

FCC RF Test Report

APPLICANT : Fujitsu Toshiba Mobile Communication Ltd.
EQUIPMENT : CDMA TSI12
BRAND NAME : Fujitsu Toshiba Mobile Communication Ltd.
MODEL NAME : TSI12
FCC ID : YUW-TSI12
STANDARD : FCC 47 CFR Part 2, 22(H)
CLASSIFICATION : PCS Licensed Transmitter Held to Ear (PCE)
Tx/Rx FREQUENCY RANGE : 824.70 ~ 848.31 MHz / 869.70 ~ 893.31 MHz
MAX. ERP/EIRP POWER : 0.08 W
EMISSION DESIGNATOR : 1M28F9W

The product was received on May 10, 2011 and completely tested on Jun. 12, 2011. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI / TIA / EIA-603-C-2004 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:



Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

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FCC ID : YUW-TSI12

Page Number : 1 of 27

Report Issued Date : Jun. 27, 2011

Report Version : Rev. 01

TABLE OF CONTENTS

REVISION HISTORY.....	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Applicant.....	5
1.2 Manufacturer	5
1.3 Feature of Equipment Under Test.....	5
1.4 Testing Site.....	6
1.5 Applied Standards	6
1.6 Ancillary Equipment List.....	6
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	7
2.1 Test Mode.....	7
2.2 Connection Diagram of Test System	8
3 TEST RESULT	9
3.1 Conducted Output Power Measurement.....	9
3.2 Effective Radiated Power and Effective Isotropic Radiated Power Measurement	10
3.3 Occupied Bandwidth Measurement	12
3.4 Band Edge Measurement.....	14
3.5 Conducted Emission Measurement	16
3.6 Field Strength of Spurious Radiation Measurement	19
3.7 Frequency Stability Measurement.....	23
4 LIST OF MEASURING EQUIPMENTS.....	26
5 UNCERTAINTY OF EVALUATION	27
APPENDIX A. PHOTOGRAPHS OF EUT	
APPENDIX B. SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG151009B	Rev. 01	Initial issue of report	Jun. 27, 2011

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	§2.1046	N/A	Conducted Output Power	N/A	PASS	-
3.2	§22.913(a)(2)	RSS-132(4.4) SRSP-503(5.1.3)	Effective Radiated Power	< 7 Watts	PASS	-
3.3	§2.1049 §22.917(a)	N/A	Occupied Bandwidth	N/A	PASS	-
3.4	§2.1051 §22.917(a)	RSS-132 (4.5.1)	Band Edge Measurement	< 43+10log ₁₀ (P[Watts])	PASS	-
3.5	§2.1051 §22.917(a)	RSS-132 (4.5.1)	Conducted Emission	< 43+10log ₁₀ (P[Watts])	PASS	-
3.6	§2.1053 §22.917(a)	RSS-132 (4.5.1)	Field Strength of Spurious Radiation	< 43+10log ₁₀ (P[Watts])	PASS	Under limit 18.88 dB at 1672 MHz
3.7	§2.1055 §22.355	RSS-132 (4.3)	Frequency Stability for Temperature & Voltage	< 2.5 ppm	PASS	-

1 General Description

1.1 Applicant

Fujitsu Toshiba Mobile Communication Ltd.

1-1, Kamikodanaka 4-chome, Nakahara-ku Kawasaki 211-8588, Japan

1.2 Manufacturer

Fujitsu Toshiba Mobile Communication Ltd.

1-1, Kamikodanaka 4-chome, Nakahara-ku Kawasaki 211-8588, Japan

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	CDMA TSI12
Brand Name	Fujitsu Toshiba Mobile Communication Ltd.
Model Name	TSI12
FCC ID	YUW-TSI12
Tx Frequency	824 MHz ~ 849 MHz
Rx Frequency	869 MHz ~ 894 MHz
Maximum Output Power to Antenna	24.04 dBm
Maximum ERP/EIRP	0.08 W (18.98 dBm)
Antenna Type	Fixed Internal Antenna
HW Version	CS1.0
SW Version	CS1.0
Type of Modulation	QPSK
Type of Emission	1M28F9W
EUT Stage	Identical Prototype

Remark:

1. For other wireless features of this EUT, the test report will be issued separately.
2. This test report recorded only product characteristics and test results of PCS Licensed Transmitter Held to Ear (PCE).
3. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No.	
	TH02-HY	03CH05-HY

1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ Preliminary Guidance for Receiving Applications for Certification of 3G Device. May 9, 2006.
- ♦ 47 CFR Part 2, 22(H)
- ♦ ANSI / TIA / EIA-603-C-2004
- ♦ IC RSS-132 Issue 2

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B (DoC), recorded in a separate test report.

1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU200	N/A	N/A	Unshielded, 1.8 m

2 Test Configuration of Equipment Under Test

2.1 Test Mode

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

Frequency range investigated for radiated emission is as follows:

1. 30 MHz to 9000 MHz for CDMA2000 BC0.

