TEST REPORT

Number 14-027074-01

According to

FCC CFR 47 Part 2, Part 22(H), Part 24(E)

For

Applicant	**Suntech International Ltd.**
Manufacturer	**Suntech International Ltd.**
Model or Type	**ST940** **GSM Mobile Equipment (asset tracker)**
Final H/W Version	**ST940 Rev05**
Final S/W Version	**ST940 Rev001**

Issue To: **Suntech International Ltd** **B-1506, Greatvally, 32, 9-Gil, Digital-Ro,** **Geumcheon-Gu, Seoul, KOREA**	**Date of Application**	**2014-07-15**
	Date of Report	**2014-10-27**
	Date of Issue	**2014-10-27**

This Test Report consists of 27 pages

Korea Testing Laboratory

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1. GENERAL INFORMATIONS

1.1. Applicant (Client)

Name	Suntech International Ltd.
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Facsimile No.	+82-2-2027-5654
E-mail address	yhkim@suntechint.com
Manufacturer Name	Suntech International Ltd.
Manufacturer Address	room 605, IT mirea Tower, 9 Gil 33, Digital-Ro Geumcheon-Gu, Seoul, Korea

1.2. Equipment (EUT)

Type of equipment	Quad band GSM/GPRS Personal/Asset Tracker
Model Name	ST940
FCC ID	WA2ST940
FCC Classification	PCS Licensed Transmitter (PCB)
Tx frequency Band	(824.2 ~ 848.8) MHz (GSM850) (1 850.2 ~ 1 909.8) MHz (GSM1900)
Rx frequency Band	(869.2 ~ 893.8) MHz (GSM850) (1 930.2 ~ 1 989.8) MHz (GSM1900)
Max. Power Rating	31.55 dBm (GSM850) / 28.84 dBm (GSM1900)
MODE	GSM / GPRS
Antenna Type	Intenna
Power class	Class 4 for GSM850, Class 1 for GSM1900
Class of GPRS	12
Hardware Version	ST940 Rev05
Software Version	ST940 Rev001

1.3. Testing Laboratory

Testing Place	Korea Testing Labortory (KTL) 1271-12, Sa-Dong Sangnok-Gu, Ansan-si Gyunggi-Do , Korea
FCC registration number	408324
Industry Canada filing number	6298
Test Engineer	Jea-Jun, Park
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E-mail address	jjpark@ktl.re.kr
Other Comments	-

1.4. Description of test mode

Band	Mode		Frequency (MHz)	Average Output Power (dBm)
GSM 850	GSM	-	**824.2**	**31.46**
			836.6	**31.55**
			848.8	**31.52**
	GPRS	1 Tx Slot	824.2	31.58
			836.6	31.48
			848.8	31.51
		2 Tx Slot	824.2	30.96
			836.6	30.87
			848.8	30.90
		3 Tx Slot	824.2	29.24
			836.6	29.15
			848.8	29.18
		4 Tx Slot	824.2	28.14
			836.6	28.07
			848.8	28.06

* We found out the test mode with the highest power level after we analyze all the data rates. So we chose worst case as a representative of GSM 850 band.

Band	Mode		Frequency (MHz)	Average Output Power (dBm)
GSM 1900	GSM	-	1850.2	28.54
			1880.0	28.59
			1909.8	28.76
	GPRS	**1 Tx Slot**	**1850.2**	**28.57**
			1880.0	**28.64**
			1909.8	**28.84**
		2 Tx Slot	1850.2	27.56
			1880.0	27.64
			1909.8	27.81
		3 Tx Slot	1850.2	25.44
			1880.0	25.54
			1909.8	25.72
		4 Tx Slot	1850.2	24.35
			1880.0	24.47
			1909.8	24.66

* We found out the test mode with the highest power level after we analyze all the data rates. So we chose worst case as a representative of GSM 1900 band.

2. SUMMARY OF TEST RESULTS

Testing performed for : Suntech International Ltd.

Equipment Under Test : ST940

Receipt of Test Sample : 2014. 07. 16.

Test Start Date : 2014. 07. 30.

Test End Date : 2014. 09. 15.

The following table represents the list of measurements required under the FCC CFR47 Part 22H and 24E.

FCC Rules	Test Requirements	Result
22.913(a), 24.232(c)	Conducted RF power output	Pass
22.913(a), 24.232(c)	ERP & EIRP	Pass
22.917, 24.238	Radiated Spurious Emission	Pass
2.1049	Occupied bandwidth	Pass
22.917, 24.238	Conducted Spurious Emission	Pass
22.355, 24.235	Frequency Stability	Pass

Note 1 : Test results reported in this document relate only to the items tested
Note 2 : The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria
Note 3 : Test results apply only to the item(s) tested

*** Modifications required for compliance**
No modifications were implemented by KTL.
All results in this report pertain to the un-modified sample provided to KTL.

3. Measurement & Results

3.1. Conducted Output Power

3.1.1. Test Procedure

A base station simulator (CMU200) was used to establish communication with the EUT. The base station simulator parameters were set to produce the maximum power from the EUT. Conducted Output Powers of EUT are reported below.

3.1.2. Test Results

Mode		Frequency (MHz)	Average Output Power (dBm)
GSM 850	-	824.2	31.46
		836.6	31.55
		848.8	31.52

Mode		Frequency (MHz)	Average Output Power (dBm)
GSM 1900	-	1850.2	28.57
		1880.0	28.64
		1909.8	28.84

3.2. Effective Radiated Power

3.2.1. Test Procedure

The radiated and spurious measurements were made Fully-anechoic chamber at a 3-meter test range. The EUT was placed on the rotating device at 1.5m and at a distance of 3-meters from the receive antenna. The rotating device which can rotate horizontal axis was mounted on the turn unit to facilitate rotation around a vertical axis. The measurement was made for each horizontal/vertical position combination with receive antenna horizontally polarized. This measurement was repeated with receive antenna vertically polarized. The substitution antenna will replace the EUT antenna it the same position and in vertical polarization. The frequency of the signal generator shall be set to the frequencies that were measured on the EUT. The signal generator, output level, shall be adjusted until an equal or a known related level to what was measured from the EUT is obtained in the spectrum analyzer. This level was recorded. For readings above 1 GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

All modes of operation were investigated, and the worst-case results are reported.

3.2.2. Limit

FCC 22.913(b) : The Effective Radiated Power (ERP) of mobile transmitters must not exceed 7 Watts.
FCC 24.232(b) : The equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

3.2.3. Test Result

• GSM 850 Test Data

Frequency(MHz)	Substitute Level [dBm]	Substitute Antenna Gain [dBd]	Polarization [H/V]	ERP [dBm]
824.2	24.40	1.10	H	25.50
836.6	25.08	1.32	H	26.40
848.8	26.44	1.50	H	27.94

• GSM 1900 Test Data

Frequency(MHz)	Substitute Level [dBm]	Substitute Antenna Gain [dBd]	Polarization [H/V]	EIRP [dBm]
1850.2	19.15	9.42	H	28.57
1880.0	17.51	9.53	H	27.04
1909.8	17.94	9.26	H	27.20

3.3. Field Strength of Spurious Radiation

3.3.1. Test Results (GSM850 test data)

Operating Frequency : 824.2 MHz
Measured Output Power : 25.50 dBm = 0.355 W
Limit : 43 + 10 $\log_{10}$(0.355 W) = 38.50 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
1 648.1	-47.86	8.51	-39.35	H	67.45
2 472.4	-52.18	10.35	-41.83	H	69.93
3 296.3	-54.64	11.77	-42.87	V	70.97
4 120.5	-49.59	12.51	-37.08	H	65.18
4 945.5	-52.70	12.73	-39.97	V	68.07
5 752.5	-51.98	12.64	-39.34	H	67.44

