TEST REPORT

of

FCC Part 22 Subpart H and Part 24 Subpart E
FCC ID: U7XM3ORANGE

Equipment Under Test	:	Industrial PDA phone
Model Name	:	M3 ORANGE
The addition of model name	:	CR4100
Serial No.	:	N/A
Applicant	:	M3 Mobile
Manufacturer	:	M3 Mobile
Date of Test(s)	:	2010. 08. 25 ~ 2010. 11. 15
Date of Issue	:	2010. 11. 15

In the configuration tested, the EUT complied with the standards specified above.

Tested By: Grant Lee **Date** 2010. 11. 15

Approved By Feel Jeong **Date** 2010. 11. 15

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1. General information

1.1. Testing laboratory

SGS Testing Korea Co., Ltd.
- 705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.
- Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

www.electrolab.kr.sgs.com
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

1.2. Details of applicant

Applicant : M3 Mobile
Address : Dongwon-Bldg, 725-30 Yeoksam-Dong, Gangnam-Gu, Seoul, Korea
Contact Person : Jooheon Kwon
Phone No. : +82 +2 2022-1328

1.3. Description of EUT

Kind of Product	Industrial PDA phone
Modular FCC ID	QIPHC25
Model Name	M3 ORANGE
The addition of model name	CR4100
Serial Number	N/A
Power Supply	DC 3.7 V (Li-Ion Battery)
Rated Power	GSM850 : 33.00 ㏈m GSM1900 : 30.00 ㏈m
Frequency Range	GSM850 : 824.2 ㎒ ~ 848.8 ㎒ GSM1900: 1 850.2 ㎒ ~ 1 909.8 ㎒
Number of Channels	GSM850 : 125 GSM1900 : 300
Class of GPRS	Class 10, Class B

- All models are exactly same for the hardware and software.

1.4. Description of test mode

Band	Frequency (MHz)	Voice GSM	GPRS Data	
			GPRS	GPRS
			1 TX Slot	2 TX Slot
		(dBm)	(dBm)	(dBm)
GSM 850	824.2	**32.40**	32.30	30.77
	836.6	**32.54**	32.49	30.89
	848.8	**32.51**	32.47	30.91
GSM 1900	1850.2	**27.69**	27.69	25.70
	1880.0	**28.85**	28.80	26.80
	1909.8	**29.61**	29.60	27.50

Band	Frequency (MHz)	EDGE Data	
		EDGE	EDGE
		1 TX Slot	2 TX Slot
		(dBm)	(dBm)
EDGE 850	824.2	**27.35**	27.33
	836.6	**27.49**	27.46
	848.8	**27.51**	27.48
EDGE 1900	1850.2	**24.30**	22.40
	1880.0	**26.40**	23.30
	1909.8	**26.10**	24.00

GSM (850 / 1900)
We found out the test mode with the highest power level after we analyze all the data rates. So we chose **GSM(850 & 1900) voice** (worst case) as a representative.

1.5. Test equipment list

Equipment	Manufacturer	Model	Cal Due.
Signal Generator	Agilent	E4438C	Mar. 31, 2011
Signal Generator	Rohde & Schwarz	SMR40	Jul. 15, 2011
Spectrum Analyzer	Rohde & Schwarz	FSV30	Mar. 31, 2011
Mobile Test Unit	Agilent	E5515C	Mar. 31, 2011
Directional Coupler	Narda	4226-20	Jan. 07, 2011
High Pass Filter	Wainwright	WHK3.0/18G-10SS	Sep. 29, 2011
Band Reject Filter	Wainwright	WRCG824/849-814/85 960/10SS	Apr. 01, 2011
DC power Supply	Agilent	U8002A	Jan. 06, 2011
Preamplifier	H.P.	8447F	Jul. 05, 2011
Preamplifier	Empower RF Systems,Inc	2002-BBS2C4AEL	Mar. 31, 2011
Test Receiver	R & S	ESU26	Apr. 08, 2011
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	Jul. 22, 2011
Horn Antenna	Rohde & Schwarz	HF 906	Oct. 08, 2011
Horn Antenna	SCHWARZBECK	BBH 9120D	Nov. 09, 2011
Dipole Antenna	VHAP/UHAP	975/958	Oct. 10, 2011
Antenna Master	EMCO	1050	N.C.R.
Turn Table	Daeil EMC	DI-1500	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	Jan. 27, 2011

1.6. Summary of test results

The EUT has been tested according to the following specifications:

APPLIED STANDARD : FCC Part 22, 24		
Section in FCC part	**Test Item**	**Result**
§2.1046 §22.913(a) §24.232(b)	RF Radiated Output Power	Complied
§2.1053 §22.917(e) §24.238(a)	Spurious Radiated Emission	Complied
§2.1046(a)	Conducted Output Power	Complied
§2.1049(h) (i)	Occupied Bandwidth	Complied
§2.1051 §22.917(e) §24.238(a)	Spurious Emission at Antenna Terminal	Complied
§2.1055 §22.355 §24.235	Frequency Stability	Complied
§22.917(e) §24.238(a)	Band Edge	Complied

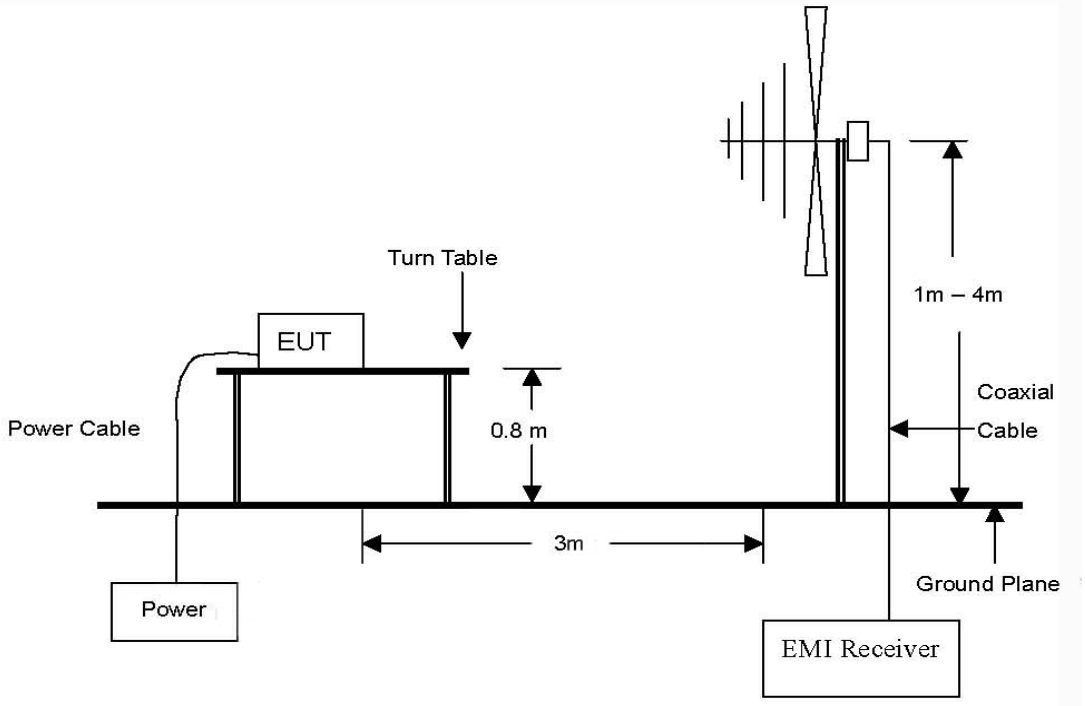
1.7. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL004276	Initial