Test Modes		
Band	Radiated TCs	Conducted TCs
CDMA2000 BC0	■ 1xRTT Link Mode	■ 1xRTT Link Mode

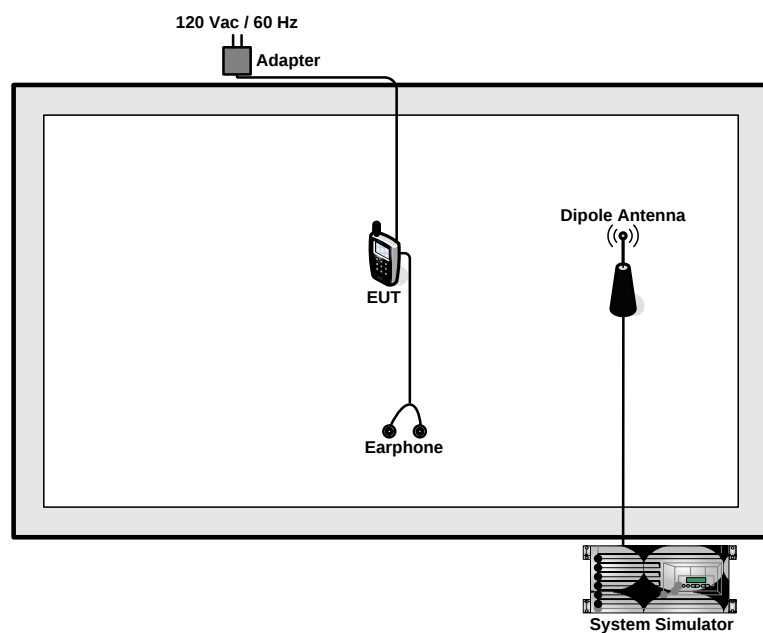
Note:

1. The maximum RF output power levels are 1xRTT RC1+SO55 mode for CDMA2000 BC0, only this mode was used for all tests.
2. Because there are individual antennas for each CDMA2000, WLAN, and Bluetooth, the co-location test modes are not required.

The conducted power tables are as follows:

Conducted Power (*Unit: dBm)			
Band	CDMA2000 BC0		
Channel	1013	384	777
Frequency	824.7	836.52	848.31
RC1+SO55	24.04	23.86	23.95
RC3+SO55	23.93	23.68	23.82
RC3+SO32(+ F-SCH)	23.92	23.74	23.99
RC3+SO32(+SCH)	23.87	23.71	23.88
RTAP 153.6	24.04	23.86	23.95
RETAP 4096	23.93	23.68	23.82

2.2 Connection Diagram of Test System



3 Test Result

3.1 Conducted Output Power Measurement

3.1.1 Description of the Conducted Output Power Measurement

A base station simulator was used to establish communication with the EUT. Its parameters were set to transmit the maximum power on the EUT. The measured power in the radio frequency on the transmitter output terminals shall be reported.

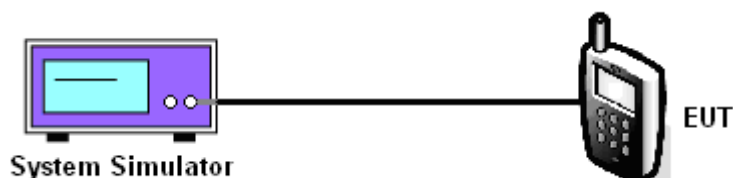
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedures

1. The transmitter output port was connected to base station.
2. Set EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different modulation.

3.1.4 Test Setup



3.1.5 Test Result of Conducted Output Power

CDMA2000 BC0					
Test Mode	Test Status	Channel	Frequency (MHz)	Conducted Power (dBm)	Conducted Power (Watts)
CDMA 2000 1xRTT	RC1+SO55	1013 (Low)	824.70	24.04	0.25
		384 (Mid)	836.52	23.86	0.24
		777 (High)	848.31	23.95	0.25

3.2 Effective Radiated Power and Effective Isotropic Radiated Power Measurement

3.2.1 Description of the ERP/EIRP Measurement

ERP/EIRP is measured by substitution method according to ANSI / TIA / EIA-603-C-2004. The ERP of mobile transmitters must not exceed 7 Watts.

3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The EUT was placed on a turntable with 1.0 meter height in a fully anechoic chamber.
2. The EUT was set at 1.2 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiated power.
4. The height of the receiving antenna is adjusted to look for the maximum ERP/EIRP.
5. Taking the record of maximum ERP/EIRP.
6. A dipole antenna was substituted in place of the EUT and was driven by a signal generator.
7. The conducted power at the terminal of the dipole antenna is measured.
8. Repeat step 3 to step 5 to get the maximum ERP/EIRP of the substitution antenna.
9. $ERP/EIRP = P_s + E_t - E_s + G_s = P_s + R_t - R_s + G_s$

P_s (dBm) : Input power to substitution antenna.

G_s (dBi or dBd) : Substitution antenna Gain.

$E_t = R_t + AF$

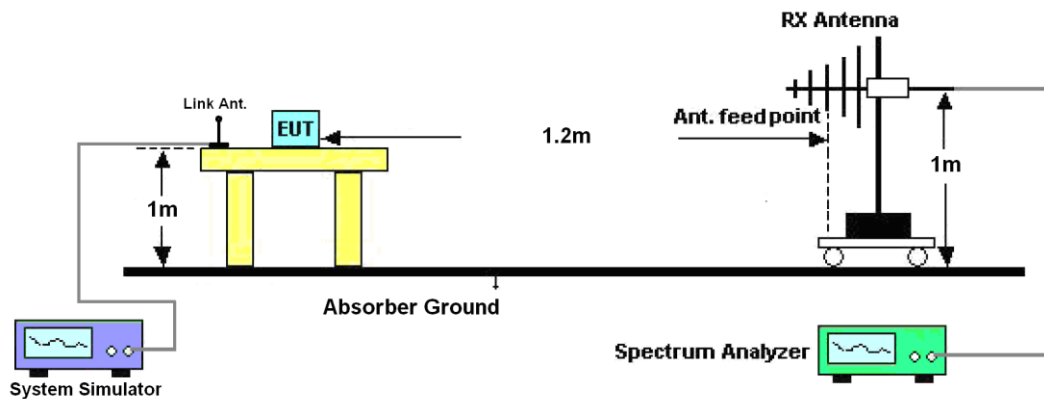
$E_s = R_s + AF$

AF (dB/m) : Receive antenna factor

R_t : The highest received signal in spectrum analyzer for EUT.

