

FCC Radio Test Report

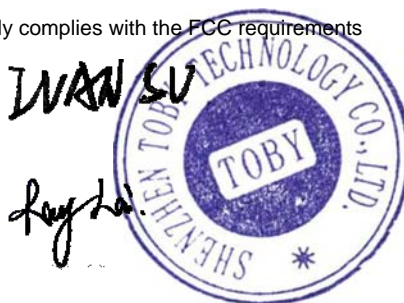
FCC ID: 2AC2S-X8

Original Grant

Report No. : TB-FCC141909
Applicant : Wm Wireless& Mobile Ltda.
Equipment Under Test (EUT)
EUT Name : Rugged smart phone
Model No. : Rock X8
Serial No. : N/A
Brand Name : Extrem
Receipt Date : 2014-08-11
Test Date : 2014-08-11 to 2014-09-23
Issue Date : 2014-09-23
FCC Part 2
Standards : FCC Part 22 Subpart H
FCC Part 24 Subpart E
Conclusions : **PASS**

In the configuration tested, the EUT complied with the standards specified above,
The EUT technically complies with the FCC requirements

Test/Witness Engineer :



Approved& Authorized :

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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1. General Information about EUT

1.1 Client Information

Applicant	:	Wm Wireless& Mobile Ltda.
Address	:	Calle 84#28-12 Bogota-Colombia
Manufacturer	:	Shenzhen Ematic Technology Co.,Ltd
Address	:	Hua lun Industrial Zone Phoenix Street Fu yong Town Bao an district Shen zhen City.

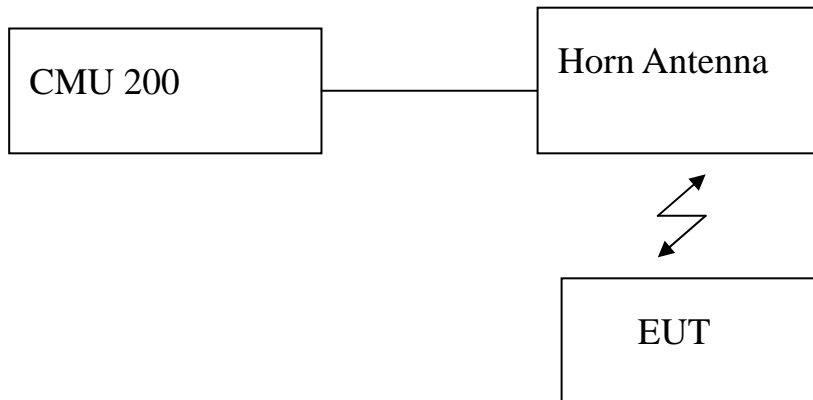
1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	Rugged smart phone
Model No.	:	Rock X8
Product Description	:	Operation Frequency: GSM/GPRS 850/1900; WCDMA Band V
	:	GSM 850 Power : Cond:32.40 dBm ERP:30.41 dBm
	:	PCS 1900 Power : Cond:30.46 dBm EIRP:28.86 dBm
	:	WCDMA Band V Power: Cond:23.54 dBm ERP:22.15 dBm
	:	Antenna Gain: GSM 850: -1.0 dBi PCS 1900: -1.0 dBi WCDMA Band V: -1.0 dBi
	:	Modulation Type: GSM/GPRS:GMSK, UMTS:QPSK
FCC Operating Frequency	:	GSM 850: 824.20MHz-848.80MHz PCS1900: 1850.20MHz-1909.80MHz WCDMA Band V:826.4MHz-846.6MHz
Power Supply	:	DC power supplied by AC/DC Adapter DC Voltage supplied from Li-Polymer battery.
Power Rating	:	AC/DC Adapter Input: AC 100~240V 50-60 Hz 0.15A Max Output: DC 5V 500mA DC 3.7V 2800mAh Li-ion battery
Connecting I/O Port(S)	:	Please refer to the User's Manual

Note:

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

1.3 Block Diagram Showing the Configuration of System Tested



The above block diagram of setup is the normal mode. And more detail please refer to the test setup of each test item of bellow.

1.4 Description of Support Units

The EUT has been tested as an independent unit.

1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

Operating Mode		
Mode	Channel	Frequency(MHz)
GSM 850	128	824.20
	190	836.60
	251	848.80
PCS 1900	512	1850.20
	661	1880.00
	810	1909.80
WCDMA Band V	4132	826.40
	4183	836.60
	4233	846.60

Pre-scanning test Mode	Description
GSM 850	highest , middle, lowest channels
GPRS 850	highest , middle, lowest channels
GSM 1900	highest , middle, lowest channels
GPRS 1900	highest , middle, lowest channels
RMC UMTS850	highest , middle, lowest channels
HSDPA UMTS850	highest , middle, lowest channels
HSUPA UMTS850	highest , middle, lowest channels
Final test Mode	Description
GSM 850	highest , middle, lowest channels
GSM 1900	highest , middle, lowest channels
RMC UMTS 850	highest , middle, lowest channels

Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2) During the testing procedure, the EUT is in link mode with base station emulator at maximum power level in each test mode.
- (3) The EUT has GSM, GPRS functions, and after pre-testing, GSM function is the worst case for all the emission tests.
- (4) The EUT has RMC, HSDP, HSUP functions in UMTS band V, and after pre-testing, RMC mode is the worst case for all the emission tests.

1.6 Test Facility

The testing was performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at: 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China.

At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

FCC List No.: (811562)

The Laboratory is listed in the United States of American Federal Communications Commission (FCC), and the registration number is 811562.

IC Registration No.: (11950A-1)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A-1.

2. Test Summary

Test Standards and Test Results			
Standard	Document Title		
FCC Part 2 (10-1-05 Edition)	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations		
FCC Part 22 (10-1-05 Edition)	Public Mobile Services		
FCC Part 24 (10-1-05 Edition)	Personal Communications Services		
Standard Section	Test Item	Judgment	Remark
2.1046	Conducted RF Output Power	PASS	N/A
2.1049; 22.917; 24.238	99% & -26 dB Occupied Bandwidth	PASS	N/A
2.1055; 22.355; 24.235	Frequency Stability	PASS	N/A
2.1051; 2.1057; 22.917; 24.238	Conducted Out of Band Emissions	PASS	N/A
2.1051; 2.1057; 22.917; 24.238	Band Edge	PASS	N/A
22.913; 24.238	Transmitter Radiated Power (EIRP/ERP)	PASS	N/A
2.1053; 2.1057; 22.917; 24.238	Radiated Out of Band Emissions	PASS	N/A
Note: N/A is an abbreviation for Not Applicable.			

3. Frequency Stability

3.1 Test Standard and Requirement

3.1.1 Test Standard

FCC Part 2.1055

FCC Part 22.355

FCC Part 24.235

3.1.2 Requirement

According to FCC section 22.355 and FCC section 24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. According to FCC section 2.1055, the test conditions are:

(1) Temperature:

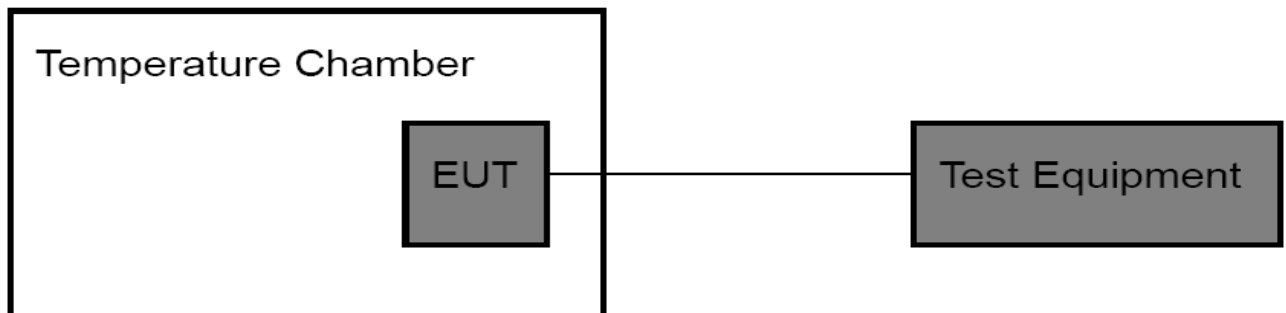
The temperature is varied from -30°C to $+50^{\circ}\text{C}$ at intervals of not more than 10°C .

(2) Primary Supply Voltage:

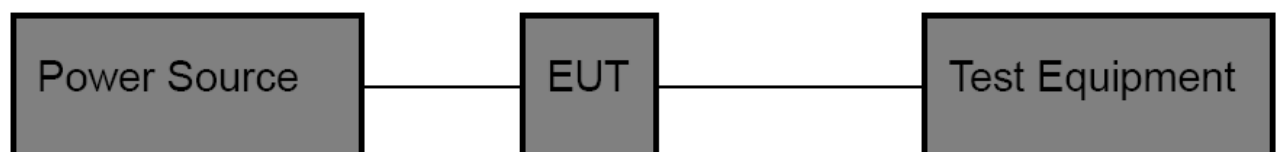
For hand carried battery powered equipment, the primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacture. The supply voltage shall be measured at input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided.

3.2 Test Setup

For Temperature Test:



For Voltage Test:



3.3 Test Procedure

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 set up to 50°C and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency 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.

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) Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.
- (3) The variation in frequency was measured for the worst case.

3.4 EUT Operating Condition

The Equipment Under Test was set to Communication with the Base Station.

3.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug. 07, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Base Station	Rohde&Schwarz	CMU200	1100.864.02	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368574	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368575	May 20, 2014	May 19, 2015
Power Splitter	Anritsu	K240C	06872	May 20, 2014	May 19, 2015
Temp. & Humidity Chamber	ZHONG ZHI	CZ-A-225D	HW08053	Aug. 08, 2014	Aug. 07, 2015
DC Power Supply	MATRIX	MPS-3005L-3	D806050W	Aug. 08, 2014	Aug. 07, 2015

AC Power Supply	Heng Jie	HPC-1110	2010007	Aug. 08, 2014	Aug. 07, 2015
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3.6 Test Data

EUT: Rugged smart phone		Model: Rock X8	
Temperature:25℃		Humidity: 55%	
Test Engineer: Jason			
Frequency Error (Voltage)			
Mode	Voltage (Vdc)	Frequency Error (Hz)	Frequency Error (ppm)
GSM 850 CH 190 836.6 MHz	4.25	18	0.021516
	3.70	22	0.026927
	3.40	23	0.027492
PCS 1900 CH 661 1880.0 MHz	4.25	21	0.011170
	3.70	23	0.012234
	3.40	28	0.012893
RMC UMTS 850 CH 4183 836.60MHz	4.25	79	0.094430
	3.70	85	0.101602
	3.40	67	0.080086

