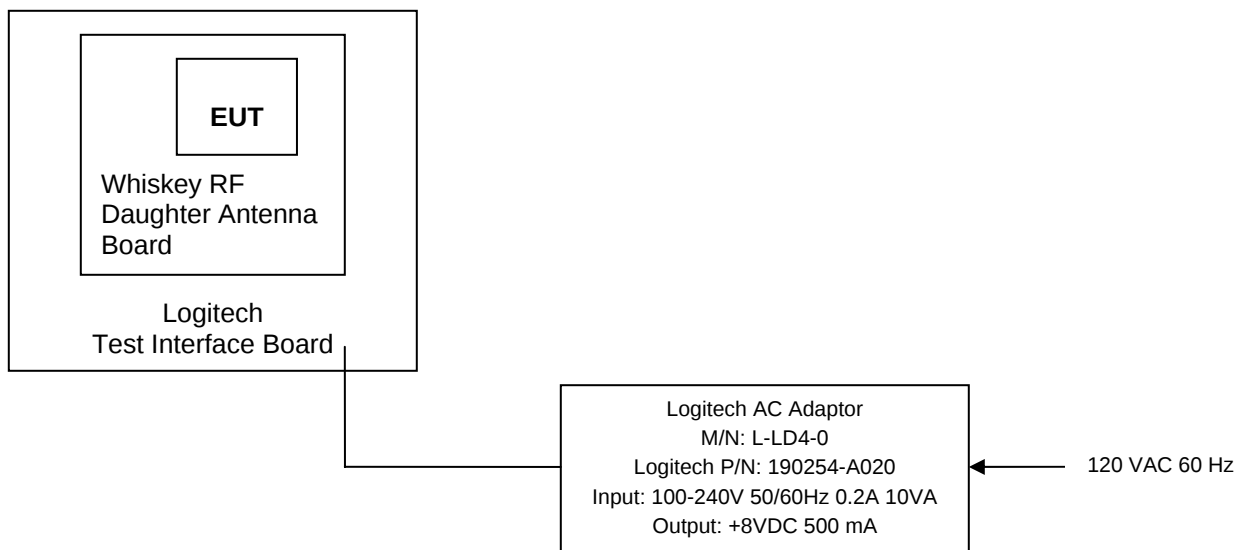


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	3.3 V

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	EUT was configured to transmit continuously for emissions measurements.
Special Test Software:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signals:	
Frequency Band(s):	908.42 MHz
Test Frequency(ies):	908.42 MHz
Transmitter Wanted Output Test Signals:	
• RF Power Output (measured maximum output power):	92.65 dBµV/m Peak
• Normal Test Modulation:	FSK
• Modulating signal source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

- All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.
- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.
- The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Jan. 10, 2005

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.107(a) & 15.207	AC Power Conducted Emissions	Yes, see original filing
--	20 dB Bandwidth	Yes
15.249(a), 15.209, 15.205	Transmitter Radiated Emissions, Harmonic Emissions	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4 and ULTR-P001-2004.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 6 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

The Radio-Z Module is a fully integrated RF communication module that uses the unlicensed Short-Range-Device (SRD) frequency band of 908.42MHz. The module is dedicated for wireless control and monitoring of residential products like lighting and appliance control, energy management, access control, security and building automation.

5.5. 20 dB BANDWIDTH

5.5.1. Limits

No limit. Test is performed for information only.

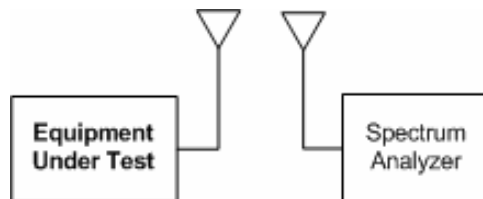
5.5.2. Method of Measurements

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI 63.4

5.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz- 40 GHz
Log Periodic	EMCO	3148	23845	200 MHz – 2 GHz