R_s : The highest received signal in spectrum analyzer for substitution antenna.

3.2.4 Test Setup



3.2.5 Test Result of ERP

CDMA2000 BC0 1xRTT_RC1+SO55 Radiated Power ERP						
Horizontal Polarization						
Frequency (MHz)	Rt (dBm)	Rs (dBm)	Ps (dBm)	Gs (dBd)	ERP (dBm)	ERP (W)
824.70	-49.19	-48.12	0.00	-1.08	18.98	0.08
836.52	-49.50	-48.28	0.00	-0.93	18.75	0.07
848.31	-49.74	-48.35	0.00	-0.76	17.85	0.06
Vertical Polarization						
Frequency (MHz)	Rt (dBm)	Rs (dBm)	Ps (dBm)	Gs (dBd)	ERP (dBm)	ERP (W)
824.70	-49.04	-47.97	0.00	-1.08	3.82	0.00
836.52	-49.23	-48.01	0.00	-0.93	3.56	0.00
848.31	-49.44	-48.05	0.00	-0.76	2.54	0.00

3.3 Occupied Bandwidth Measurement

3.3.1 Description of Occupied Bandwidth Measurement

The emission bandwidth is defined as the width of the signal between two points, located at the 2 sides of the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

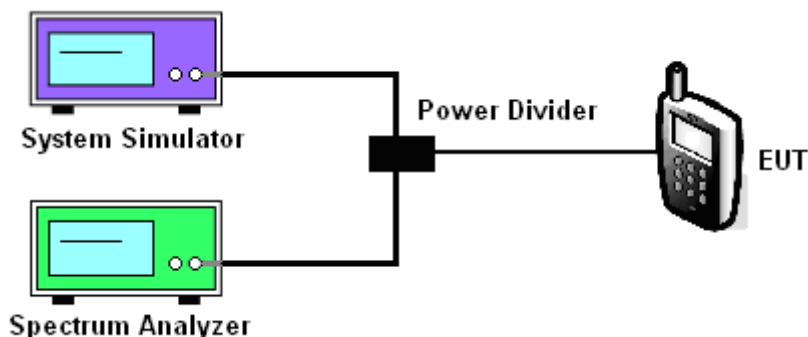
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The 99% and 26 dB occupied bandwidth (BW) of the middle channel for the highest RF powers were measured.

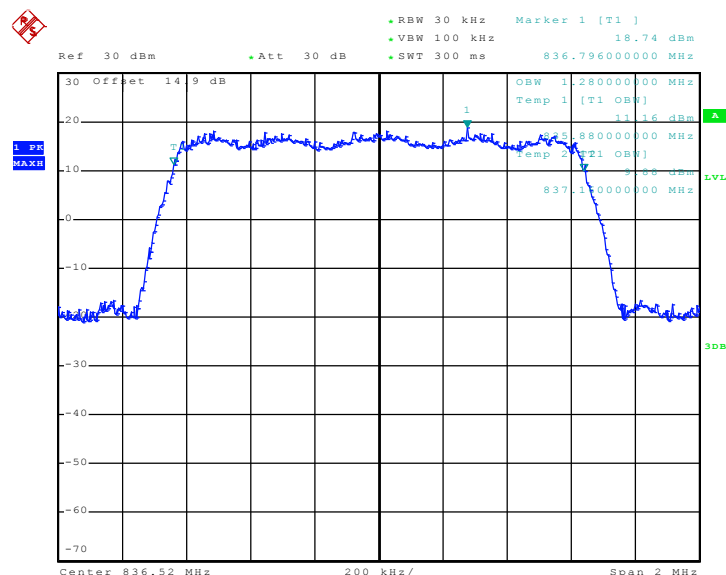
3.3.4 Test Setup



3.3.5 Test Result (Plots) of Occupied Bandwidth

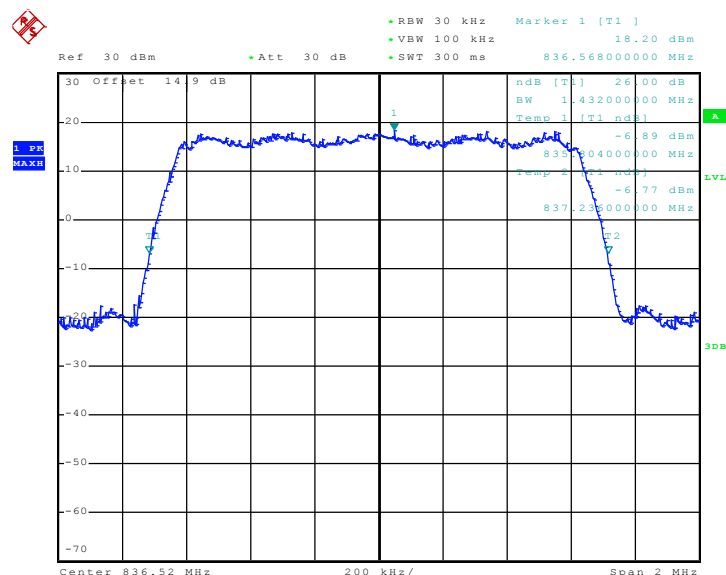
Band :	CDMA2000 BC0	Power Stage :	High
Test Mode :	1xRTT_RC1+SO55		