EUT: Rugged smart phone		Model: Rock X8	
Temperature:25℃		Humidity: 55%	
Test Engineer: Jason			
Frequency Error (Temperature)			
Mode	Temperature (℃)	Frequency Error (Hz)	Frequency Error (ppm)
GSM 850 CH 190 836.6 MHz	-30	25	0.029882
	-20	22	0.026296
	-10	21	0.025101
	0	20	0.023906
	10	20	0.023906
	20	18	0.027492
	30	18	0.021515
	40	16	0.019125
	50	16	0.019125
PCS 1900 CH 661 1880.0 MHz	-30	24	0.012765
	-20	22	0.011702
	-10	20	0.010638
	0	19	0.010106
	10	19	0.010106
	20	18	0.009574
	30	16	0.008510
	40	15	0.007978
	50	16	0.008510
RMC UMTS 850 CH 4183 836.60MHz	-30	102	0.058871
	-20	98	0.056562
	-10	78	0.045019
	0	69	0.039825
	10	85	0.049059
	20	90	0.051945
	30	85	0.049059
	40	74	0.04271
	50	68	0.039247
	-30	102	0.058871

4. Conducted RF Output Power

4.1 Test Standard and Limit

4.1.1 Test Standard

FCC Part 2: 2.1046

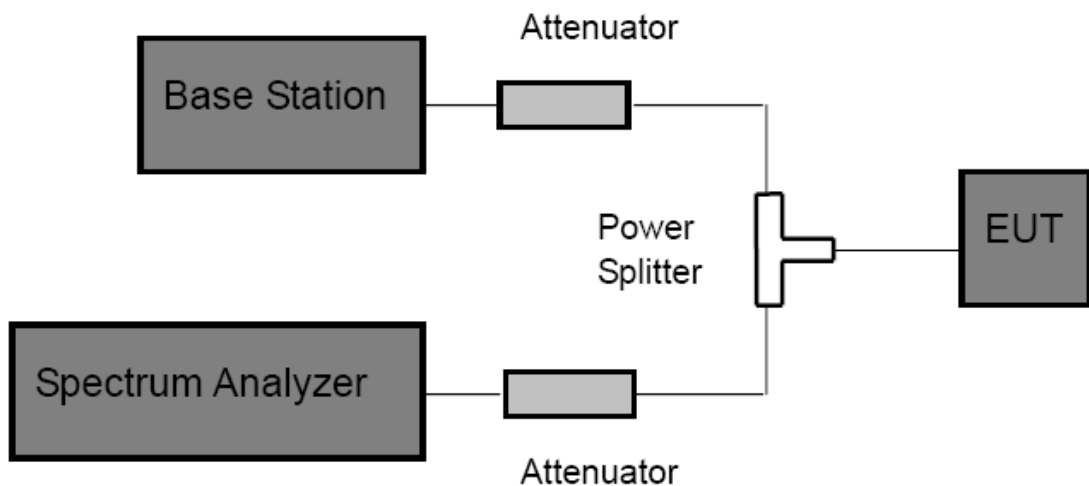
FCC Part 22H : 22.913 (a)

FCC Part 24E: 24.232 (c)

4.1.2 Test Limit

GSM850	WCDMA 850	PCS 1900
38.5 dBm (ERP)	38.5 dBm (ERP)	33 dBm (EIRP)

4.2 Test Setup



4.3 Test Procedure

- (1) The EUT is coupled to the Spectrum Analyzer and the Base Station with the suitable Attenuators through the Power Splitter, the path loss is calibrated to correct the reading.
- (2) A call is set up by the Base Station to the generic call set up procedure.
- (3) Set EUT at maximum power level through base station by power level command.
- (4) Set the frequency range of the Spectrum Analyzer suitably to capture the waveform; search peak and mark it; finally record the peak and the plot.

4.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

4.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug. 07, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Base Station	Rohde&Schwarz	CMU200	1100.864.02	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368574	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368575	May 20, 2014	May 19, 2015
Power Splitter	Anritsu	K240C	06872	May 20, 2014	May 19, 2015

4.6 Test Data

Mode	Channel	PK Output Power(dBm)	Result
GSM 850	128	32.32	PASS
	190	32.28	
	251	32.40	
GPRS 850 Slot1	128	32.23	
	190	32.01	
	251	32.12	
GPRS 850 Slot2	128	31.48	
	190	31.47	
	251	31.60	
GPRS 850 Slot3	128	29.56	
	190	29.55	
	251	29.77	
GPRS 850 Slot4	128	28.33	
	190	28.34	
	251	28.55	

Mode	Channel	PK Output Power(dBm)	Result
PCS 1900	512	30.46	PASS
	661	29.91	
	810	29.64	
GPRS 1900 Slot1	512	30.21	
	661	29.60	
	810	29.48	
GPRS 1900 Slot2	512	29.69	
	661	29.20	
	810	28.97	
GPRS 1900 Slot3	512	27.87	
	661	27.44	
	810	27.43	
GPRS 1900 Slot4	512	26.68	
	661	26.28	
	810	26.42	

EUT Mode	Channel		
WCDMA850	4132	4138	4233
	Frequency(MHz)		
	826.4	836.8	846.6
12.2k	23.54	23.38	23.41
64k	23.52	23.37	23.40
144k	22.34	22.57	22.57
384k	23.51	23.14	23.24
HSDPA			
Subtest 1	22.53	22.43	22.42
Subtest 2	22.19	22.00	22.06
Subtest 3	20.74	20.46	20.59
Subtest 4	20.74	20.51	20.60
HSUPA			
Subtest 1	22.50	22.28	22.36
Subtest 2	22.51	22.38	22.40
Subtest 3	20.69	20.43	20.64
Subtest 4	22.54	22.41	22.41
Subtest 5	21.68	21.44	21.55
Result	PASS		

5. Radiated Output Power

5.1 Test Standard and Limit

5.1.1 Test Standard

FCC Part 22H : 22.913 (a)

FCC Part 24E: 24.232 (c)

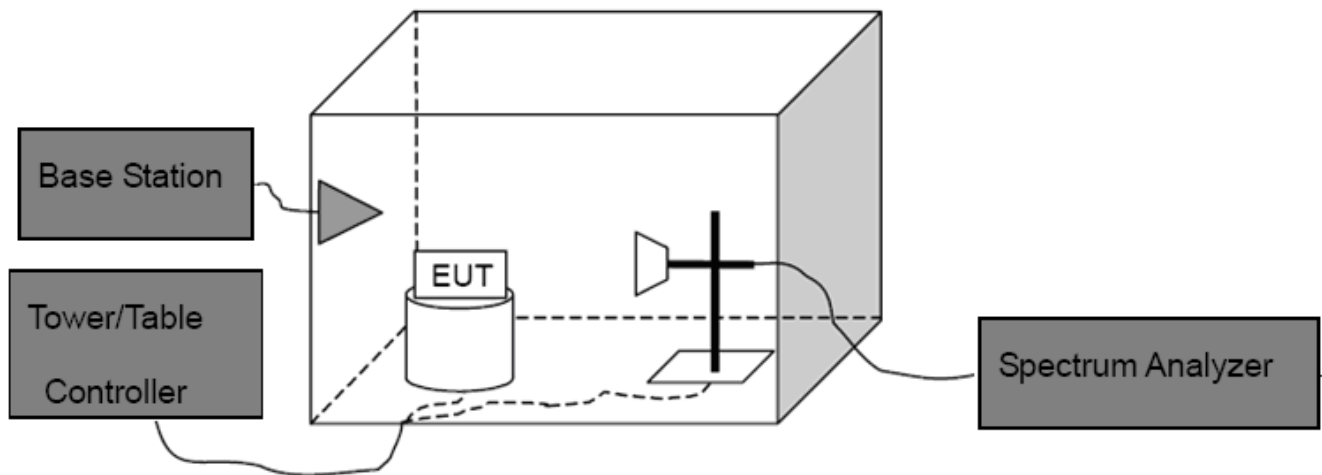
5.1.2 Test Limit

According to FCC Part 22.913 (a), the ERP of Cellular mobile transmitters must not exceed 7 Watts(38.5 dBm).

According to FCC Part 24.232 (c), the Mobile/portable stations are limited to 2 Watts(33 dBm) EIRP peak power.

GSM850	WCDMA 850	PCS 1900
38.5 dBm (ERP)	38.5 dBm (ERP)	33 dBm (EIRP)

5.2 Test Setup



5.3 Test Procedure

- (1) The EUT was placed on an non-conductive rotating platform with 0.8 meter height in an anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer with RBW=3 MHz, VBW=3 MHz and peak detector settings.
- (2) During the measurement, the EUT was enforced in maximum power and linked with the Base Station. The highest was recorded from analyzer power level (LVT) from the 360 degrees rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4

meters in both horizontally and vertically polarized orientations.

- (3) Effective Isotropic Radiated Power (EIRP) was measured by substitution method according to TIA/EIA-603-D. The EUT was replaced by dipole antenna (for frequency below 1 GHz) or Horn antenna (for frequency above 1 GHz) at same location with same polarize of receiver antenna and then a known power of each measure frequency from S.G. was applied into the dipole antenna or Horn antenna through a TX cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna.

Then the EUT's EIRP and ERP was calculated with the correction factor:

$ERP = S.G. Level + Antenna Gain Cord.(dBd) - Cable Loss(dB)$

$EIRP = S.G. Level + Antenna Gain Cord.(dBi) - Cable Loss(dB)$

5.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

5.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug. 07, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
EMI Test Receiver	Rohde & Schwarz	ESCI	101165	Aug. 08, 2014	Aug. 07, 2015
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar. 07, 2014	Mar.06, 2015
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar. 07, 2014	Mar.06, 2015
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar. 07, 2014	Mar.06, 2015
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar. 07, 2014	Mar.06, 2015
Pre-amplifier	HP	11909A	185903	Mar. 07, 2014	Mar.06, 2015
Pre-amplifier	HP	8447B	3008A00849	Mar. 07, 2014	Mar.06, 2015
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar. 07, 2014	Mar.06, 2015
Base Station	Rohde&Schwarz	CMU200	1100.864.02	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368574	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368575	May 20, 2014	May 19, 2015
Power Splitter	Anritsu	K240C	06872	May 20, 2014	May 19, 2015

5.6 Test Data

Measurement Data (worst case)

EUT mode	Channel	EUT Pol.	Antenna Pol.	ERP(dBm)	Limit (dBm)	Result
GSM850	251	H	V	31.26	38.45	Pass
			H	31.41		
		E1	V	30.12		
			H	30.24		
		E2	V	30.25		
			H	30.27		

EUT mode	Channel	EUT Pol.	Antenna Pol.	EIRP(dBm)	Limit (dBm)	Result
PCS1900	512	H	V	28.38	33.00	Pass
			H	25.72		
		E1	V	28.11		
			H	25.23		
		E2	V	28.86		
			H	25.08		

EUT mode	Channel	EUT Pol.	Antenna Pol.	ERP(dBm)	Limit (dBm)	Result
UMTS 850 12.2k RMC	4132	H	V	22.15	38.45	Pass
			H	21.25		
		E1	V	21.92		
			H	21.89		
		E2	V	21.75		
			H	20.23		

6. Occupied Bandwidth

6.1 Test Standard and Limit

6.1.1 Test Standard

FCC Part 2: 2.1049

FCC Part 22H : 22.913 (a)

