


FCC RF Test Report

APPLICANT : Quanta Computer Inc.
EQUIPMENT : LTE sip module
BRAND NAME : Quanta;Aptos;Topmore
MODEL NAME : LI170;S901100003
MARKETING NAME : LI170;S901100003
FCC ID : HFS-LI170
STANDARD : 47 CFR Part 2, 27
CLASSIFICATION : PCS Licensed Transmitter (PCB)

The product was received on Oct. 02, 2012 and completely tested on Oct. 26, 2012. 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.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.



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SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1046	Conducted Output Power	NA	PASS	
3.2	NA	NA	Peak-to-Average Ratio	<13 dB	PASS
3.3	§2.1049	Occupied Bandwidth	NA	PASS	-
3.4	§2.1049 §27.53(c)(4)	Band Edge and Emission Mask Measurement	< 43+10log ₁₀ (P[Watts]) < 65+10log ₁₀ (P[Watts]) in a 6.25 KHz bandwidth for emissions in the 763 ~ 805 MHz bands	PASS	-
3.5	§2.1051 §27.53(c)	Conducted Spurious Emission	< 43+10log ₁₀ (P[Watts])	PASS	-
3.5	§2.1053 §27.53(f)	Undesirable Emissions in the 1559 ~ 1610 MHz band	< -40 dBm/MHz (wideband) < -50 dBm (narrowband)	PASS	-
3.6	§2.1053 §27.53(c)(2) §27.53(c)(4)	Undesirable Out of Band Emissions	< 43+10log ₁₀ (P[Watts])	PASS	Under limit 35.76 dB at 3137.000 MHz
3.7	§2.1055 §27.54	Frequency Stability Temperature & Voltage	< 2.5 ppm	PASS	-

1 General Description

1.1 Applicant

Quanta Computer Inc.
 211 Wen Hwa 2nd Rd., Kueishan, Taoyuan 33377, Taiwan

1.2 Manufacturer

1. **Quanta Computer Inc.**
 211 Wen Hwa 2nd Rd., Kueishan, Taoyuan 33377, Taiwan
2. **Aptos Technology Inc.**
 No. 398, Youyi Rd., Jhunan Township, Miaoli County 350, Taiwan
3. **Topmore Technology Inc.**
 1F., No. 2, Liujia 7th Rd., Zhubei City, Hsinchu County 302, Taiwan R.O.C.

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	LTE sip module
Brand Name	Quanta;Aptos;Topmore
Model Name	LI170;S901100003
Marketing Name	LI170;S901100003
FCC ID	HFS-LI170
EUT supports Radios application	LTE
HW Version	LI170116
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Product Specification subjective to this standard	
Tx Frequency Range	LTE Band 13: 779.5 MHz ~784.5 MHz
Rx Frequency Range	LTE Band 13: 748.5 MHz ~ 753.5 MHz
Bandwidth	5MHz / 10MHz
Maximum Output Power to Antenna	23.68 dBm
Antenna Type	Dipole Antenna
Type of Modulation	LTE: 16QAM (Uplink)

1.4 Emission Designator and Conducted Power

FCC Rule	System	Type of Modulation	BW	Conducted Power (dBm)	Emission Designator
Part 27	LTE	QPSK	BW 5MHz	23.42	4M54G7D
Part 27	LTE	16QAM	BW 5MHz	23.68	4M55D7W
Part 27	LTE	QPSK	BW 10MHz	23.11	9M10G7D
Part 27	LTE	16QAM	BW 10MHz	23.29	9M10D7W

1.5 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	TW1022/4086B-1

1.6 Applied Standards

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

- 47 CFR Part 2, 27
- ANSI / TIA / EIA-603-C-2004
- FCC KDB 971168 D01 Power Meas. License Digital Systems v01

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, recorded in a separate test report.



1.7 Ancillary Equipment List

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT-8820C	N/A	N/A	Unshielded, 1.8 m
2.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2 Test Configuration of Equipment Under Test

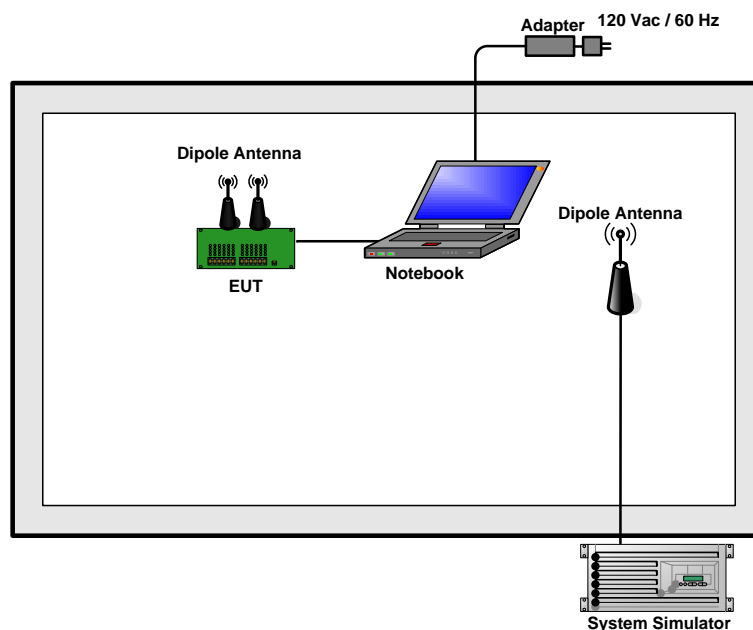
2.1 Test Mode

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.

Frequency range investigated for radiated emission: 30MHz to 10th harmonic.

Test Modes			
Band		Radiated TCs	Conducted TCs
		Modulation : QPSK / 16QAM	Modulation : QPSK / 16QAM
LTE Band 13	BW 5MHz	<ul style="list-style-type: none"> ■ LTE (RB Size 1, RB Offset 24) Link 	<ul style="list-style-type: none"> ■ LTE (RB Size 1, RB Offset 0) Link ■ LTE (RB Size 1, RB Offset 24) Link ■ LTE (RB Size 12, RB Offset 6) Link ■ LTE (RB Size 25, RB Offset 0) Link
	BW 10MHz	<ul style="list-style-type: none"> ■ LTE (RB Size 1, RB Offset 0) Link 	<ul style="list-style-type: none"> ■ LTE (RB Size 1, RB Offset 0) Link ■ LTE (RB Size 1, RB Offset 49) Link ■ LTE (RB Size 25, RB Offset 13) Link ■ LTE (RB Size 50, RB Offset 0) Link

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.

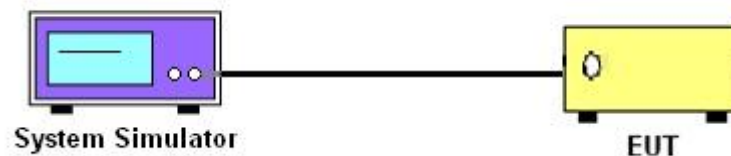
3.1.2 Measuring Instruments

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. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

3.1.4 Test Setup





3.1.5 Test Result of Conducted Output Power

Modes	Band width	Modulation	Channel	Frequency (MHz)	Conducted Power (dBm)	Conducted Power (Watts)
LTE Band 13	5MHz	QPSK	23205	779.5	23.18	0.2080
			23230	782.0	23.11	0.2046
			23255	784.5	23.42	0.2198
		16QAM	23205	779.5	23.28	0.2128
			23230	782.0	23.29	0.2133
			23255	784.5	23.68	0.2333
	10MHz	QPSK	23230	782.0	23.11	0.2046
		16QAM	23230	782.0	23.29	0.2133

Note: Maximum average power for LTE.

3.2 Peak-to-Average Ratio

3.2.1 Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

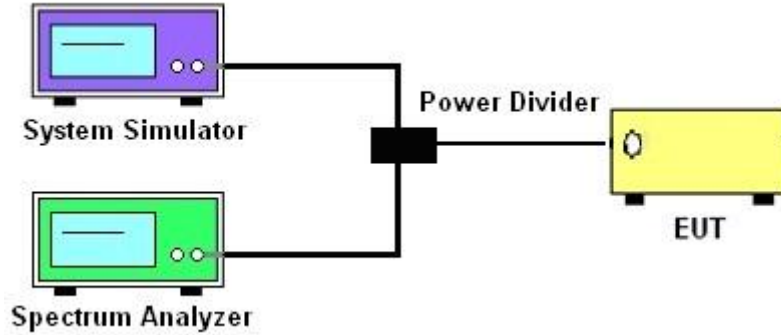
3.2.2 Measuring Instruments

See list of measuring instruments 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 RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. For GSM/EGPRS operating modes:
 - a. Set the RBW = 1MHz, VBW = 1MHz, Peak detector in spectrum analyzer.
 - b. Set EUT in maximum power output, and triggered the burst signal.
 - c. Measured respectively the Peak level and Mean level, and the deviation was recorded as Peak to Average Ratio.
4. For UMTS operating modes:
 - a. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
 - b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.

