

FCC RF Test Report

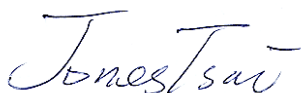
APPLICANT : Xplore Technologies Corp.
EQUIPMENT : Wireless Modules
BRAND NAME : Xplore Technologies
MODEL NAME : EM7355
FCC ID : Q2GEM7355
STANDARD : FCC 47 CFR Part 2, and 90(S)
CLASSIFICATION : PCS Licensed Transmitter (PCB)

The product was received on Nov. 20, 2013 and testing was completed on Dec. 13, 2013. 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: Joseph Lin / Supervisor



Approved by: Jones Tsai / Manager



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FCC ID : Q2GEM7355

Page Number : 1 of 27

Report Issued Date : Jan. 23, 2014

Report Version : Rev. 01



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FW3N2012	Rev. 01	Initial issue of report	Jan. 23, 2014

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1046	Conducted Output Power	N/A , Reporting only	PASS	-
3.2	§2.1049 §90.209	Bandwidth limitations	N/A, Reporting only	PASS	-
3.3	§2.1051 §90.691	Emission masks – In-band emissions	$< 50+10\log_{10}(P[\text{Watts}])$	PASS	-
3.4	§2.1051 §90.691	Emission masks – Out of band emissions	$< 43+10\log_{10}(P[\text{Watts}])$	PASS	-
3.5	§2.1053 §90.691	Field Strength of Spurious Radiation	$< 43+10\log_{10}(P[\text{Watts}])$	PASS	Under limit 9.89 dB at 1640.000 MHz
3.6	§2.1055 §90.213	Frequency Stability for Temperature & Voltage	$< 2.5 \text{ ppm}$	PASS	-

1 General Description

1.1 Applicant

Xplore Technologies Corp.

14000 Summit Road Suite 900, Austin, Texas, 78728 USA

1.2 Manufacturer

Sierra Wireless Inc.

13811, Wireless Way, Richmond, British Columbia, Canada

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	Wireless Modules
Brand Name	Xplore Technologies
Model Name	EM7355
FCC ID	Q2GEM7355
Installed into Rugged Tablet PC	Brand name : Xplore Technologies Corp Model name : iX104C6
EUT supports Radios application	CDMA/EV-DO/GSM/EGPRS/WCDMA/HSPA/LTE
EUT Stage	Production Unit

1.4 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx Frequency	817.9 MHz ~ 823.1 MHz
Rx Frequency	862.9 MHz ~ 868.1 MHz
Maximum Output Power to Antenna	23.71 dBm
Antenna Type	PIFA Antenna
Type of Modulation	QPSK

Remark: This test report recorded only product characteristics and test results of PCS Licensed Transmitter (PCB).

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 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.		FCC/IC Registration No.
	TH02-HY	03CH07-HY	722060/4086B-1

1.7 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.
- ♦ FCC 47 CFR Part 2, 90
- ♦ ANSI / TIA / EIA-603-C-2004

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

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 30 MHz to 9000 MHz for CDMA2000 BC10.

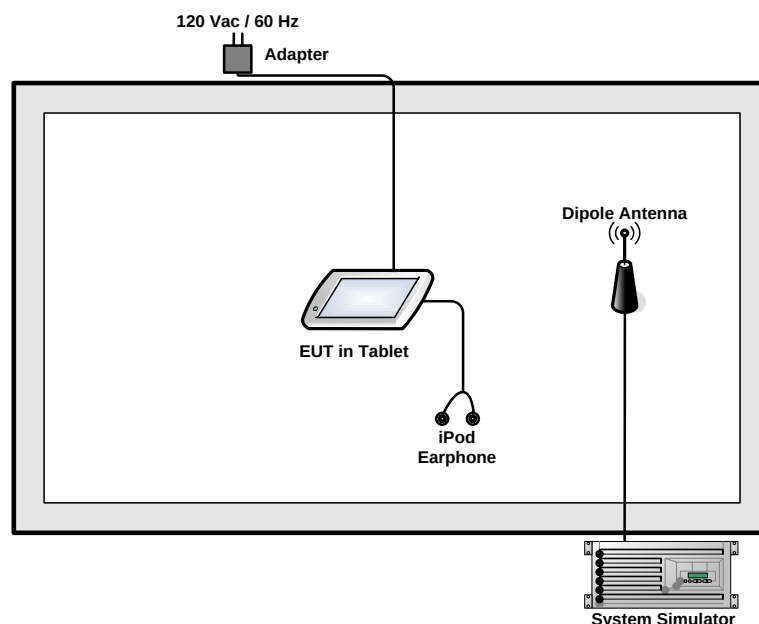
Test Modes		
Band	Radiated TCs	Conducted TCs
CDMA2000 BC10	■ 1xEV-DO Rev. 0 Link	■ 1xEV-DO Rev. 0 Link

Note: The maximum RF output power levels are 1xEV-DO Rev. 0 RTAP 153.6kbps mode for CDMA2000 BC10 on QPSK Link; only these modes were used for all tests.