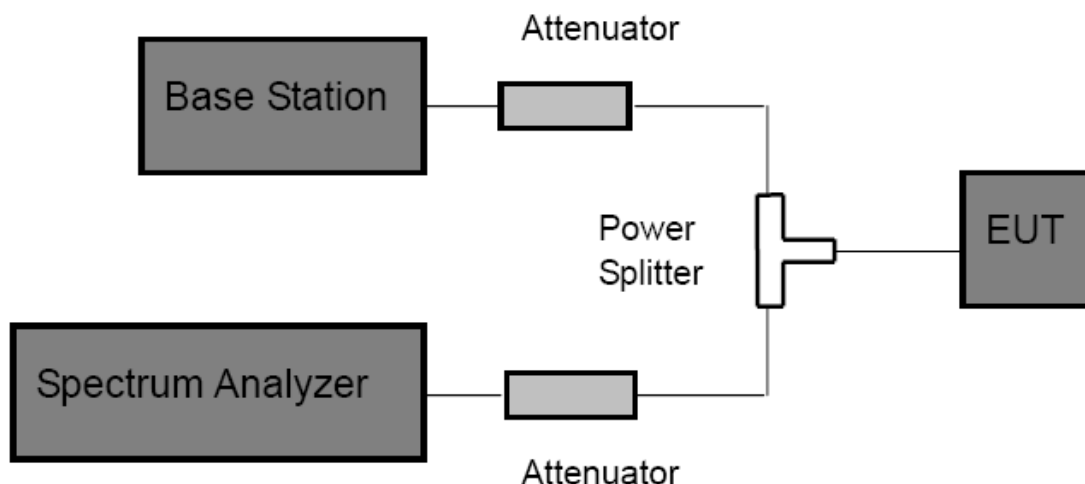
FCC Part 24E: 24.232 (c)

6.1.2 Test Requirement

According to FCC section 2.1049, the occupied bandwidth is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Occupied bandwidth is also known as 99% power and -26dBC occupied bandwidths.

6.2 Test Setup



6.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
- (2) The resolution bandwidth of the Spectrum Analyzer is set to at least 1% of the occupied bandwidth. For testing, set RBW=30 kHz, VBW=100 kHz
- (3) The low, middle and the high channels are selected to perform tests respectively.
- (4) Set the frequency range of the Spectrum Analyzer suitably to capture the waveform; search peak; make a line whose value is 26dB lower than the peak; mark two points which the line intersected the waveform at; finally record the delta of the two points as the occupied bandwidth and the plot.
- (5) Set the Spectrum Analyzer Occupied bandwidth function to measure the 99% occupied bandwidth.

6.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

6.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug. 07, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Base Station	Rohde&Schwarz	CMU200	1100.864.02	May 20, 2014	May 19, 2015
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Power Splitter	Anritsu	K240C	06872	May 20, 2014	May 19, 2015

6.6 Test Data

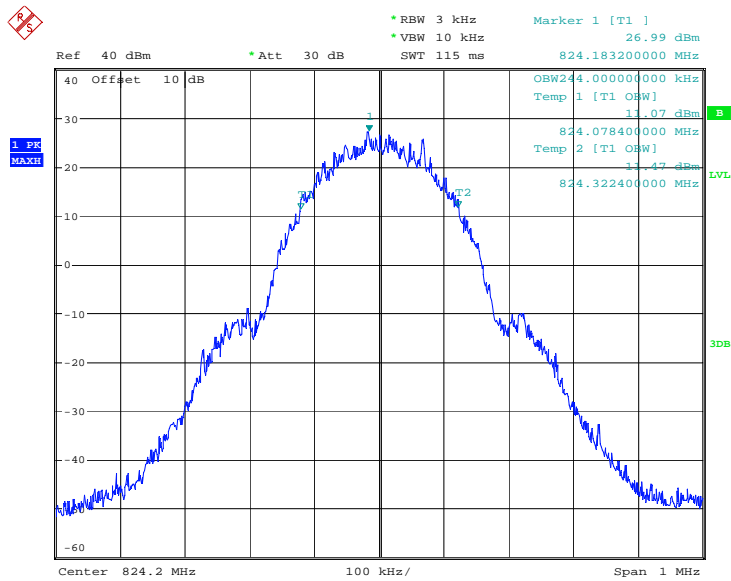
Please refer following pages.

EUT: Rugged smart phone			Model: Rock X8	
Temperature: 24			Humidity: 55%	
Power Supply: AC 120V/60 Hz			Test Engineer: Allen	
Mode	Channel	Frequency	99% Occupied Bandwidth (kHz)	-26dBc Bandwidth (kHz)
GSM 850	128	824.2 MHz	244	311
	190	836.6 MHz	243	314
	251	848.8 MHz	241	314
PCS 1900	512	1850.2 MHz	246	314
	661	1880.0 MHz	242	320
	810	1909.8 MHz	243	318
RMC UMTS 850	4132	826.4 MHz	4136	4680
	4138	836.6 MHz	4160	4656
	4233	846.6 MHz	4168	4672

Please refer the follow plots:

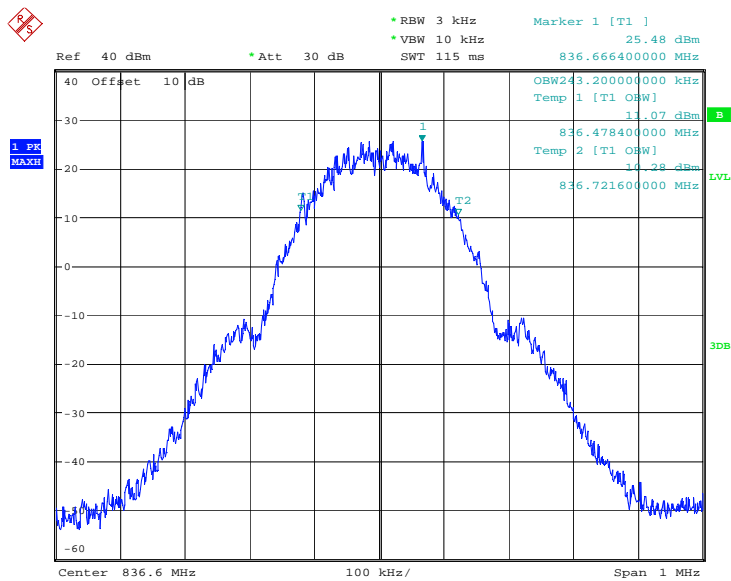
Test plot as follows:

Test Item:	99% Occupy bandwidth	Test Mode:	GSM850
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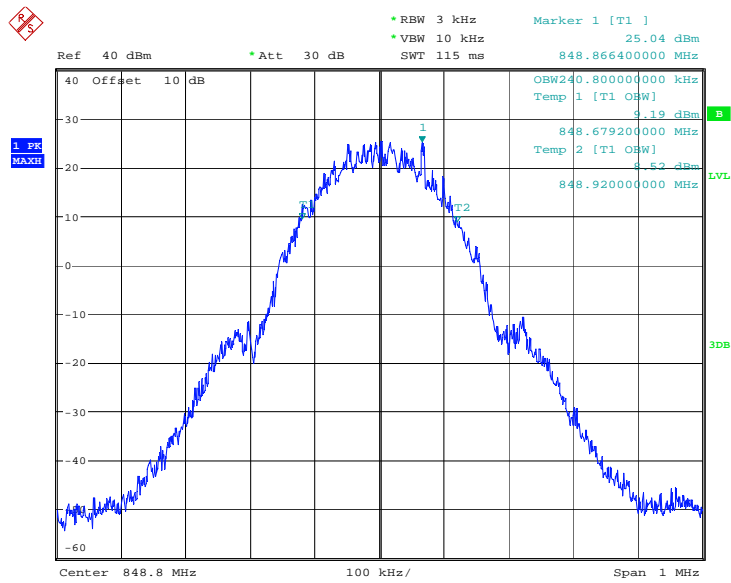
Date: 13.AUG.2014 10:45:56

Lowest channel



Date: 13.AUG.2014 10:46:35

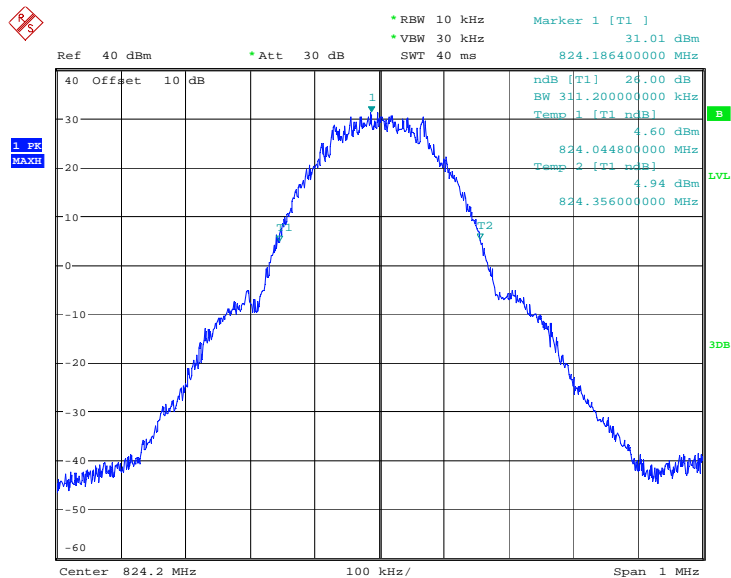
Middle channel



Date: 13.AUG.2014 10:47:09

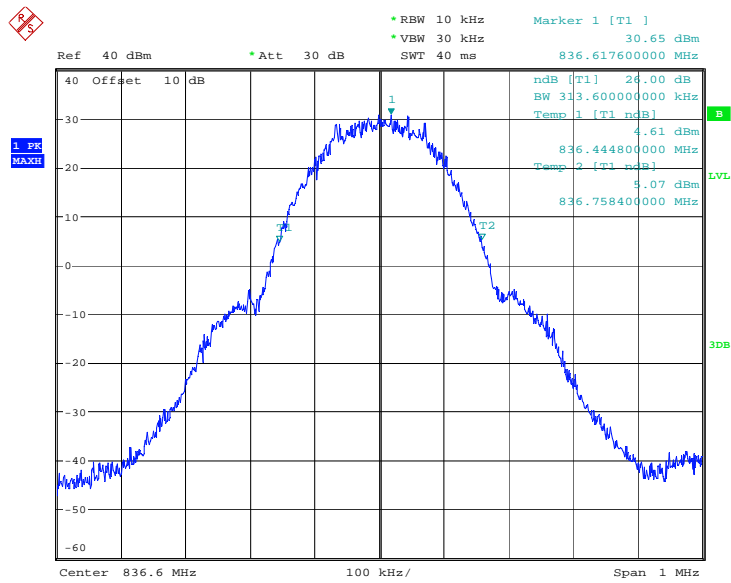
Highest channel

Test Item:	-26dB bandwidth	Test Mode:	GSM850
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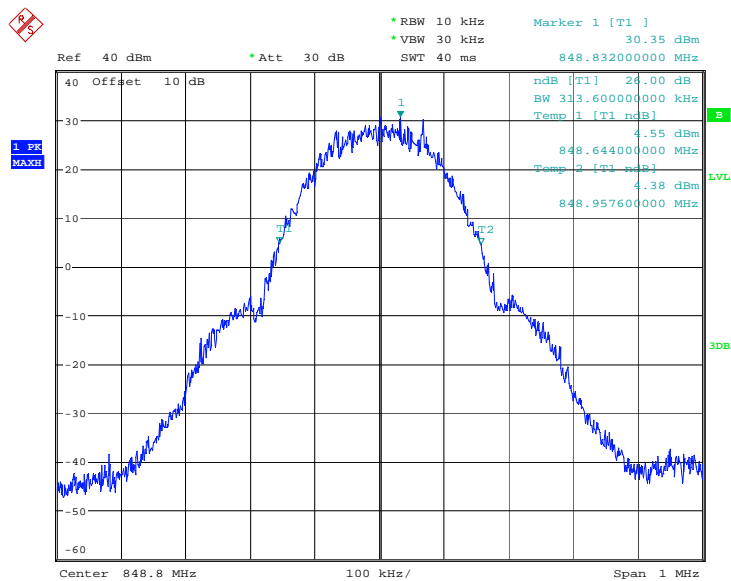
Date: 13.AUG.2014 10:49:19

