EMI MEASUREMENT AND TEST REPORT

For

Hangzhou Tuolima Network Technologies Co., Ltd.

608, Zhejiang Enterprise Center, 555 Wensan Road, Hangzhou, China

FCC ID: XYWGSM

Dec.10, 2009

This Report Concerns: Original Report	Equipment Type： GSM Voice Modem
Test Engineer:	Eric Li
Report No.:	BST09113832410R-3
Receive EUT Date/Test Date:	Dec.02,2009/ Dec.02-10,2009
Reviewed By:	Christina
Prepared By:	**Shenzhen BST Technology Co.,Ltd.** 3F,Weames Technology Building, No. 10 Kefa Road,Science Park, Nanshan District,Shenzhen,Guangdong,China Tel: 0755-26747751～3 Fax: 0755-26747751～3 ext.826

TABLE OF CONTENTS

1. GENERAL INFORMATION 3
1.1. Report infor mation 3
1.2. Measurement Uncertainty 3
2. PRODUCT DESCRIPTION 4
2.1. EUT Description 4
2.2. Block Diagram of EUT Configuration 4
2.3. Test Conditions 5
3. FCC ID LABEL 5
4. TEST RESULTS SUMMARY 6
Modifications 6
5. TEST EQUIPMENT USED 7
6. §15.107 CONDUCTED EMISSION TEST 8
6.1. Applicable Standard 8
6.2. Test Procedure 8
6.3. Test Data 9
6.4. Plot(s) of Test Data 10
7. §1.1310 - RF EXPOSURE (MPE) 12
7.1. Applicable Standard 12
7.2. Test Data 12
8. § 2.1046& § 24.232 (C) - RF OUTPUT POWER 14
8.1. Applicable Standard 14
8.2. Test Procedure 14
8.3. Test Data 15
9. MODULATION CHARACTERISTIC 20
10. §2.1049& §24.238 - OCCUPIED BANDWIDTH 21
10.1. Applicable Standards 21
10.2. Test Procedure 21
10.3. Test Data 21
11. §2.1051&§24.238(A) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS 24
11.1. Applicable Standards 24
11.2. Test Procedure 24
11.3. Test Data 24
12. §2.1053§24.238 - SPURIOUS RADIATED EMISSIONS 27
12.1. Applicable Standards 27
12.2. Test Procedure 27
12.3. Test Data 27
13. §2.1055& §24.235 - FREQUENCY STABILITY 29
13.1. Applicable Standard 29
13.2. Test Data 29

1. GENERAL INFORMATION

1.1. Report infor mation

1.1.1.This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that BST approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that BST in any way guarantees the later performance of the product/equipment.

1.1.2.The sample/s mentioned in this report is/are supplied by Applicant, BST therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.

Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through BST, unless the applicant has authorized BST in writing to do so.

Test Facility -
The test site used to collect the radiated data is located on the address of
emitel (Shenzhen) Limited
(FCC Registered Test Site Number: 746887) on
Building 2, 171 Meihua Road,Futian District,Shenzhen, 518049 China
The Test Site is constructed and calibrated to meet the FCC requirements.

1.2. Measurement Uncertainty

Available upon request.

2. PRODUCT DESCRIPTION

2.1. EUT Description

Description : GSM Voice Modem

Applicant : Hangzhou Tuolima Network Technologies Co., Ltd.
608, Zhejiang Enterprise Center, 555 Wensan Road,
Hangzhou, China

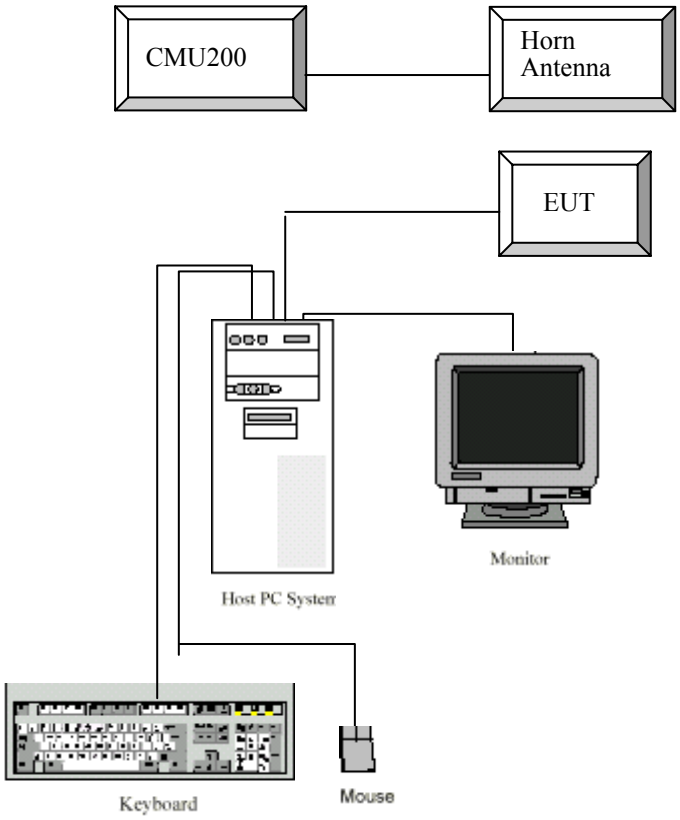
Model Number : GSM Voice Modem

Additonal Information

Frequency : 1850.2MHZ-1909.8MHZ

Power Supply : DC5V(PC)

2.2. Block Diagram of EUT Configuration



2.3. Test Conditions

Temperature: 23~25℃
Relative Humidity: 55~63 %

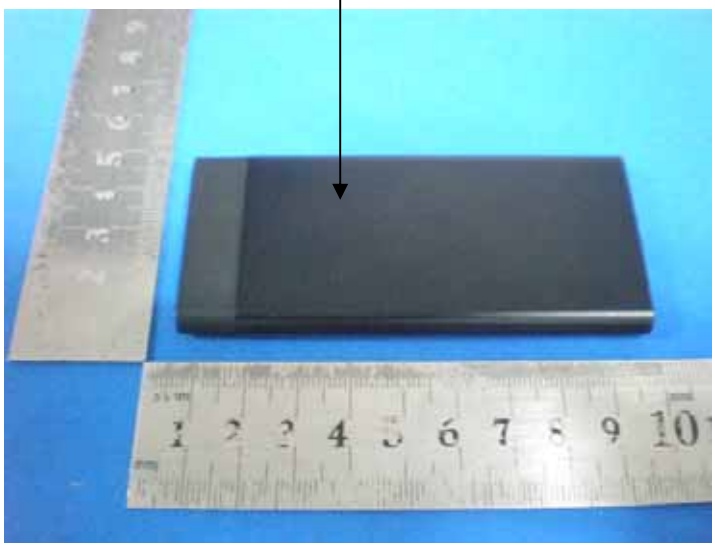
3. FCC ID LABEL

FCC ID: XYWGSM

:

Label Location on EUT

EUT Bottom View/ FCC ID Label Location



4. TEST RESULTS SUMMARY

FCC PART 24E

FCC Rules	Description of Test	Result
§15.107	Conducted Emission	Compliant
§1.1310	RF Exposure (MPE)	Compliant
§2.1046; § 24.232 (c)	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	N/A
§ 2.1049 § 24.238	99% & -26 dB Occupied Bandwidth	Compliant
§ 2.1051, § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliant
§ 2.1053 § 24.238 (a)	Field Strength of Spurious Radiation	Compliant
§ 2.1055 § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant

Modifications

No modification was made.

5. TEST EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Horn Antenna	DRH-118	A052604	2009-09-25	2010-09-25
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2009-03-11	2010-03-11
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2009-05-09	2010-05-09
HP	Preamplifier	8449B	3008A00277	2009-09-29	2010-09-29
HP	Signal Generator	HP8657A	2849U00982	2009-10-16	2010-10-16
HP	Amplifier	HP8447D	2944A09795	2009-11-15	2010-11-15
Giga-tronics	Signal Generator	1026	270801	2009-09-29	2010-09-29
COM POWER	Dipole Antenna	AD-100	041000	2009-09-25	2010-09-25
A.H. System	Horn Antenna	SAS-200/571	135	2009-05-17	2010-05-17
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	1100.0008.02	2009-06-21	2010-06-21
Rohde & Schwarz	EMI Test Receiver	ESCI	100224	2009-10-16	2010-10-16
WUHUAN	Temperature & Humidity Chamber	HTP205	20021115	2008-12-28	2009-12-28

6. §15.107 CONDUCTED EMISSION TEST

6.1. Applicable Standard

According to FCC §15.107, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the
following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV), Class B digital device	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

6.2. Test Procedure

a. The EUT was placed on a 0.8m high insulating table and kept 0.4 meters from the conducting
wall of shielded room.
b. The EUT was connected to the power mains through a line impedance stabilization network (LISN). The LISN provide 50Ω/50μH of coupling impedance for the measuring instrument.
c. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
d. The frequency range from 150 kHz to 30 MHz was searched using CISPR Quasi-Peak and Average detector.

6.3. Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56%
ATM Pressure:	100.0kPa