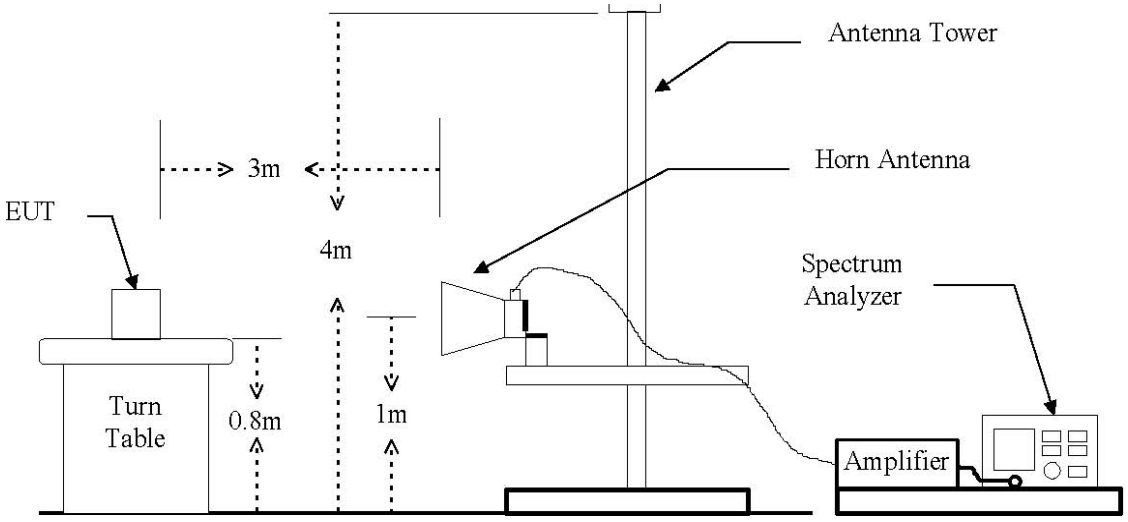
2. RF radiated output power & spurious radiated emission

2.1. Test setup

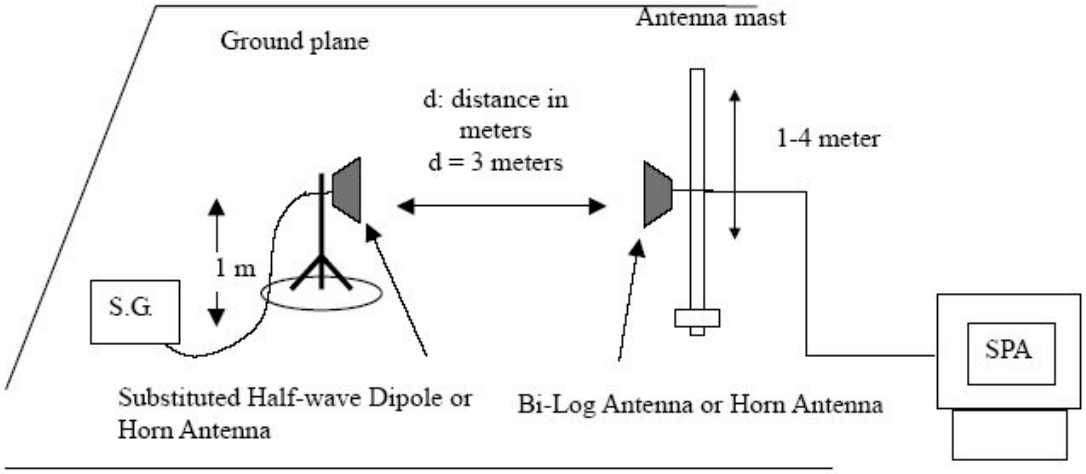
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 G㎐ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 G㎐ to 18 G㎐ Emissions.



The diagram below shows the test setup for substituted method



2.2. Limit

FCC §22.913(a), the ERP of mobile transmitters must not exceed 7 watts. FCC §24.232(b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

2.3. Test procedure : Based on ANSI/TIA 603C: 2004

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to he fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 1 ㎒ and the average bandwidth was set to 1 ㎒.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
7. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 ㎒) or horn antenna (1 850 ~ 1 910 ㎒) connected to a signal generator.
11. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase he sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

2.4. Test result for RF radiated output power

Ambient temperature : (23 ± 2) ℃
Relative humidity : 46 % R.H.

GSM850

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P.	
					(dB m)	(㎽)
824.2	V	40.59	3.42	-11.17	26.00	398.11
824.2	H	41.67	3.42	-11.17	27.08	510.50
836.6	V	38.81	3.38	-11.47	23.97	249.46
836.6	H	40.51	3.38	-11.47	25.67	368.98
848.8	V	37.54	3.33	-11.76	22.44	175.39
848.8	H	40.10	3.33	-11.76	25.00	316.23

GSM850 (EDGE)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P.	
					(dB m)	(㎽)
824.2	V	28.96	3.42	-11.17	14.37	27.35
824.2	H	36.60	3.42	-11.17	22.01	158.85

GSM1900

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(㎽)
1 850.2	V	21.77	4.87	9.12	26.02	399.94
1 850.2	H	20.65	4.87	9.12	24.90	309.03
1 880.0	V	21.09	4.91	9.20	25.38	345.14
1 880.0	H	19.87	4.91	9.20	24.16	260.62
1 909.8	V	23.65	4.94	9.27	27.98	628.06
1 909.8	H	20.20	4.94	9.27	24.53	283.79

GSM1900 (EDGE)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.I.R.P.	
					(dB m)	(㎽)
1 909.8	V	11.04	4.94	9.27	15.37	34.43
1 909.8	H	17.10	4.94	9.27	21.43	139.00

Remark:
1. E.R.P. & E.I.R.P = [S.G level + Amp.](dB m) - Cable loss(dB) + Ant. gain (dB d/dB i)
2. The E.I.R.P was measured in three orthogonal EUT position(x-axis, y-axis and z-axis). Worst cases are z-axis.

2.5. Spurious radiated emission

- Measured output Power : 27.08 ㏈m =0.511 W
- Modulation Signal : GSM850
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = - 40.08 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level (㏈m)	Cable loss (㏈)	Ant. gain (㏈d)	E.R.P (㏈m)	㏈c	Margin (㏈)
Low Channel (824.2 ㎒)							
1 648.40	V	-31.86	4.54	6.44	-29.96	-57.04	16.96
1 648.40	H	-37.15	4.54	6.44	-35.25	-62.33	22.25
2 472.62	V	-26.61	5.67	7.97	-24.31	-51.39	11.31
2 472.62	H	-29.09	5.67	7.97	-26.79	-53.87	13.79
Middle Channel (836.6 ㎒)							
1 673.20	V	-30.61	4.58	6.51	-28.68	-55.76	15.68
1 673.20	H	-41.46	4.58	6.51	-39.53	-66.61	26.53
2 510.00	V	-21.91	5.72	8.02	-19.61	-46.69	6.61
2 510.00	H	-24.73	5.72	8.02	-22.43	-49.51	9.43
High Channel (848.8 ㎒)							
1 697.60	V	-32.79	4.62	6.57	-30.84	-57.92	17.84
1 697.60	H	-43.81	4.62	6.57	-41.86	-68.94	28.86
2 546.59	V	-25.25	5.75	8.07	-22.93	-50.01	9.93
2 546.59	H	-27.60	5.75	8.07	-25.28	-52.36	12.28

- Measured output Power : 27.98 ㏈m =0.628 W
- Modulation Signal : GSM1900
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = -40.94 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P (㏈m)	㏈c	Margin (㏈)
Low Channel(1 850.2 ㎒)							
3 700.40	V	-39.89	7.13	11.85	-35.17	-63.15	22.17
3 700.40	H	-39.47	7.13	11.85	-34.75	-62.73	21.75
Middle Channel(1 880.0 ㎒)							
3 760.00	V	-40.22	7.23	11.85	-35.61	-63.59	22.61
3 760.00	H	-43.64	7.23	11.85	-39.03	-67.01	26.03
High Channel(1 909.8 ㎒)							
3 819.60	V	-39.79	7.33	11.84	-35.28	-63.26	22.28
3 819.60	H	-43.67	7.33	11.84	-39.16	-67.14	26.16

Remark:
1. E.R.P. & E.I.R.P = S.G level (㏈m) - Cable loss (㏈) + Ant. gain (㏈d/㏈i)
2. No more harmonic above 3rd harmonic for all channel.