The conducted power table is as follows:

Conducted Power (*Unit: dBm)			
Band	CDMA2000 BC10		
Channel	476	580	684
Frequency	817.90	820.50	823.10
1xRTT RC1 SO55	23.70	23.68	23.51
1xRTT RC3 SO55	23.66	23.53	23.41
1xEVDO RTAP 153.6kbps	23.71	23.68	23.45
1xEVDO RETAP 4096Bits	23.68	23.58	23.49

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

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.

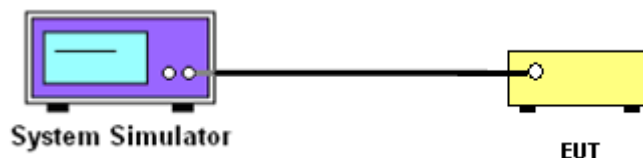
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 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.
4. Measure maximum average power for CDMA.

3.1.4 Test Setup



3.1.5 Test Result of Conducted Output Power

CDMA 2000 BC10			
Modes	CDMA 2000 1xEV-DO Rev. 0		
Test Status	RTAP 153.6K		
Channel	467 (Low)	580 (Mid)	684 (High)
Frequency (MHz)	817.9	820.5	823.1
Conducted Power (dBm)	23.71	23.68	23.51
Conducted Power (Watts)	0.24	0.23	0.22

Note: maximum burst average power for CDMA.

3.2 Bandwidth Limitations Measurement

3.2.1 Description of (Occupied) Bandwidth Limitations 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.

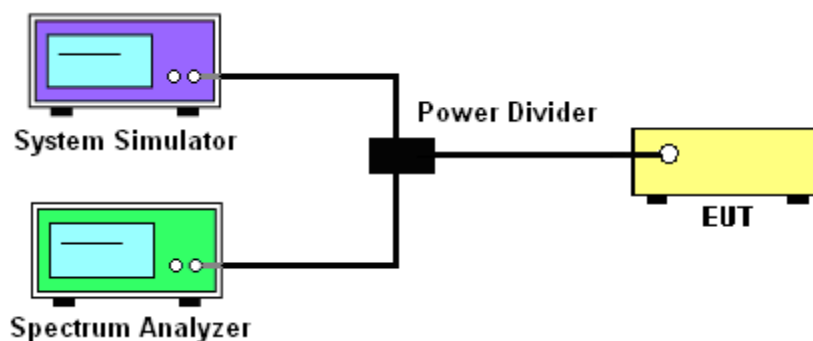
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

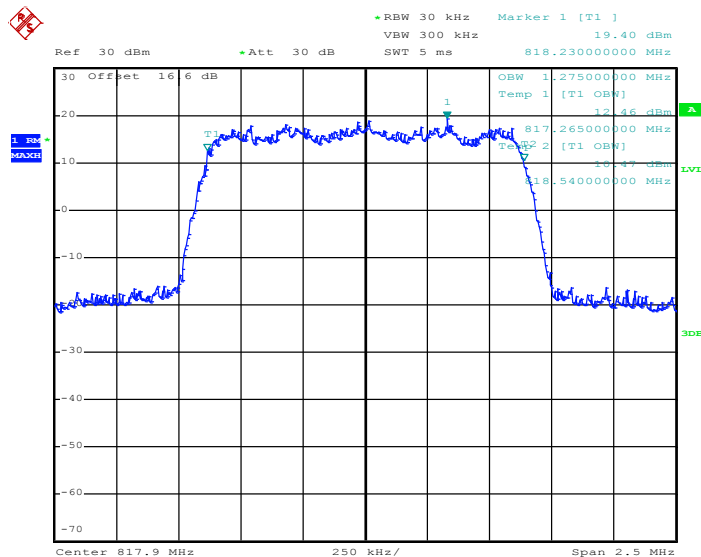
1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The 99% and 26 dB occupied bandwidth (BW) of the middle channel for the highest RF powers were measured.

3.2.4 Test Setup

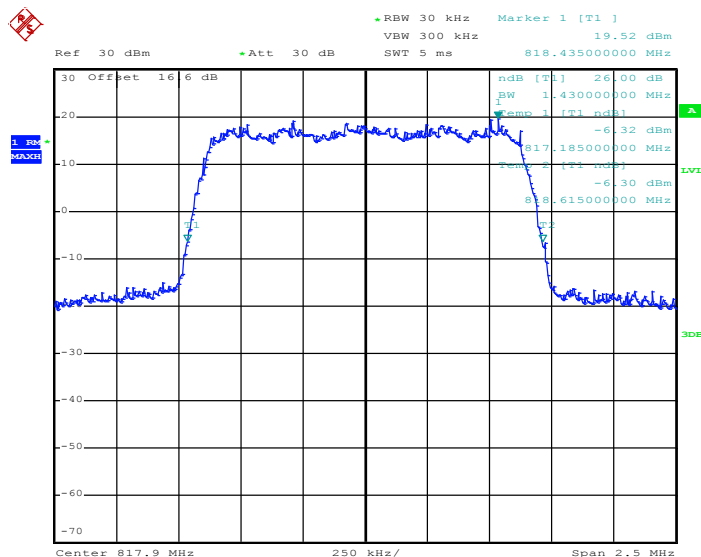


3.2.5 Test Result (Plots) of Occupied Bandwidth

Band :	CDMA2000 BC10	Power Stage :	High
Test Mode :	1xEV-DO Rev. 0_RTAP 153.6K Link (QPSK)		