99% Occupied Bandwidth Plot on Channel 384



Date: 20.MAY.2011 14:22:58

26dB Bandwidth Plot on Channel 384



Date: 20.MAY.2011 14:18:41

3.4 Band Edge Measurement

3.4.1 Description of Band Edge Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

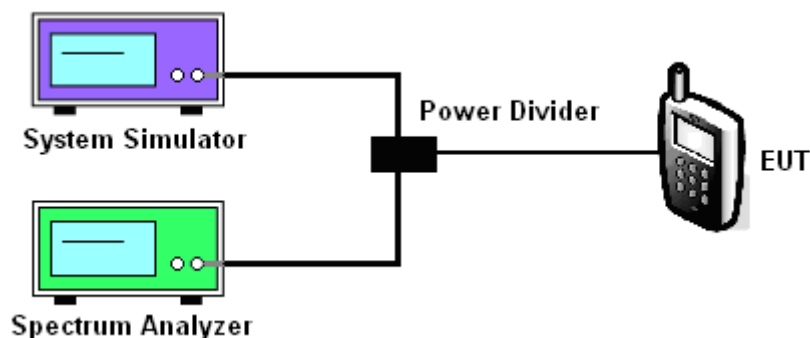
3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The band edges of low and high channels for the highest RF powers were measured. Setting RBW as roughly BW/100.
3. The RBW was replaced by 10 kHz, due to the spectrum analyzer IF-Filter including an excess of the limit. A worst case correction factor of $10 \log (1\% \text{ BW/measurement RBW})$ was implemented.

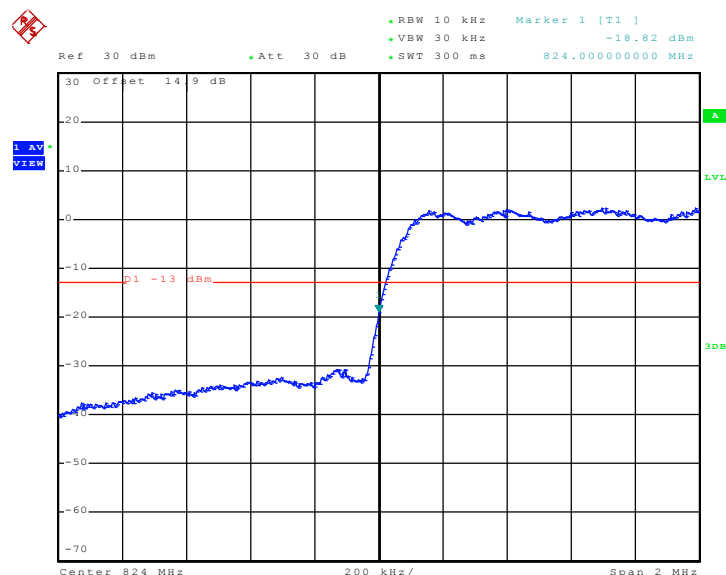
3.4.4 Test Setup



3.4.5 Test Result (Plots) of Conducted Band Edge

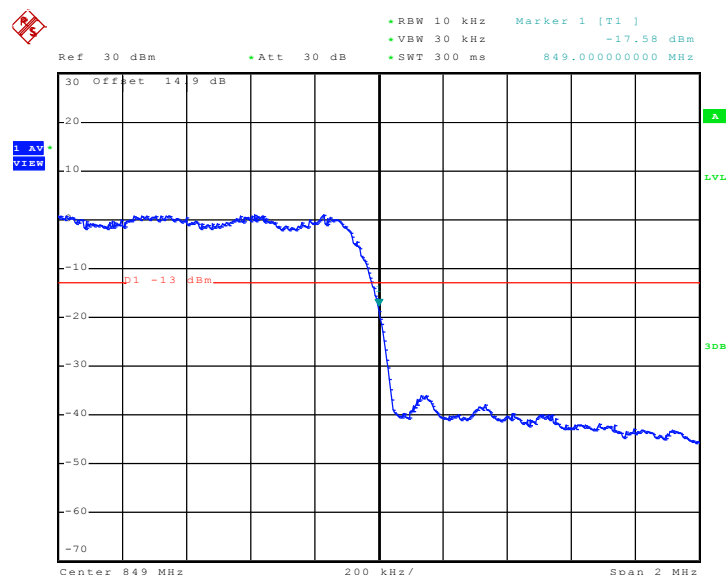
Band :	CDMA2000 BC0	Power Stage :	High
Test Mode :	1xRTT_RC1+SO55		

Lower Band Edge Plot on Channel 1013



Date: 20.MAY.2011 14:32:45

Higher Band Edge Plot on Channel 777



Date: 20.MAY.2011 14:33:15

3.5 Conducted Emission Measurement

3.5.1 Description of Conducted Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

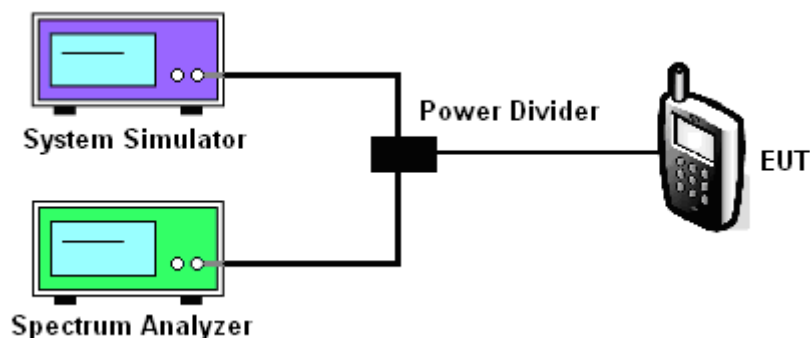
3.5.2 Measuring Instruments

See list of measuring instruments of this test report.