Lowest channel



Date: 13.AUG.2014 10:48:32

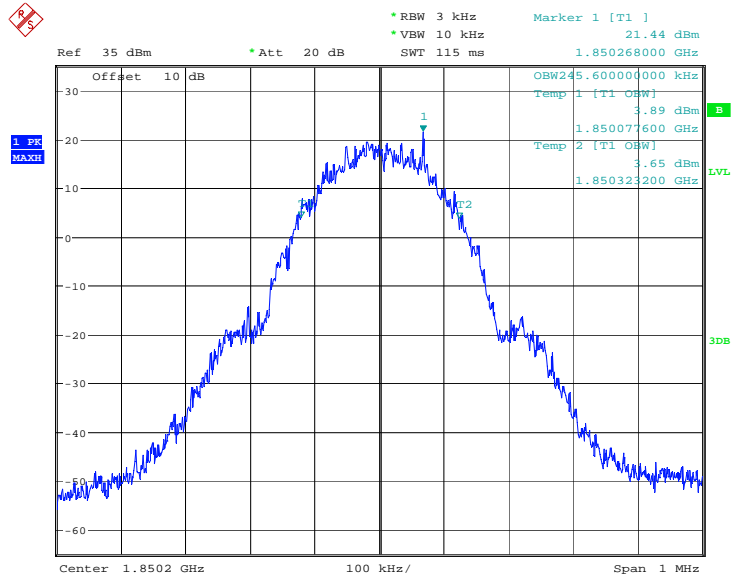
Middle channel



Date: 13.AUG.2014 10:47:39

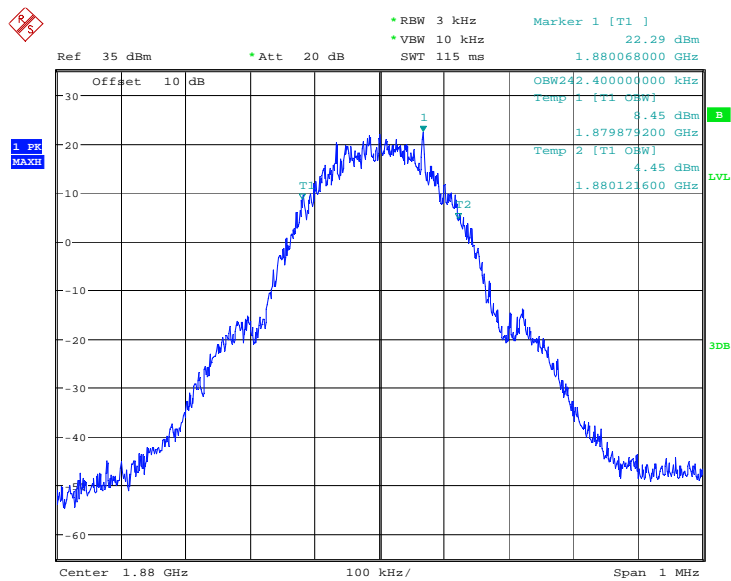
Highest channel

Test Item:	99% Occupy bandwidth	Test Mode:	PCS 1900
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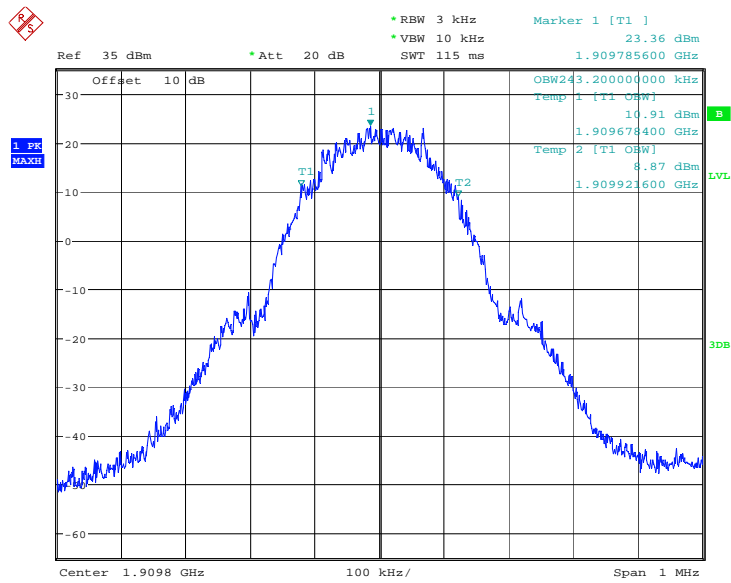
Date: 13.AUG.2014 11:05:42

Lowest channel



Date: 13.AUG.2014 11:06:16

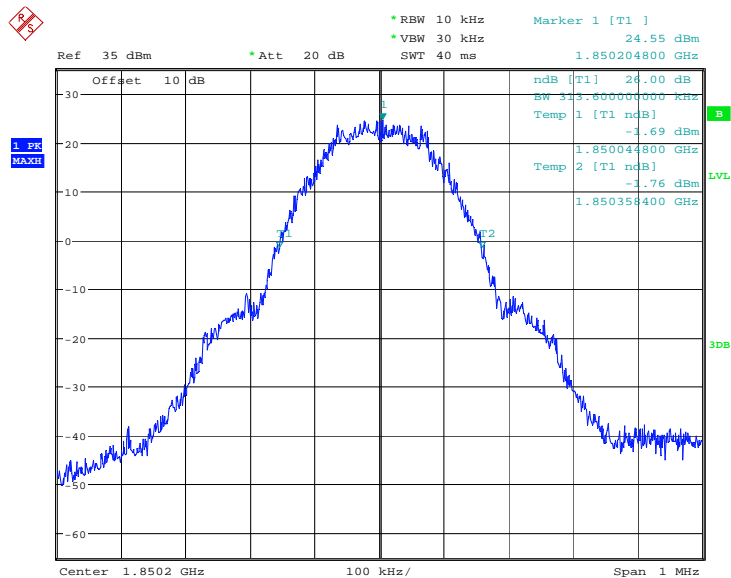
Middle channel



Date: 13.AUG.2014 11:05:02

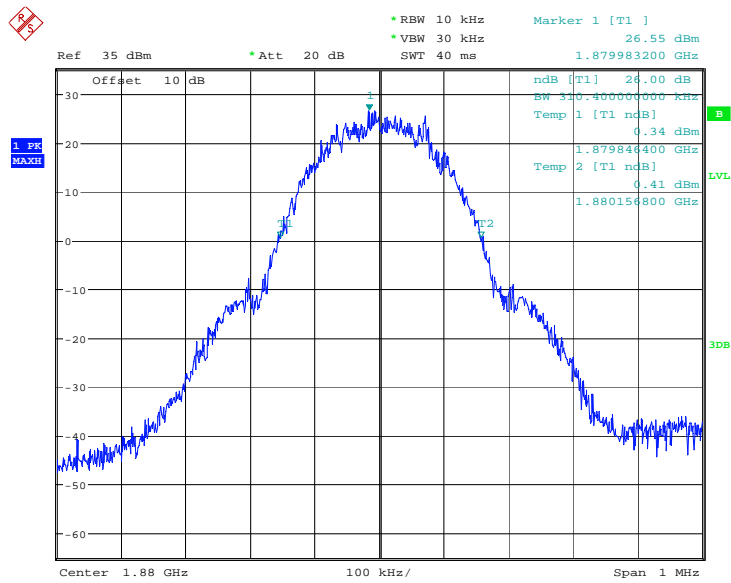
Highest channel

Test Item:	-26dB bandwidth	Test Mode:	PCS 1900
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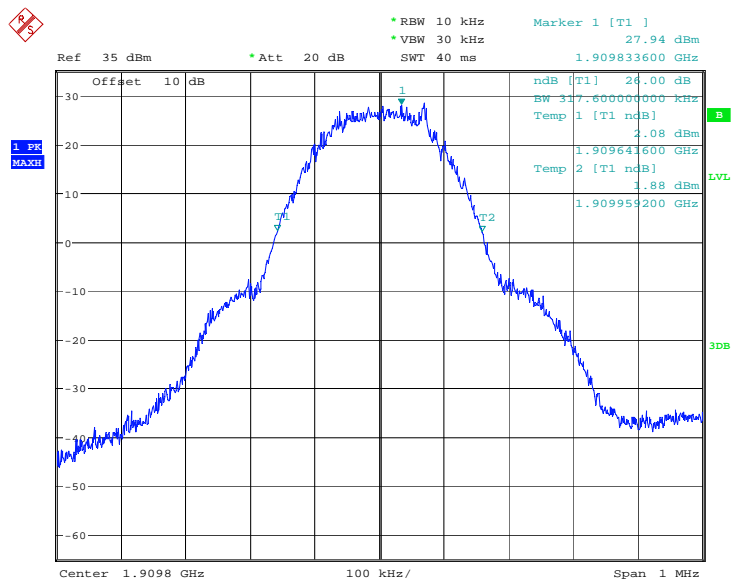
Date: 13.AUG.2014 11:07:41