99% Occupied Bandwidth Plot on Channel 476


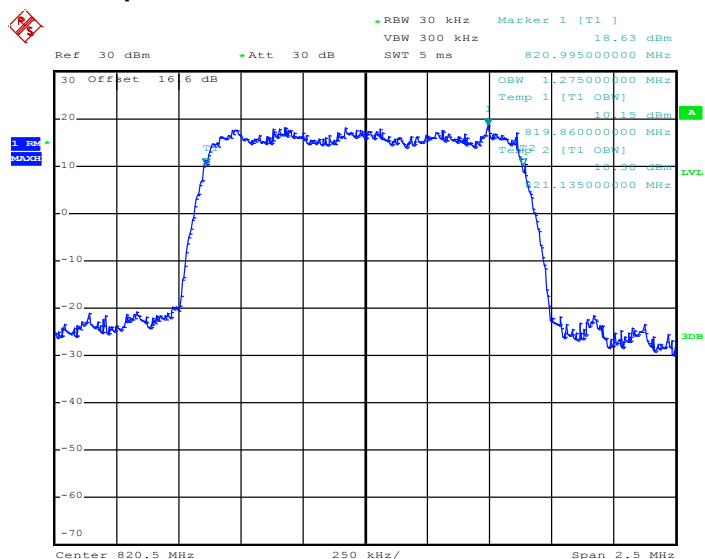
Date: 13.DEC.2013 15:44:05

26dB Bandwidth Plot on Channel 476


Date: 13.DEC.2013 15:40:28

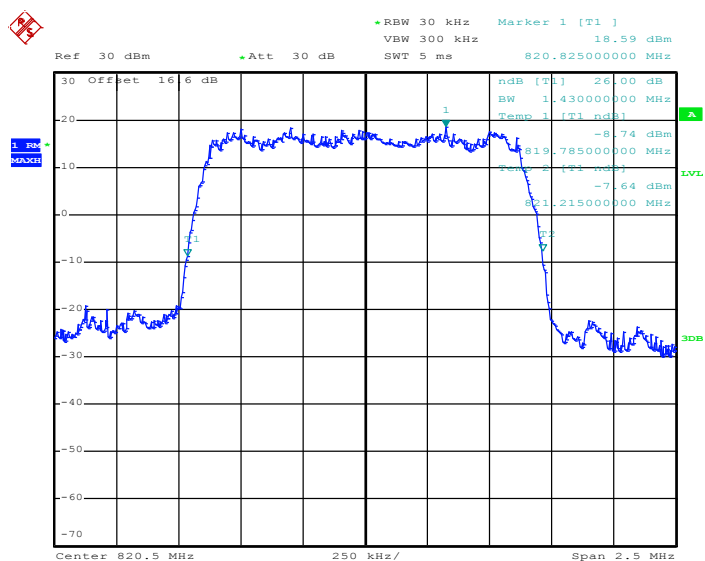


99% Occupied Bandwidth Plot on Channel 580

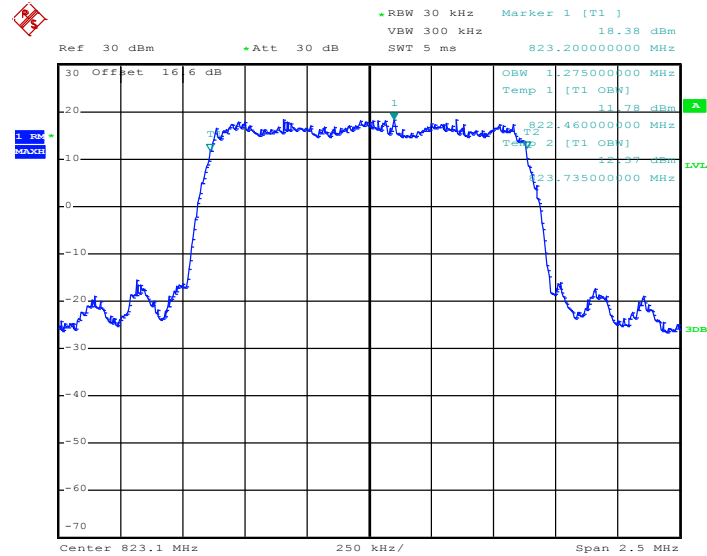


Date: 13.DEC.2013 15:43:31

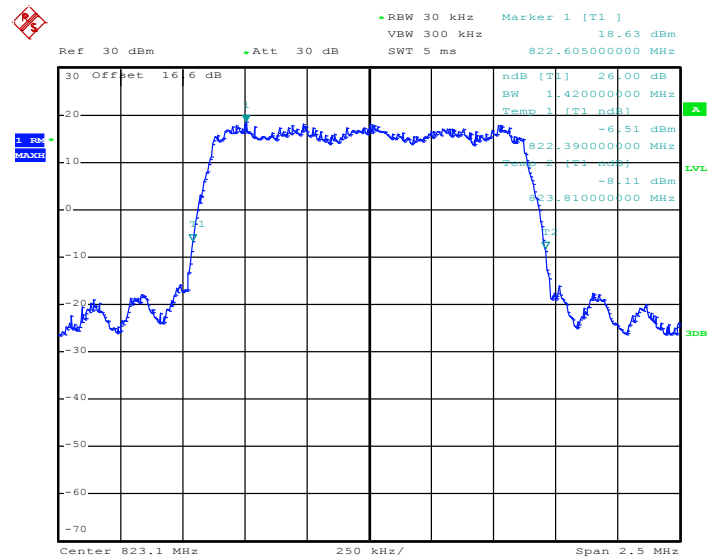
26dB Bandwidth Plot on Channel 580



Date: 13.DEC.2013 15:41:03

99% Occupied Bandwidth Plot on Channel 684


Date: 13.DEC.2013 15:42:53

26dB Bandwidth Plot on Channel 684


Date: 13.DEC.2013 15:41:32

3.3 Emissions Mask Measurement

3.3.1 Description of Emissions Mask Measurement

Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of FCC Part 90.691.(a)(1)

(a). Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