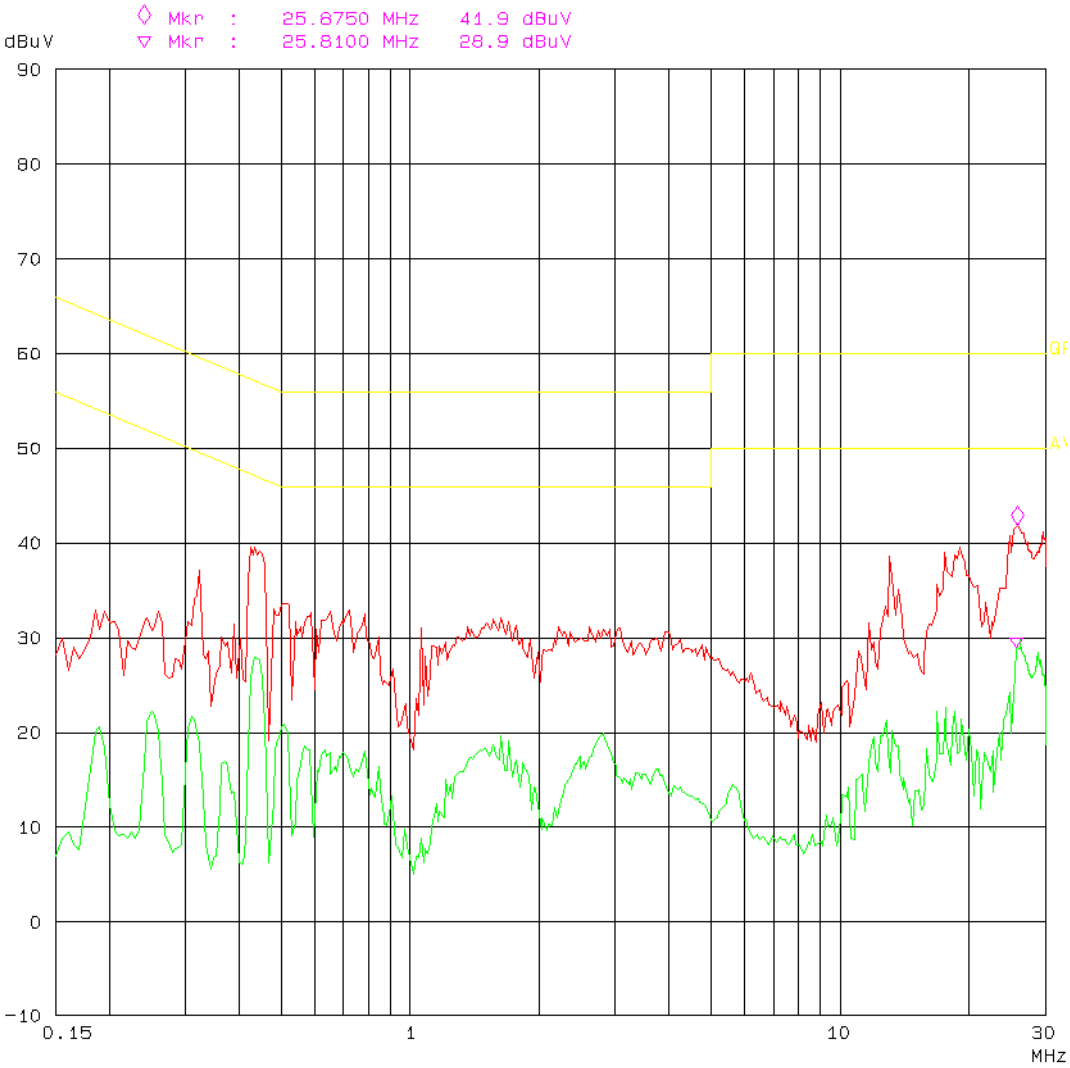
Test Mode: Operating

Line Conducted Emissions				FCC PART 15	
Frequency (MHz)	**Amplitude (dBμV)**	**Detector (QP/AV)**	**Conductor (Line/Neutral)**	**Limit (dBμV)**	**Margin (dB)**
26.235	52.10	QP	Neutral	60.00	7.90
0.435	40.30	QP	Neutral	57.20	16.90
0.435	39.60	QP	Line	57.20	17.60
25.875	41.90	QP	Line	60.00	18.10
0.435	28.00	AV	Line	47.20	19.20
0.435	27.50	AV	Neutral	47.20	19.70
3.720	36.20	QP	Neutral	56.00	19.80
13.145	39.90	QP	Neutral	60.00	20.10
25.810	28.90	AV	Line	50.00	21.10
26.235	28.80	AV	Neutral	50.00	21.20
13.085	38.60	QP	Line	60.00	21.40
0.305	38.10	QP	Neutral	60.10	22.00
0.720	33.90	QP	Neutral	56.00	22.10
0.325	37.10	QP	Line	59.60	22.50
0.645	32.40	QP	Line	56.00	23.60
2.810	30.90	QP	Line	56.00	25.10
2.815	19.90	AV	Line	46.00	26.10
3.725	19.30	AV	Neutral	46.00	26.70
0.650	17.80	AV	Line	46.00	28.20
0.305	21.10	AV	Neutral	50.10	29.00
0.720	15.50	AV	Neutral	46.00	30.50
13.145	19.50	AV	Neutral	50.00	30.50
0.325	18.80	AV	Line	49.60	30.80
13.145	15.60	AV	Line	50.00	34.40

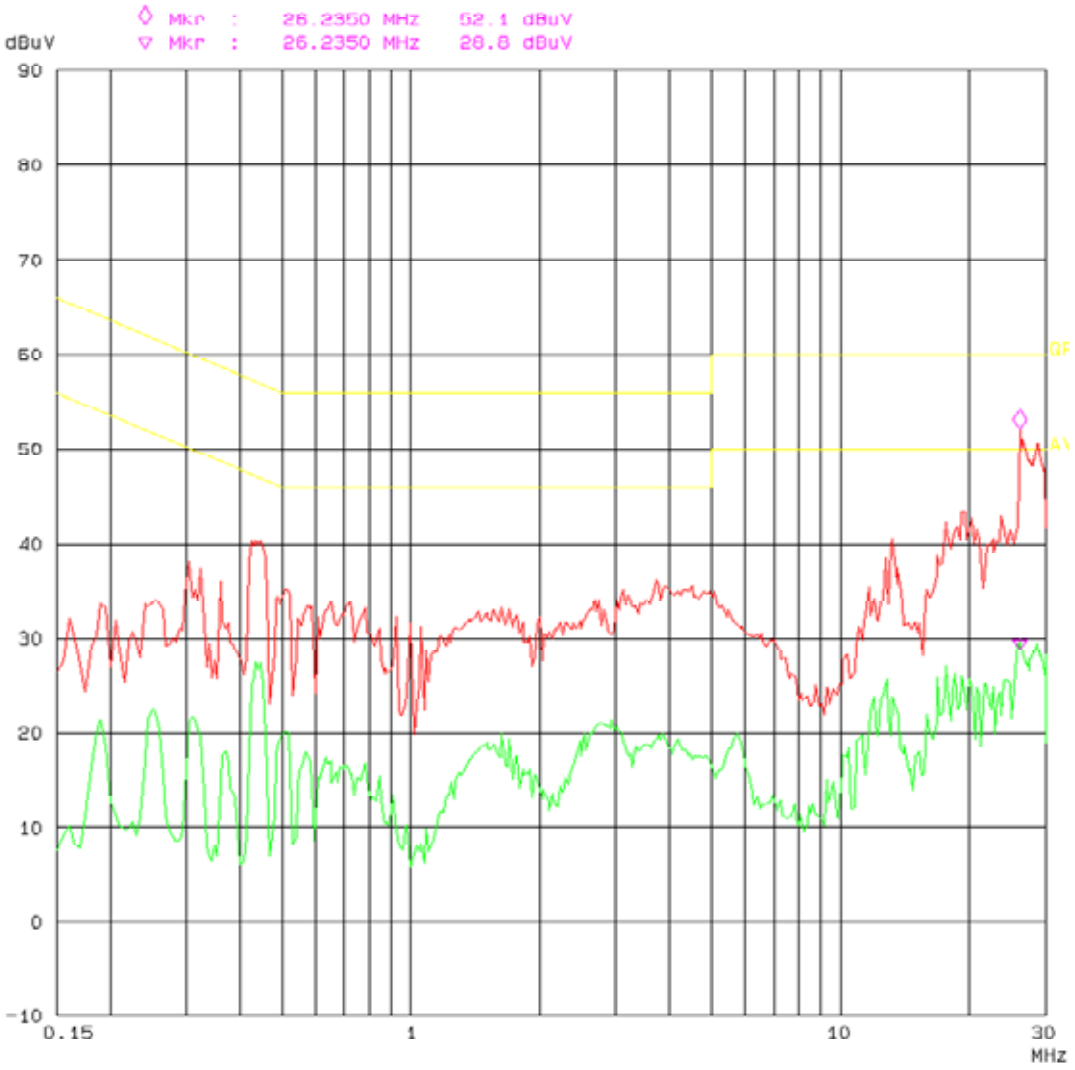
6.4. Plot(s) of Test Data

Plot(s) of Test Data is presented hereinafter as reference.

Line:



Neutral:



7. §1.1310 - RF EXPOSURE (MPE)

7.1. Applicable Standard

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Radio frequency radiation exposure was calculated based on § 1.1310 limits.

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Polulation/Uncontrolled Exposures				
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	842/f	2.19/f	*(180/ f^2)	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	/	/	f/1500	30
1500 - 100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

7.2. Test Data

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$

S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)
The maximum antenna gain is -3.0dBi

Maximum peak output power at antenna input terminal: 28.44(dBm)
Maximum peak output power at antenna input terminal: 698 (mW)
Prediction distance:20(cm)
Predication frequency: 1909.8 (MHz)
Antenna Gain (typical): -3 (dBi)
Antenna Gain (typical): 0.5(numeric)

The worst case is power density at predication frequency at 20 cm: 0.0695(mW/cm^2)

MPE limit for general polulation/uncontrolled exposure at prediction frequency: 1.0 (mW/cm^2)

Result: This MPE level is below the MPE Limit at 20 cm distance for General Population / Uncontrolled Exposure as stated in OET 65-C.The precautions are outlined in the User's Manual to prevent exposure to high levels of RF energy.