3.2.4 Test Setup

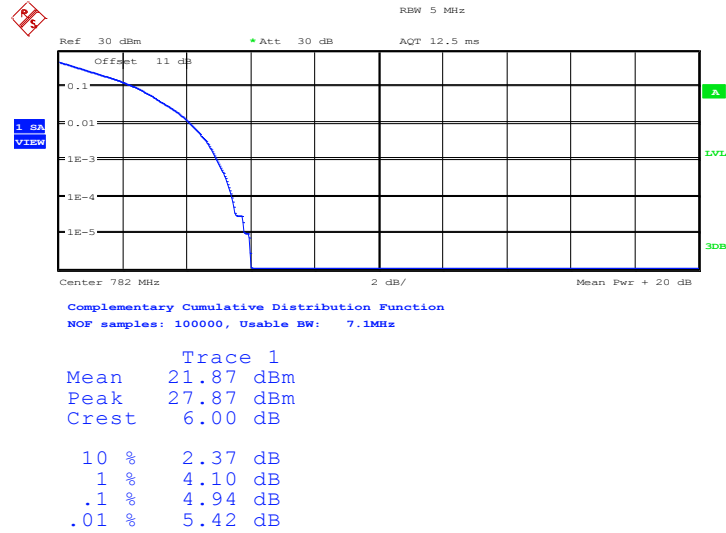


3.2.5 Test Result of Peak-to-Average Ratio

Modes	LTE Band 13			
BW / Mod.	5MHz / QPSK	5MHz / 16QAM	10MHz / QPSK	10MHz / 16QAM
Peak-to-Average Ratio (dB)	4.94	5.26	5.03	5.38

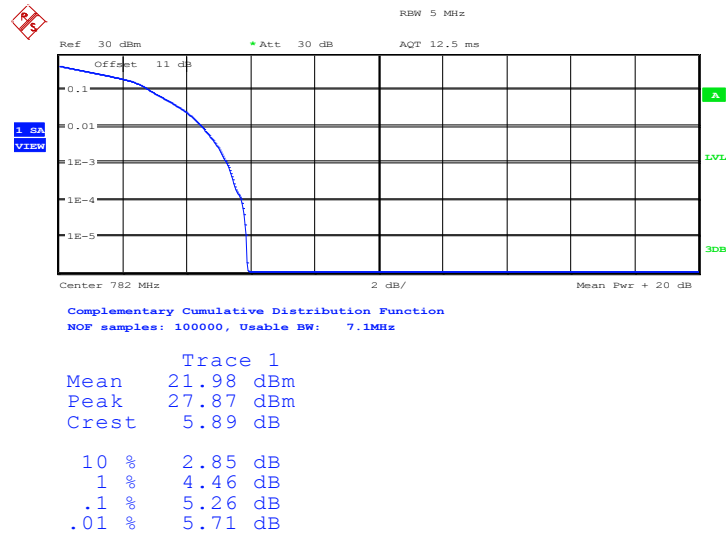
3.2.6 Peak to Average Power Ratio

Peak-to-Average Ratio on LTE Band 13 5MHz / QPSK



Date: 14.OCT.2012 15:03:14

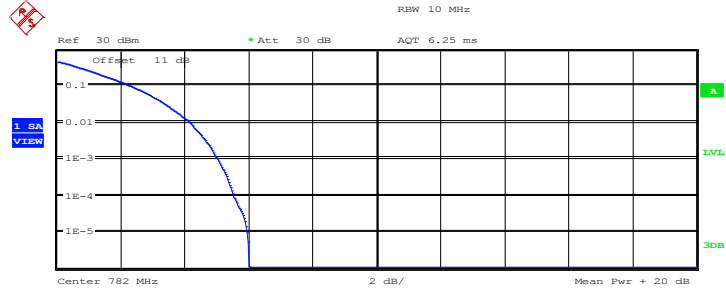
Peak-to-Average Ratio on LTE Band 13 5MHz / 16QAM



Date: 14.OCT.2012 15:03:37



Peak-to-Average Ratio on LTE Band 13 10MHz / QPSK

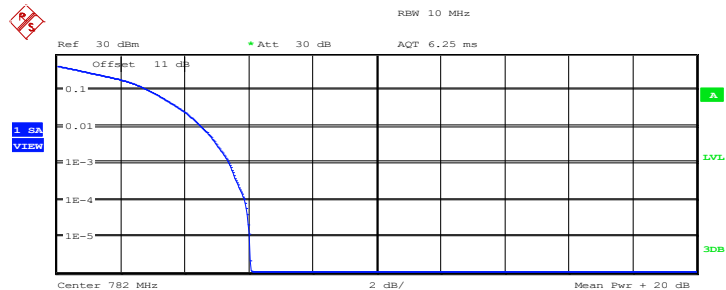


Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

Trace 1	
Mean	21.91 dBm
Peak	27.93 dBm
Crest	6.02 dB
10 %	2.31 dB
1 %	4.13 dB
.1 %	5.03 dB
.01 %	5.51 dB

Date: 14.OCT.2012 14:04:53

Peak-to-Average Ratio on LTE Band 13 10MHz / 16QAM



Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

Trace 1	
Mean	22.15 dBm
Peak	28.21 dBm
Crest	6.06 dB
10 %	2.88 dB
1 %	4.52 dB
.1 %	5.38 dB
.01 %	5.87 dB

Date: 14.OCT.2012 14:05:56

3.3 Occupied Bandwidth Measurement

3.3.1 Description of Occupied Bandwidth and 26dB Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

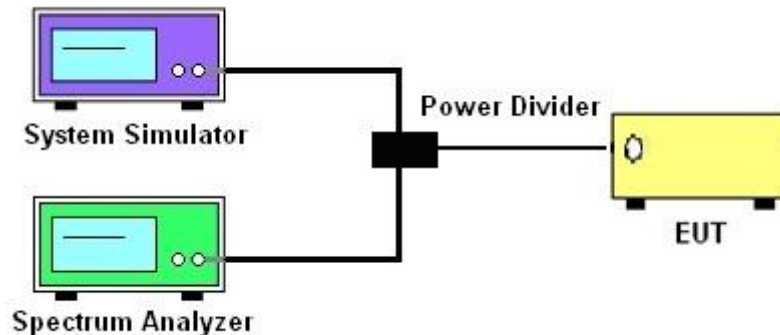
3.3.2 Measuring Instruments

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 RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. The 99% occupied bandwidth of the middle channel for the highest RF powers were measured.

3.3.4 Test Setup





3.3.5 Test Result of Occupied Bandwidth

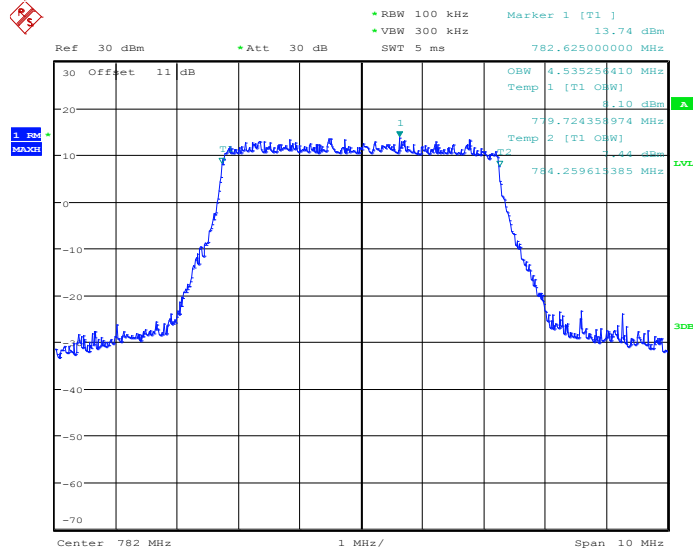
Modes	LTE Band 13			
BW / Modulation	5MHz / QPSK	5MHz / 16QAM	10MHz / QPSK	10MHz / 16QAM
99% OBW (MHz)	4.54	4.55	9.10	9.10



3.3.6 Test Result (Plots) of Occupied Bandwidth

Band :	LTE Band 13	BW/Mode :	5MHz / QPSK
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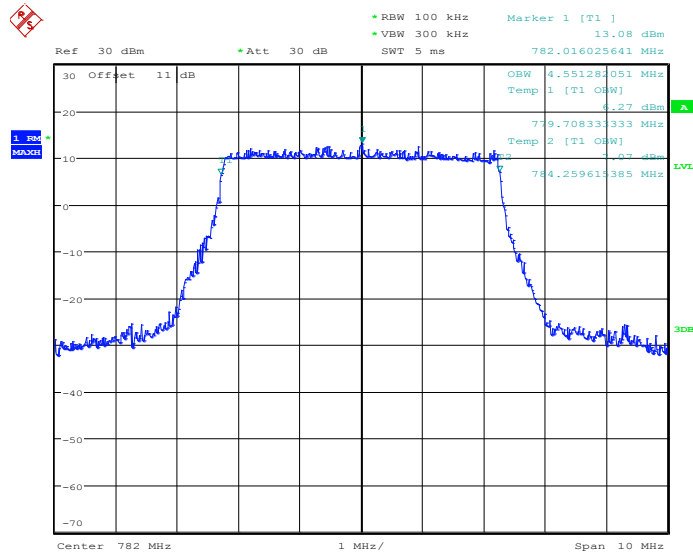
99% Occupied Bandwidth Plot on Channel 23230



Date: 14.OCT.2012 13:47:43

Band :	LTE Band 13	BW/Mode :	5MHz / 16-QAM
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99% Occupied Bandwidth Plot on Channel 23230