Operating Frequency : 836.60 MHz
Measured Output Power : 26.40 dBm = 0.437 W
Limit : 43 + 10 $\log_{10}$(0.437 W) = 39.40 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
1 672.9	-56.33	8.53	-47.80	V	74.39
2 509.9	-55.77	10.37	-45.40	H	71.99
3 345.8	55.71	11.79	-43.92	H	70.51
4 182.8	52.26	12.54	-39.72	H	66.31
5 019.0	53.13	12.76	-40.37	H	66.96
5 856.0	52.74	12.59	-40.15	H	66.74

Operating Frequency : 848.80 MHz
Measured Output Power : 27.94 dBm = 0.622 W
Limit : 43 + 10 $\log_{10}$(0.622 W) = 40.93 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
1 697.3	-53.98	8.99	-44.99	H	69.96
2 547.0	-54.99	10.39	-44.60	V	69.57
3 395.3	-56.00	11.89	-44.11	H	69.08
4 243.5	-49.51	12.53	-36.98	H	61.95
5 941.5	-51.66	12.59	-39.07	V	64.04

3.3.2. Test Results (GSM1900 test data)

Operating Frequency : 1850.2 MHz
Measured Output Power : 28.57 dBm = 0.719 W
Limit : 43 + 10 $\log_{10}$(0.719 W) = 41.56 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
3 700.5	-49.45	12.31	-37.14	V	68.67
5 550.8	-48.39	12.89	-35.50	H	67.03
7 400.6	-49.37	10.83	-38.54	H	70.07
9 250.1	-39.22	12.01	-27.21	V	58.74
11 101.3	-46.13	10.62	-35.51	H	67.04

Operating Frequency : 1880.0 MHz
Measured Output Power : 27.04 dBm = 0.506 W
Limit : 43 + 10 $\log_{10}$(0.506 W) = 40.04 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
3 759.8	-49.75	12.29	-37.46	V	68.24
5 640.0	-47.62	12.83	-34.79	V	65.57
7 520.4	-49.46	10.81	-38.65	H	69.43
9 400.3	-42.55	11.78	-30.77	H	61.55
11 280.2	-45.99	10.87	-35.12	H	65.90

Operating Frequency : 1909.8 MHz
Measured Output Power : 27.20 dBm = 0.525 W
Limit : 43 + 10 $\log_{10}$(0.525 W) = 40.20 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
3 819.8	-48.03	12.38	-35.65	H	66.41
5 236.5	-52.30	12.80	-39.50	H	70.26
5 730.0	-50.49	12.76	-37.73	H	68.49
7 638.6	-45.86	10.89	-34.97	H	65.73
9 548.8	-42.82	11.81	-31.01	V	61.77
11 459.1	-47.05	11.46	- 35.59	H	66.35

3.4. Occupied Bandwidth

3.4.1. Test Procedure

The EUT's output RF connector was connected with a short cable to spectrum analyzer. The EUT was setup to maximum output power. The EUT's occupied bandwidth is measured as the width of the signal between two points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. RBW was set to about 1% of emission BW, VBW is set to 3 times.

3.4.2. Limit

(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB Below the transmitter power.

(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the license's frequency block edges, both upper and lower, as the design permits.

(d) The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

Block 1 : 824 – 835 MHz (A* Low + A)
Block 2 : 835 – 845 MHz (B)
Block 3 : 845 – 846.5 MHz (A* High)
Block 4 : 846.5 – 849 MHz (B*)

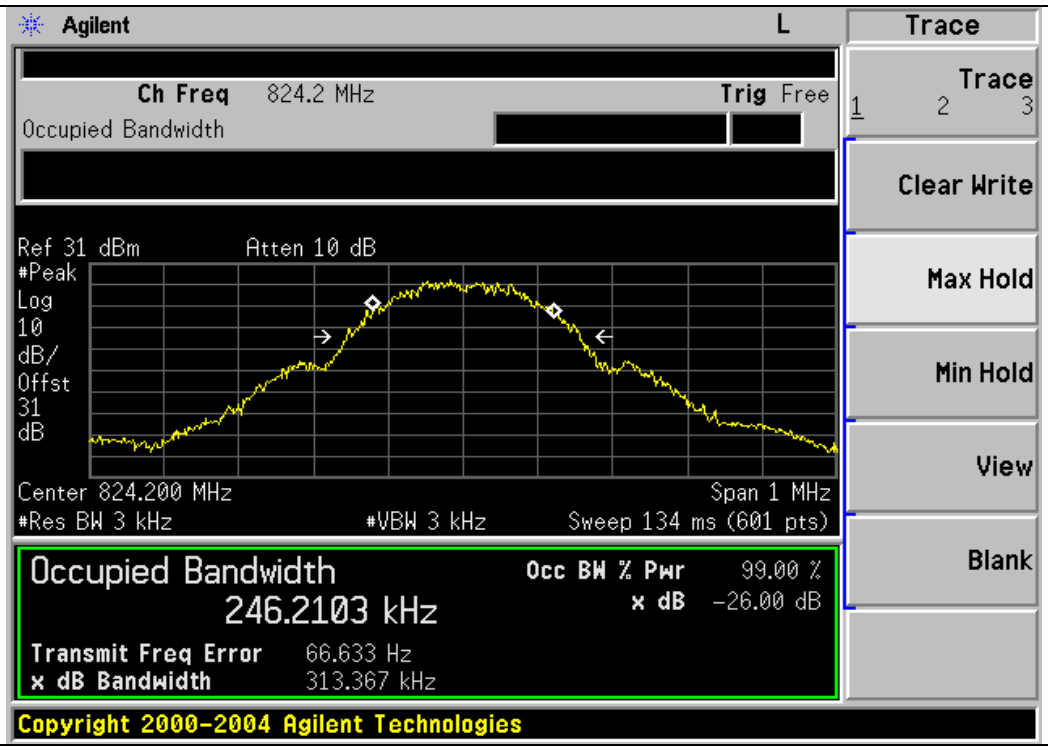
- Cellular Service Frequency Blocks -

Block 1 : 1850 – 1865 MHz (A)
Block 2 : 1865 – 1870 MHz (D)
Block 3 : 1870 - 1885 MHz (B)
Block 4 : 1885 - 1890 MHz (E)
Block 5 : 1890 - 1895 MHz (F)
Block 6 : 1895 - 1910 MHz (C)