- (1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

3.3.2 Measuring Instruments

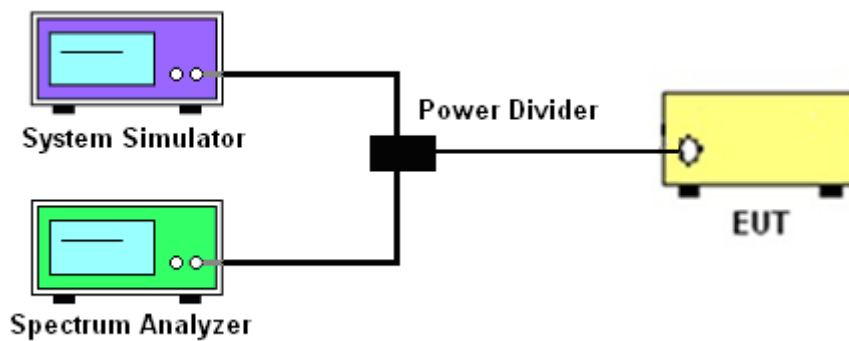
The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The EUT was connected to spectrum analyzer and base station via power divider.
2. The emissions mask of low and high channels for the highest RF powers were measured.
3. The RBW was set 30 kHz, higher than 1% of bandwidth 1.27MHz, and VBW was set 3 times of RBW.
4. The final test results were shown below plots with a correction offset factor including cable loss, insertion loss of power divider.
5. The 1% of bandwidth 1.27MHz approximately was 13kHz. The test results need to follow below equation.

$$\text{Test Result(dBm)} = \text{PwrAbs(dBm)} + 10 \cdot \text{LOG}(13\text{kHz}/30\text{KHz})(\text{dB}) (\sim -3.63\text{dB})$$