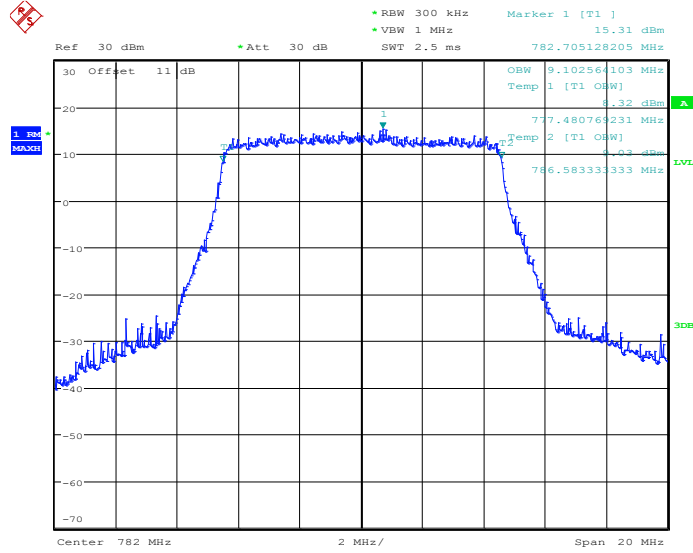


Date: 14.OCT.2012 13:53:50



Band :	LTE Band 13	BW/Mode :	10MHz / QPSK
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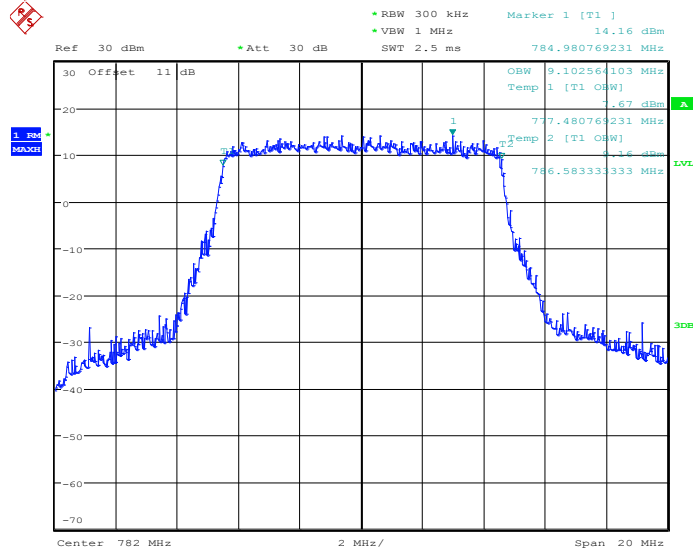
99% Occupied Bandwidth Plot on Channel 23230



Date: 14.OCT.2012 13:57:58

Band :	LTE Band 13	BW/Mode :	10MHz / 16-QAM
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99% Occupied Bandwidth Plot on Channel 23230



Date: 14.OCT.2012 13:58:12

3.4 Band Edge Measurement

3.4.1 Limit

The emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit is $65 + 10\log_{10}(P[\text{Watts}]) = -35\text{dBm}$ in a 6.25KHz bandwidth.

3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

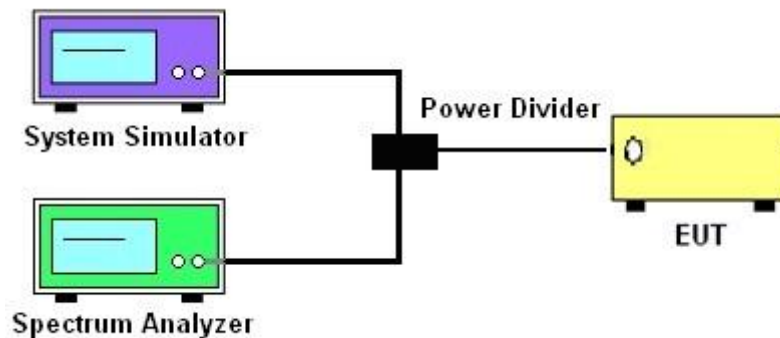
3.4.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. The band edges of low and high channels for the highest RF powers were measured. Setting RBW = 10KHz, Detector = RMS.

Limit line = $-35(\text{dBm}) - 10 \cdot \text{Log}_{10}(6.25\text{k}/10\text{k})(\text{dB}) \sim -32.96(\text{dBm})$

$10 \cdot \text{Log}_{10}(6.25\text{k}/10\text{k}) \sim -2.04\text{dB}$

3.4.4 Test Setup

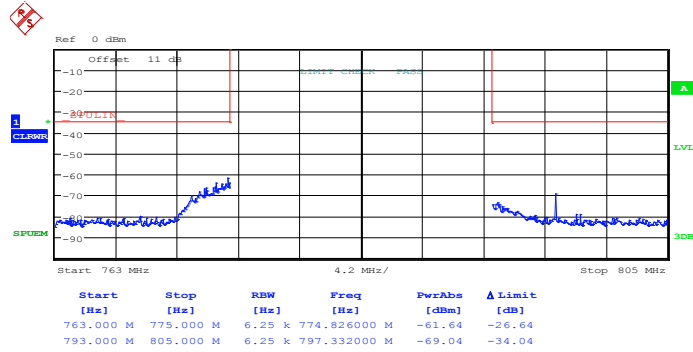




3.4.5 Test Result (Plots) of Conducted Band Edge

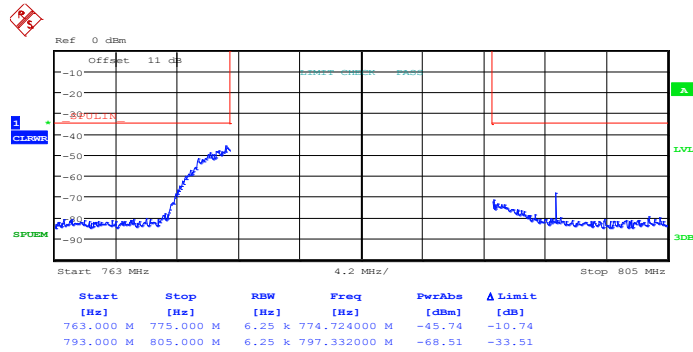
Band :	LTE Band 13	BW / Mode :	5MHz / QPSK
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Lower Band Edge Plot for QPSK-RB Size 1, RB Offset 0



Date: 16.OCT.2012 23:09:40

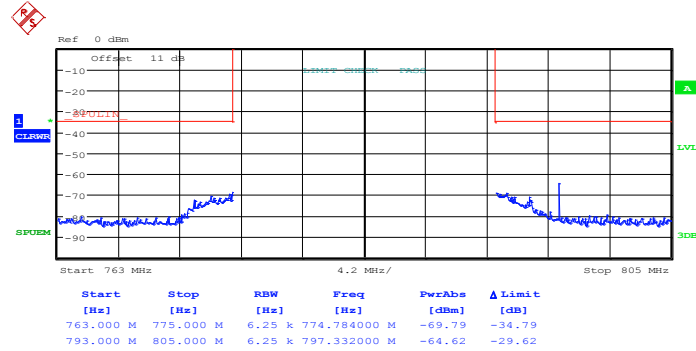
Lower Band Edge Plot for QPSK-RB Size 25, RB Offset 0



Date: 16.OCT.2012 23:10:23

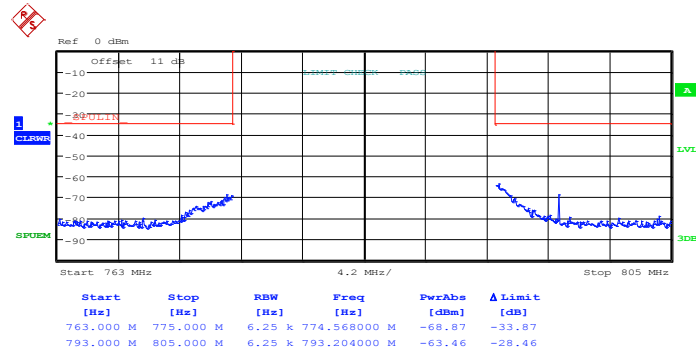


Higher Band Edge Plot for QPSK-RB Size 1, RB Offset 24



Date: 16.OCT.2012 23:13:54

Higher Band Edge Plot for QPSK-RB Size 25, RB Offset 0

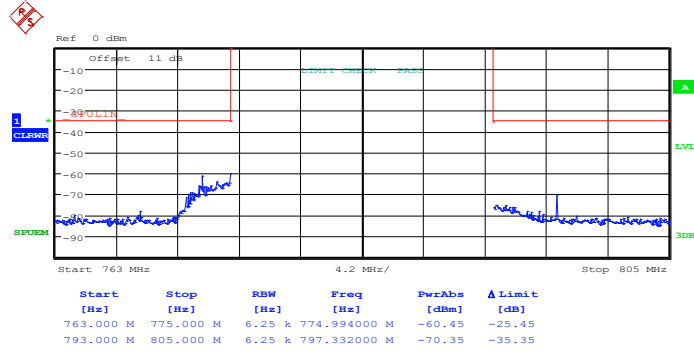


Date: 16.OCT.2012 23:12:53



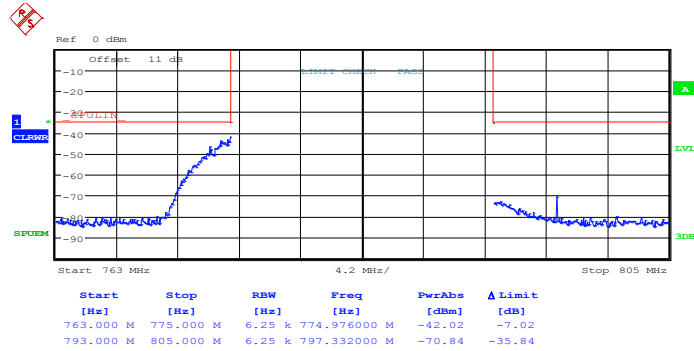
Band :	LTE Band 13	BW / Mode :	5MHz / 16QAM
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Lower Band Edge Plot for 16QAM-RB Size 1, RB Offset 0