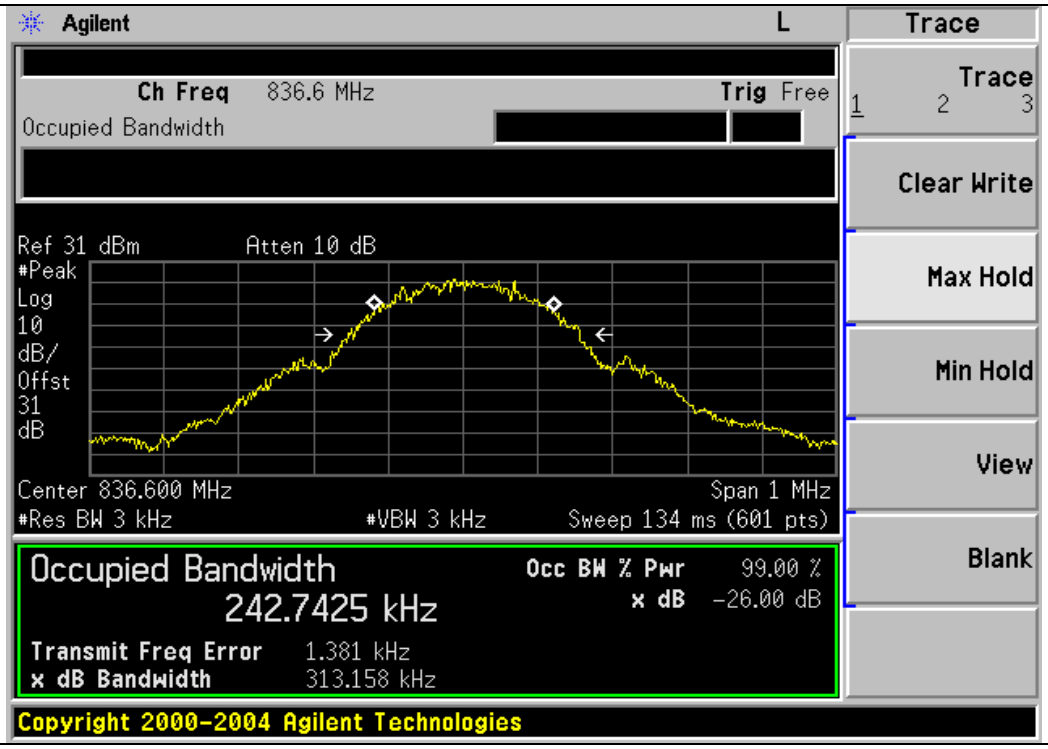
- Broadband PCS Service Frequency Blocks -