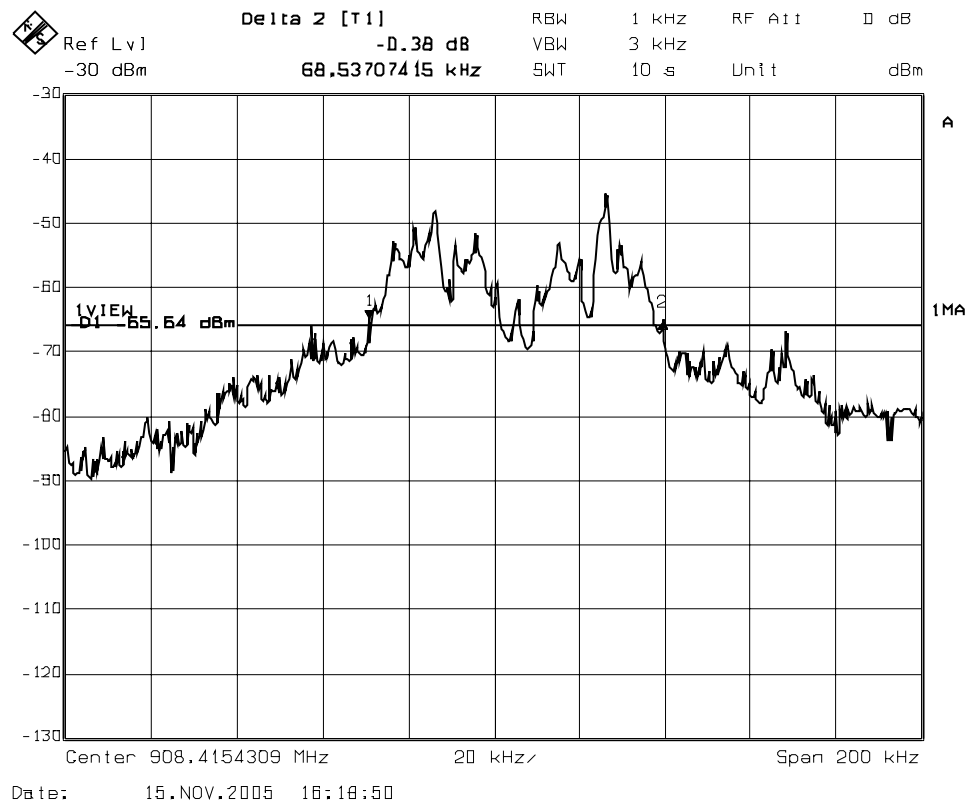
5.5.4. Test Arrangement



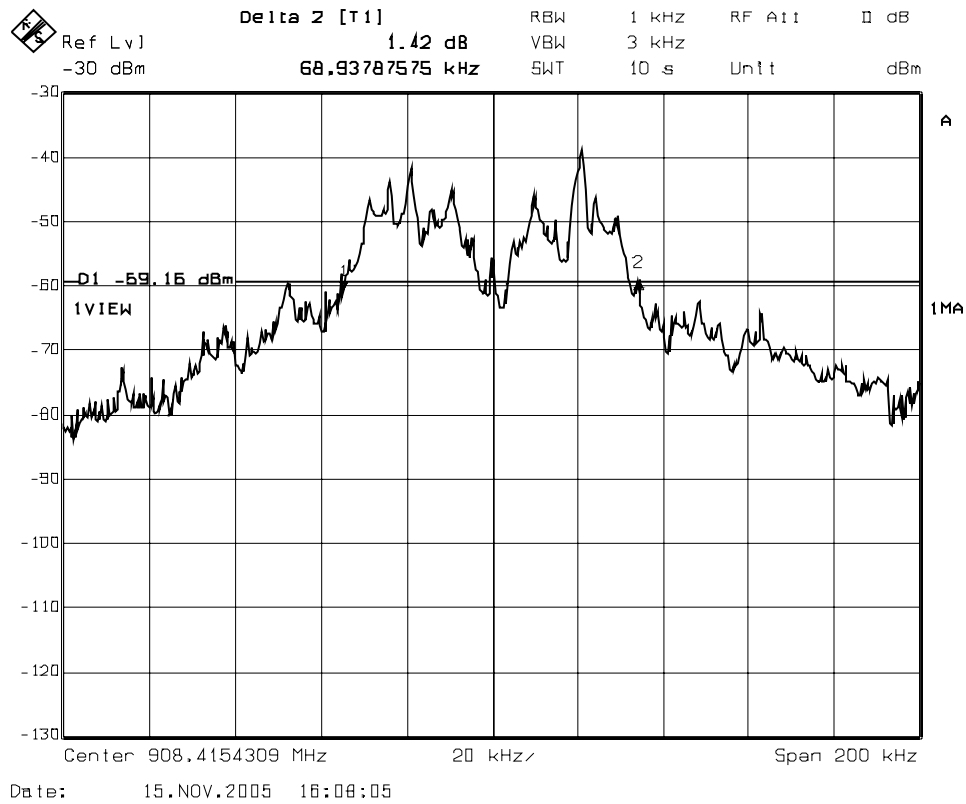
5.5.5. Test Data

Frequency (MHz)	20 dB Bandwidth (kHz)
EUT with Rigid Wire Antenna	
908.42	69.54
EUT with Inverted F Antenna	
908.42	69.94