Date: 16.OCT.2012 23:10:03

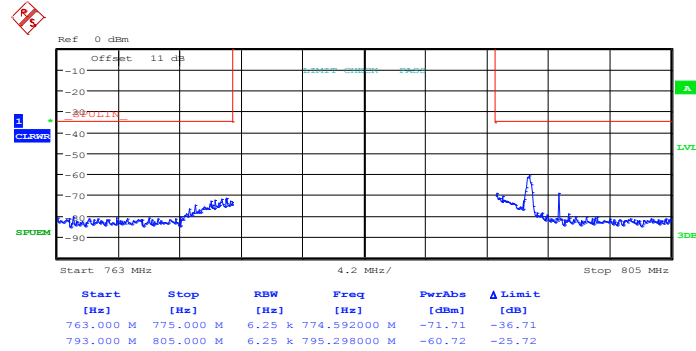
Lower Band Edge Plot for 16QAM-RB Size 25, RB Offset 0



Date: 16.OCT.2012 23:10:42

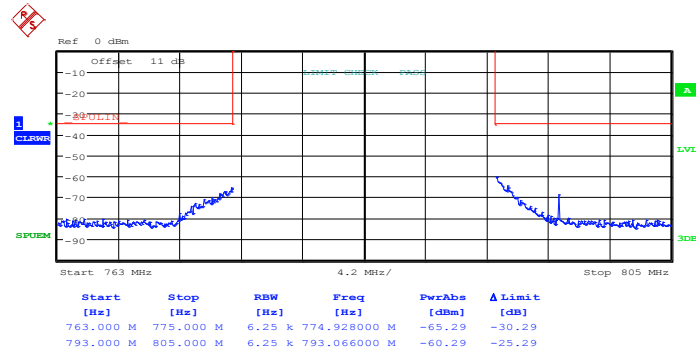


Higher Band Edge Plot for 16QAM-RB Size 1, RB Offset 24



Date: 16.OCT.2012 23:14:09

Higher Band Edge Plot for 16QAM-RB Size 25, RB Offset 0

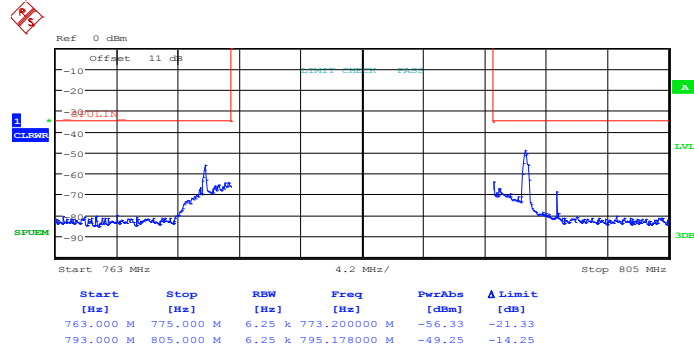


Date: 16.OCT.2012 23:13:09



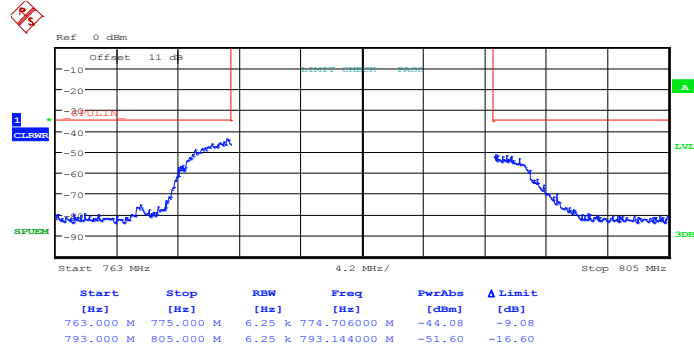
Band :	LTE Band 13	BW / Mode :	10MHz / QPSK
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Lower Band Edge Plot for QPSK -RB Size 1, RB Offset 0



Date: 16.OCT.2012 23:18:48

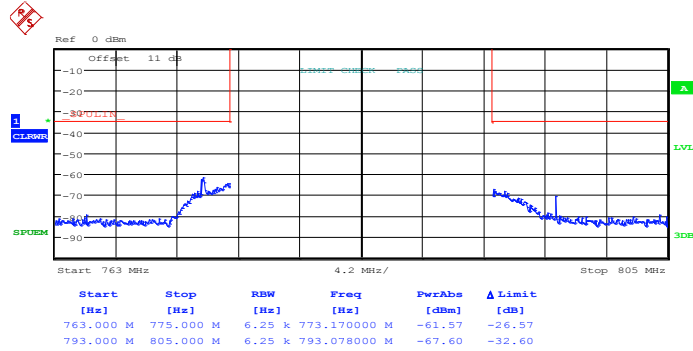
Lower Band Edge Plot for QPSK -RB Size 50, RB Offset 0



Date: 16.OCT.2012 23:18:03



Higher Band Edge Plot for QPSK -RB Size 1, RB Offset 49

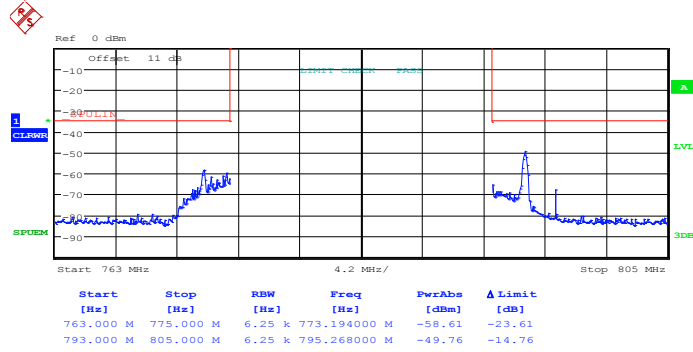


Date: 16.OCT.2012 23:20:21



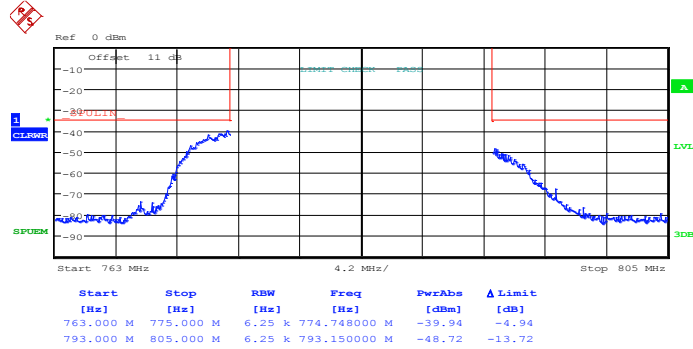
Band :	LTE Band 13	BW / Mode :	10MHz / 16QAM
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Lower Band Edge Plot for 16QAM-RB Size 1, RB Offset 0



Date: 16.OCT.2012 23:19:54

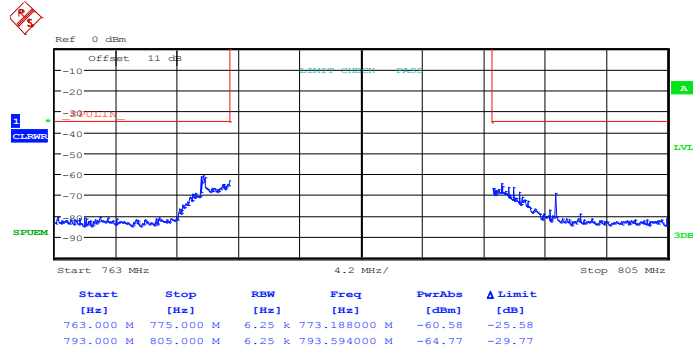
Lower Band Edge Plot for 16QAM-RB Size 50, RB Offset 0



Date: 16.OCT.2012 23:18:23



Higher Band Edge Plot for 16QAM-RB Size 1, RB Offset 49



Date: 16.OCT.2012 23:20:36

3.5 Conducted Spurious Emission Measurement

3.5.1 Description of Conducted Spurious 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.

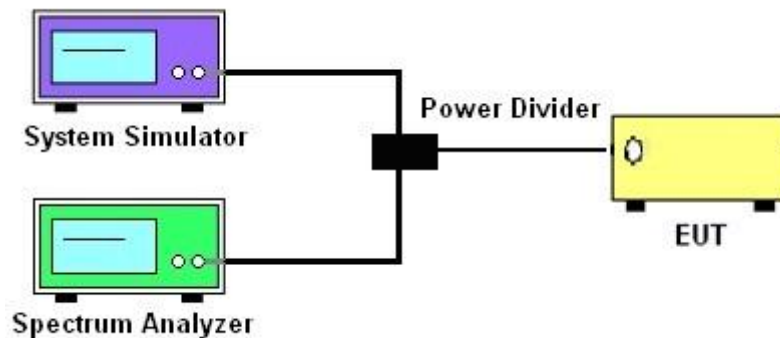
3.5.2 Measuring Instruments

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 RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.