3.4.3. Test Results

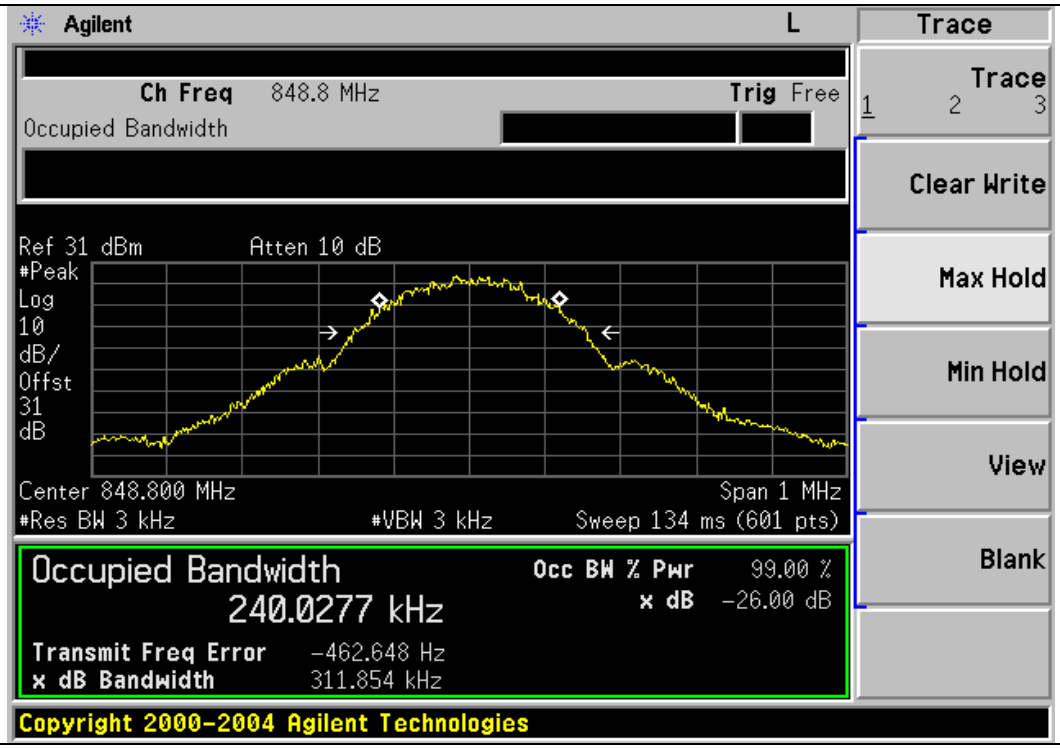
- *GSM 850 Test Data*



– GSM850, Channel 128 –

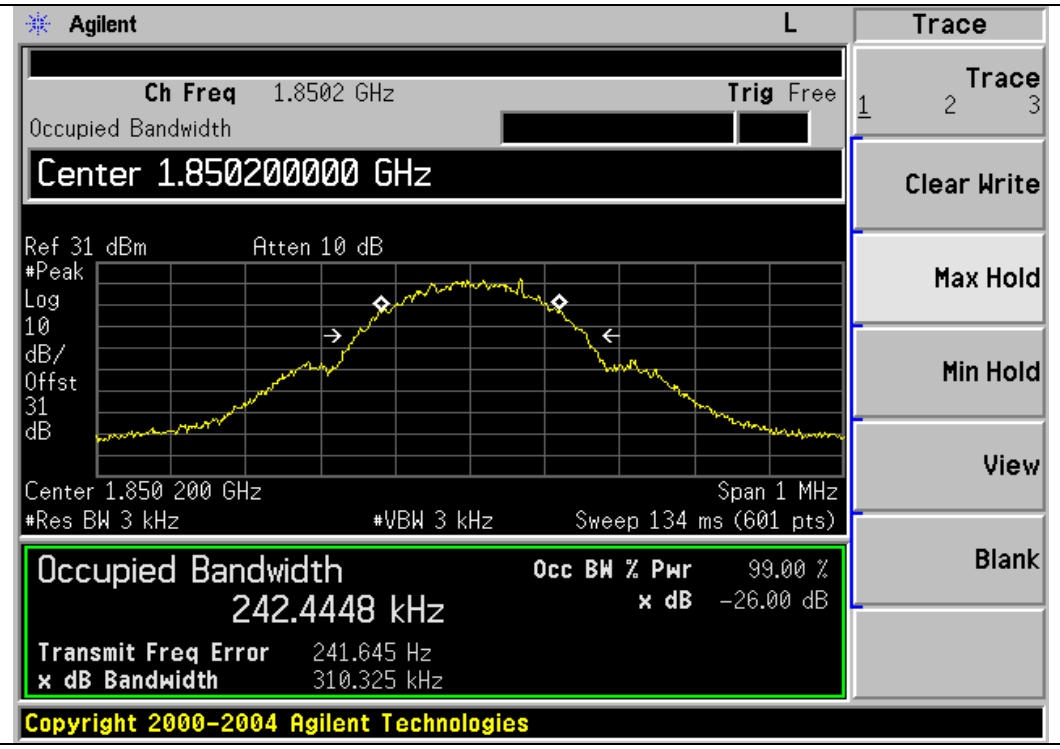


– GSM850, Channel 190 –

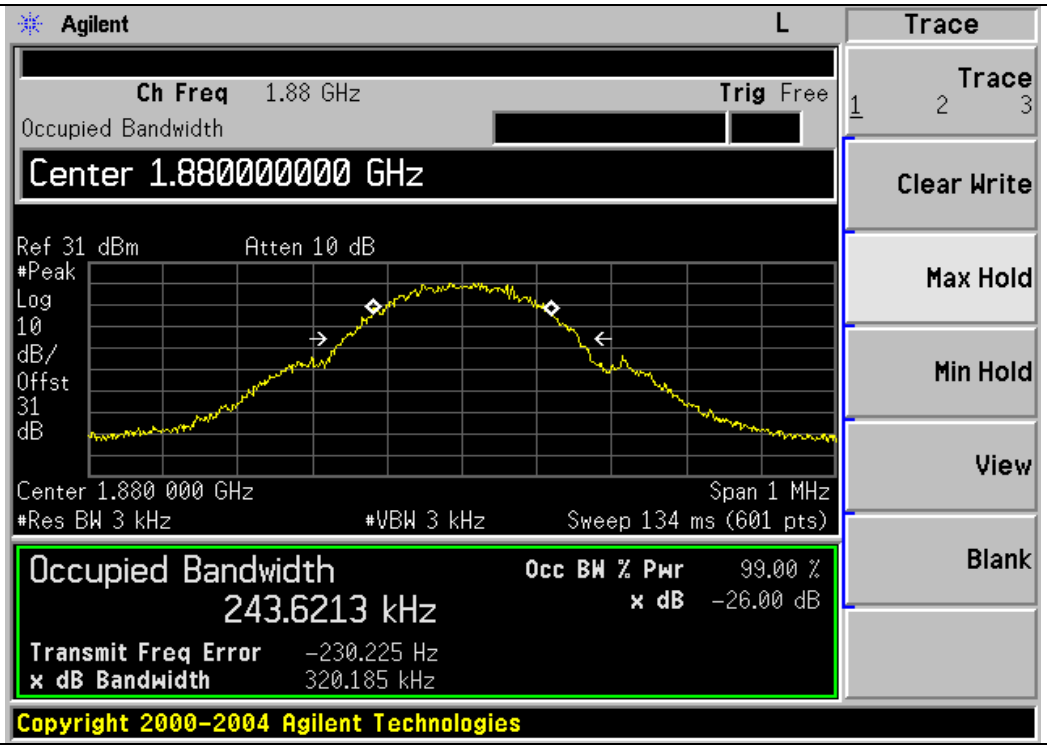


– GSM850, Channel 251 –

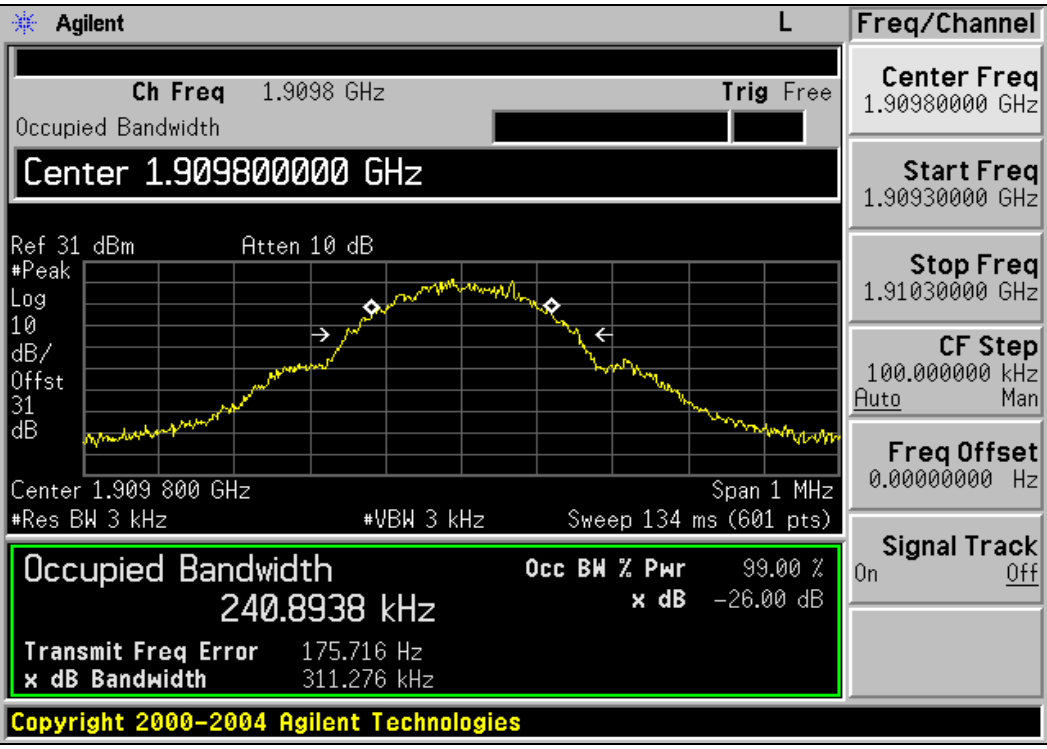
• *GSM 1900 Test Data*



– GSM1900, Channel 512 –



– GSM1900, Channel 661 –



– GSM1900, Channel 810 –

3.5. Conducted Spurious Emission

3.5.1. Test Procedure

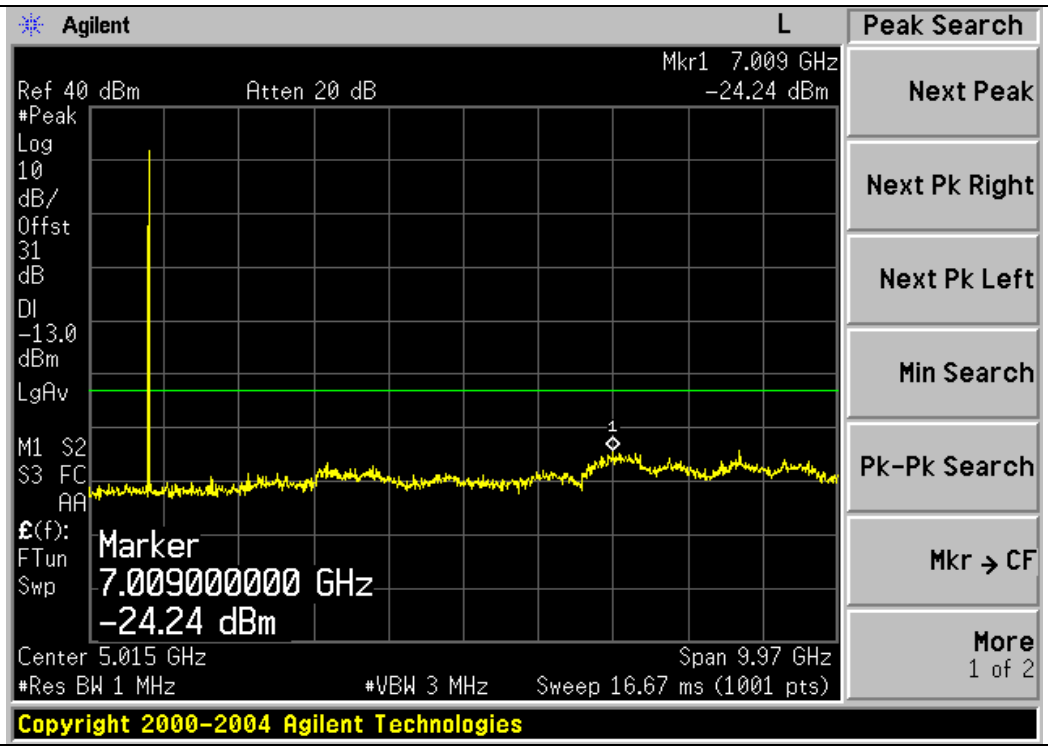
The EUT's output RF connector was connected with a short cable to spectrum analyzer. The EUT was setup to maximum output power. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. Compliance with the out-of-band emissions requirement is based on test being performed with an analyzer resolution bandwidth of 1 MHz. However in the 1 MHz band immediately outside and adjacent to the frequency block a resolution bandwidth of at least 1% of the fundamental emissions bandwidth may be employed. A display line was placed at -13 dBm to show compliance.