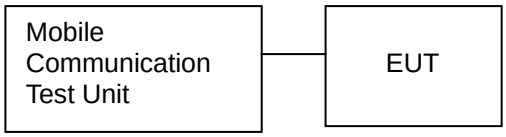
3. Conducted Output Power

3.1. Limit

Requirements: CFR 47, Section §2.1046

3.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The mobile was set up for the max. output power with pseudo random data modulation.
3. The power was measured with Mobile Communication Test unit.



3.3. Test Result

Ambient temperature : (23 ± 2) ℃
Relative humidity : 46 % R.H.

Band	Frequency (MHz)	Voice GSM	GPRS Data	
			GPRS 1 TX Slot	GPRS 2 TX Slot
		(dBm)	(dBm)	(dBm)
GSM 850	824.2	**32.40**	32.30	30.77
	836.6	**32.54**	32.49	30.89
	848.8	**32.51**	32.47	30.91
GSM 1900	1850.2	**27.69**	27.69	25.70
	1880.0	**28.85**	28.80	26.80
	1909.8	**29.61**	29.60	27.50

Band	Frequency (MHz)	EDGE Data	
		EDGE 1 TX Slot	EDGE 2 TX Slot
		(dBm)	(dBm)
EDGE 850	824.2	**27.35**	27.33
	836.6	**27.49**	27.46
	848.8	**27.51**	27.48
EDGE 1900	1850.2	**24.30**	22.40
	1880.0	**26.40**	23.30
	1909.8	**26.10**	24.00

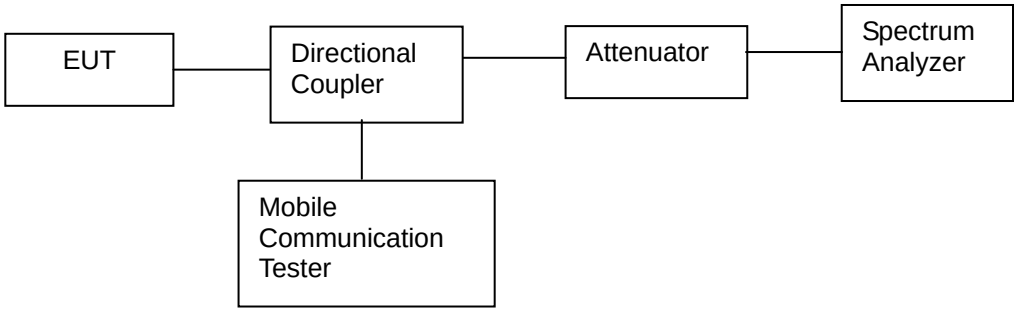
4. Occupied Bandwidth 99 %

4.1. Limit

Requirements: CFR 47, Section §2.1049.

4.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The resolution bandwidth of the spectrum analyzer was set.
   Occupied Bandwidth 99 % and -26 dB was tested under



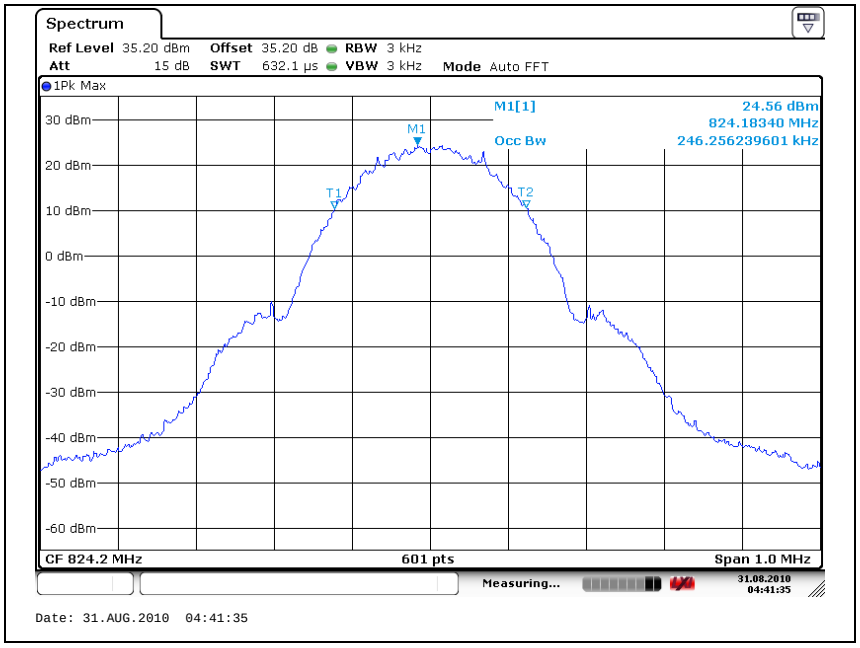
4.3 Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 46 % R.H.

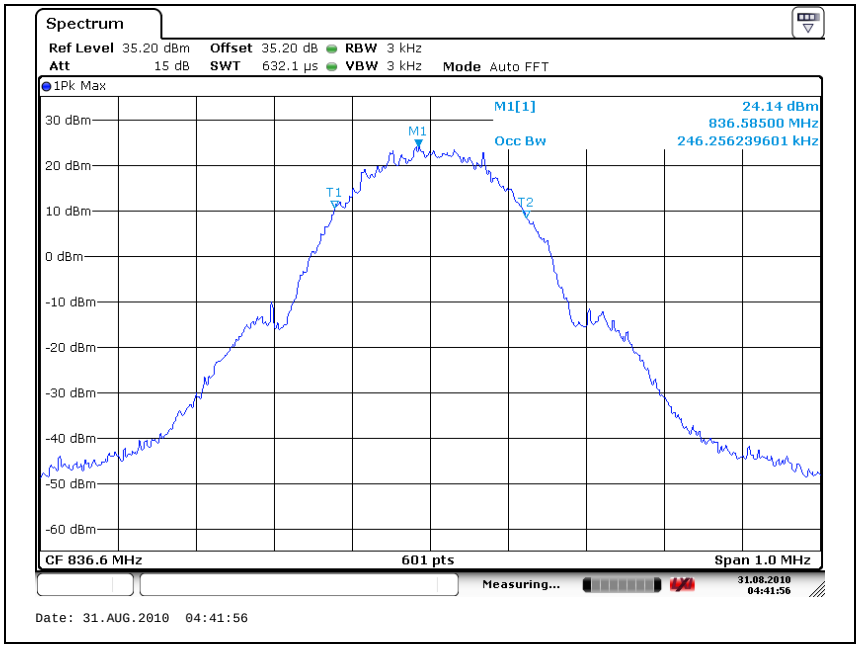
Band	Mode	Frequency (㎒)	Occupied Bandwidth (㎒)
GSM850	Voice	824.2	246.26
		836.6	246.26
		848.8	246.26
	EDGE	848.8	236.27
GSM1900	Voice	1 850.2	242.93
		1 880.0	242.93
		1 909.8	244.59
	EDGE	1 909.8	242.93

Please refer to the following plots.