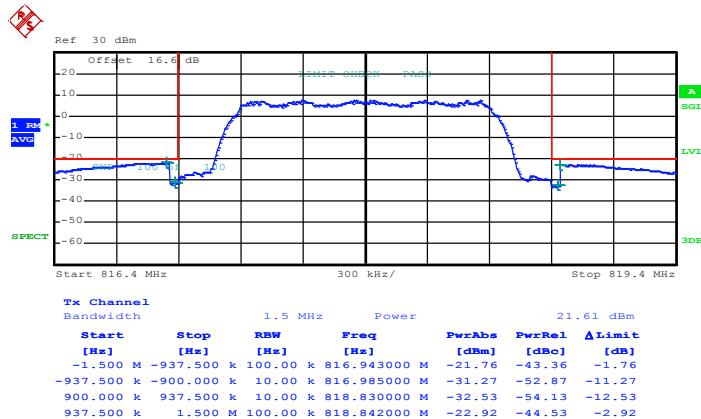
3.3.4 Test Setup



3.3.5 Test Result (Plots) of Conducted Emissions Mask

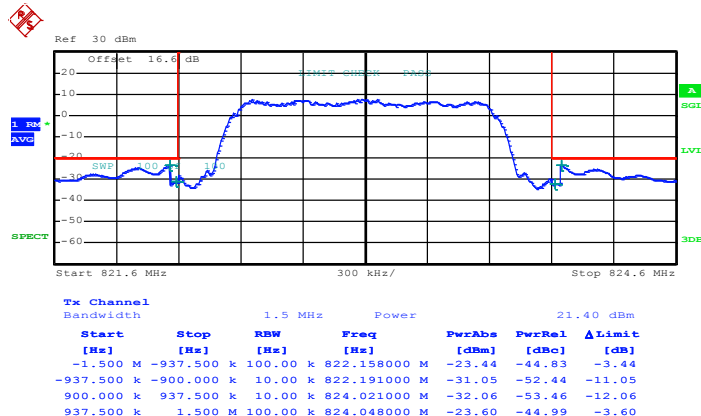
Band :	CDMA2000 BC10	Power Stage :	High
Test Mode :	1xEV-DO Rev. 0_RTAP 153.6K Link (QPSK)		

Lower Band Edge Plot on Channel 476



Date: 13.DEC.2013 18:33:00

Higher Band Edge Plot on Channel 684



Date: 13.DEC.2013 18:34:19

3.4 Emissions Mask – Out Of Band Emissions Measurement

3.4.1 Description of Conducted Emissions Out of band emissions measurement

The power of any emission FCC Part 90.691 (a)(2) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth 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 10^{th} harmonic.

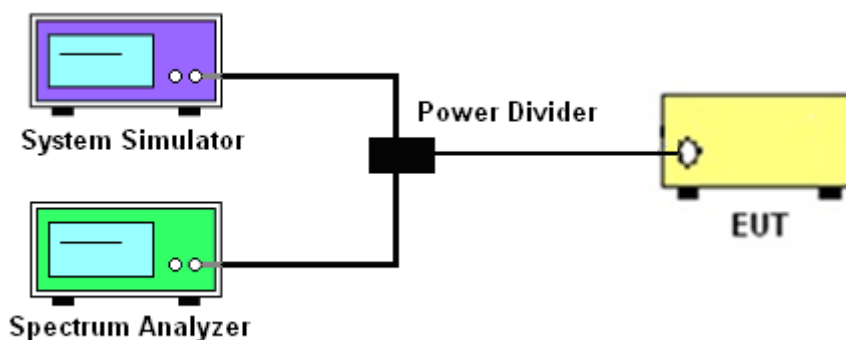
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

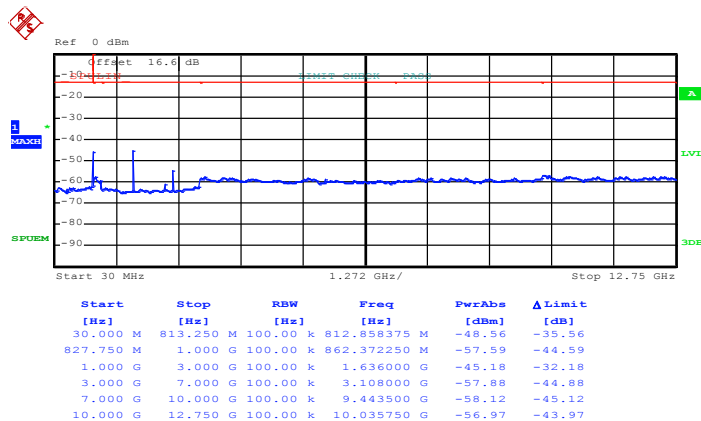
1. The EUT was connected to spectrum analyzer and base station via power divider.
2. The middle channel for the highest RF power within the transmitting frequency was measured.
3. The conducted spurious emission for the whole frequency range was taken.
4. The final test results were shown below plots with a correction offset factor including cable loss, insertion loss of power divider.

3.4.4 Test Setup

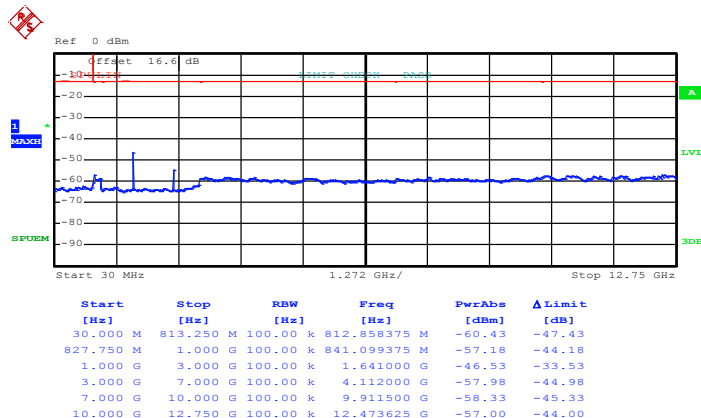


3.4.5 Test Result (Plots) of Conducted Emission

Band :	CDMA2000 BC10	Power Stage :	High
Test Mode :	1xEV-DO Rev. 0_RTAP 153.6K Link (QPSK)		