3.5.3 Test Procedures

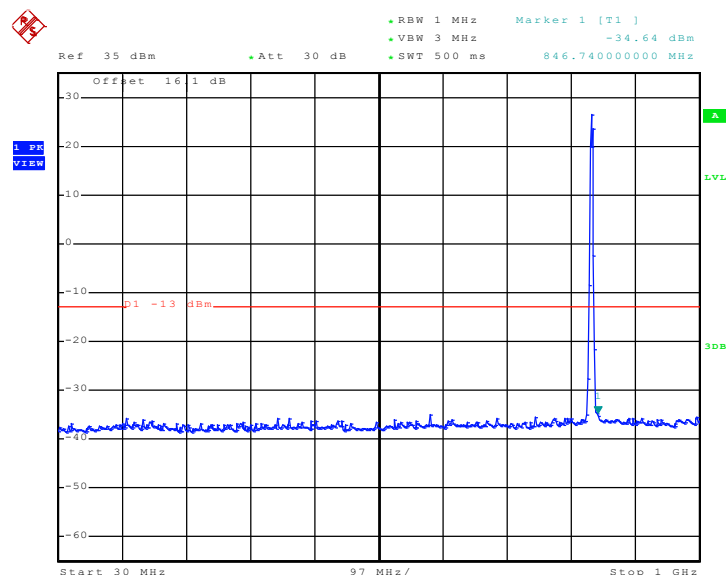
1. The EUT was connected to spectrum analyzer and base station via power divider.
2. The middle channel for the highest RF power within the transmitting frequency was measured.
3. The conducted spurious emission for the whole frequency range was taken.

3.5.4 Test Setup

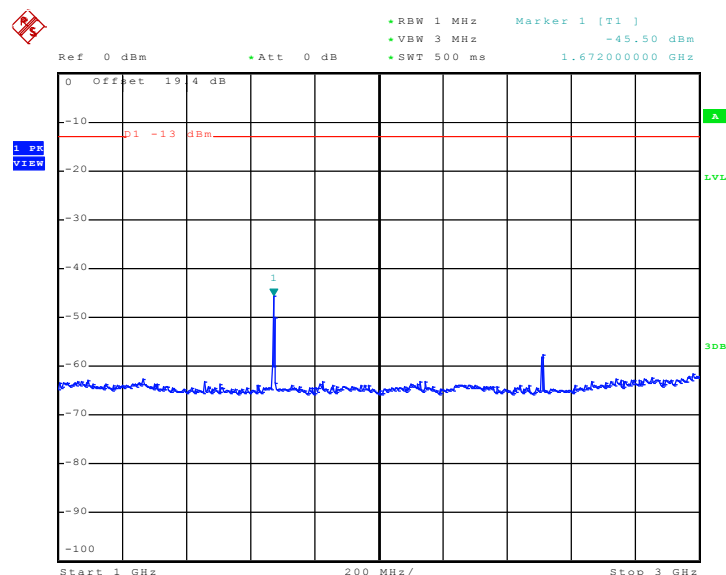


3.5.5 Test Result (Plots) of Conducted Emission

Band :	CDMA2000 BC0	Power Stage :	High
Test Mode :	1xRTT_RC1+SO55		

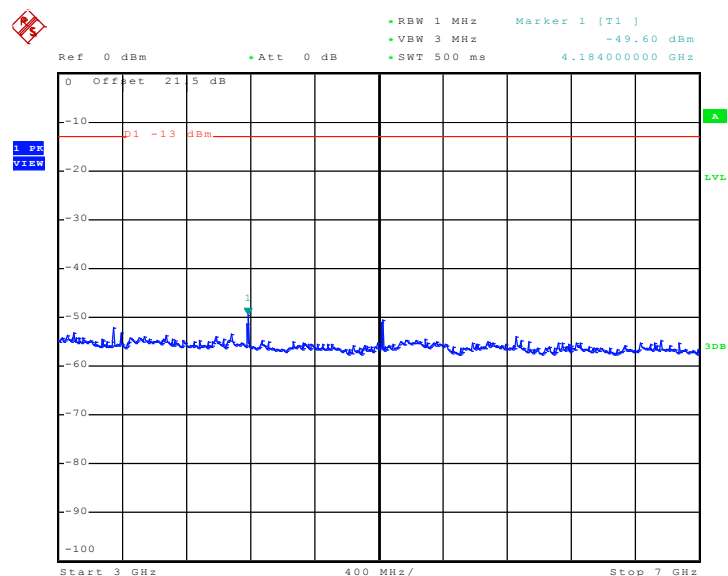
Conducted Emission Plot between 30MHz ~ 1GHz