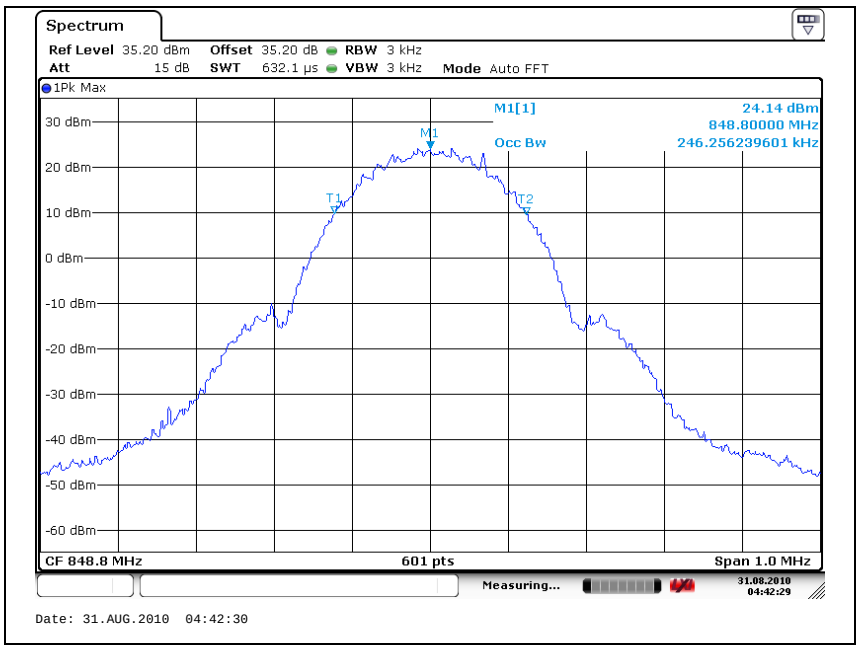
GSM850
99 %
Low Channel



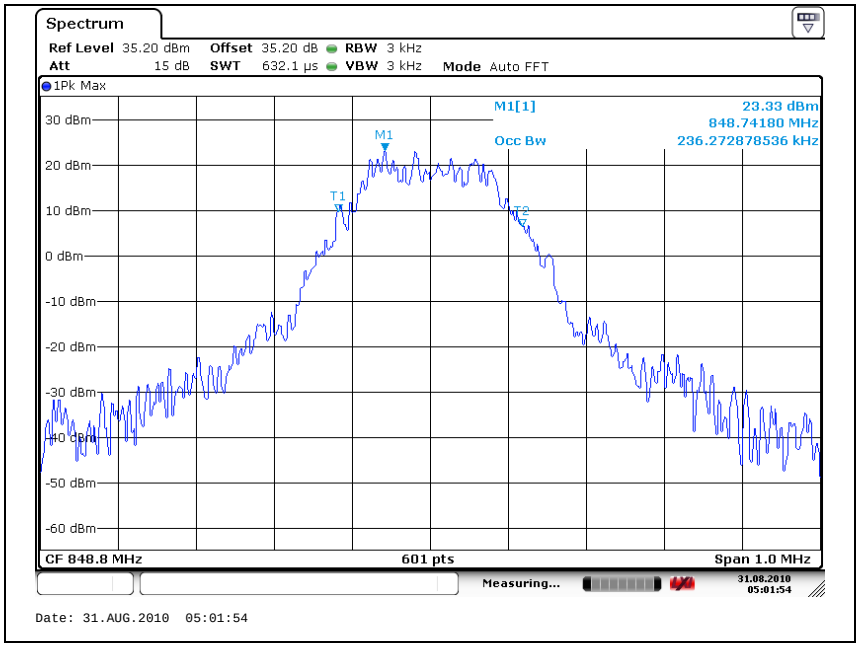
Middle Channel



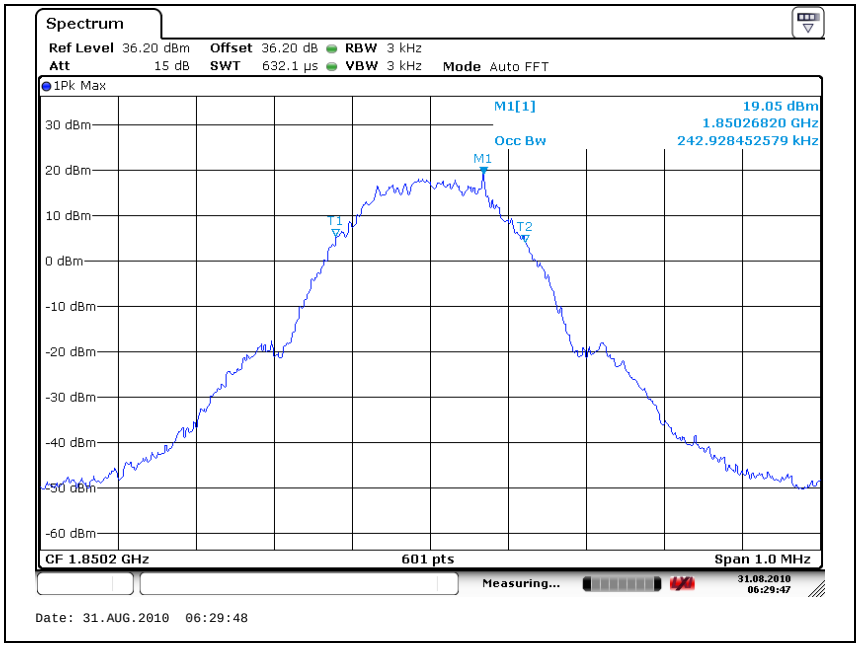
High Channel



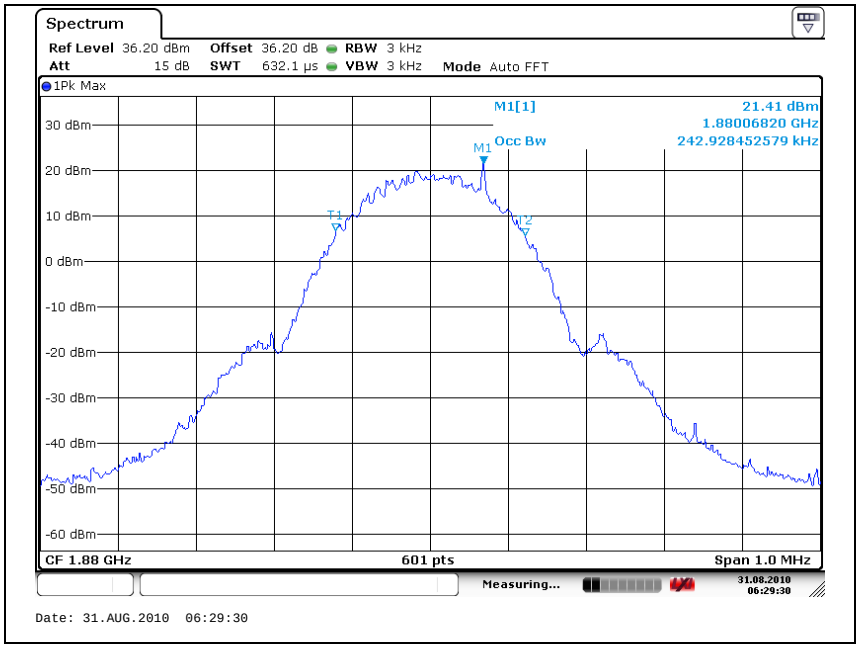
GSM850 EDGE
99 %
High Channel



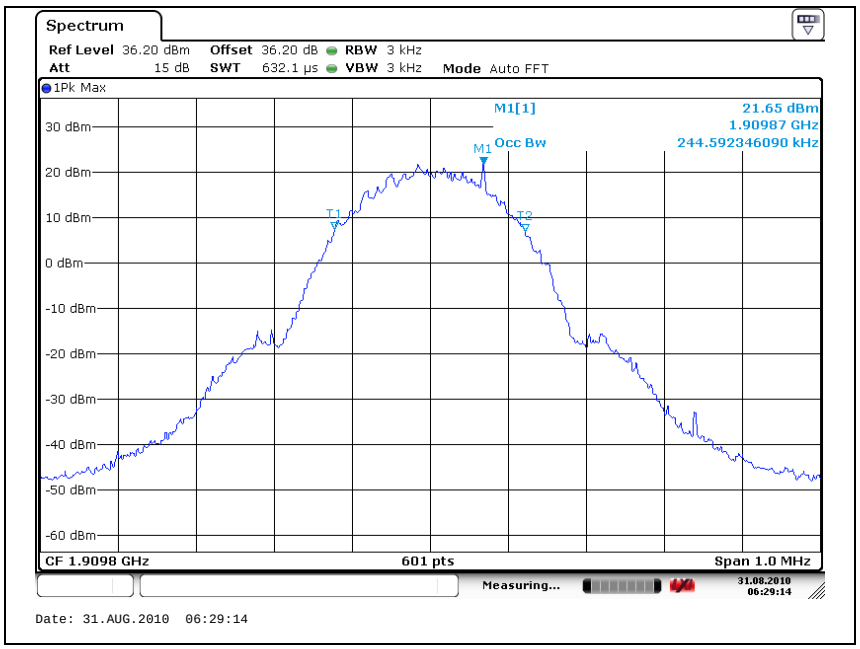
GSM1900
99 %
Low Channel



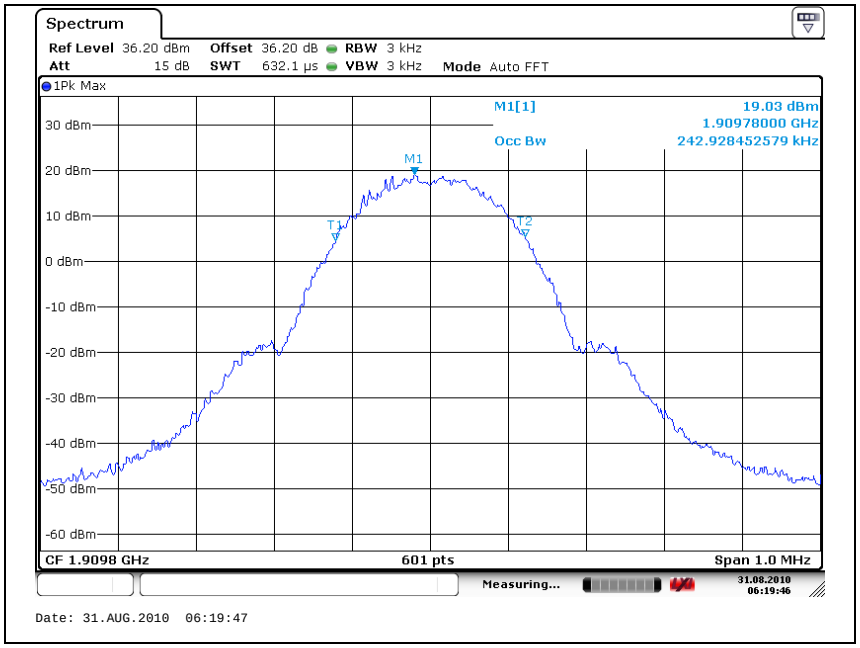
Middle Channel



High Channel



GSM1900 EDGE
99 %
High Channel



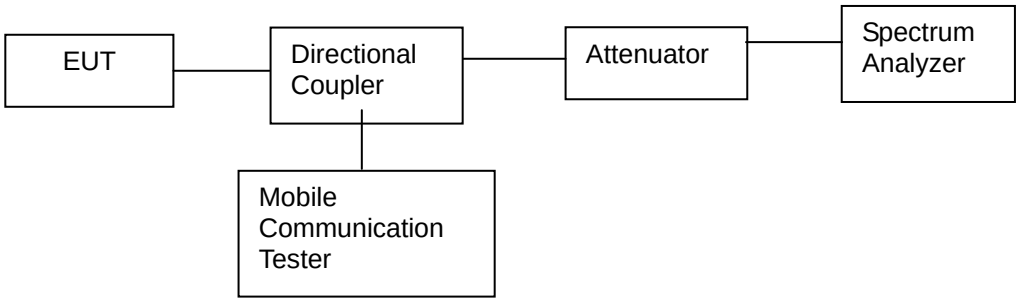