Lowest channel



Date: 13.AUG.2014 11:06:42

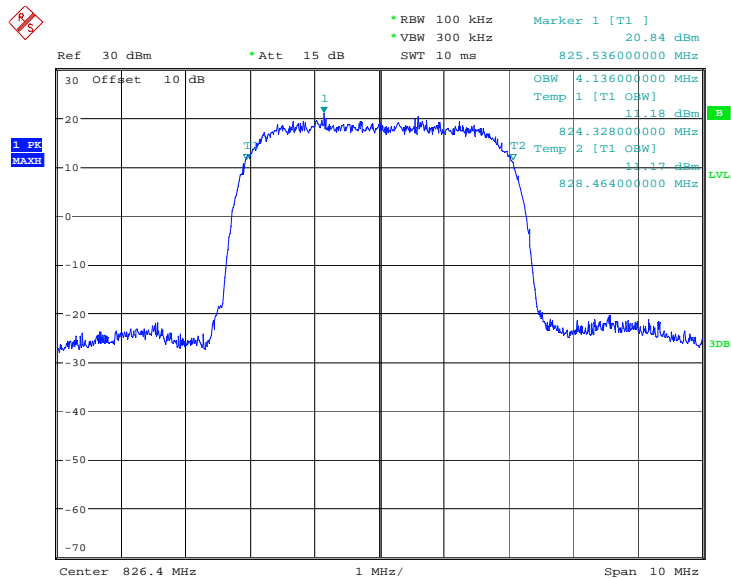
Middle channel



Date: 13.AUG.2014 11:08:40

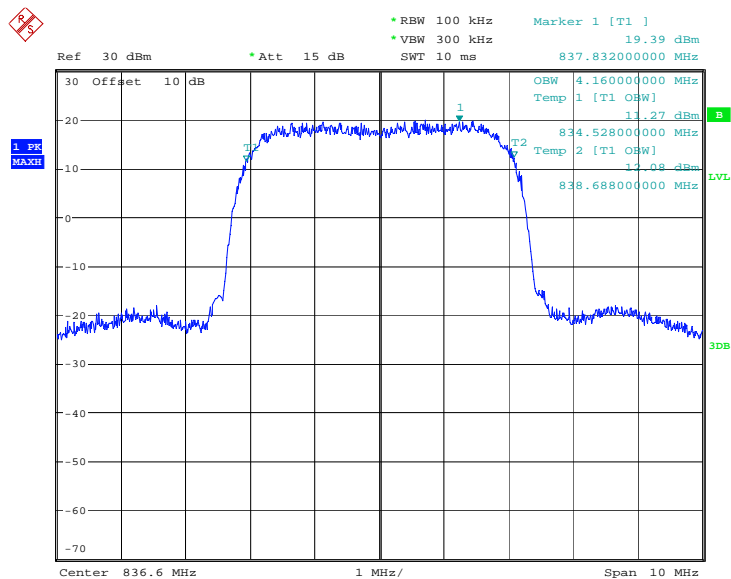
Highest channel

Test Item:	99% Occupy bandwidth	Test Mode:	UMTS 850 12.2k RMC
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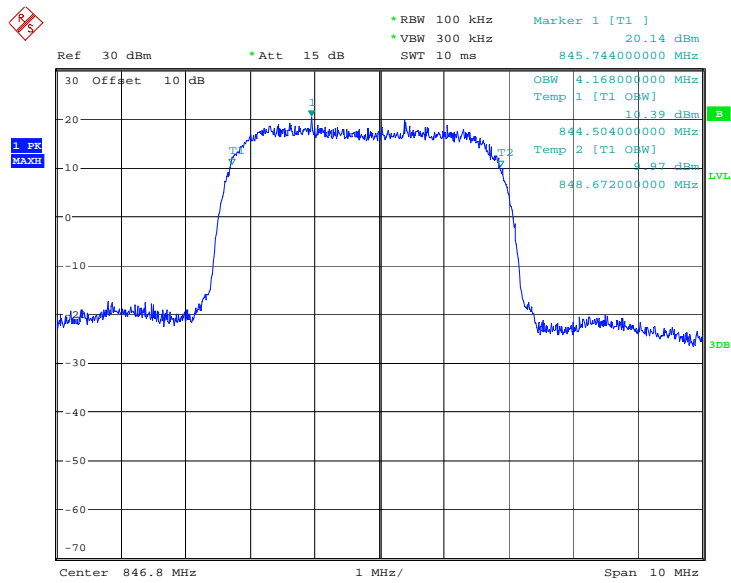
Date: 13.AUG.2014 11:15:11

Lowest channel



Date: 13.AUG.2014 11:18:50

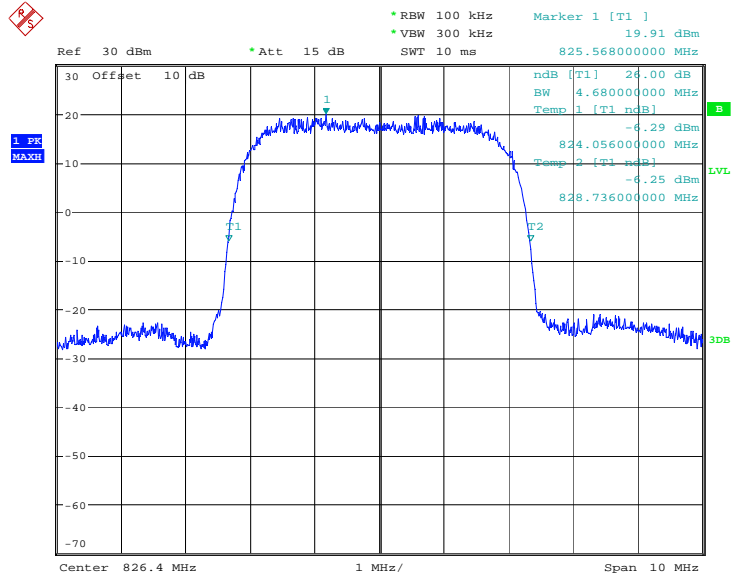
Middle channel



Date: 13.AUG.2014 11:16:42

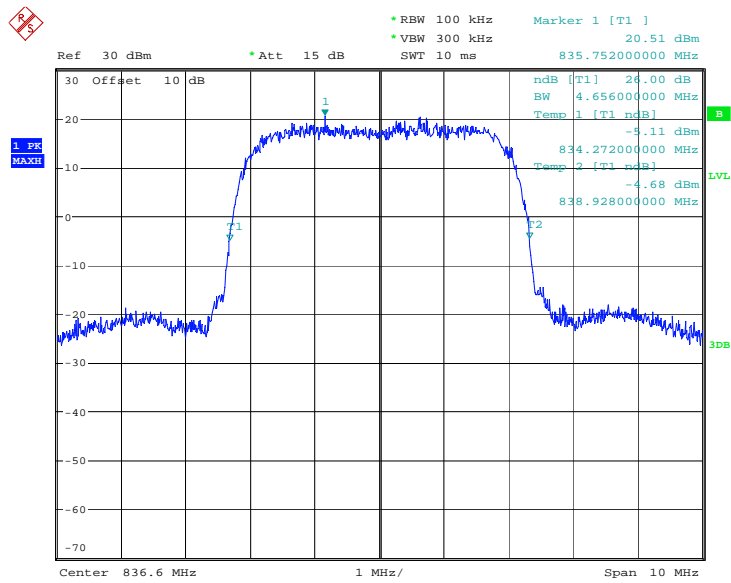
Highest channel

Test Item:	-26dB bandwidth	Test Mode:	UMTS 850 12.2k RMC
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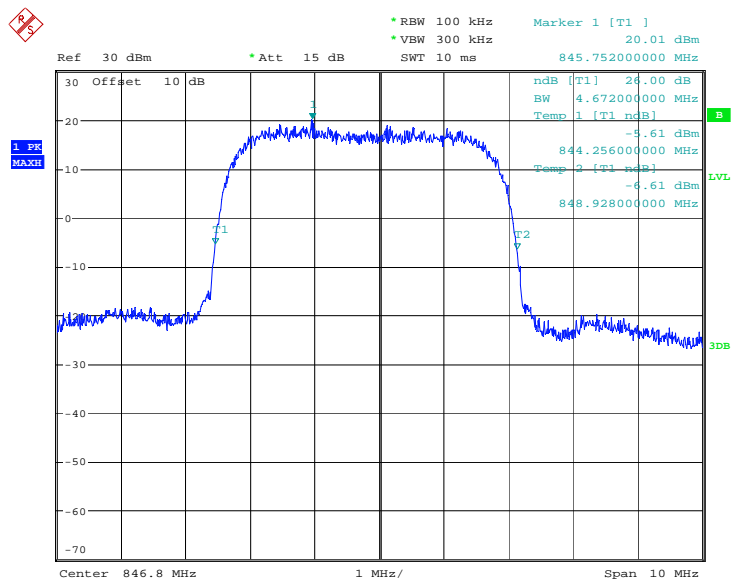
Date: 13.AUG.2014 11:19:28

Lowest channel



Date: 13.AUG.2014 11:19:08

Middle channel



Date: 13.AUG.2014 11:19:49

Highest channel

7. Conducted Out of Band Emissions

7.1 Test Standard and Limit

7.1.1 Test Standard

FCC Part 2: 2.1051, 2.1057

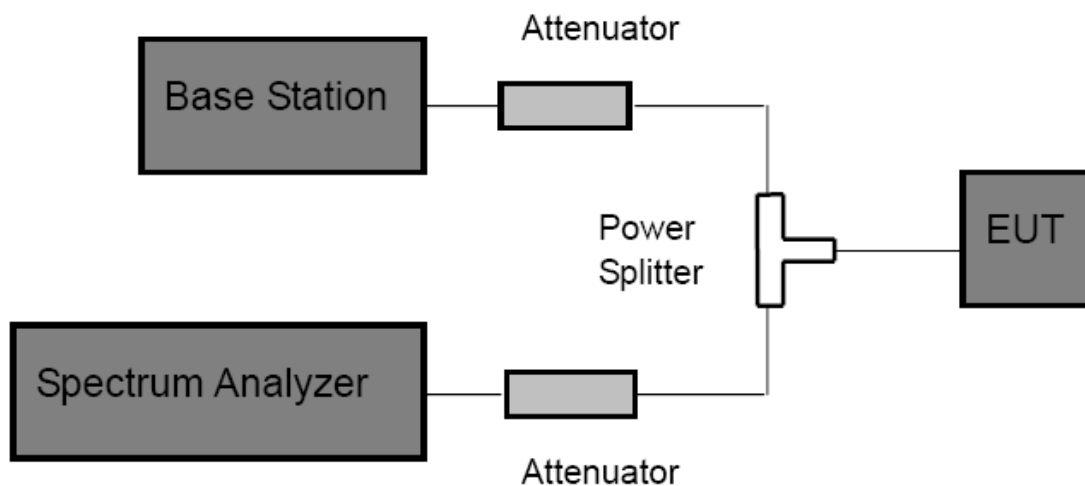
FCC Part 22H: 22.917(a)

FCC Part 24E: 24.238(a)

7.1.2 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power(P) by a factor of at least $43+10\log(P)$ dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

7.2 Test Setup



7.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
- (2) Spectrum Setting:
 Frequency bellow 1 GHz: RBW=100 kHz, VBW=300 kHz.
 Frequency above 1 GHz: RBW=1 MHz, VBW=3 MHz.
- (3) The low, middle and high channels of each band and mode's spurious emissions for 30 MHz to 10th Harmonic were measured by Spectrum analyzer.