Plot 5.5.5.1: 20 dB Bandwidth
Test Frequency: 908.42 MHz
EUT with Rigid Wire Antenna



Plot 5.5.5.2: 20 dB Bandwidth
Test Frequency: 908.42 MHz
EUT with Inverted F Antenna



5.6. FUNDAMENTAL FIELD STRENGTH AND HARMONIC EMISSIONS (RADIATED @ 3 METERS) [47 CFR 15.249(a), 15.209 & 15.205]

5.6.1. Limits

- The Field Strength of emissions from intentional radiators operated within this frequency band shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m)	Field Strength of Harmonics (µV/m)
902 - 928	50	500

- The fundamental frequency shall not fall within any restricted frequency band specified in 15.205 All rf other emissions that fall in the restricted bands shall not exceed the general radiated emission limits specified in @ 15.209(a).

FCC 47 CFR 15.205(a) -- Restricted Frequency Bands --

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 - 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 - 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 - 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 - 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 - 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 - 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 - 156.9	2200 - 2300	9000 - 9200	

FCC 47 CFR 15.209(a) -- Field Strength Limits within Restricted Frequency Bands --

Frequency (MHz)	Field Strength Limits (µV/m)	Distance (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

5.6.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

5.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

5.6.4. Test Data

The emissions were scanned from 30 MHz to 10 GHz and all emissions within 20 dB below the limits were recorded.

▪ EUT with Rigid Wire Antenna

Frequency (MHz)	Peak E-Field @3m (dB μ V/m)	*QP/AV E-Field @3m (dB μ V/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dB μ V/m)	Field Strength Limit of § 15.209 (dB μ V/m)	Margin (dB)
908.42	92.65	91.65	V	94.0	--	-2.3
908.42	89.79	88.41	H	94.0	--	-5.6
2725.26	51.07	41.34	V	54.0	54.0	-12.6
2725.26	51.05	41.72	H	54.0	54.0	-12.3
3633.68	55.23	47.14	V	54.0	54.0	-6.8
3633.68	52.55	42.73	H	54.0	54.0	-11.2

*Quasi-peak (QP) detector below 1 GHz and average (AV) above.

▪ EUT with Inverted F Antenna

Frequency (MHz)	Peak E-Field @3m (dB μ V/m)	*QP/AV E-Field @3m (dB μ V/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dB μ V/m)	Field Strength Limit of § 15.209 (dB μ V/m)	Margin (dB)
908.42	78.55	78.33	V	94.0	--	-15.6
908.42	77.82	76.85	H	94.0	--	-17.1
2725.26	48.88	37.42	V	54.0	54.0	-16.6
2725.26	54.18	43.29	H	54.0	54.0	-10.7
3633.68	50.03	37.45	V	54.0	54.0	-16.5
3633.68	52.47	44.15	H	54.0	54.0	-9.8

*Quasi-peak (QP) detector below 1 GHz and average (AV) above.

EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34

6.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	± 1.5	± 1.5
LISN coupling specification	Rectangular	± 1.5	± 1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	± 0.3	± 0.5
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	± 0.2	± 0.3
System repeatability	Std. deviation	± 0.2	± 0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	± 1.25	± 1.30
Expanded uncertainty U	Normal (k=2)	± 2.50	± 2.60

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

6.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (+ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	± 1.0	± 1.0
Cable Loss Calibration	Normal (k=2)	± 0.3	± 0.5
EMI Receiver specification	Rectangular	± 1.5	± 1.5
Antenna Directivity	Rectangular	± 0.5	± 0.5
Antenna factor variation with height	Rectangular	± 2.0	± 0.5
Antenna phase center variation	Rectangular	0.0	± 0.2
Antenna factor frequency interpolation	Rectangular	± 0.25	± 0.25
Measurement distance variation	Rectangular	± 0.6	± 0.4
Site imperfections	Rectangular	± 2.0	± 2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	± 1.1 -1.25	± 0.5
System repeatability	Std. Deviation	± 0.5	± 0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	$+2.19 / -2.21$	$+1.74 / -1.72$
Expanded uncertainty U	Normal (k=2)	$+4.38 / -4.42$	$+3.48 / -3.44$

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$