3.5.4 Test Setup

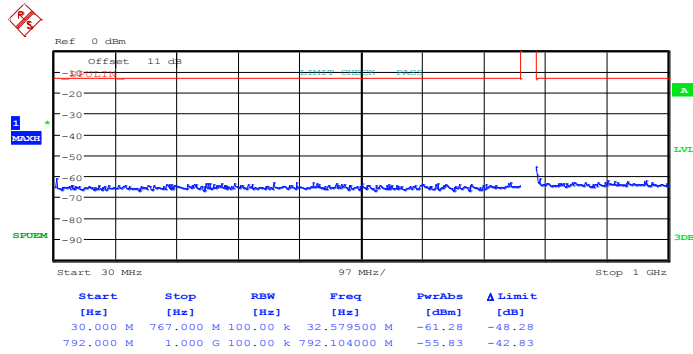




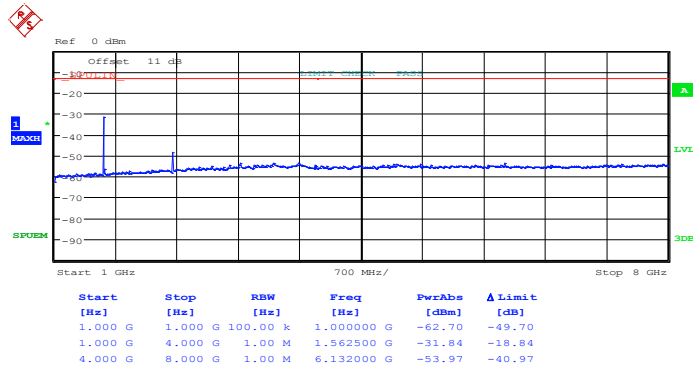
3.5.5 Test Result (Plots) of Conducted Spurious Emission

Band :	LTE Band 13	Channel :	CH23205 (Low)
Bandwidth	5MHz		

QPSK (RB Size 1, RB Offset 0)



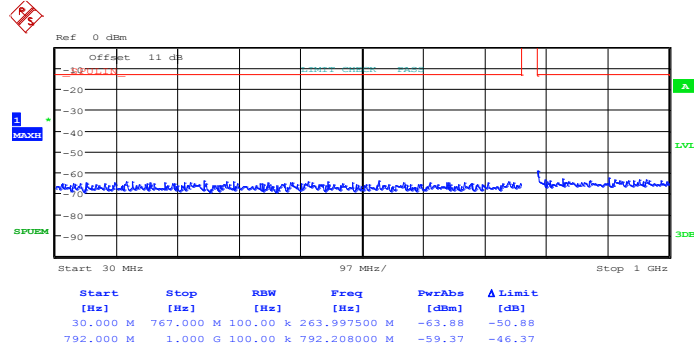
Date: 14.OCT.2012 14:48:34



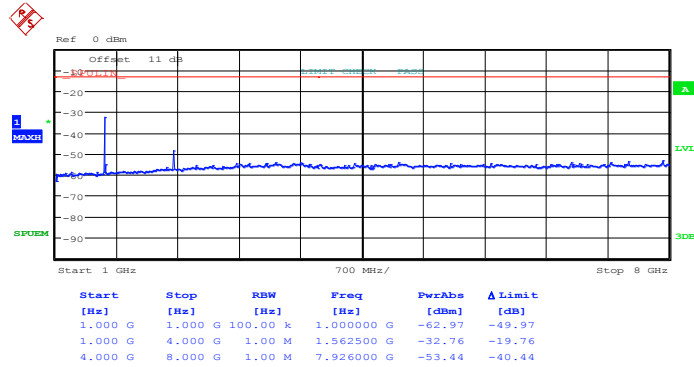
Date: 14.OCT.2012 14:49:47



16QAM (RB Size 1, RB Offset 0)



Date: 14.OCT.2012 14:48:57

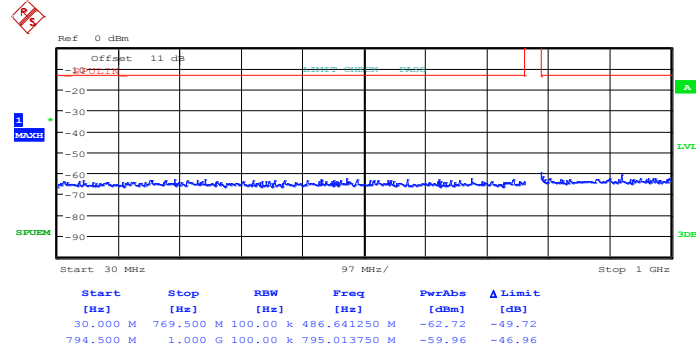


Date: 14.OCT.2012 14:50:06

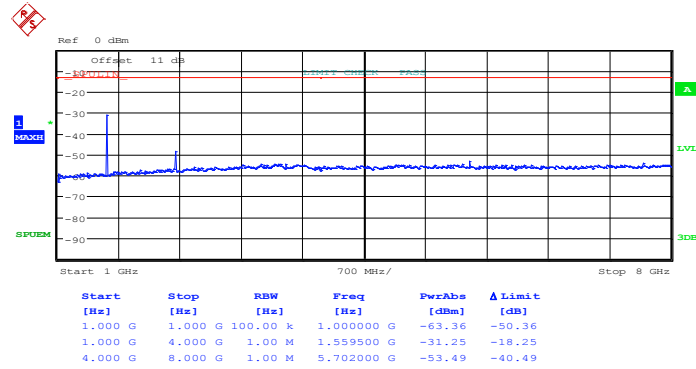


Band :	LTE Band 13	Channel :	CH23230 (Middle)
Bandwidth	5MHz		

QPSK (RB Size 1, RB Offset 0)



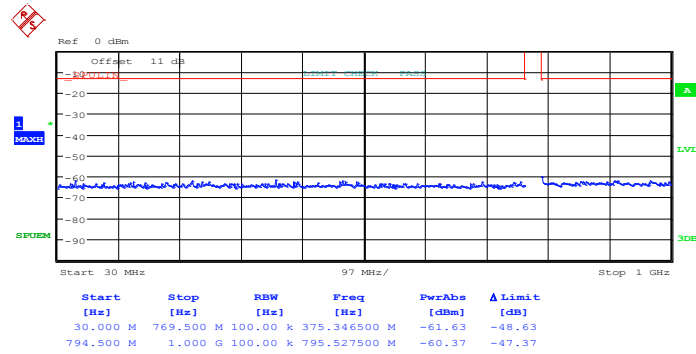
Date: 14.OCT.2012 14:43:38



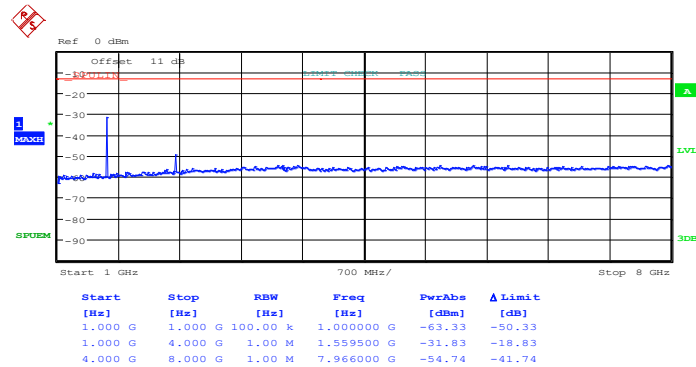
Date: 14.OCT.2012 14:40:57



16QAM (RB Size 1, RB Offset 0)



Date: 14.OCT.2012 14:43:20

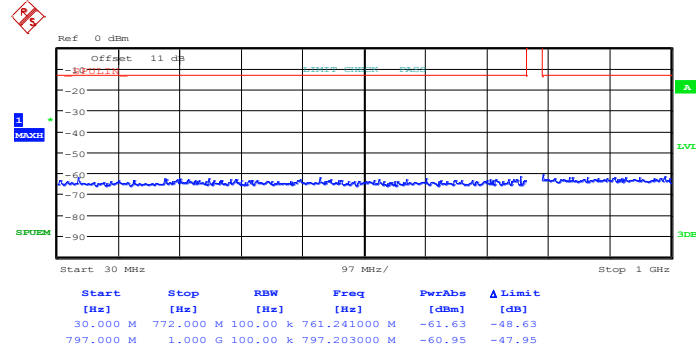


Date: 14.OCT.2012 14:40:17

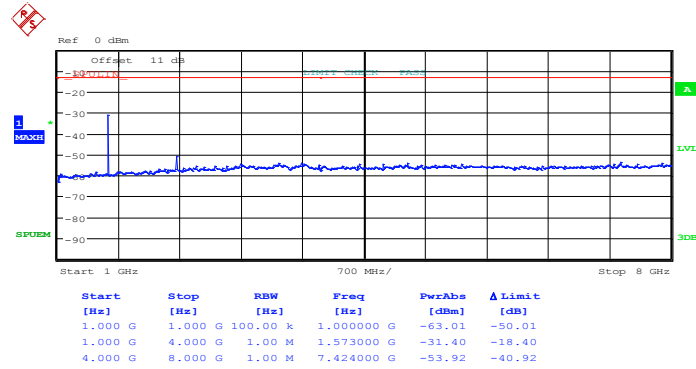


Band :	LTE Band 13	Channel :	CH23255 (High)
Bandwidth	5MHz		

QPSK (RB Size 1, RB Offset 0)



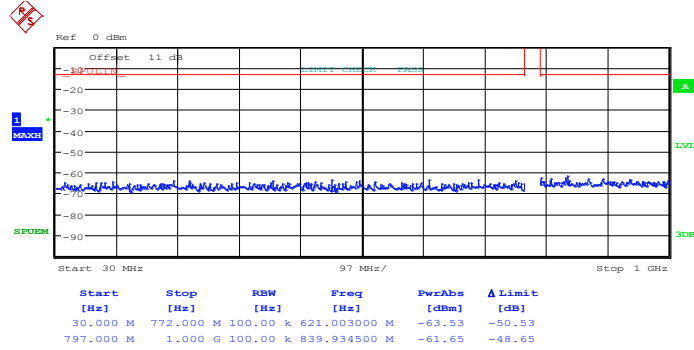
Date: 14.OCT.2012 14:53:18



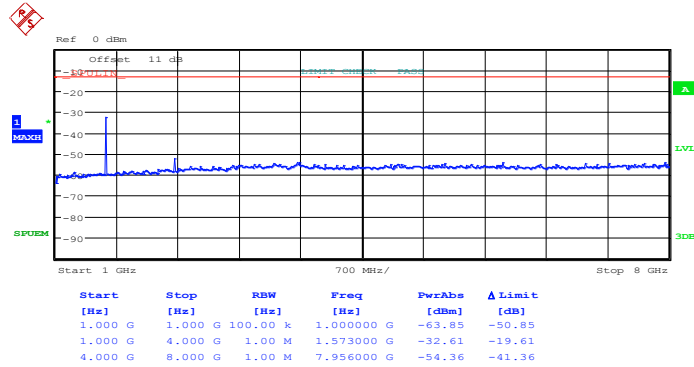
Date: 14.OCT.2012 14:52:16



16QAM (RB Size 1, RB Offset 0)