3.5.2. Limit

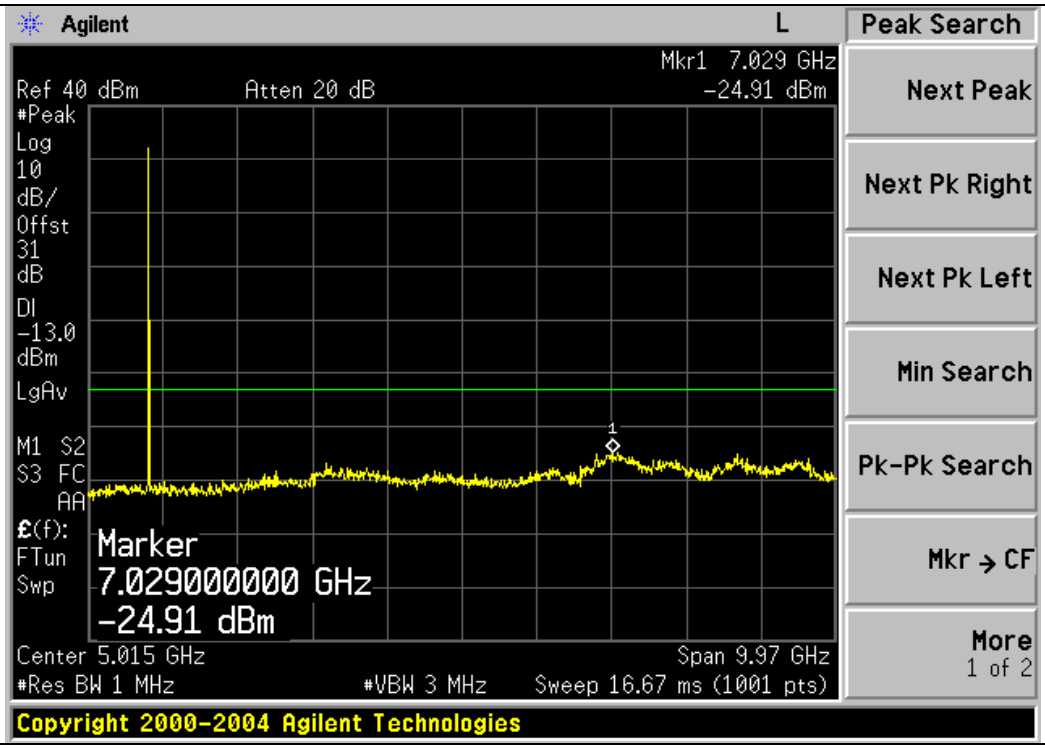
On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