8. § 2.1046& § 24.232 (C) - RF OUTPUT POWER

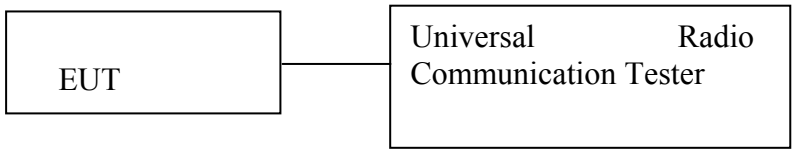
8.1. Applicable Standard

According to FCC §2.1046 and §24.232 (C), in no case may the peak output power of a base station transmitter exceed 2 watt EIRP.

8.2. Test Procedure

Conducted method:

The RF output of the transmitter was connected to the wireless test set and the spectrum analyzer through sufficient attenuation.



Radiated method:

TIA 603-C section 2.2.17

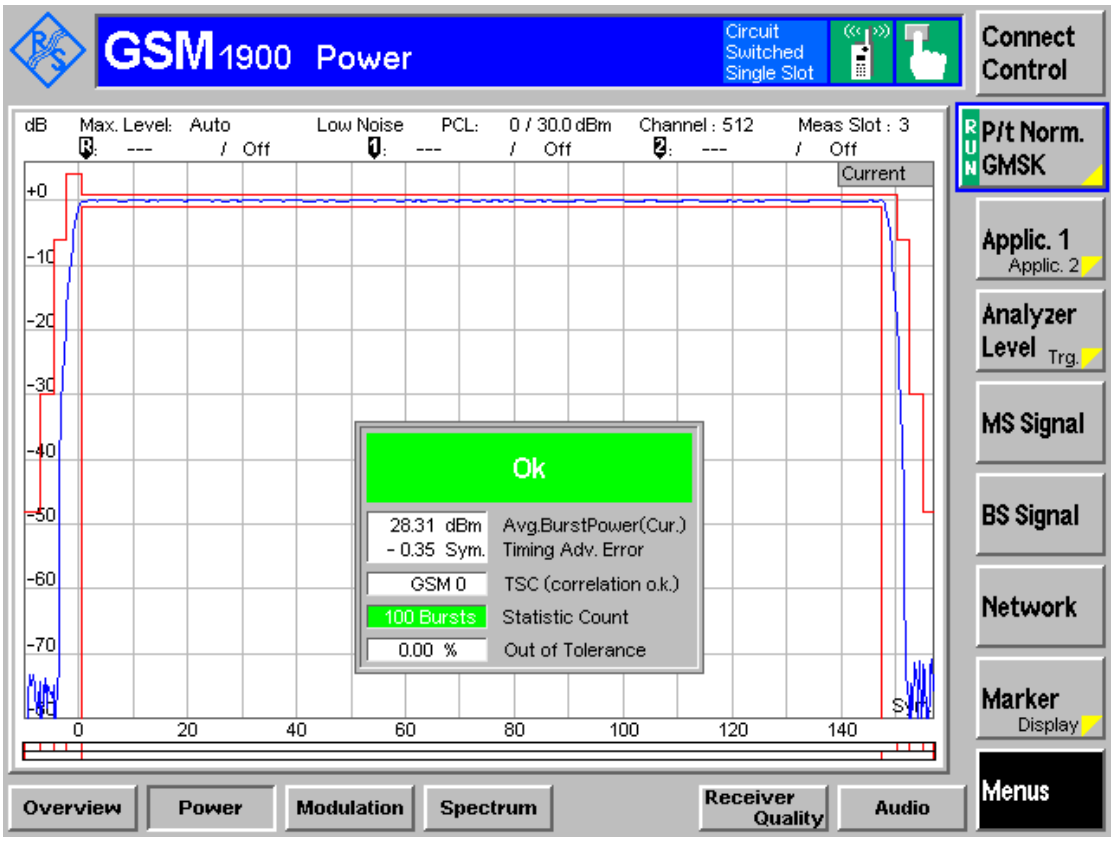
8.3. Test Data

Environmental Conditions

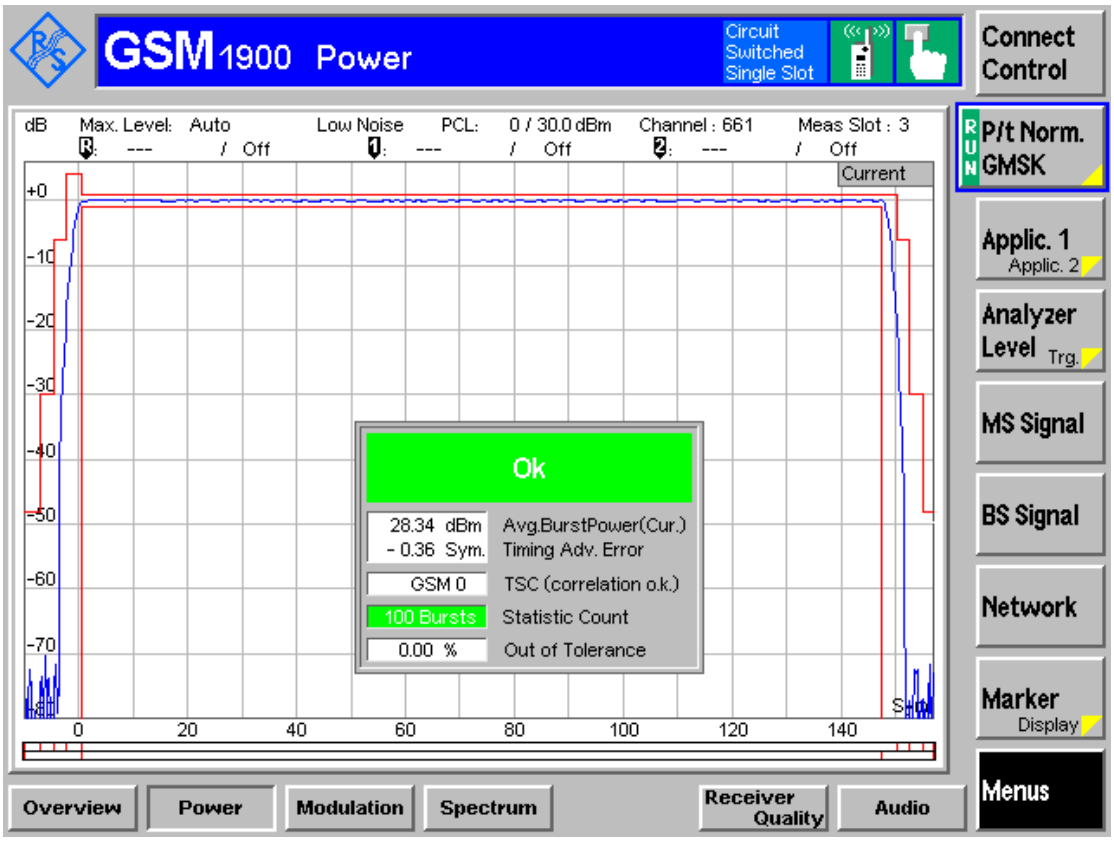
Temperature:	25 ° C
Relative Humidity:	56%
ATM Pressure:	100.0kPa