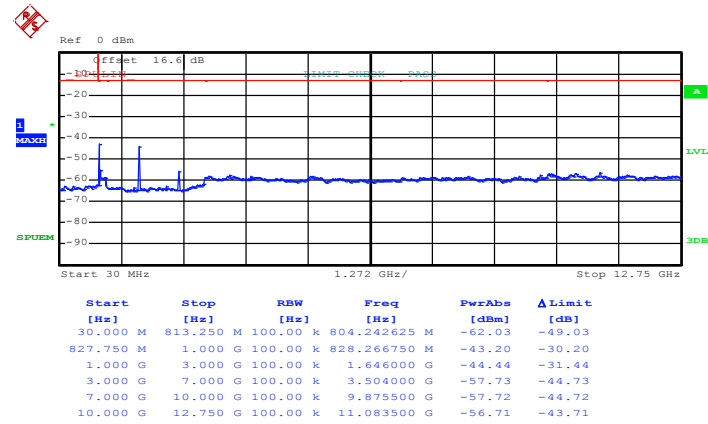
Conducted Emission Plot between on Channel 476


Date: 13.DEC.2013 15:51:07

Conducted Emission Plot between on Channel 580


Date: 13.DEC.2013 15:53:13

Conducted Emission Plot between on Channel 684



Date: 13.DEC.2013 15:54:15

3.5 Field Strength of Spurious Radiation Measurement

3.5.1 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 FCC Part 90.691 on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least $43 + 10 \log (P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

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 $43 + 10 \log_{10}(P[\text{Watts}])$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.5.2 Measuring Instruments

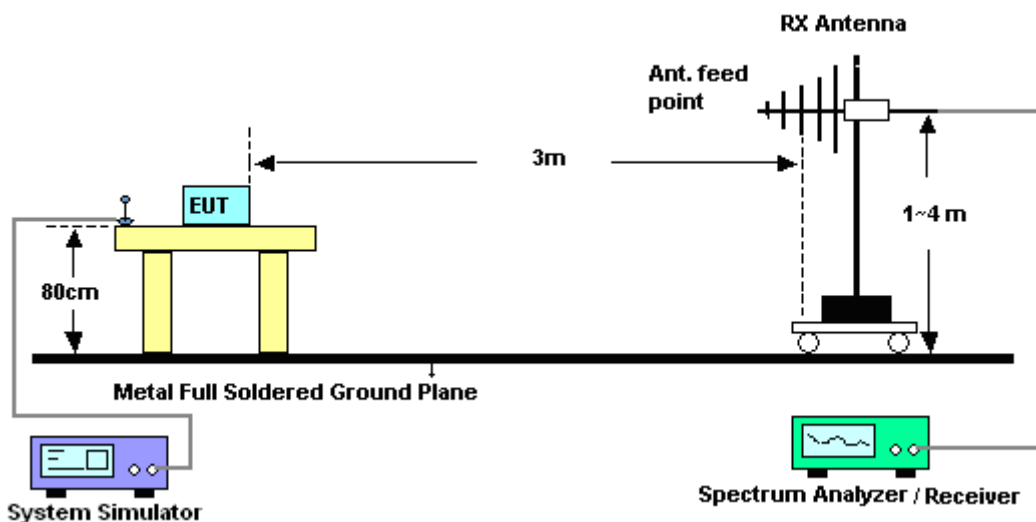
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

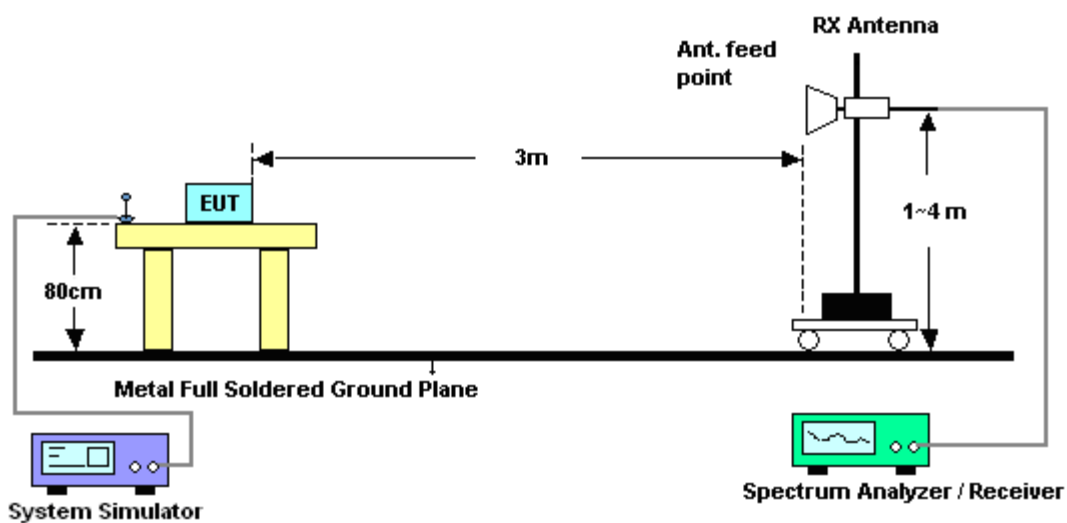
1. The EUT was placed on a rotatable wooden table with 0.8 meter about ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, 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. $\text{ERP (dBm)} = \text{EIRP} - 2.15$
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
13. The limit line is derived from $43 + 10 \log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10 \log(P)] \text{ (dB)}$
 $= [30 + 10 \log(P)] \text{ (dBm)} - [43 + 10 \log(P)] \text{ (dB)}$
 $= -13 \text{ dBm}.$