3.5.3. Test Results

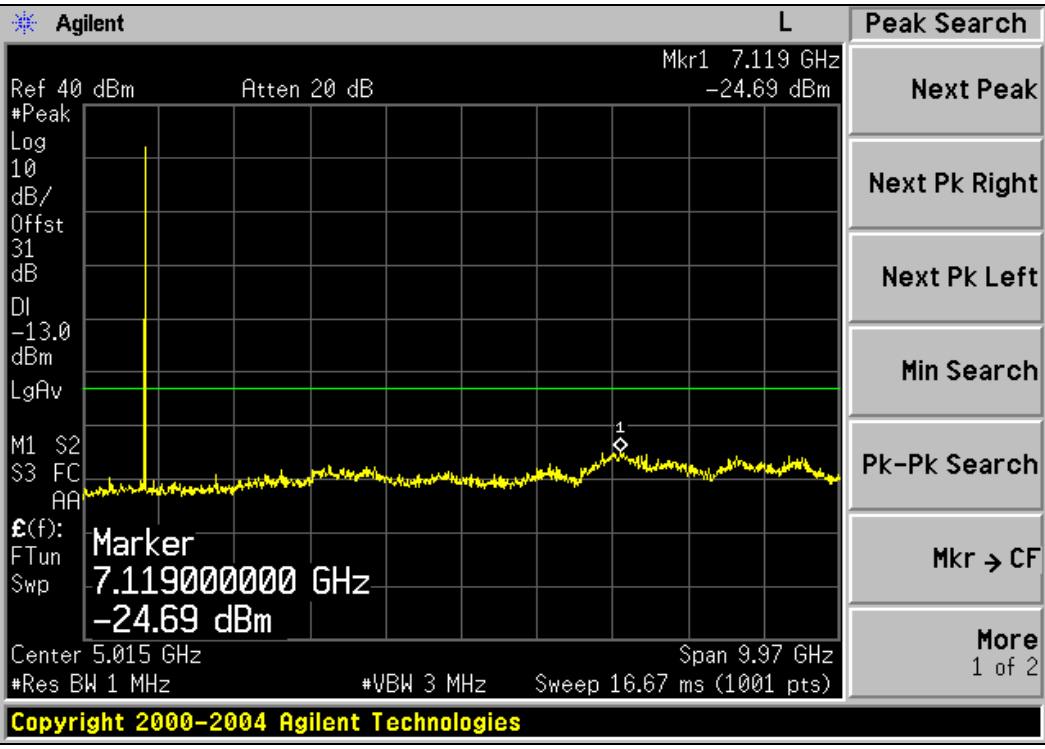
- *GSM 850 Test Data*



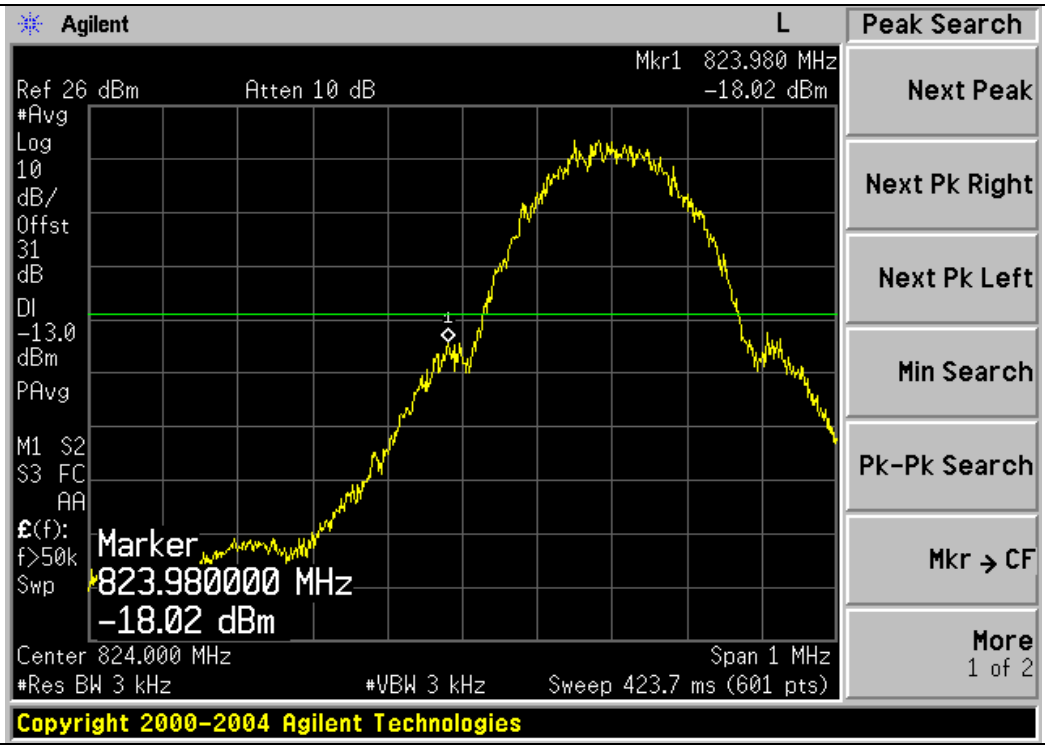
- GSM850, Channel 128 -



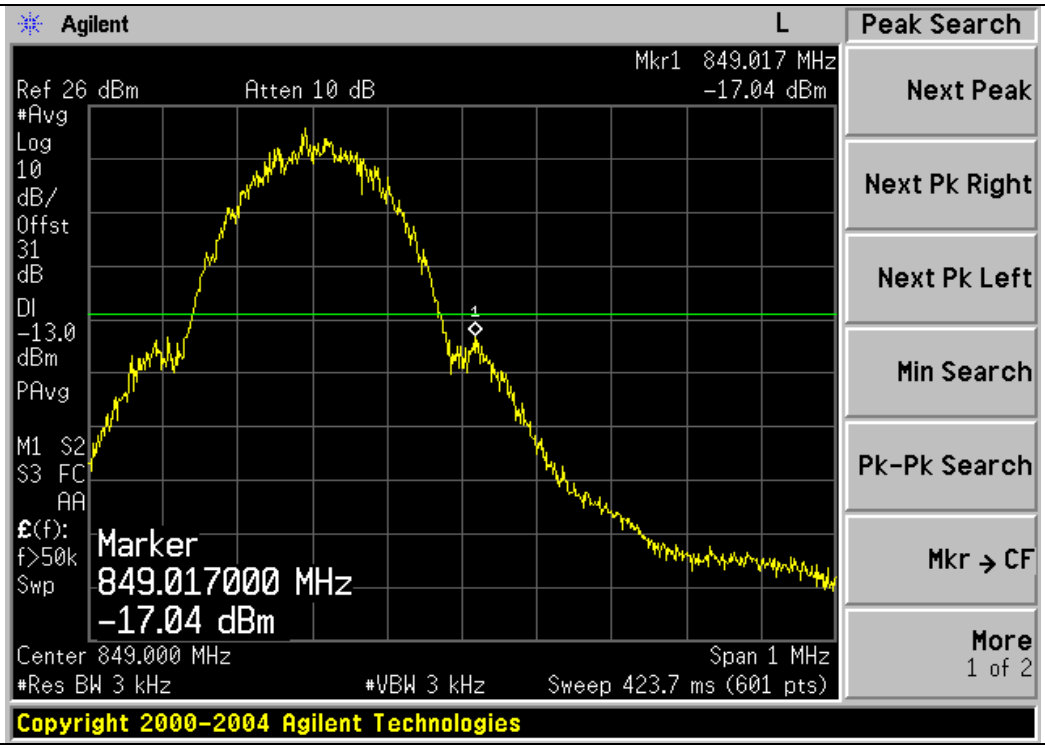
- GSM850, Channel 190 -



- GSM850, Channel 251 -

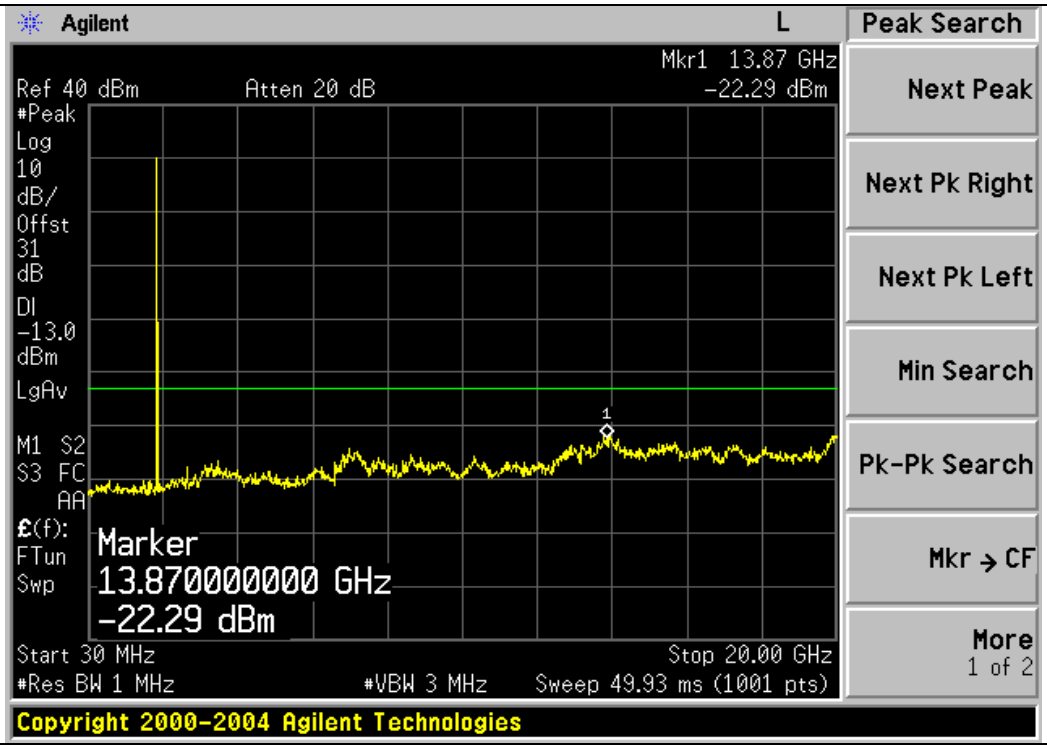


- Lower band Edge emissions, GSM850 -

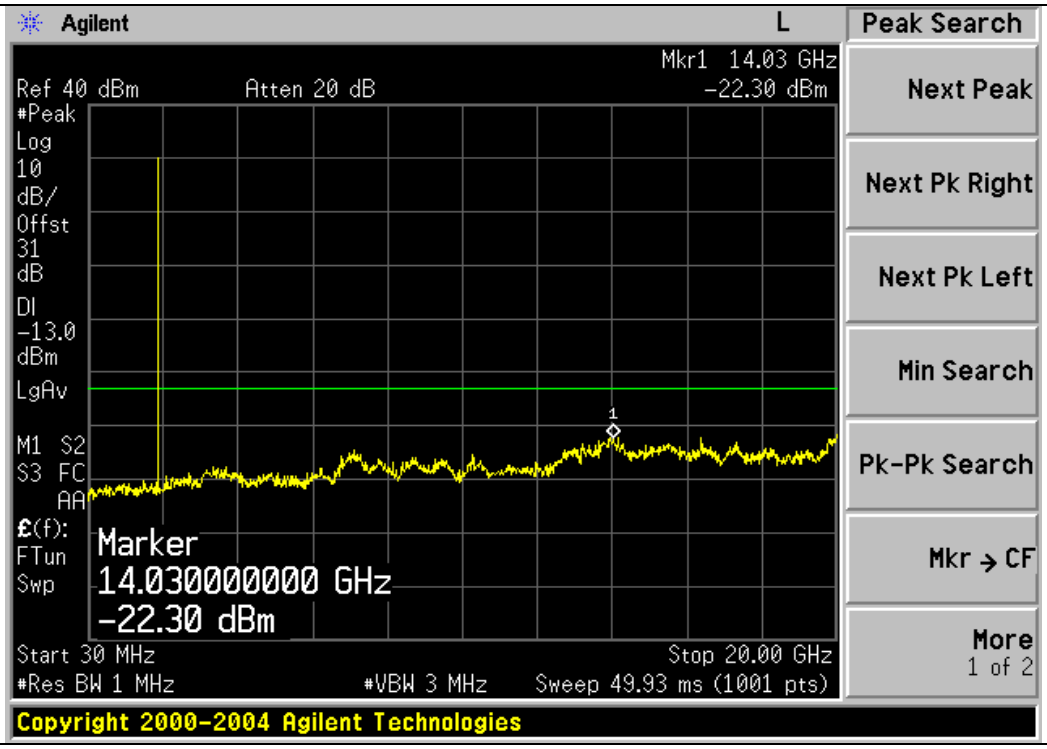


- Upper band Edge emissions, GSM850 -

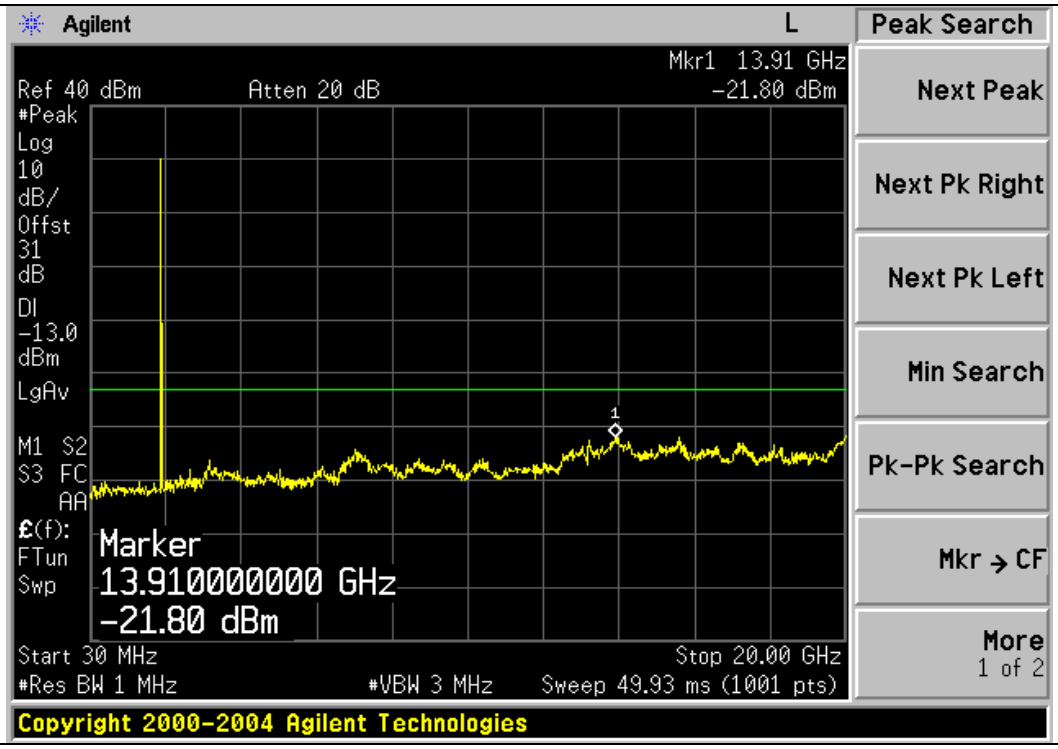
- *GSM 1900 Test Data*



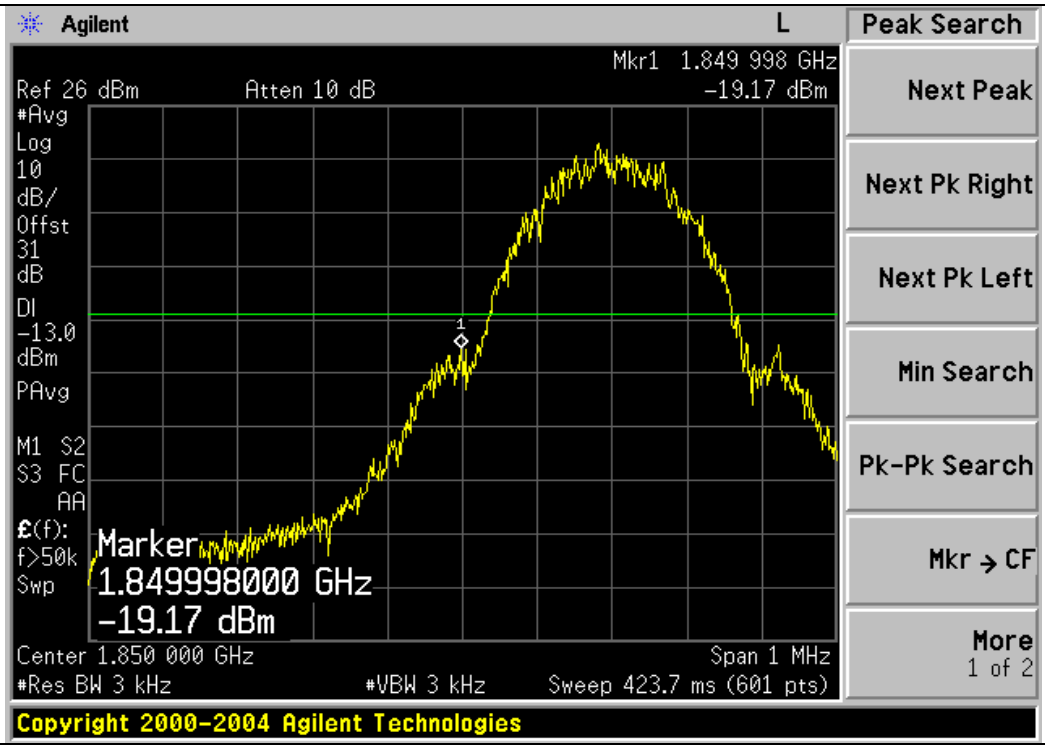
- GSM1900, Channel 512 -



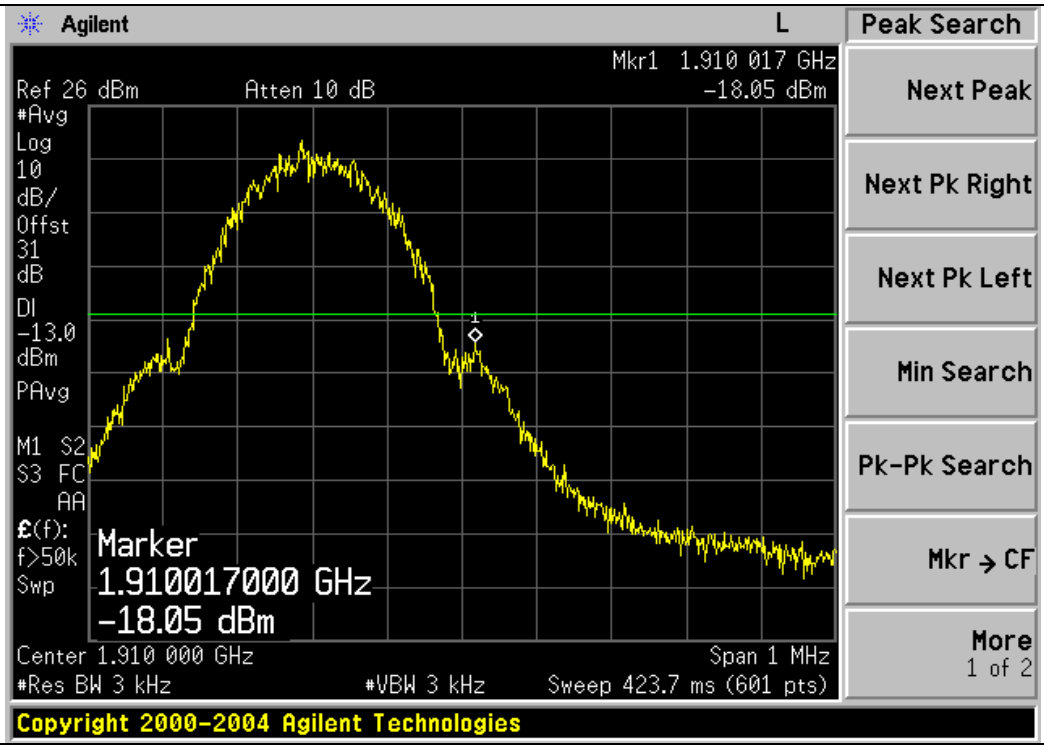
- GSM1900, Channel 661 -



- GSM1900, Channel 810 -



- Lower band Edge emissions, GSM1900 -



- Lower band Edge emissions, GSM1900 -

3.6. Frequency Stability / Temperature Variation

3.6.1. Test Procedure

The equipment under test is placed in an environmental chamber. Frequency measurements are made at the extremes of the temperature range -30º C to +50º C and at intervals of 10º C with the primary supply voltage set to the nominal battery operating voltage. A period of time sufficient to stabilize all components of the equipment is allowed at each frequency measurement. The maximum variation of frequency is measured. The test was done at middle channel.