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	1850.2	28.31	0.678	33
Middle	1880.0	28.34	0.682	33
High	1909.8	28.44	0.698	33

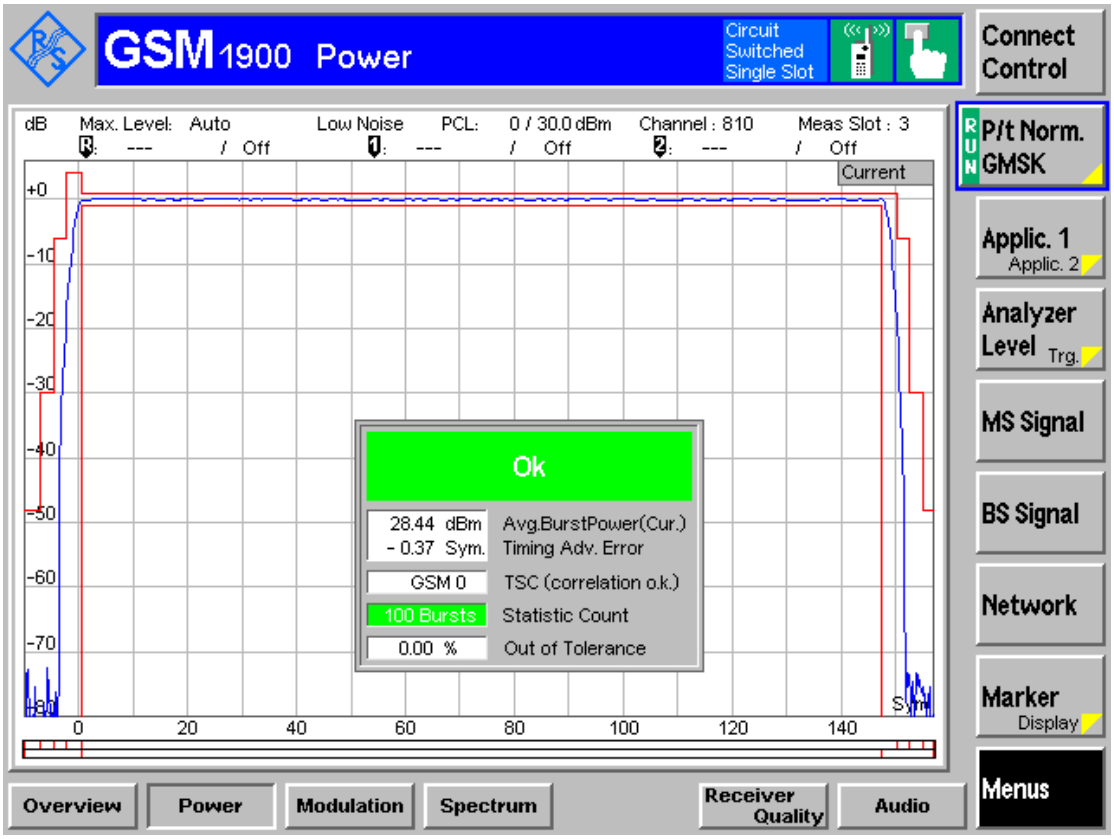
Low Channel



Middle Channel


GSM 1900 Power
Circuit Switched Single Slot
Connect Control
dB
Max. Level: Auto
Low Noise
PCL: 0 / 30.0 dBm
Channel : 661
Meas Slot : 3
Current
+0
-10
-20
-30
-40
-50
-60
-70
0
20
40
60
80
100
120
140
Ok
28.34 dBm
Avg.BurstPower(Cur.)
- 0.36 Sym.
Timing Adv. Error
GSM 0
TSC (correlation o.k.)
100 Bursts
Statistic Count
0.00 %
Out of Tolerance
RUN P/t Norm. GMSK
Applic. 1
Applic. 2
Analyzer Level Trg.
MS Signal
BS Signal
Network
Marker Display
Menus
Overview
Power
Modulation
Spectrum
Receiver Quality
Audio

High Channel



E.I.R.P

Indicated		Table	Test Antenna		Substituted			Antenna Gain Correction	Cable Loss dB	Absolute Level	Limit (dBm)
Frequency MHz	Ampl dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V			dBm	
Frequency in Low Channel											
1850.2	87.95	19	1.6	H	1850.2	19.67	H	6.2	1.02	24.85	33
1850.2	88.41	84	2.0	V	1850.2	20.01	V	6.2	1.02	25.19	33
Frequency in Middle Channel											
1880	87.74	42	1.8	H	1880	19.62	H	6.2	1.03	24.79	33
1880	89.29	321	2.0	V	1880	21.35	V	6.2	1.03	26.52	33
Frequency in High Channel											
1909.8	82.84	69	1.9	H	1909.8	17.78	H	6.2	1.03	22.95	33
1909.8	86.63	271	1.2	V	1909.8	19.32	V	6.2	1.03	24.49	33

9. MODULATION CHARACTERISTIC

According to FCC § 2.1047(d), 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