5. Spurious Emissions at Antenna Terminal

5.1. Limit

§ 22.917(e) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least 43 + 10log(P)㏈.

5.2. Test Procedure

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set at 1 ㎒. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.
3. Spurious Emission was tested



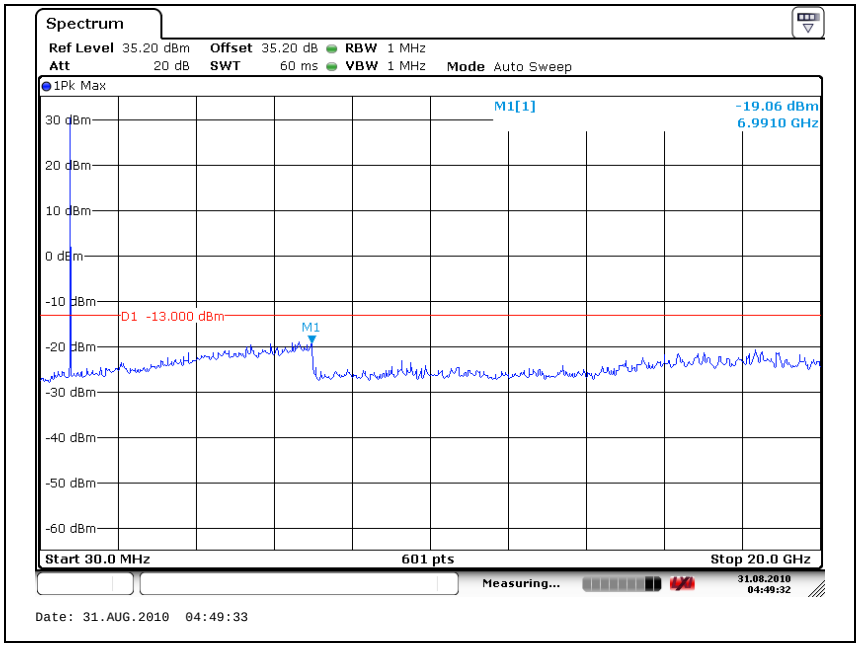
5.3. Test Results

Ambient temperature	:	(23 ± 2) ℃
Relative humidity	:	46 % R.H.

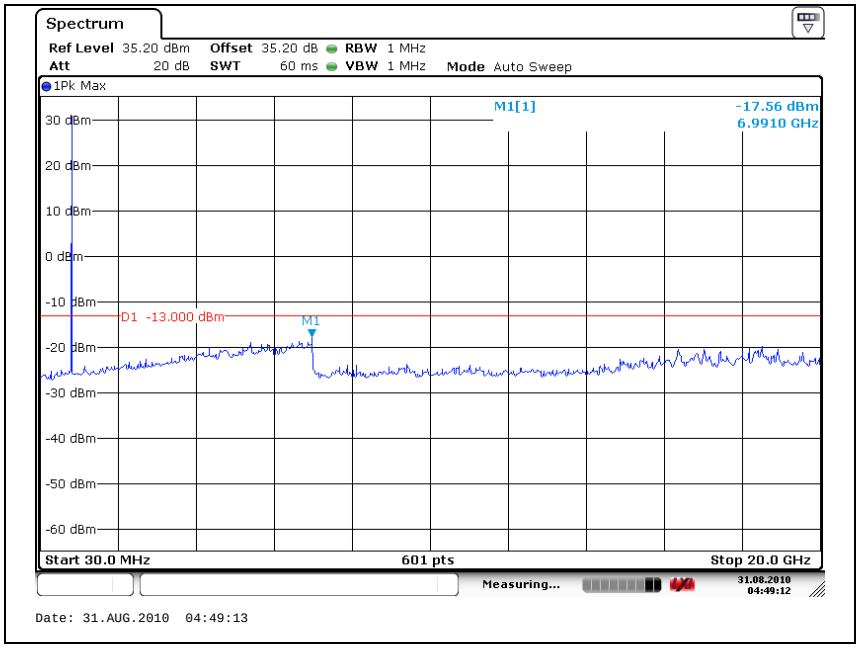
Please refer to the following plots.