3.5.4 Test Setup

For radiated emissions from 30MHz to 1GHz

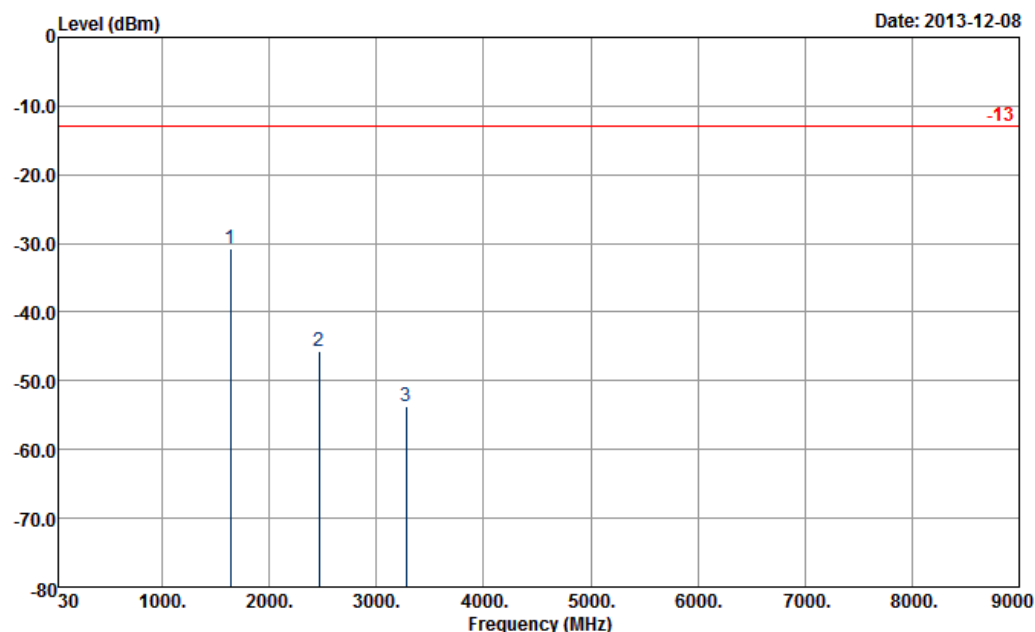


For radiated emissions above 1GHz



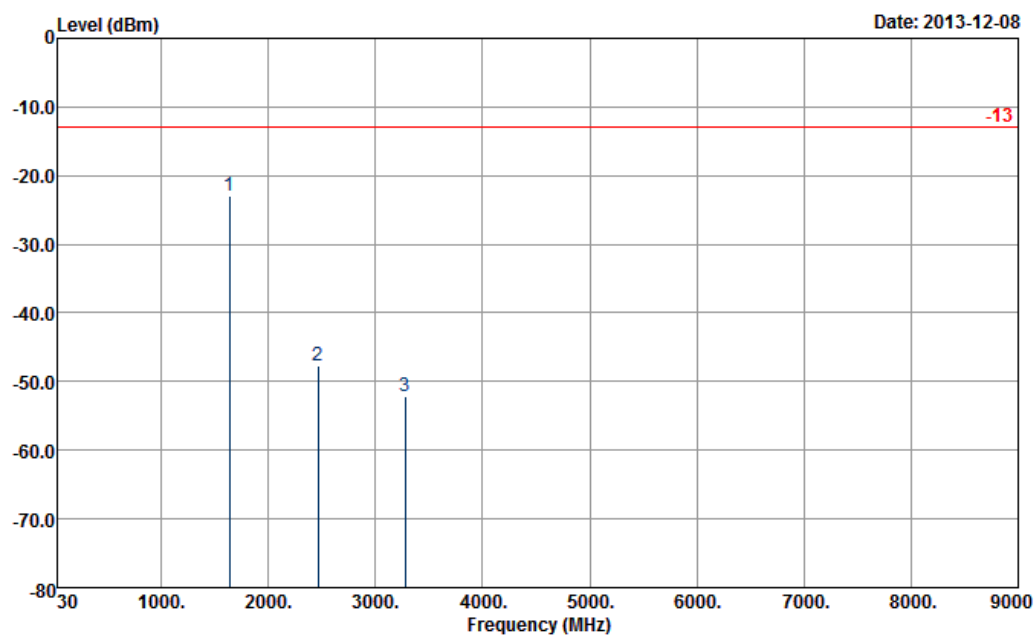
3.5.5 Test Result of Field Strength of Spurious Radiated