10. §2.1049& §24.238 - OCCUPIED BANDWIDTH

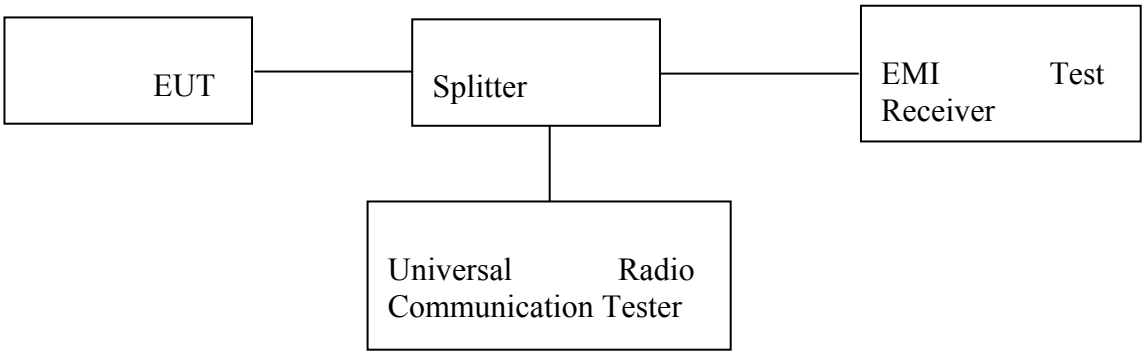
10.1.Applicable Standards

CFR 47 §2.1049, §24.238.

10.2.Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 30 kHz (Cellular /PCS) and the 26 dB & 99% bandwidth was recorded.



10.3.Test Data

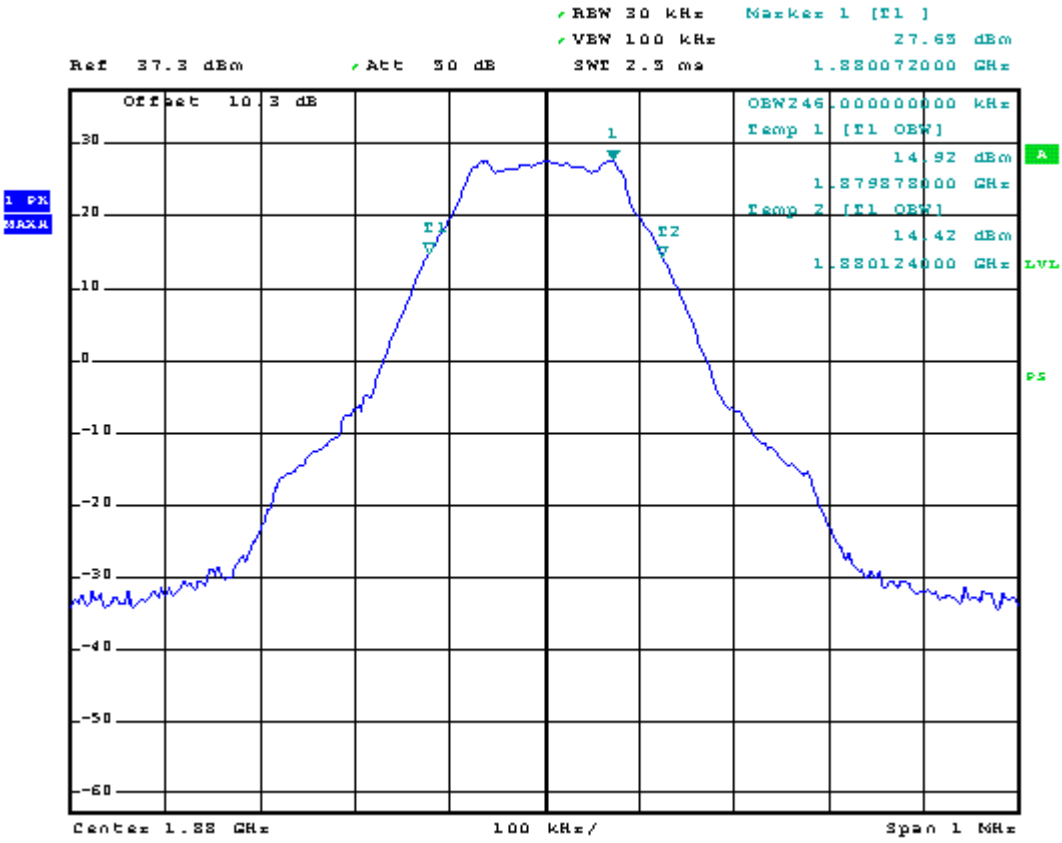
10.3.1.Environmental Conditions

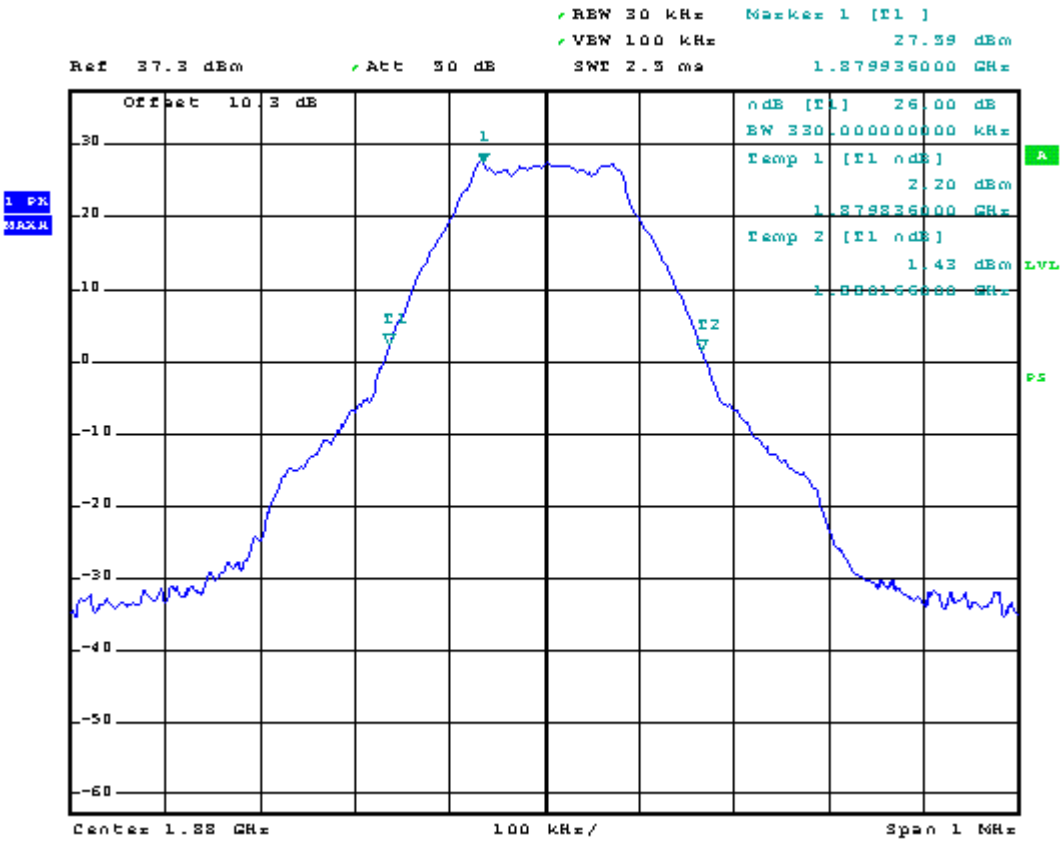
Temperature:	**25 ° C**
Relative Humidity:	**56%**
ATM Pressure:	**100.0kPa**