7.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

7.5 Test Equipment

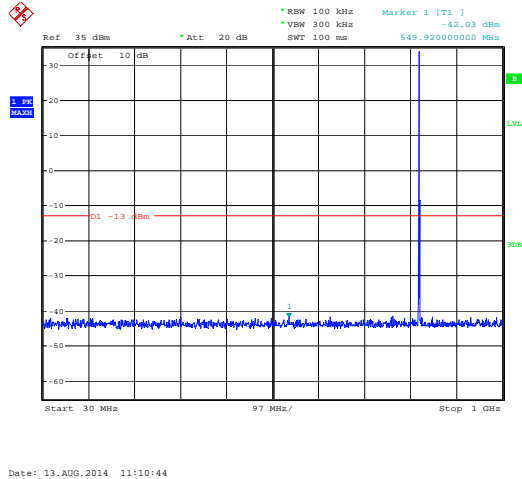
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug. 07, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Base Station	Rohde&Schwarz	CMU200	1100.864.02	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368574	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368575	May 20, 2014	May 19, 2015
Power Splitter	Anritsu	K240C	06872	May 20, 2014	May 19, 2015

7.6 Test Data

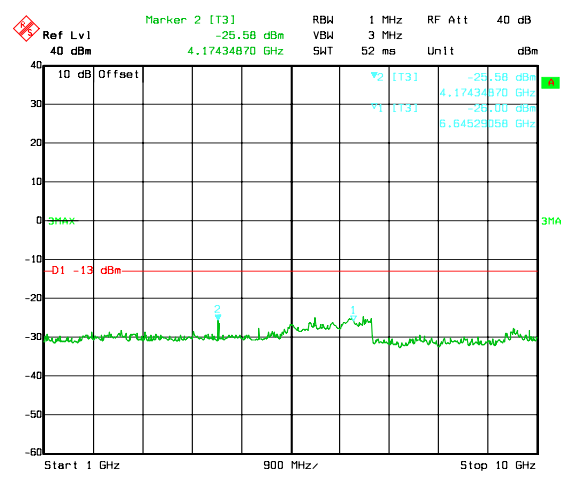
Please refer following plots:

Spurious emission

Test Mode:	GSM850	Test Channel:	Lowest channel
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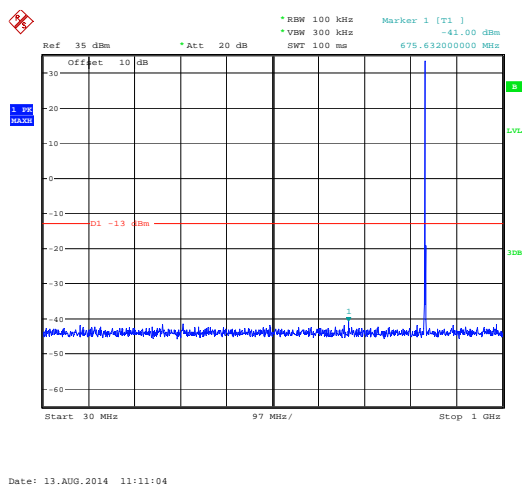


30MHz~1GHz

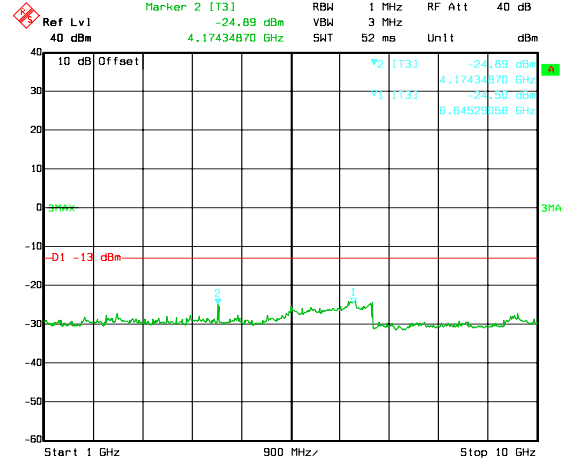


1GHz~10GHz

Test Mode:	GSM850	Test Channel:	Middle channel
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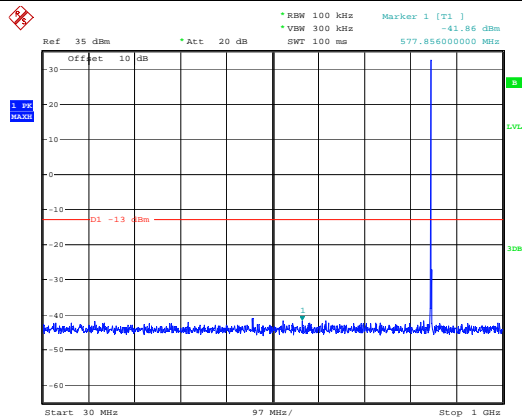


30MHz~1GHz



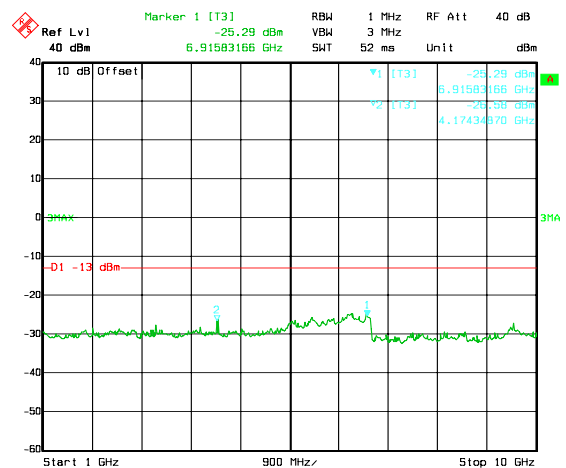
1GHz~10GHz

Test Mode:	GSM850	Test Channel:	Highest channel
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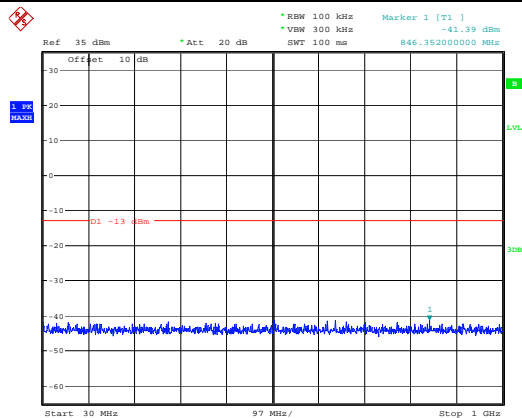
Date: 13.AUG.2014 11:11:19

30MHz~1GHz



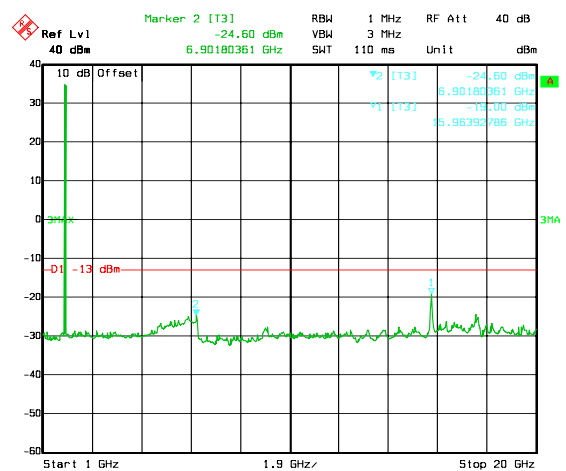
1GHz~10GHz

Test Mode:	PCS1900	Test Channel:	Lowest channel
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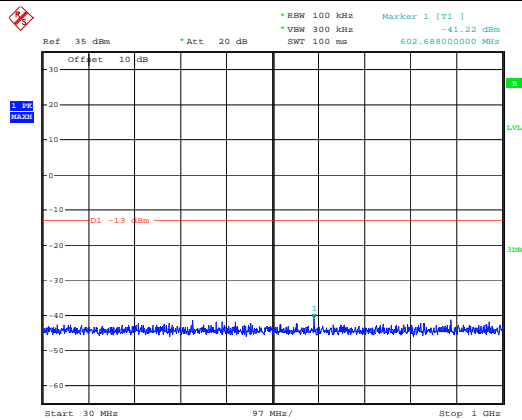
Date: 13.AUG.2014 11:09:49

30MHz~1GHz



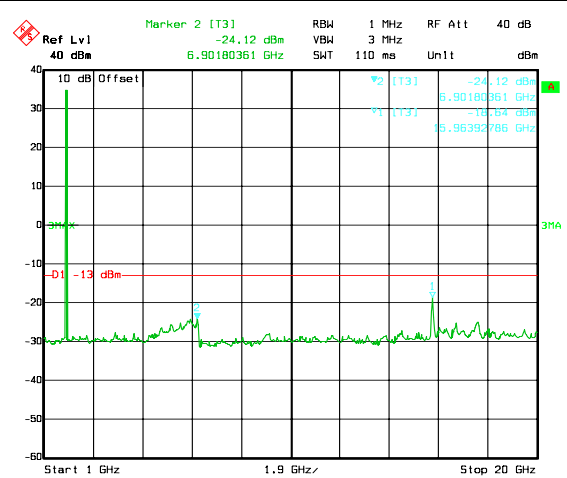
1GHz~20GHz

Test Mode:	PCS1900	Test Channel:	Middle channel
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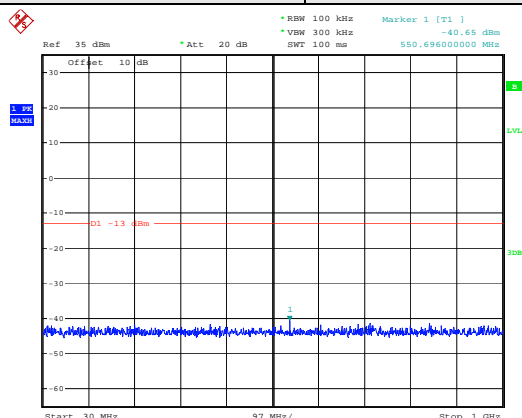
Date: 13.AUG.2014 11:10:04

30MHz~1GHz



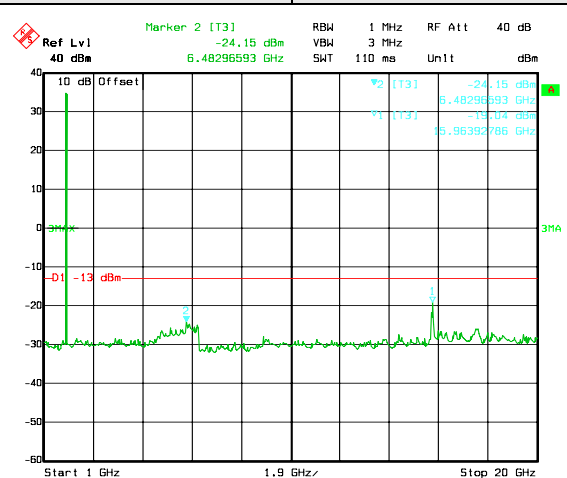
1GHz~20GHz

Test Mode:	PCS1900	Test Channel:	Highest channel
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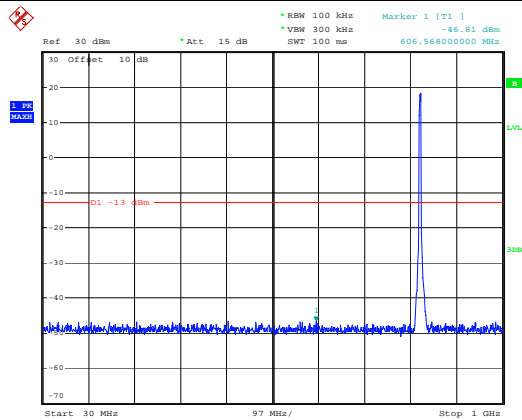
Date: 13.AUG.2014 11:09:31