Band :	CDMA2000 BC10	Temperature :	21~23°C
Test Mode :	1xEV-DO Rev. 0_RTAP 153.6K (QPSK)	Relative Humidity :	53~56%
Test Engineer :	Stan Hsieh	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
1640	-30.70	-13	-17.70	-39.46	-34.69	1.51	5.50	H	Pass
2464	-45.69	-13	-32.69	-58.65	-49.76	2.04	6.11	H	Pass
3280	-53.71	-13	-40.71	-67.72	-59.11	2.45	7.85	H	Pass

Band :	CDMA2000 BC10	Temperature :	21~23°C
Test Mode :	1xEV-DO Rev. 0_RTAP 153.6K (QPSK)	Relative Humidity :	53~56%
Test Engineer :	Stan Hsieh	Polarization :	Vertical
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
1640	-22.89	-13	-9.89	-33.89	-26.88	1.51	5.50	V	Pass
2464	-47.58	-13	-34.58	-61.18	-51.65	2.04	6.11	V	Pass
3280	-52.12	-13	-39.12	-67.72	-57.52	2.45	7.85	V	Pass

3.6 Frequency Stability Measurement

3.6.1 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 according to FCC Part 90.213.

3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

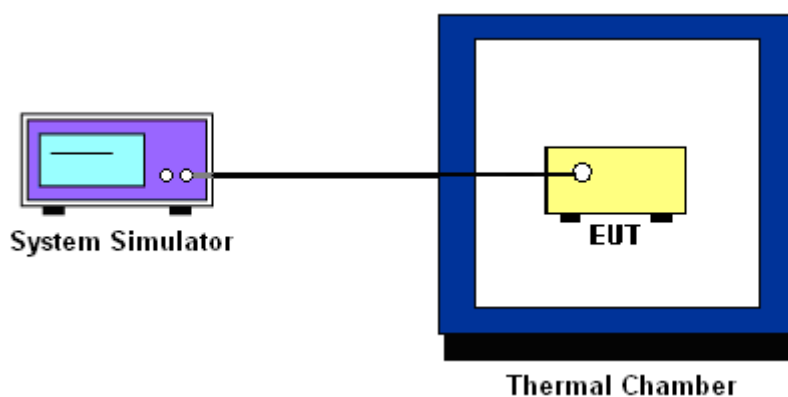
3.6.3 Test Procedures for Temperature Variation

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.

3.6.4 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.

3.6.5 Test Setup



3.6.6 Test Result of Temperature Variation

Band :	CDMA2000 BC10	Channel :	580
Test Mode :	1xEV-DO Rev. 0_RTAP 153.6K	Limit (ppm) :	2.5

Temperature (°C)	Deviation (ppm)	Result
50	0.0171	PASS
40	0.0122	
30	0.0134	
20	0.0098	
10	0.0122	
0	0.0134	
-10	0.0183	
-20	0.0171	
-30	0.0207	

3.6.7 Test Result of Voltage Variation

Band & Channel	Mode	Voltage (Volt)	Deviation (ppm)	Limit (ppm)	Result
CDMA2000 BC10 CH580	1xEV-DO Rev. 0_RTAP 153.6K	8.74	0.0171	2.5	PASS
		7.60	0.0098		
		BEP	0.0122		

Note:

1. Normal Voltage = 7.60V.
2. Battery End Point (BEP) = 6.46 V.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
System Simulator	Rohde & Schwarz	CMU200	117995	N/A	Aug. 01, 2013	Dec. 13, 2013	Jul. 31, 2014	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 07, 2013	Dec. 13, 2013	Jun. 06, 2014	Conducted (TH02-HY)
Thermal Chamber	Ten Billion	TTH-D3SP	TBN-930701	N/A	Jul. 19, 2013	Dec. 13, 2013	Jul. 18, 2014	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9kHz ~ 30GHz	Nov. 20, 2013	Dec. 08, 2013	Nov. 19, 2014	Radiation (03CH07-HY)
Bilog Antenna	Schaffner	CBL6111C	2726	30MHz ~ 1GHz	Oct. 10, 2013	Dec. 08, 2013	Oct. 09, 2014	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	75962	1GHz~18GHz	Aug. 22, 2013	Dec. 08, 2013	Aug. 21, 2014	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	30MHz~1GHz	Feb. 26, 2013	Dec. 08, 2013	Feb. 25, 2014	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz~26.5GHz	Aug. 12, 2013	Dec. 08, 2013	Aug. 11, 2014	Radiation (03CH07-HY)
Turn Table	ChainTek	ChainTek 3000	N/A	0 ~ 360 degree	N/A	Dec. 08, 2013	N/A	Radiation (03CH07-HY)
Antenna Mast	ChainTek	ChainTek 3000	N/A	N/A	N/A	Dec. 08, 2013	N/A	Radiation (03CH07-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.50
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