GSM850

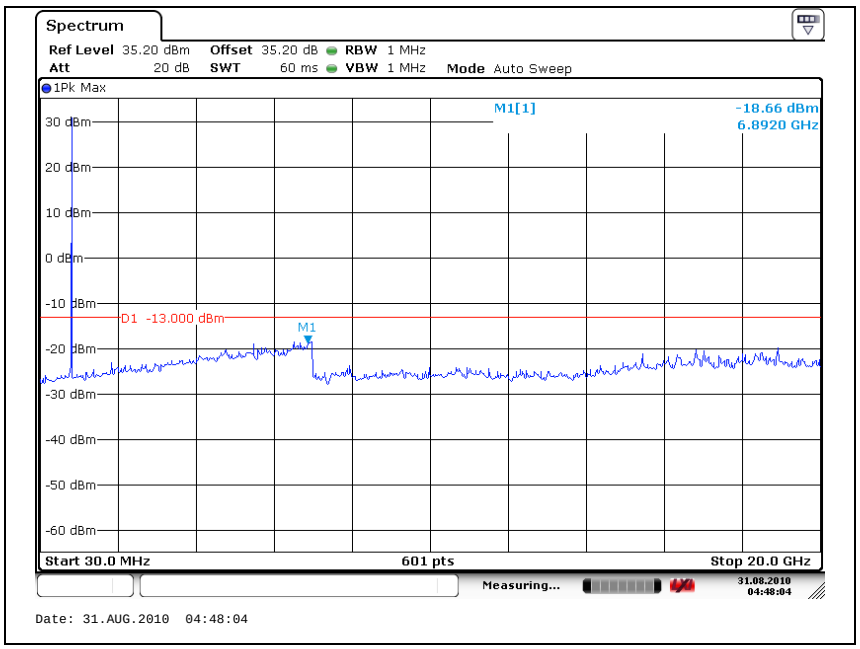
Low Channel



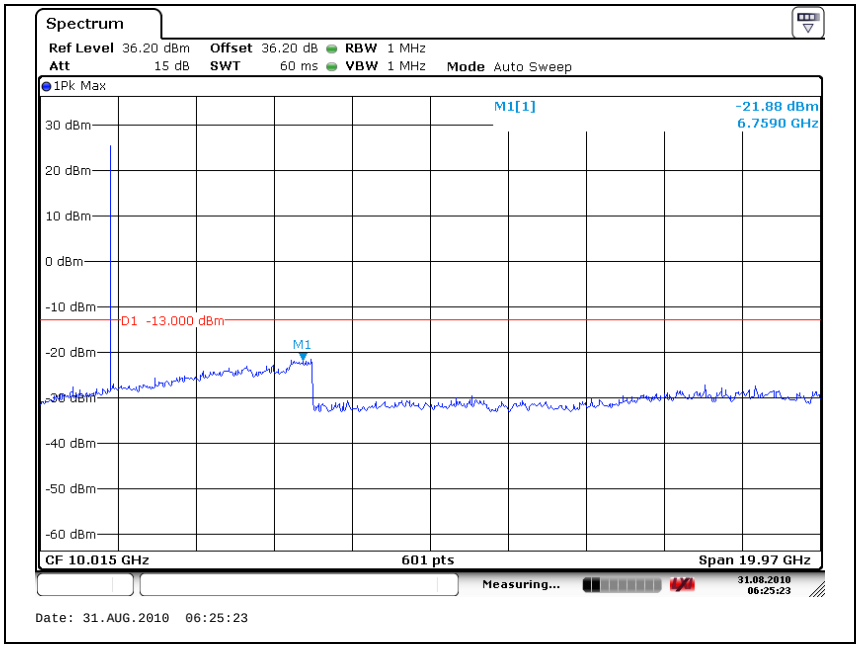
Middle Channel



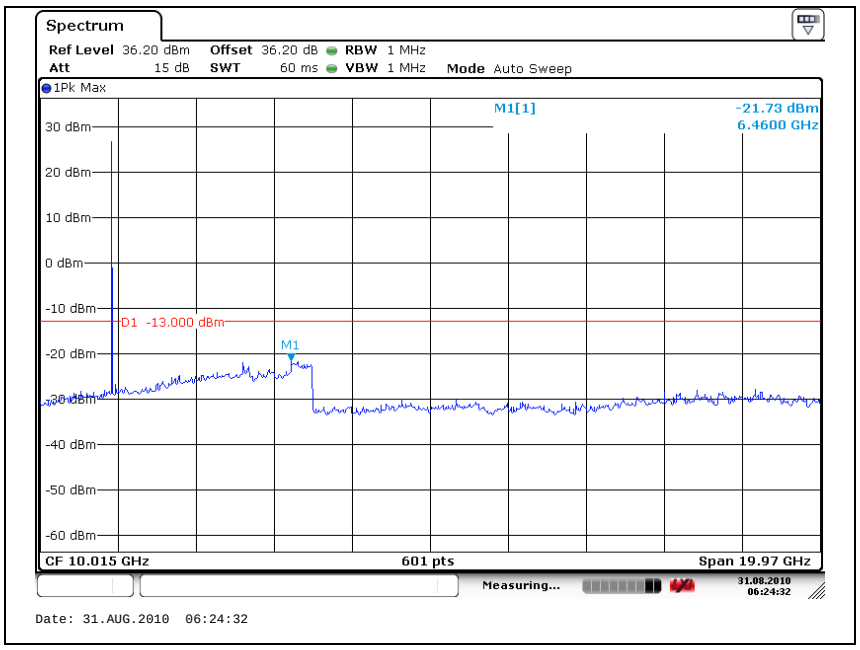
High Channel



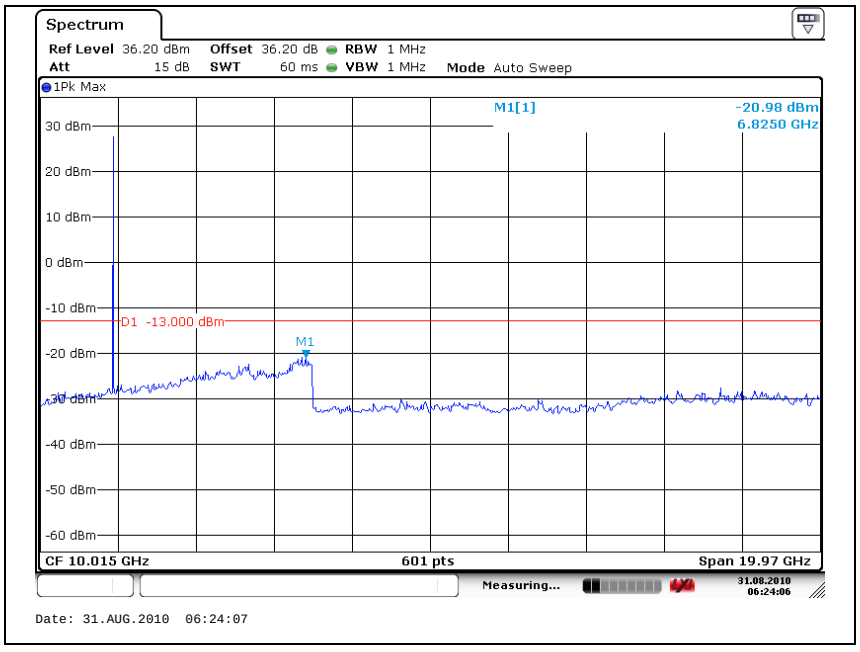
GSM1900
Low Channel



Middle Channel



High Channel



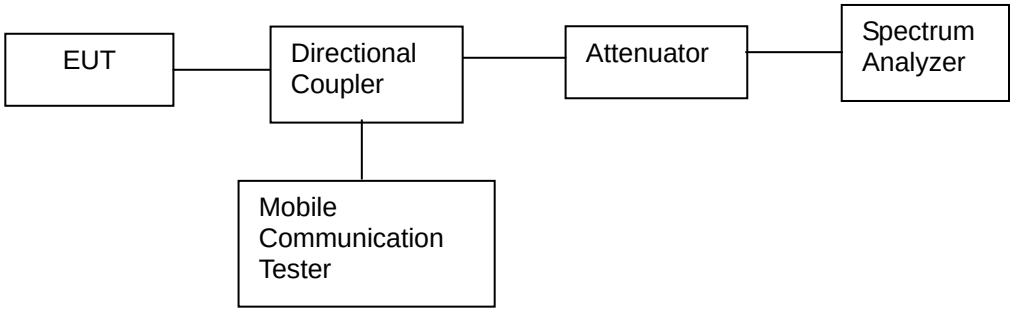
6. Band Edge

6.1. Limit

§ 22.917(e) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least 43+10log(P)dB.