Date: 20.MAY.2011 14:34:43

Conducted Emission Plot between 1GHz ~ 3GHz


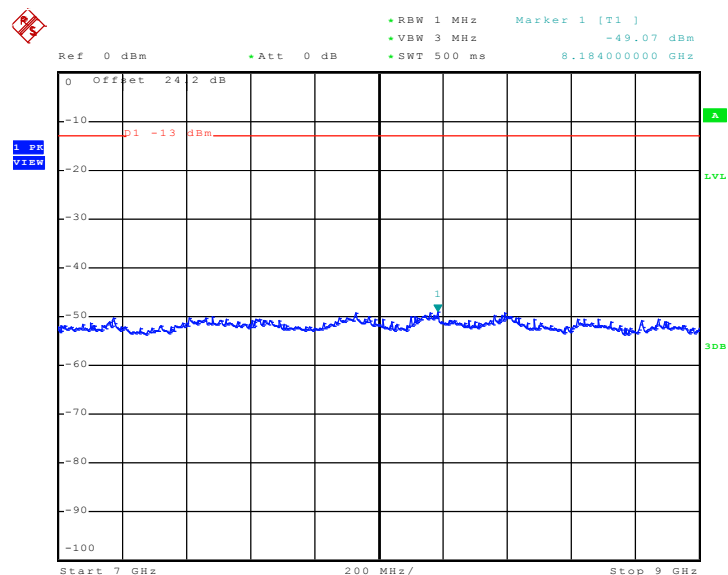
Date: 20.MAY.2011 14:34:59

Conducted Emission Plot between 3GHz ~ 7GHz



Date: 20.MAY.2011 14:35:11

Conducted Emission Plot between 7GHz ~ 9GHz



Date: 20.MAY.2011 14:35:23

3.6 Field Strength of Spurious Radiation Measurement

3.6.1 Description of Field Strength of Spurious Radiated Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-C-2004. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

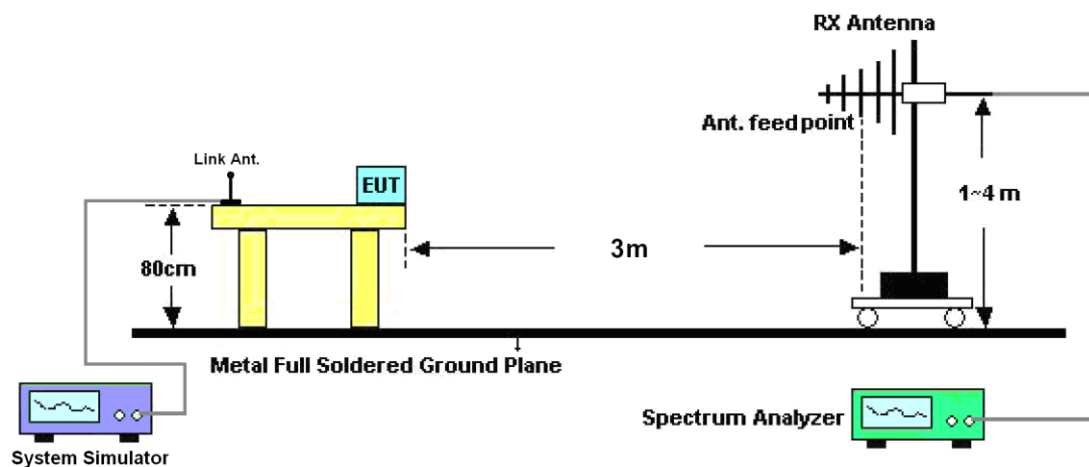
3.6.2 Measuring Instruments

See list of measuring instruments of this test report.

3.6.3 Test Procedures

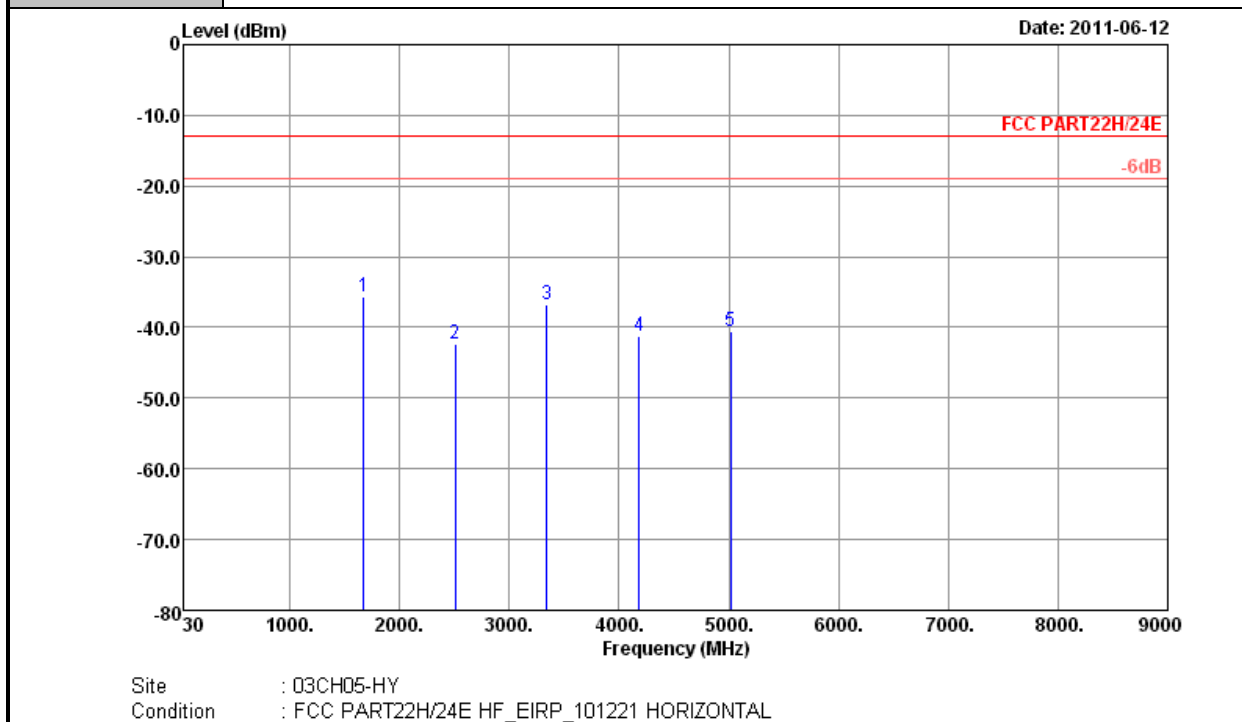
1. The EUT was placed on a rotatable wooden table with 0.8 meter about ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. $\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$
11. $\text{ERP (dBm)} = \text{EIRP} - 2.15$