Occupied Bandwidth For PCS band(part 24E)
GMSK modulation:

Channel	Channel frequency(MHz))	99% Power Bandwidth (kHz)	26dB Bandwidth (kHz)
Channel 661	1880.0	246.0	330.0

Please refer to the following plots.




RBW 30 kHz
VBW 100 kHz
SWT 2.5 ms
Marker 1 [T1]
27.59 dBm
1.879936000 GHz
Ref 37.3 dBm
Att 50 dB
Offset 10.3 dB
nDB [T1] 26.00 dB
BW 330.000000000 kHz
Temp 1 [T1 nDB]
2.20 dBm
1.879836000 GHz
Temp 2 [T1 nDB]
1.43 dBm
1.880166000 GHz
1 PK
MAXH
A
LVL
PS
30
20
10
0
-10
-20
-30
-40
-50
-60
Center 1.88 GHz
100 kHz/
Span 1 MHz

11. §2.1051&§24.238(A) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

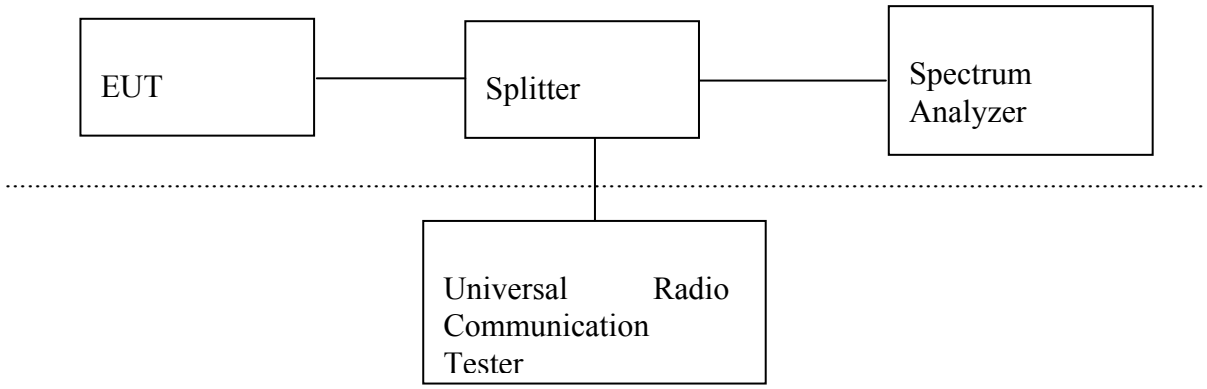
11.1.Applicable Standards

CFR 47 §2.1051and §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

11.2.Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.



11.3.Test Data

11.3.1.

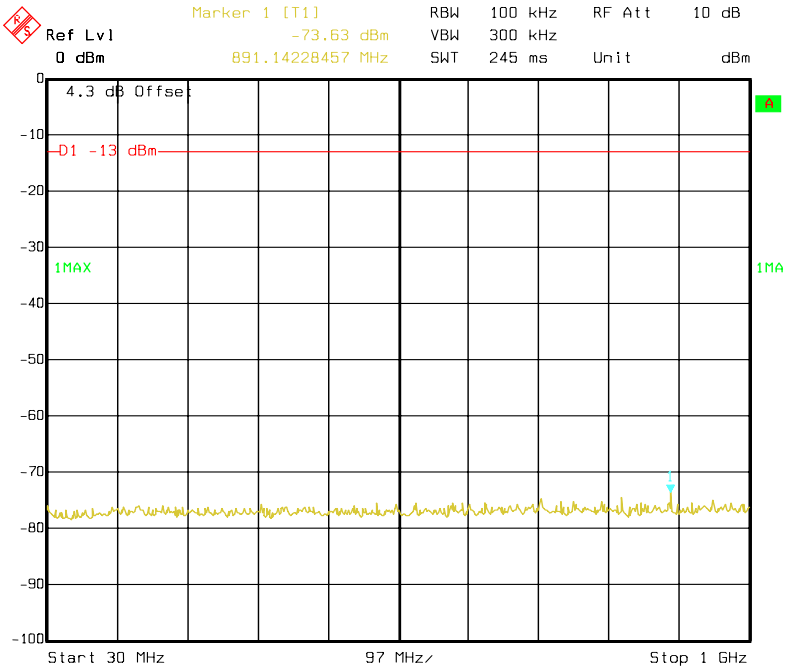
11.3.2.Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56%
ATM Pressure:	100.0kPa