30MHz~1GHz



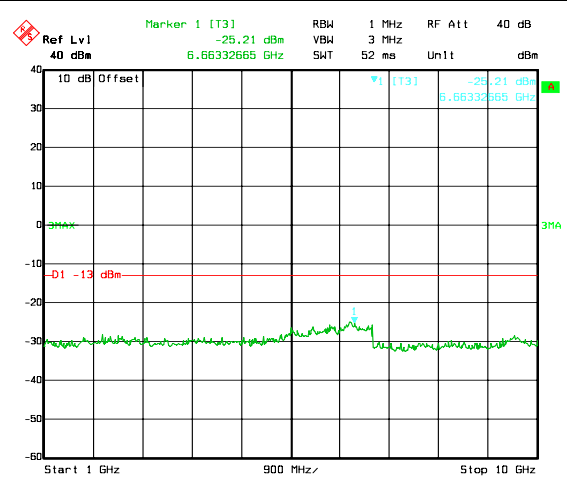
1GHz~20GHz

Test Mode:	UMTS 850 12.2k RMC	Test Channel:	Lowest channel
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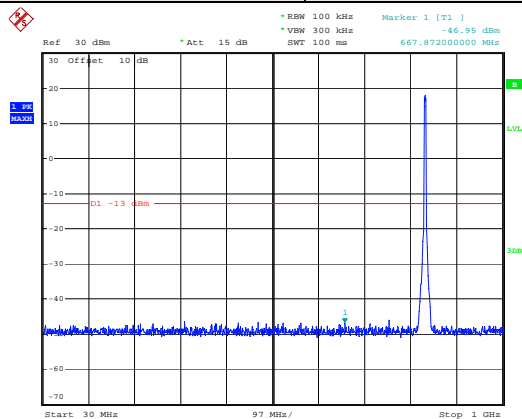
Date: 13.AUG.2014 11:29:27

30MHz~1GHz



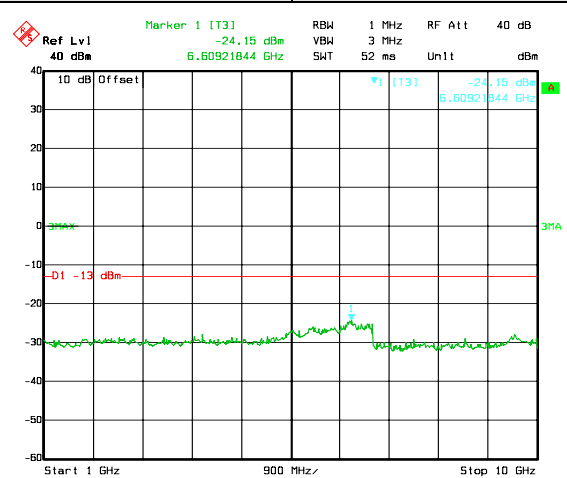
1GHz~9GHz

Test Mode:	UMTS 850 12.2k RMC	Test Channel:	Middle channel
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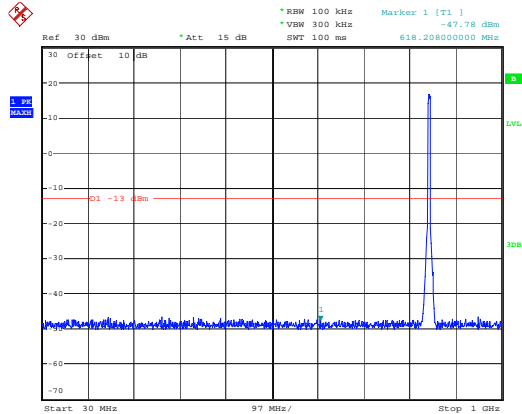
Date: 13.AUG.2014 11:30:01

30MHz~1GHz



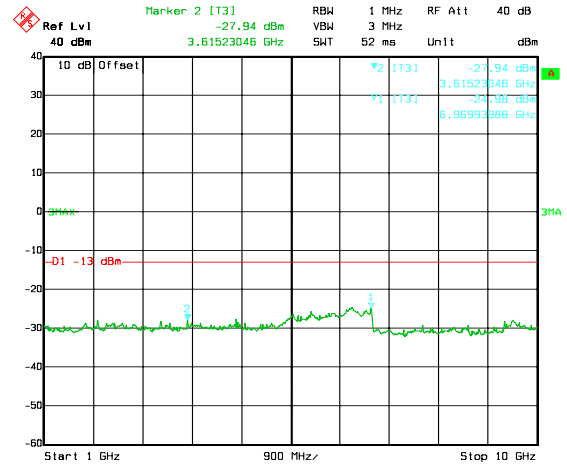
1GHz~9GHz

Test Mode:	UMTS 850 12.2k RMC	Test Channel:	Highest channel
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Date: 13.AUG.2014 11:29:47

30MHz~1GHz



1GHz~9GHz

8. Band Edge Test

8.1 Test Standard and Limit

8.1.1 Test Standard

FCC Part 2: 2.1051, 2.1057

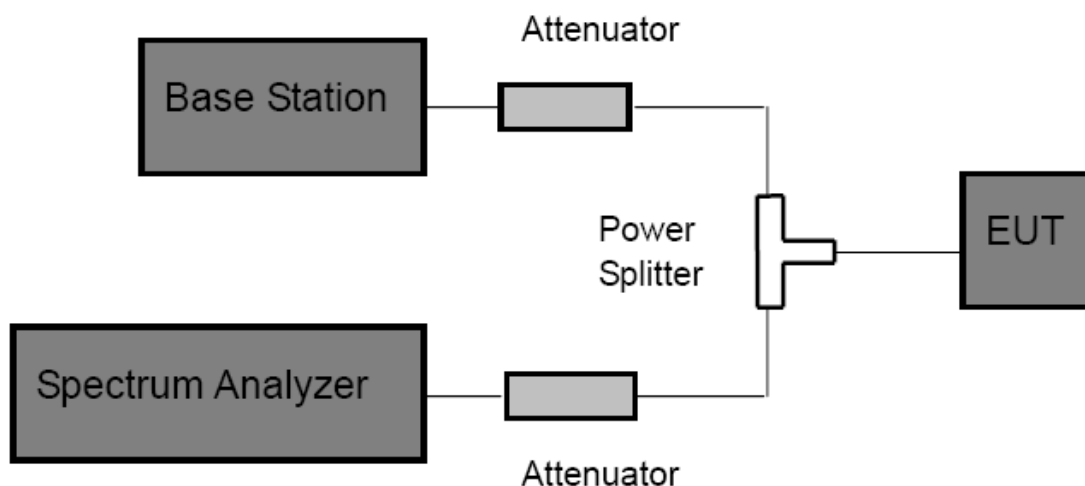
FCC Part 22H: 22.917(a)

FCC Part 24E: 24.238(a)

8.1.2 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power(P) by a factor of at least $43+10\log(P)$ dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

8.2 Test Setup



8.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
- (2) Spectrum Setting:
RBW=1% of EBW, VBW \geq RBW, Span 2 MHz, Detector: Peak Mode.
- (3) The band edges of low and high channels for the highest RF powers were measured.

8.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

8.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
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					Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug. 07, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Base Station	Rohde&Schwarz	CMU200	1100.864.02	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368574	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368575	May 20, 2014	May 19, 2015
Power Splitter	Anritsu	K240C	06872	May 20, 2014	May 19, 2015

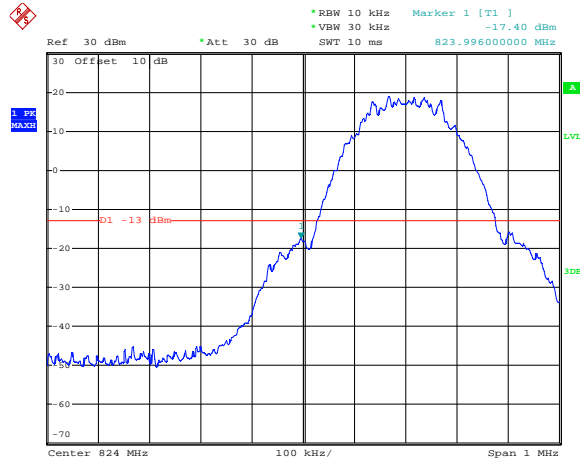
8.6 Test Data

Please refer the following plots:

Band edge emission:

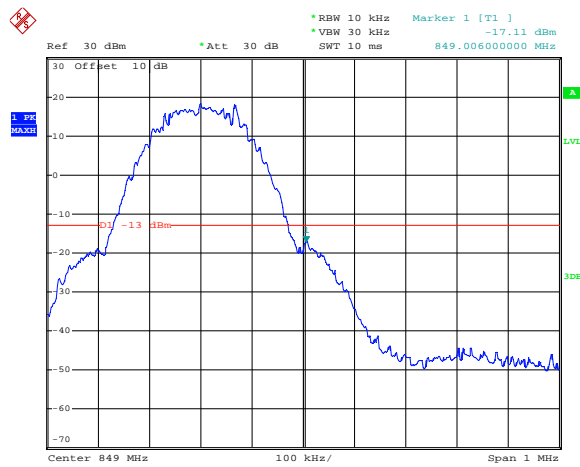
Test Mode:

GSM850



Date: 23.SEP.2014 16:04:27

Lowest channel

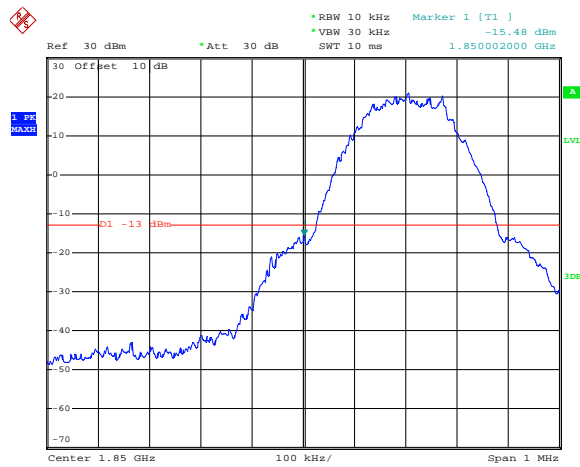


Date: 23.SEP.2014 16:05:11

Highest channel

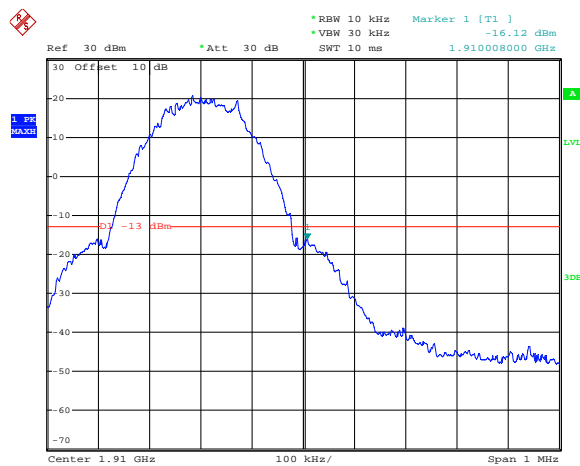
Test Mode:

PCS1900



Date: 23.SEP.2014 16:06:52

Lowest channel

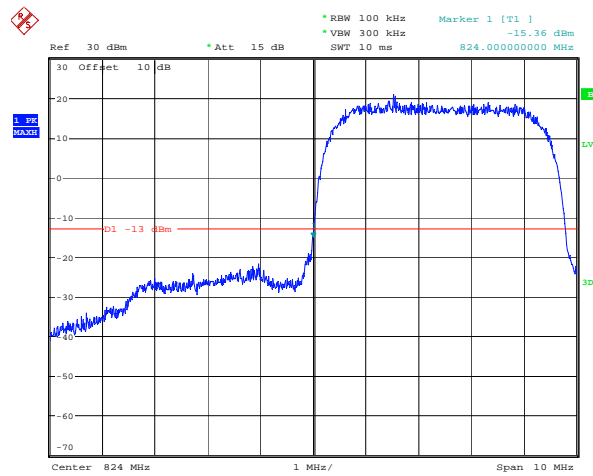


Date: 23.SEP.2014 16:07:56

Highest channel

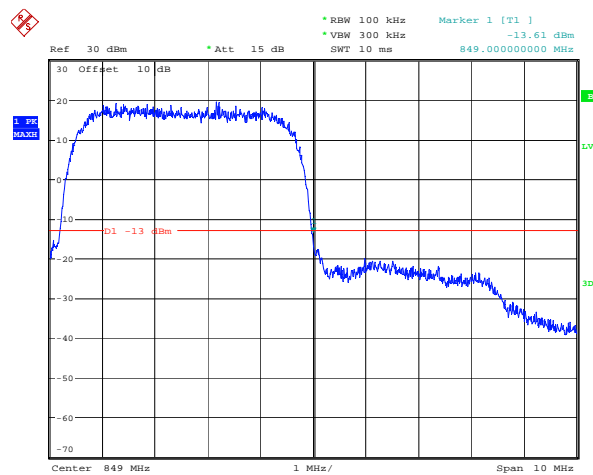
Test Mode:

UMTS850 12.2k RMC



Date: 13.AUG.2014 11:20:19

Lowest channel



Date: 13.AUG.2014 11:20:04

Highest channel

9. Radiated Out Band of Emissions

9.1 Test Standard and Limit

9.1.1 Test Standard

FCC Part 2: 2.1053, 2.1057

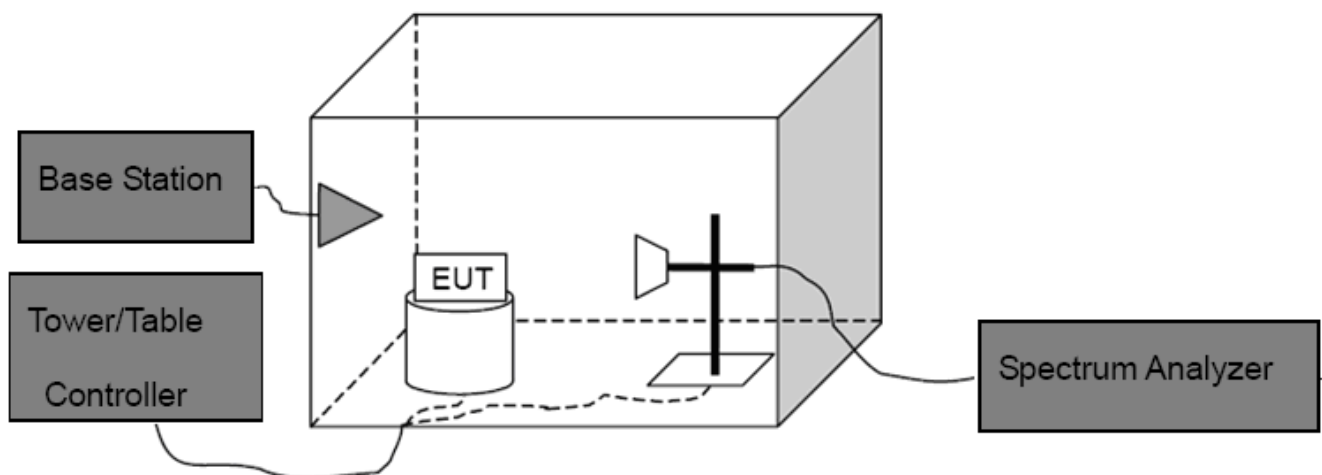
FCC Part 22H: 22.917

FCC Part 24E: 24.238

9.1.2 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power(P) by a factor of at least $43+10\log(P)$ dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

9.2 Test Setup



9.3 Test Procedure

- (1) The test system setup as show in the block diagram above.
- (2) The EUT was placed on an non-conductive rotating platform in an anechoic chamber. The radiated spurious emissions from 30MHz to 10^{th} harmonious of fundamental frequency were measured at 3 m with a test antenna and a spectrum analyzer with RBW=1 MHz, VBW=1 MHz, peak detector settings.
- (3) During the measurement, the EUT was enforced in maximum power and linked with a base station. All the spurious emissions at 3m were measured by rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
- (4) When found the maximum level of emissions from the EUT. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB=10 log(TX power in Watts/0.001)-the absolute level

Spurious attenuation limit in dB=43+10 log(power out in Watts)

9.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

9.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug. 07, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
EMI Test Receiver	Rohde & Schwarz	ESCI	101165	Aug. 08, 2014	Aug. 07, 2015
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar. 07, 2014	Mar.06, 2015
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar. 07, 2014	Mar.06, 2015
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar. 07, 2014	Mar.06, 2015
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar. 07, 2014	Mar.06, 2015
Pre-amplifier	HP	11909A	185903	Mar. 07, 2014	Mar.06, 2015
Pre-amplifier	HP	8447B	3008A00849	Mar. 07, 2014	Mar.06, 2015
Cable	HUBER+SUHNE R	100	SUCOFLEX	Mar. 07, 2014	Mar.06, 2015
Base Station	Rohde&Schwarz	CMU200	1100.864.02	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368574	May 20, 2014	May 19, 2015
Attenuator	Agilent	8504B	M368575	May 20, 2014	May 19, 2015
Power Splitter	Anritsu	K240C	06872	May 20, 2014	May 19, 2015

9.6 Test Data

Measurement Data (worst case)

Test mode:	GSM850		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1648.40	Vertical	-38.57	-13.00	Pass
2472.60	V	-43.48		
3296.80	V	-42.12		
4121.00	V	-43.18		
4945.20	V	-41.86		
5769.40	V	-40.94		
1648.40	Horizontal	-38.84	-13.00	Pass
2472.60	H	-42.87		
3296.80	H	-47.88		
4121.00	H	-43.52		
4945.20	H	-44.62		
5769.40	H	-38.57		
Test mode:	GSM850		Test channel:	Middle
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1673.20	Vertical	-36.44	-13.00	Pass
2509.80	V	-46.84		
3346.40	V	-45.63		
4183.00	V	-44.65		
5019.60	V	-41.96		
5856.20	V	-38.16		
1673.20	Horizontal	-39.84	-13.00	Pass
2509.80	H	-44.64		
3346.40	H	-47.78		
4183.00	H	-43.52		
5019.60	H	-40.87		
5856.20	H	-38.96		

Remark :

1. The emission behavior belongs to narrowband spurious emission.
2. Remark”---“ means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

Test mode:	GSM850		Test channel:	Highest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1697.60	Vertical	-31.92	-13.00	Pass
2546.40	V	-45.67		
3395.20	V	-44.49		
4244.00	V	-45.28		
5092.80	V	-40.69		
5941.60	V	-39.65		
1697.60	Horizontal	-33.24	-13.00	Pass
2546.40	H	-48.39		
3395.20	H	-48.43		
4244.00	H	-44.20		
5092.80	H	-40.74		
5941.60	H	-38.66		
Test mode:	PCS1900		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3700.40	Vertical	-61.00	-13.00	Pass
5550.60	V	-35.68		
7400.80	V	-33.56		
9251.00	V	-33.87		
11101.20	V	---		
12951.40	V	---		
3700.40	Horizontal	-48.52	-13.00	Pass
5550.60	H	-37.08		
7400.80	H	-37.76		
9251.00	H	-33.24		
11101.20	H	---		
12951.40	H	---		

Remark :

1. The emission behavior belongs to narrowband spurious emission.
2. Remark"---" means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

Test mode:	PCS1900		Test channel:	Middle
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3760.00	Vertical	-45.68	-13.00	Pass
5640.00	V	-37.11		
7520.00	V	-36.99		
9400.00	V	-33.60		
11280.00	V	---		
13160.00	V	---		
3760.00	Horizontal	-46.36	-13.00	Pass
5640.00	H	-34.99		
7520.00	H	-37.78		
9400.00	H	-33.85		
11280.00	H	---		
13160.00	H	---		
Test mode:	PCS1900		Test channel:	Highest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
3819.60	Vertical	-45.27	-13.00	Pass
5729.40	V	-40.63		
7639.20	V	-38.78		
9549.00	V	-34.06		
11458.80	V	---		
13368.60	V	---		
3819.60	Horizontal	-46.43	-13.00	Pass
5729.40	H	-41.03		
7639.20	H	-37.73		
9549.00	H	-34.46		
11458.80	H	---		
13368.60	H	---		

Remark :

1. The emission behavior belongs to narrowband spurious emission.
2. Remark"---" means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

Test mode:	UMTS850 12.2k RMC		Test channel:	Lowest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1652.80	Vertical	-51.63	-13.00	Pass
2479.20	V	-44.36		
3305.60	V	-49.52		
4132.00	V	-46.35		
4958.40	V	---		
5784.80	V	---		
1652.80	Horizontal	-51.73	-13.00	Pass
2479.20	H	-46.58		
3305.60	H	-47.90		
4132.00	H	-43.94		
4958.40	H	---		
5784.80	H	---		
Test mode:	UMTS850 12.2k RMC		Test channel:	Middle
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1672.00	Vertical	-53.15	-13.00	Pass
2508.00	V	-54.54		
3344.00	V	-48.25		
4180.00	V	-45.68		
5016.00	V	---		
5852.00	V	---		
1672.00	Horizontal	-50.11	-13.00	Pass
2508.00	H	-43.70		
3344.00	H	-48.04		
4180.00	H	-44.21		
5016.00	H	---		
5852.00	H	---		

Test mode:	UMTS850 12.2k RMC		Test channel:	Highest
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1693.20	Vertical	-44.21	-13.00	Pass
2539.80	V	-44.15		
3386.40	V	-48.43		
4233.00	V	-44.57		
5079.60	V	---		
5926.20	V	---		
1693.20	Horizontal	-46.27	-13.00	Pass
2539.80	H	-47.14		
3386.40	H	-48.59		
4233.00	H	-44.00		
5079.60	H	---		
5926.20	H	---		

Remark :

1. The emission behavior belongs to narrowband spurious emission.
2. Remark”---“ means that the emission level is too low to be measured
3. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

-----End of report-----