3.6.4 Test Setup



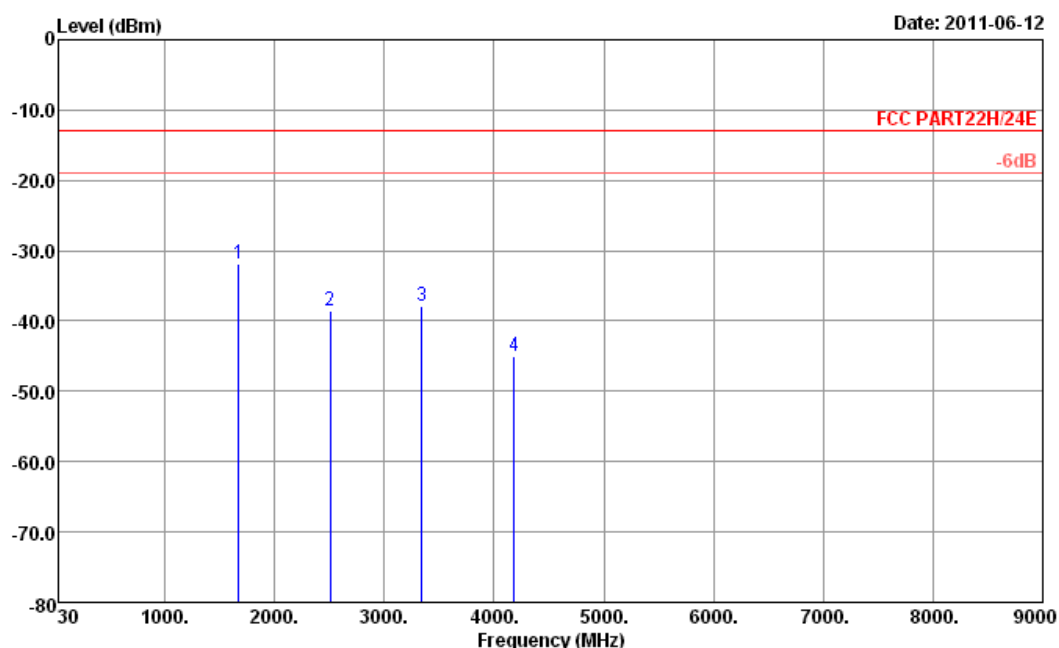
3.6.5 Test Result of Field Strength of Spurious Radiated

Band :	CDMA2000 BC0	Temperature :	23~25°C
Test Mode :	1xRTT_RC1+SO55	Relative Humidity :	49~51%
Test Engineer :	Brian	Polarization :	Horizontal
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.		



Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)	Result
1672	-35.66	-13	-22.66	-42.62	-36.85	2.15	5.49	H	Pass
2509	-42.38	-13	-29.38	-52.51	-44.27	2.38	6.41	H	Pass
3345	-36.79	-13	-23.79	-49.24	-40.12	2.86	8.34	H	Pass
4182	-41.19	-13	-28.19	-57.39	-45.13	3.26	9.35	H	Pass
5018	-40.51	-13	-27.51	-58.76	-45.25	3.62	10.51	H	Pass

Band :	CDMA2000 BC0	Temperature :	23~25°C
Test Mode :	1xRTT_RC1+SO55	Relative Humidity :	49~51%
Test Engineer :	Brian	Polarization :	Vertical
Remark :	Spurious emissions within 30-1000MHz were found more than 20dB below limit line.		



Site : 03CH05-HY
Condition : FCC PART22H/24E HF_EIRP_101221 VERTICAL

Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)	Result
1672	-31.88	-13	-18.88	-38.81	-33.07	2.15	5.49	V	Pass
2509	-38.57	-13	-25.57	-48.8	-40.46	2.38	6.41	V	Pass
3345	-37.80	-13	-24.80	-50.3	-41.13	2.86	8.34	V	Pass
4182	-45.07	-13	-32.07	-61.27	-49.01	3.26	9.35	V	Pass

3.7 Frequency Stability Measurement

3.7.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

3.7.2 Measuring Instruments

See list of measuring instruments of this test report.

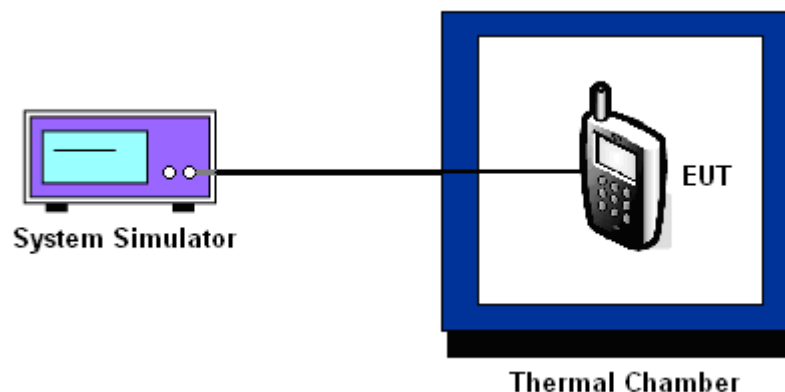
3.7.3 Test Procedures for Temperature Variation

1. The EUT was set up in the thermal chamber and connected with the base station.
2. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in 10°C step up to 50°C . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.
4. If the EUT can not be turned on at -30°C , the testing lowest temperature will be raised in 10°C step until the EUT can be turned on.