Date: 14.OCT.2012 14:53:35

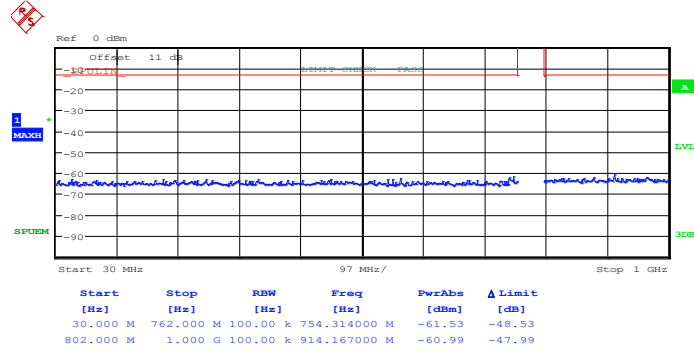


Date: 14.OCT.2012 14:52:36

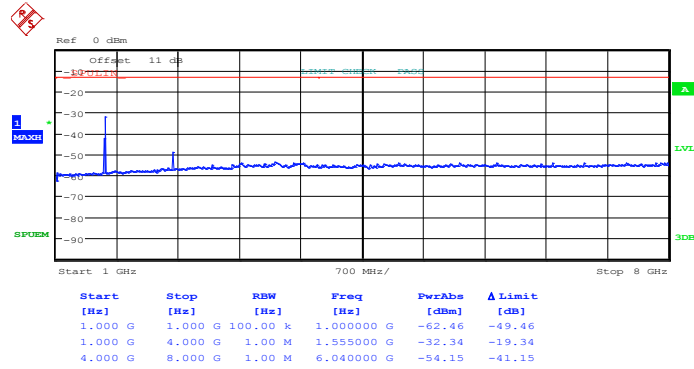


Band :	LTE Band 13	Channel :	CH23230 (Middle)
Bandwidth	10MHz		

QPSK (RB Size 1, RB Offset 0)



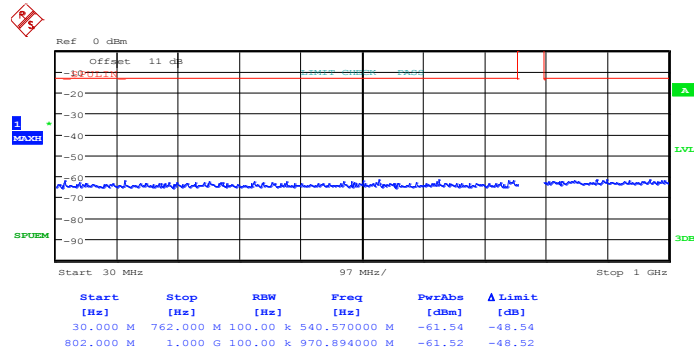
Date: 14.OCT.2012 14:33:20



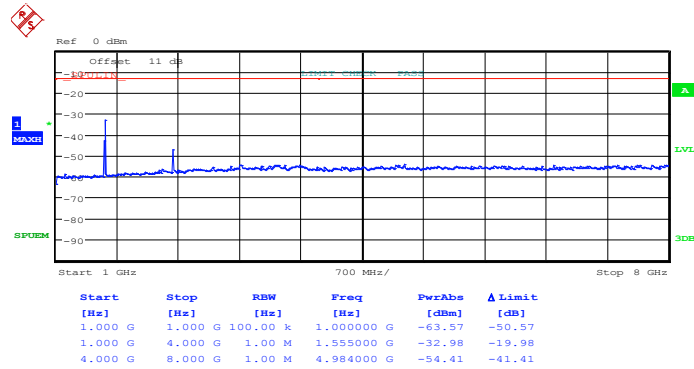
Date: 14.OCT.2012 14:37:04



16QAM (RB Size 1, RB Offset 0)



Date: 14.OCT.2012 14:32:51



Date: 14.OCT.2012 14:36:22

3.6 Field Strength of Spurious Radiation Measurement

3.6.1 Description of Field Strength of Spurious Radiated Measurement

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

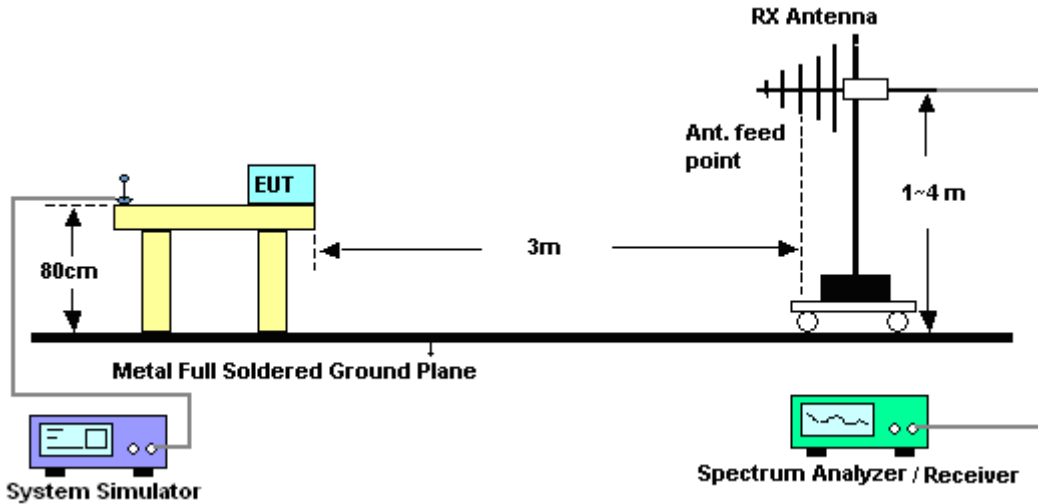
See list of measuring instruments of this test report.

3.6.3 Test Procedures

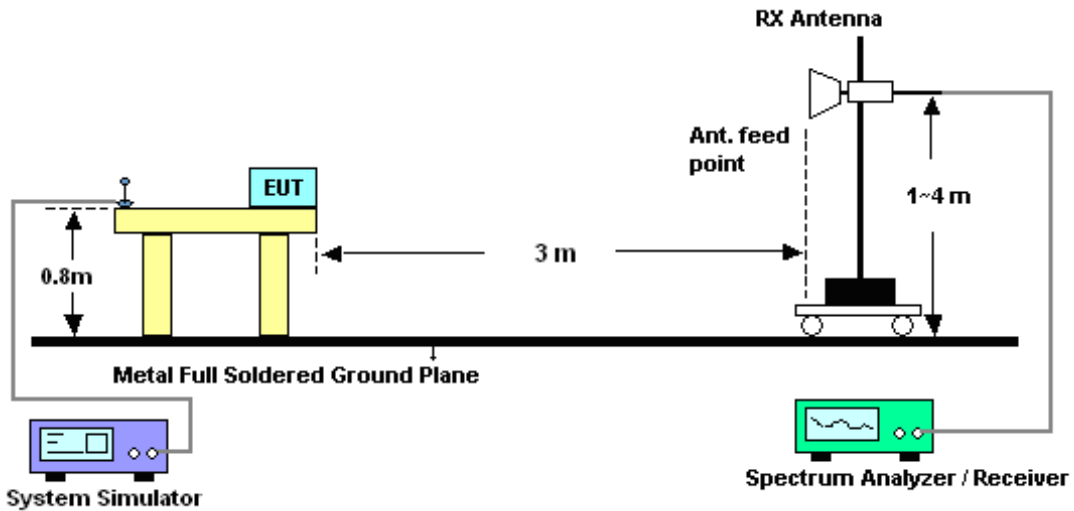
1. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving 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, 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. Emission level (dBm) = output power + substitution Gain.