6.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The center of the spectrum analyzer was set to block edge frequency.



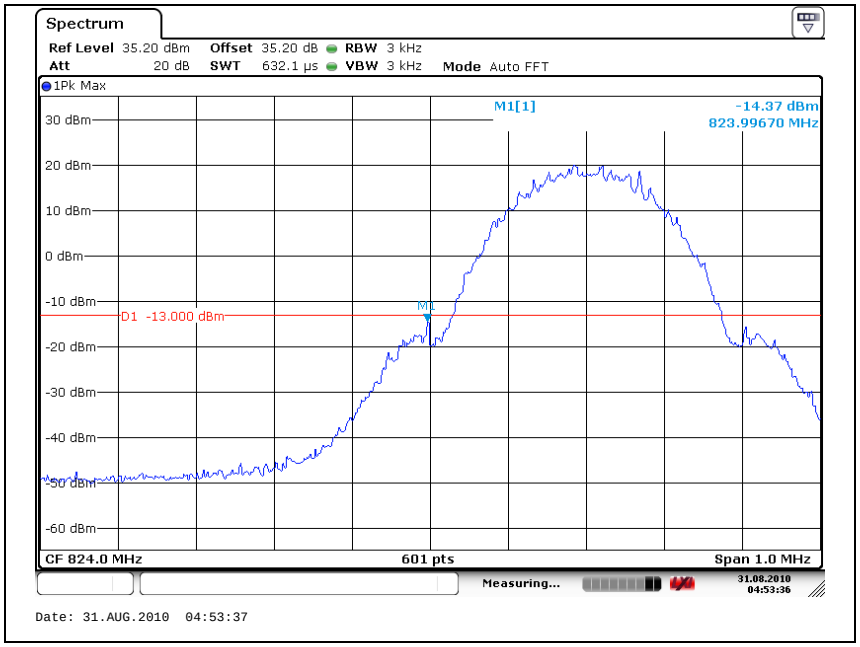
6.3. Test Results

Ambient temperature	:	(23 ± 2) ℃
Relative humidity	:	46 % R.H.

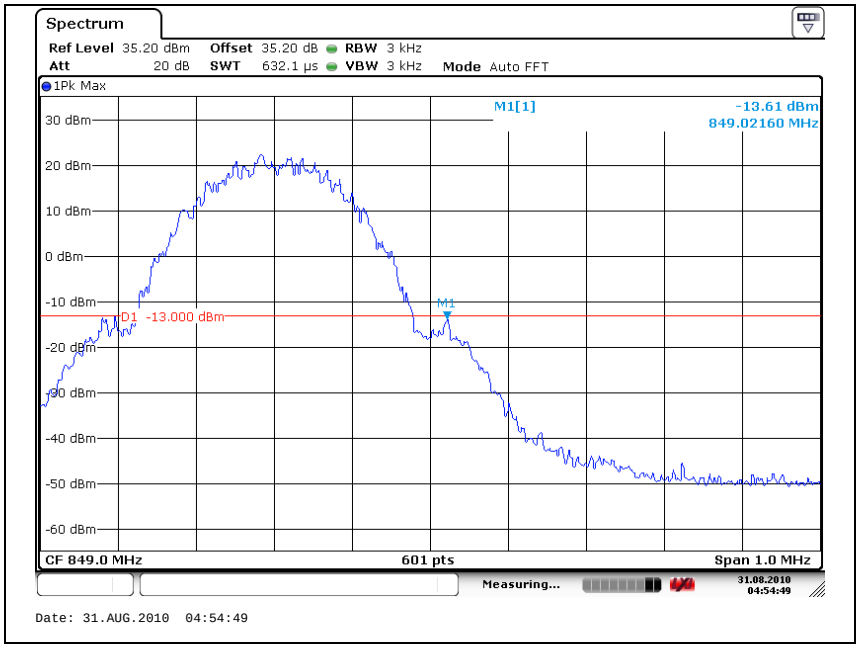
Please refer to the following plots.