3.7.4 Test Procedures for Voltage Variation

1. The EUT was placed in a temperature chamber at $25\pm 5^{\circ}\text{C}$ and connected with the base station.
2. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

3.7.5 Test Setup



3.7.6 Test Result of Temperature Variation

Band :	CDMA2000 BC0	Channel :	384
Test Mode :	1xRTT_RC1+SO55	Limit (ppm) :	2.5

Temperature (°C)	Freq. Dev. (Hz)	Deviation (ppm)	Result
-30	N/A	N/A	PASS
-20	-17	-0.02	
-10	21	0.02	
0	25	0.03	
10	23	0.03	
20	-11	-0.01	
30	-14	-0.02	
40	14	0.02	
50	-17	-0.02	

Note:

1. The EUT stops transmitting at temperature -30°C.
2. The manufacturer declared that the EUT could work properly between temperatures -20°C~60°C.
3. The standard defined the test temperatures is -30°C~50°C, so we tested temperatures from -20°C to ~50°C.

3.7.7 Test Result of Voltage Variation

Band & Channel	Mode	Voltage (Volt)	Freq. Dev. (Hz)	Deviation (ppm)	Limit (ppm)	Result
CDMA2000 BC0 CH384	1xRTT RC1+SO55	3.9	-9	-0.01	2.5	PASS
		BEP	-15	-0.02		
		4.2	-22	-0.03		

Note :

1. Normal Voltage = 3.9V.
2. Battery End Point (BEP) = 3.7 V.

4 List of Measuring Equipments

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Due Date	Remark
System Simulator	R&S	CMU200	117995	N/A	Aug. 11, 2010	Aug.10, 2011	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 13, 2011	Jun. 12, 2012	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	0932001	N/A	Sep. 13, 2010	Sep. 12, 2011	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	0846202	N/A	Sep. 14, 2010	Sep. 13, 2011	Conducted (TH02-HY)
Thermal Chamber	Ten Billion	TTH-D35P	TBN-930701	N/A	Jul. 30, 2010	Jul. 29, 2011	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP30	101352	9KHz-40GHz	Nov. 03, 2010	Nov. 02, 2011	Radiation (03CH05-HY)
Amplifier	COM-POWER	PA-103	161075	1KHz - 1GHz	Mar. 29, 2011	Mar. 28, 2012	Radiation (03CH05-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2725	30MHz ~ 1GHz	Nov. 06, 2010	Nov. 05, 2011	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA917025 1	15GHz- 40GHz	Oct. 18, 2010	Oct. 17, 2011	Radiation (03CH05-HY)
Pre Amplifier	Agilent	8449B	3008A01917	1GHz- 26.5GHz	Apr. 14, 2011	Apr. 13, 2012	Radiation (03CH05-HY)
Turn Table	HD	Deis HD 2000	420/611	0 - 360 degree	N/A	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	MA 240	240/666	1 m - 4 m	N/A	N/A	Radiation (03CH05-HY)
Horn Antenna	ESCO	3117	00066584	1GHz ~ 18GHz	Aug. 05, 2010	Aug. 04, 2011	Radiation (03CH05-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz~30 MHz	Jul. 29, 2010	Jul. 28, 2011	Radiation (03CH05-HY)

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.41	Normal (k=2)	0.21
Antenna Factor Calibration	0.83	Normal (k=2)	0.42
Cable Loss Calibration	0.25	Normal (k=2)	0.13
Pre-Amplifier Gain Calibration	0.27	Normal (k=2)	0.14
RCV/SPA Specification	2.50	Rectangular	0.72
Antenna Factor Interpolation for Frequency	1.00	Rectangular	0.29
Site Imperfection	1.43	Rectangular	0.83
Mismatch	+0.39 / -0.41	U-Shape	0.28
Combined Standard Uncertainty $U_c(y)$	1.27		
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.54		

Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Contribution	Uncertainty of X_i		$u(X_i)$	C_i	$C_i * u(X_i)$
	dB	Probability Distribution			
Receiver Reading	± 0.10	Normal (k=2)	0.10	1	0.10
Antenna Factor Calibration	± 1.70	Normal (k=2)	0.85	1	0.85
Cable Loss Calibration	± 0.50	Normal (k=2)	0.25	1	0.25
Receiver Correction	± 2.00	Rectangular	1.15	1	1.15
Antenna Factor Directional	± 1.50	Rectangular	0.87	1	0.87
Site Imperfection	± 2.80	Triangular	1.14	1	1.14
Mismatch Receiver VSWR $\Gamma_1 = 0.197$ Antenna VSWR $\Gamma_2 = 0.194$ Uncertainty = $20\log(1-\Gamma_1\Gamma_2)$	+0.34 / -0.35	U-Shape	0.244	1	0.244
Combined Standard Uncertainty $U_c(y)$	2.36				
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.72				



Appendix A. Photographs of EUT

Please refer to Sporton report number EP151009 as below.