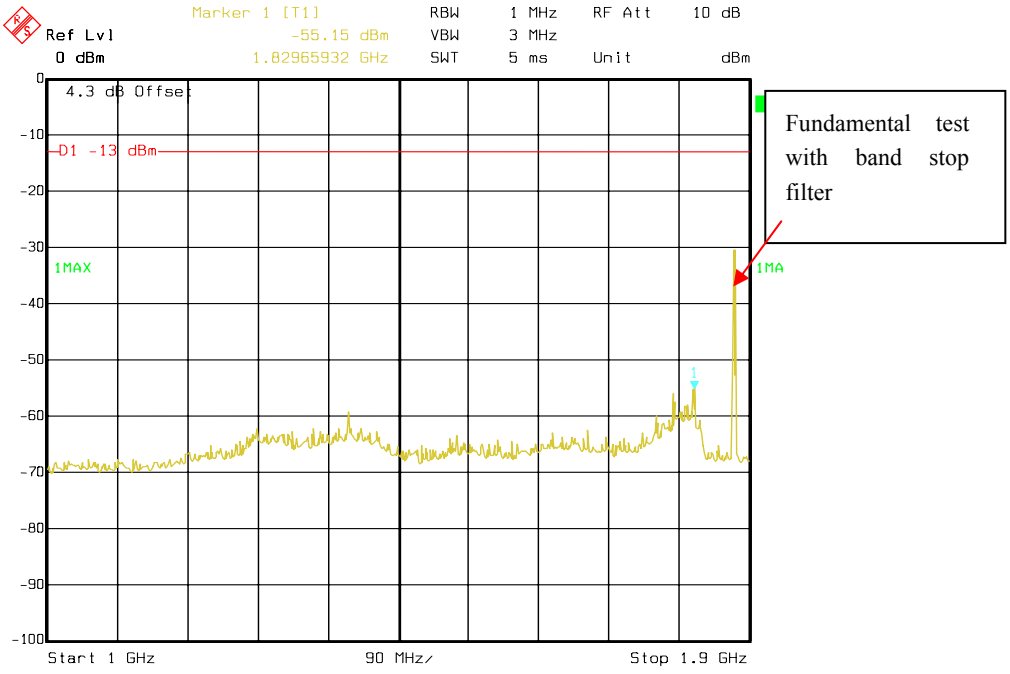
Please refer to the hereinafter plots.

For GSM 1900:

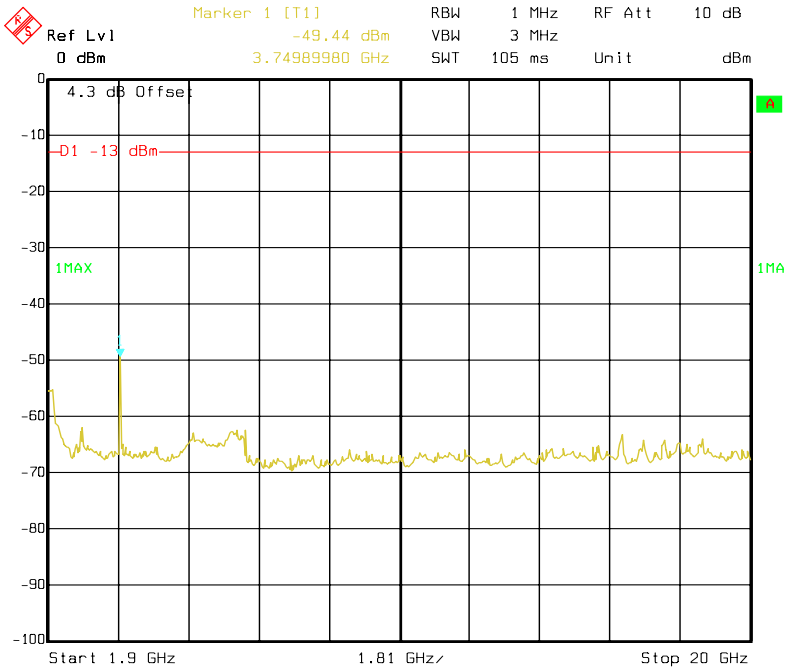
30MHz-1000MHz - Middle Channel



1GHz-1.9GHz - Middle Channel



1.9GHz-20GHz - Middle Channel



12. §2.1053§24.238 - SPURIOUS RADIATED EMISSIONS

12.1.Applicable Standards

CFR 47 § 2.1053and § 24.238.

12.2.Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

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 lg (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

12.3.Test Data

12.3.1.

12.3.2.Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56%
ATM Pressure:	100.0kPa

~~GSM 1900 (Below 1 G)~~
Middle Channel

Test mode: Transmitting

Indicated		Table	Test Antenna		Substituted			Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	Amp. (dBuV)	Angle Degree	Height (M)	Polar H/V	Frequency (MHz)	Level (dBm)	Antenna Gain Correction				
705.52	45.14	0	1.2	V	705.52	-53.67	0	0.70	-54.37	-13	41.37
763.40	47.35	102	1.3	V	763.40	-51.23	0	0.76	-51.99	-13	38.99
709.25	42.32	158	1.8	H	709.25	-56.78	0	0.70	-57.48	-13	44.48
765.32	43.10	77	1.6	H	765.32	-55.47	0	0.76	-56.23	-13	43.23

GSM1900 (Above 1 G)
Middle Channel
Test mode: Transmitting

Indicated		Table	Test Antenna		Substituted			Cable Loss dB	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	Amp. (dBu)V	Angle Degree	Height (M)	Polar H/V	Frequency (MHz)	Level (dBm)	Antenna Gain Correction				
3760	60.10	231	2.0	H	3760	-44.21	6.9	1.47	-38.78	-13	25.78
3760	57.551	205	2.0	V	3760	-46.52	6.9	1.47	-41.09	-13	28.09
5640	44.56	261	1.8	H	5640	-57.34	8.3	1.76	-50.8	-13	37.8
5640	46.43	213	1.9	V	5640	-56.09	8.3	1.76	-49.55	-13	36.55
7520	45.32	164	2.2	H	7520	-55.12	7.6	2.09	-49.61	-13	36.61
7520	44.16	0	1.4	V	7520	-56.23	7.6	2.09	-50.72	-13	37.72

13. §2.1055& §24.235 - FREQUENCY STABILITY

13.1.Applicable Standard

CFR47 § 2.1055 (a), § 2.1055 (d)§24.235

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

13.2.Test Data

13.2.1.

13.2.2.Environmental Conditions

Temperature:	**25 ° C**
Relative Humidity:	**56%**
ATM Pressure:	**100.0kPa**

Middle channel				
f_o =1880.0MHz;				
Temperature (°C)	Power Supplied (V)	Frequency Error (Hz)	Error(ppm)	Limit (ppm)
-30	5	-30	-0.016	2.5
	4.5	-33	-0.0176	2.5
-20	5	-17	-0.009	2.5
	4.5	-20	-0.0106	2.5
-10	5	-20	-0.0106	2.5
	4.5	-17	-0.009	2.5
0	5	-18	-0.0096	2.5
	4.5	-16	-0.0085	2.5
10	5	-17	-0.009	2.5
	4.5	-15	-0.008	2.5
20	5	-18	-0.0096	2.5
	4.5	-17	-0.009	2.5
30	5	-17	-0.009	2.5
	4.5	-16	-0.0085	2.5
40	5	-17	-0.009	2.5
	4.5	-16	-0.0085	2.5
55	5	-18	-0.0096	2.5
	4.5	-19	-0.0101	2.5