3.6.4 Test Setup

For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



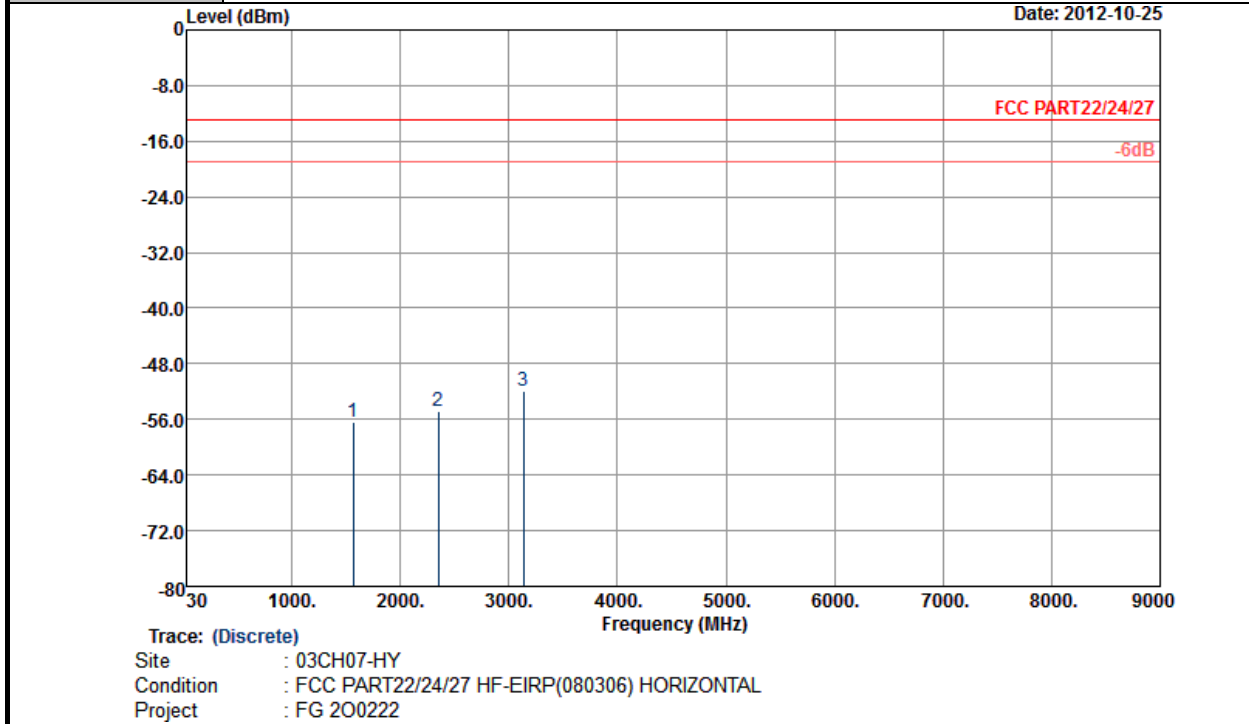
3.6.5 Test Results of Radiated Emissions (9 KHz ~ 30 MHz)

The low frequency, which started from 9 KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.



3.6.6 Test Result of Field Strength of Spurious Radiated

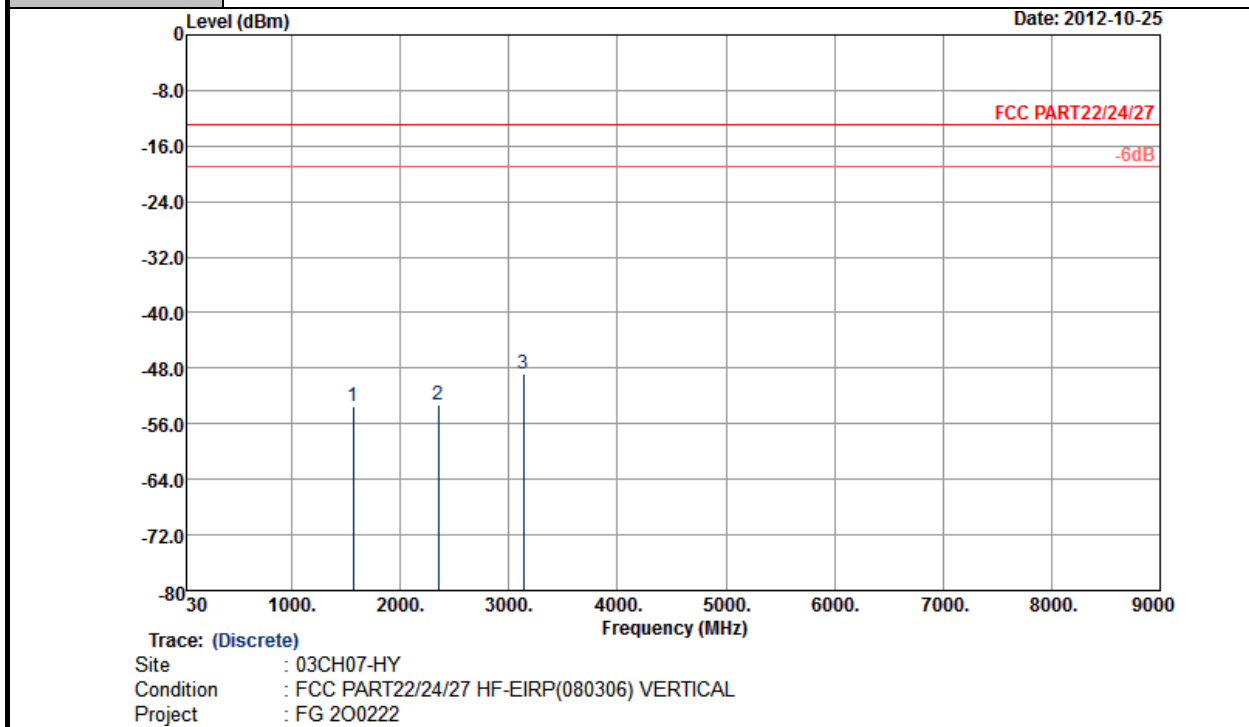
Band :	LTE Band 13	Temperature :	25~26°C
Test Mode :	5MHz, QPSK, RB Size 1	Relative Humidity :	41~42%
Test Engineer :	Gavin Wu	Polarization :	Horizontal
Remark :	Spurious emissions were found more than 20dB below limit line.		



Frequency (MHz)	EIRP (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
1569	-56.42	-13	-43.42	-65.96	-58.25	1.52	5.50	H	Pass
2353	-54.82	-13	-41.82	-67.62	-56.74	1.99	6.06	H	Pass
3137	-51.97	-13	-38.97	-65.65	-54.99	2.41	7.58	H	Pass



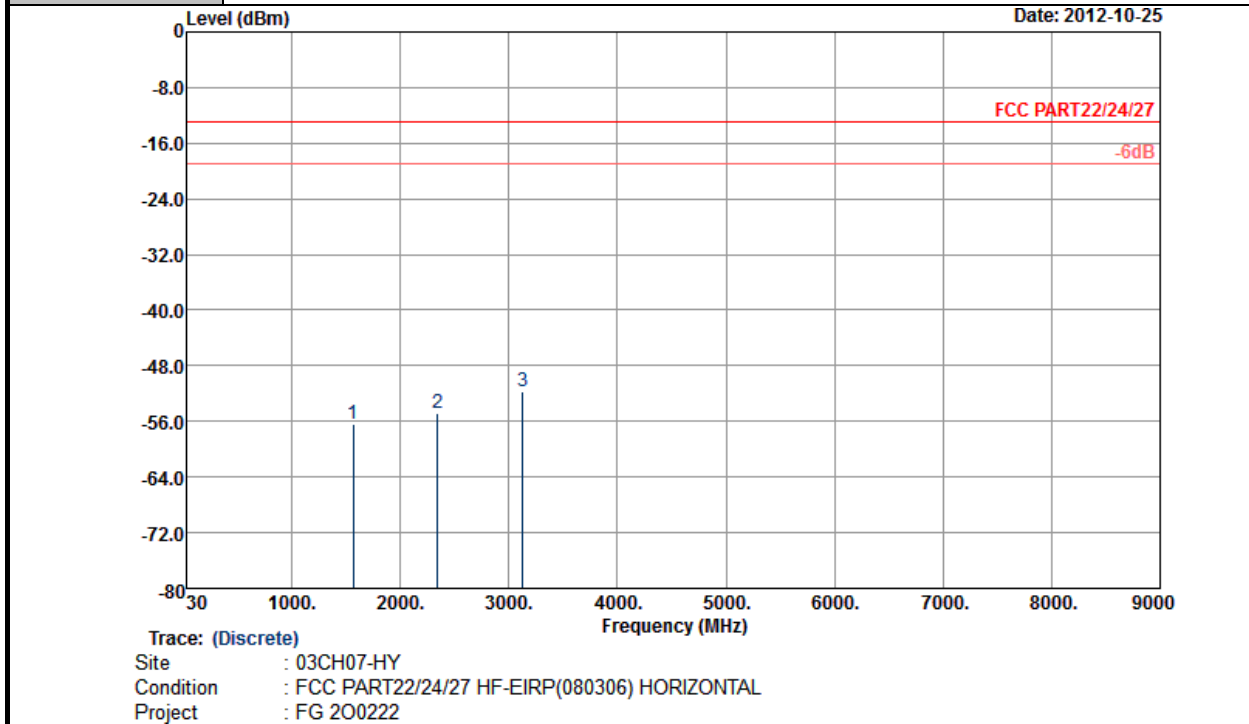
Band :	LTE Band 13	Temperature :	25~26°C
Test Mode :	5MHz, QPSK, RB Size 1	Relative Humidity :	41~42%
Test Engineer :	Gavin Wu	Polarization :	Vertical
Remark :	Spurious emissions were found more than 20dB below limit line.		