GSM850

Low Channel

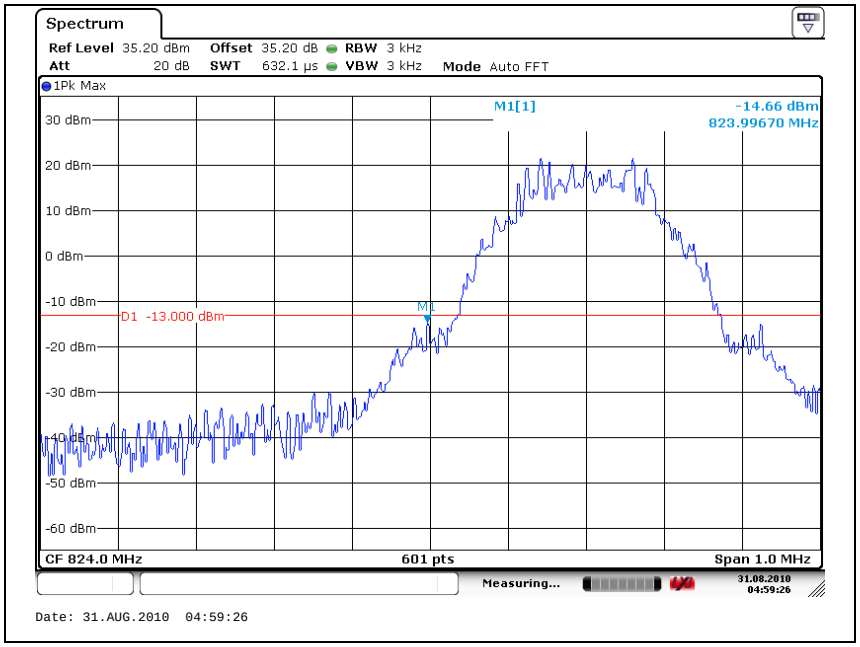


High Channel



GSM850 EDGE

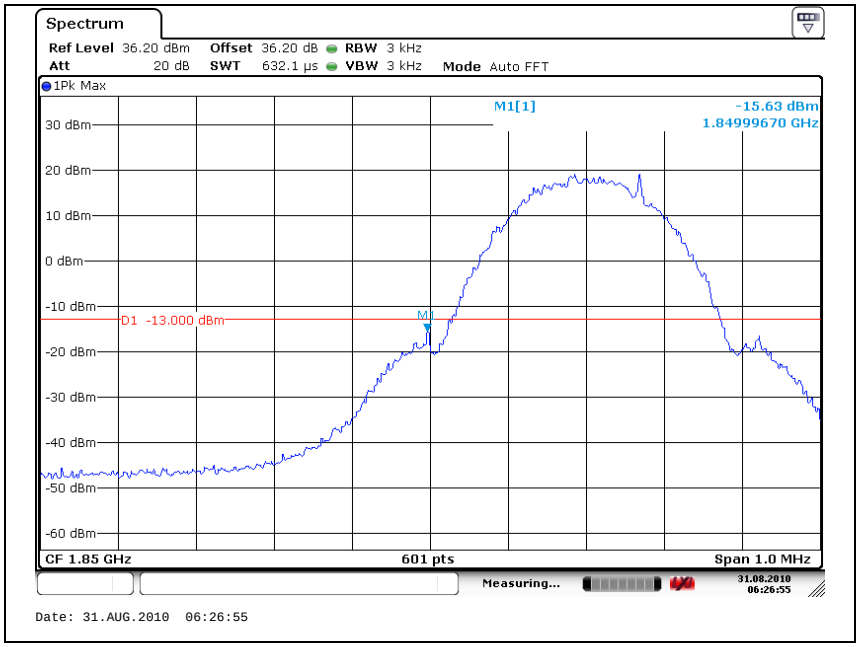
Low Channel



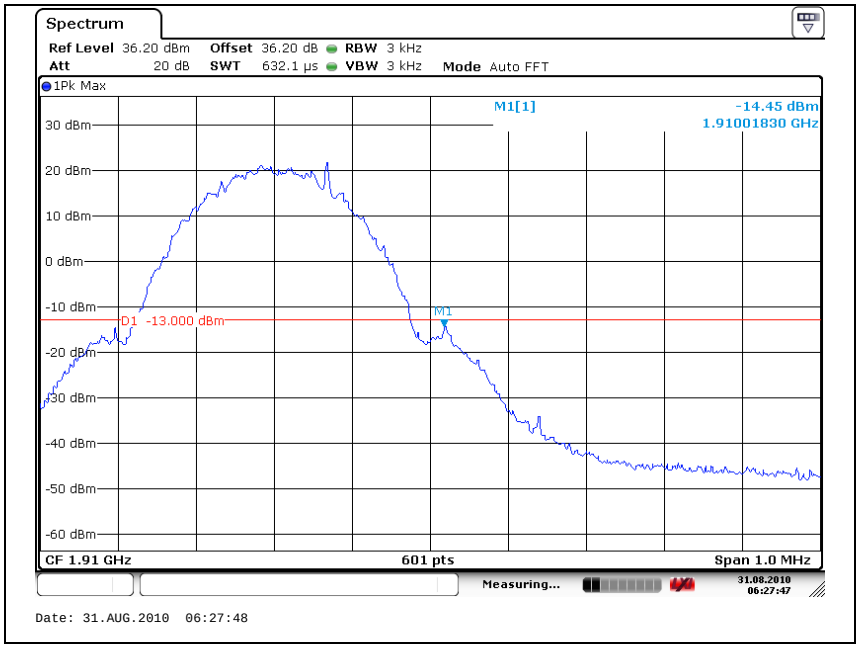
High Channel

GSM1900

Low Channel

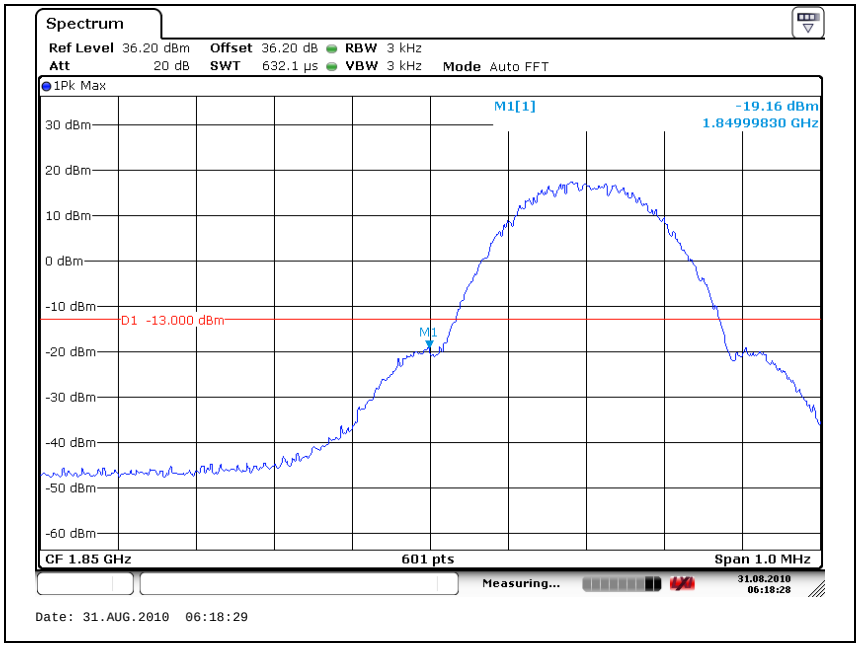


High Channel

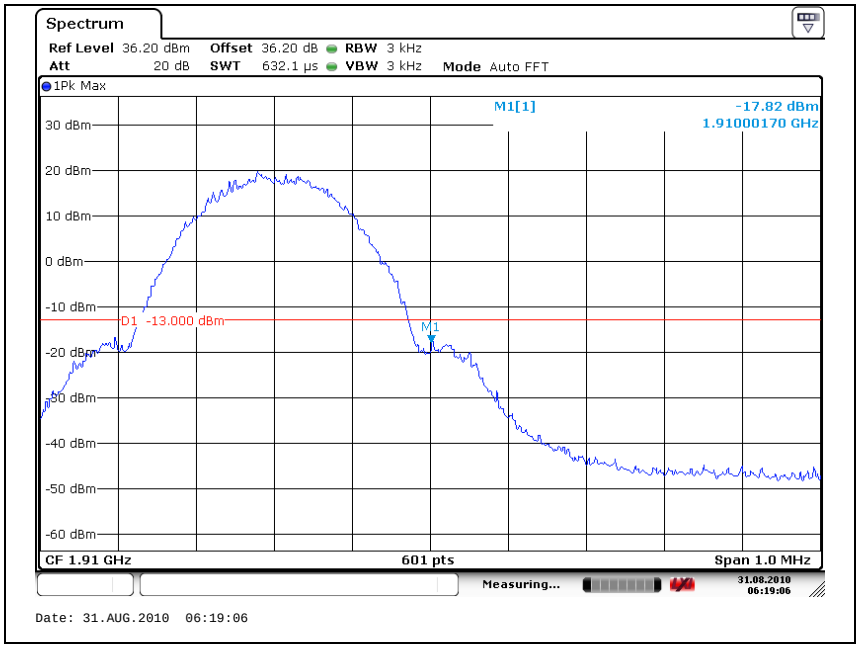


GSM1900 EDGE

Low Channel



High Channel



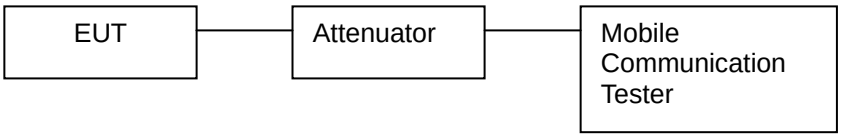
7. Frequency Stability

7.1. Limit

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:
According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.
For Mobile devices operating in the 824 to 849 ㎒ band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.
§24.235 The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

7.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.



7.3. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 46 % R.H.

GSM850 mode at middle channel

Reference Frequency: 836.6 ㎒, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (Vdc)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.7	-88	-0.105
40		-64	-0.076
30		-75	-0.090
23		-83	-0.099
10		-68	-0.082
0		-79	-0.094
-10		-70	-0.083
-20		-63	-0.076
-30		-77	-0.092
Frequency Stability versus power Supply			
Environment Temperature (℃)	**Power Supplied (Vdc)**	**Frequency Measure with Time Elapse**	
		Frequency Error (Hz)	**ppm**
23	4.155	-72	-0.086
	DC 3.25 (batt. End point)	-68	-0.081

GSM1900 mode at middle channel

Reference Frequency: 1 880.0 ㎒, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (Vdc)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.7	-83	-0.044
40		-76	-0.040
30		-89	-0.048
23		-71	-0.038
10		-83	-0.044
0		-71	-0.038
-10		-62	-0.033
-20		-81	-0.043
-30		-64	-0.034
Frequency Stability versus power Supply			
Environment Temperature (℃)	**Power Supplied (Vdc)**	**Frequency Measure with Time Elapse**	
		Frequency Error (Hz)	**Ppm**
23	4.155	-69	-0.037
	3.25 (batt. End point)	-83	-0.044