Frequency (MHz)	EIRP (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
1569	-53.41	-13	-40.41	-65.37	-55.24	1.52	5.50	V	Pass
2353	-53.19	-13	-40.19	-67.7	-55.11	1.99	6.06	V	Pass
3137	-48.76	-13	-35.76	-63.73	-51.78	2.41	7.58	V	Pass



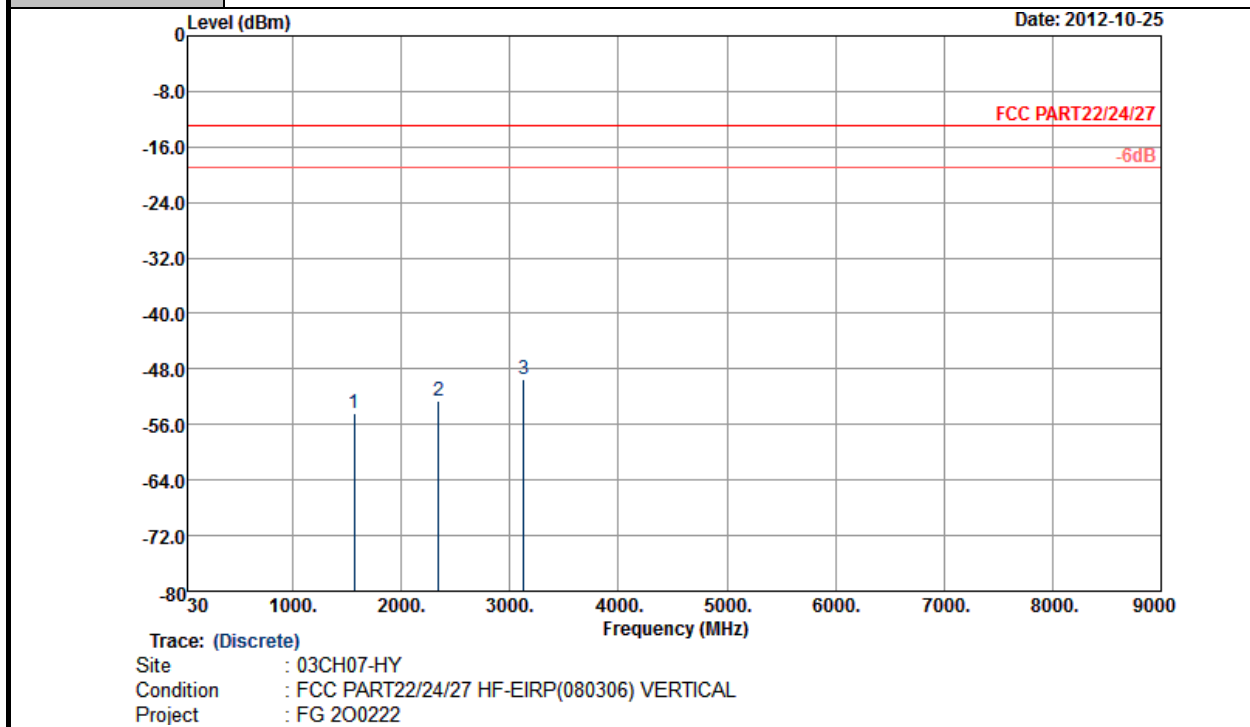
Band :	LTE Band 13	Temperature :	25~26°C
Test Mode :	10MHz, QPSK, RB Size 1	Relative Humidity :	41~42%
Test Engineer :	Gavin Wu	Polarization :	Horizontal
Remark :	Spurious emissions were found more than 20dB below limit line.		



Frequency (MHz)	EIRP (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
1564	-56.43	-13	-43.43	-64.68	-58.26	1.51	5.49	H	Pass
2346	-54.93	-13	-41.93	-68.16	-56.85	1.98	6.05	H	Pass
3128	-51.75	-13	-38.75	-66.46	-54.77	2.39	7.56	H	Pass



Band :	LTE Band 13	Temperature :	25~26°C
Test Mode :	10MHz, QPSK, RB Size 1	Relative Humidity :	41~42%
Test Engineer :	Gavin Wu	Polarization :	Vertical
Remark :	Spurious emissions were found more than 20dB below limit line.		



Frequency (MHz)	EIRP (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
1564	-54.42	-13	-41.42	-65.52	-56.25	1.51	5.49	V	Pass
2346	-52.62	-13	-39.62	-67.43	-54.54	1.98	6.05	V	Pass
3128	-49.46	-13	-36.46	-65.89	-52.48	2.39	7.56	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.

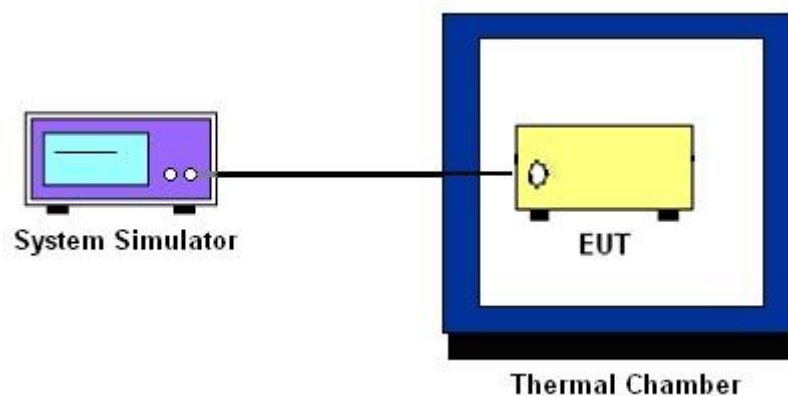
3.7.3 Test Procedures for Temperature Variation

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 before testing. 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 cannot 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 85% 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 :	LTE Band 13			Limit (ppm) :	2.5
Temperature (°C)	QPSK (RB Size 1, RB Offset 0)				Result
	BW 5MHz		BW 10MHz		
	Freq. Dev. (Hz)	Deviation (ppm)	Freq. Dev. (Hz)	Deviation (ppm)	
-20	6.5	0.009	5.8	0.008	PASS
-10	6.3	0.009	6.2	0.009	
0	6.3	0.009	6.8	0.010	
10	5.4	0.008	5.8	0.008	
20	7.2	0.010	9.1	0.013	
30	8.4	0.012	9.5	0.013	
40	10.2	0.014	9.9	0.014	
50	-14.6	-0.021	-11.8	-0.017	
60	-15.7	-0.022	-16.1	-0.023	
70	18.6	0.026	-17.2	-0.024	

Note: The manufacturer declared that the EUT could work properly between temperatures -20°C~70°C.



Band :	LTE Band 13			Limit (ppm) :	2.5
Temperature (°C)	16-QAM (RB Size 1, RB Offset 49)				Result
	BW 5MHz		BW 10MHz		
	Freq. Dev. (Hz)	Deviation (ppm)	Freq. Dev. (Hz)	Deviation (ppm)	
-20	6.4	0.009	6.1	0.009	PASS
-10	5.8	0.008	7.1	0.010	
0	6.1	0.009	5.9	0.008	
10	5.2	0.007	5.8	0.008	
20	5.5	0.008	8.9	0.013	
30	8.1	0.011	9.5	0.013	
40	9.9	0.014	10.2	0.014	
50	-10.3	-0.014	11.7	0.016	
60	-12.5	-0.018	-15.6	-0.022	
70	18.0	0.025	-17.6	-0.025	

Note: The manufacturer declared that the EUT could work properly between temperatures -20°C~70°C.

3.7.7 Test Result of Voltage Variation

Band	Bandwidth	Bandwidth	Voltage (Volt)	Freq. Dev. (Hz)	Deviation (ppm)	Limit (ppm)	Result
LTE Band 13	5MHz	QPSK	Normal	6.7	0.009	2.5	PASS
			4.5	8.4	0.012		
			5.5	7.6	0.011		
		16-QAM	Normal	6.7	0.009		
			4.5	7.6	0.011		
			5.5	7.7	0.011		
	10MHz	QPSK	Normal	6.7	0.009		
			4.5	5.4	0.008		
			5.5	6.6	0.009		
		16-QAM	Normal	6.2	0.009		
			4.5	4.5	0.006		
			5.5	6.0	0.008		

Remark:

1. Normal Voltage = 5.0V,
2. The manufacturer declared that the EUT could work properly between voltage 4.5V ~ 5.5V.



4 List of Measuring Equipments

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
System Simulator	R&S	CMU200	117995	N/A	Jul. 30, 2012	Oct. 14, 2012 ~ Oct. 16, 2012	Jul. 29, 2013	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 06, 2012	Oct. 14, 2012 ~ Oct. 16, 2012	Jun. 05, 2013	Conducted (TH02-HY)
Thermal Chamber	Ten Billion	TTH-D3SP	TBN-930701	N/A	Jul. 23, 2012	Oct. 14, 2012 ~ Oct. 16, 2012	Jul. 22, 2013	Conducted (TH02-HY)
Bilog Antenna	Schaffner	CBL6111C	2726	30MHz ~ 1GHz	Oct. 06, 2012	Oct. 25, 2012 ~ Oct. 26, 2012	Oct. 05, 2013	Radiation (03CH07-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9KHz ~ 30GHz	Dec. 06, 2011	Oct. 25, 2012 ~ Oct. 26, 2012	Dec. 05, 2012	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 22, 2012	Oct. 25, 2012 ~ Oct. 26, 2012	Aug. 21, 2013	Radiation (03CH07-HY)
Pre Amplifier	Agilent	8449B	3008A02362	1GHz ~ 26.5GHz	Dec. 05, 2011	Oct. 25, 2012 ~ Oct. 26, 2012	Dec. 04, 2012	Radiation (03CH07-HY)
Pre Amplifier	MITEQ	AMF-7D-00 101800-30-1	159088	1GHz ~ 18GHz	Mar. 10, 2012	Oct. 25, 2012 ~ Oct. 26, 2012	Mar. 09, 2013	Radiation (03CH07-HY)
Pre Amplifier	COM-POWER	PA-103A	161241	10-1000MHz.32dB. GAIN	Feb. 27, 2012	Oct. 25, 2012 ~ Oct. 26, 2012	Feb. 26, 2013	Radiation (03CH07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Sep. 03, 2012	Oct. 25, 2012 ~ Oct. 26, 2012	Sep. 02, 2013	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA917025 1	15GHz ~ 40GHz	Sep. 28, 2012	Oct. 25, 2012 ~ Oct. 26, 2012	Sep. 27, 2013	Radiation (03CH07-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9KHz ~ 30MHz	Jul. 03, 2012	Oct. 25, 2012 ~ Oct. 26, 2012	Jul. 02, 2014	Radiation (03CH07-HY)
LTE Base Station	Anritsu	MT8820C	6201074414	N/A	Jan. 05, 2012	Oct. 14, 2012 ~ Oct. 26, 2012	Jan. 04, 2013	-



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.54
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.72
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Appendix A. Photographs of EUT

Please refer to Sporton report number EP2O0222 as below.