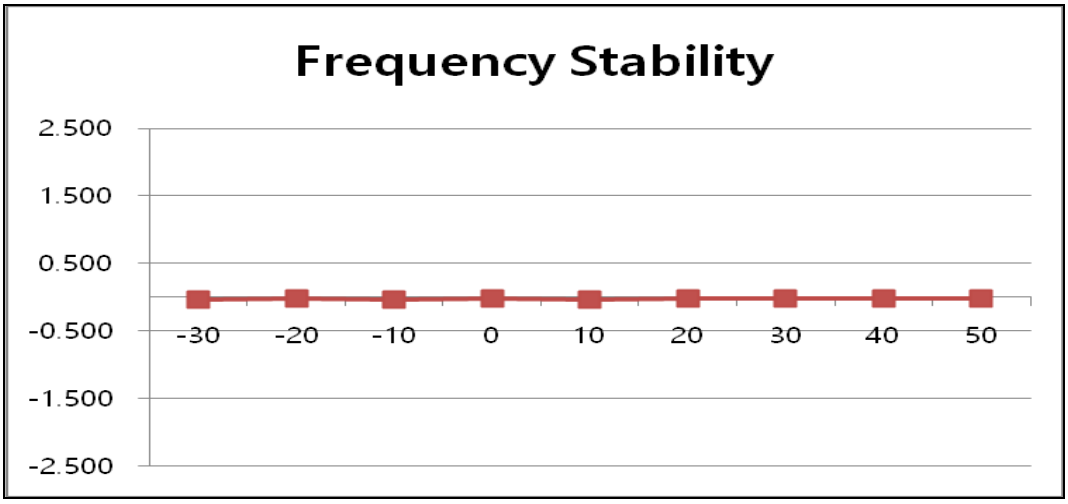
3.6.2. Limit

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 0.00025 (± 2.5ppm) of the center frequency.

3.6.3. Test Results

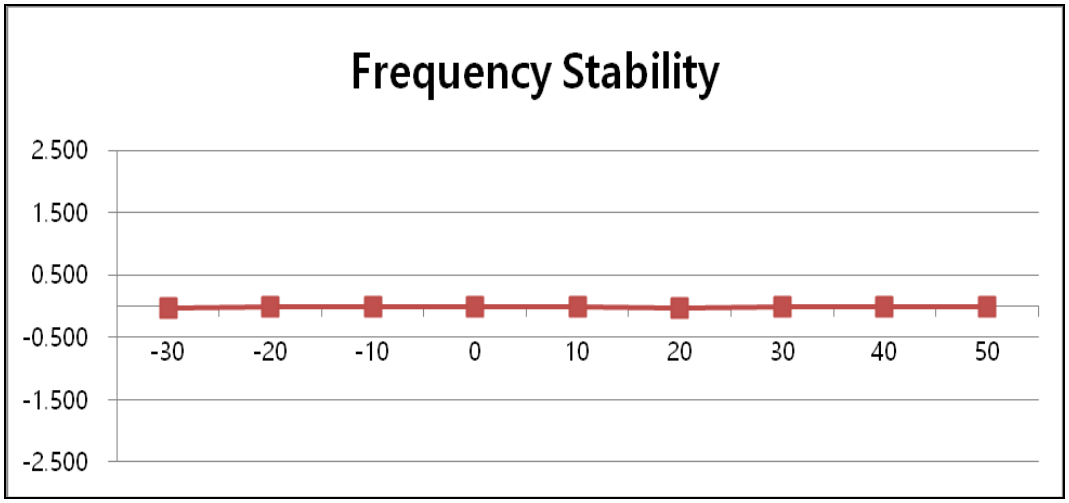
- GSM 850 Test Data

Voltage (%)	Power (VDC)	Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	+3.8	- 30	-24	-0.029
100 %		- 20	-19	-0.023
100 %		- 10	-28	-0.033
100 %		0	-21	-0.025
100 %		+ 10	-24	-0.029
100 %		+ 20	-17	-0.020
100 %		+ 30	-22	-0.026
100 %		+ 40	-21	-0.025
100 %		+ 50	-14	-0.017
Battery End Point	+3.5	+ 20	-13	-0.016
115 %	+4.37	+ 20	20	0.024



• GSM 1900 Test Data

Voltage(%)	Power (VDC)	Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	+3.8	- 30	-41	-0.022
100 %		- 20	-32	-0.017
100 %		- 10	-36	-0.019
100 %		0	-33	-0.018
100 %		+ 10	-39	-0.021
100 %		+ 20	-43	-0.023
100 %		+ 30	-27	-0.014
100 %		+ 40	-31	-0.016
100 %		+ 50	-27	-0.014
Battery End Point	+3.5	+ 20	-40	-0.021
115 %	+4.37	+ 20	-42	-0.022



4. TEST EQUIPMENTS

No.	Equipment	Manufacturer	Model	S/N	Calibration Due date
1	Spectrum Analyzer	Agilent	E4407B	US41443316	03-11-2015
2	Synthesized Sweeper	HP	83620A	3250A01653	03-03-2015
3	Digital RF Signal Generator	Agilent	E4438C	US41460859	02-18-2015
4	Signal Generator	R&S	SMIQ O3	DE22348	02-14-2015
5	PSA Series Spectrum Analyzer	Agilent	E4448A	US44300484	02-19-2015
6	DC Power Supply	Agilent	E4356A	MY41000296	02-11-2015
7	DC Power Supply	Agilent	E3645A	MY40000851	02-11-2015
8	AC Power Supply	Agilent	6811B	MY41000446	02-07-2015
9	Oscilloscope	Agilent	DSO6054A	MY44001104	01-22-2015
10	Directional Coupler	Agilent	87300C	MY44300126	03-04-2015
11	Directional Coupler	Agilent	773D	MY28390213	03-04-2015
12	VHF Attenuator	HP	355D	2522A45959	03-04-2015
13	Coaxial Attenuator	Weinschel	56-20	N8527	03-04-2015
14	Coaxial Attenuator	Agilent	8491B	50109	03-04-2015
15	Power Divider	HP	11636A	09084	03-07-2015
16	Power Spliter	HP	11667A	21063	03-04-2015
17	Temp/Humidity Chamber	ESPEC	SH-641	92007482	01-14-2015
18	Function/Arbitrary Waveform Generator	Agilent	33250A	MY40015758	04-24-2015
19	EMI Receiver	R&S	ESIB26	100280	03-12-2015
20	Pre-Amplifier	HP	83017A	MY39500982	02-19-2015
21	Pre-Amplifier	SONA INSTRUMENT	310	284609	01-08-2015
22	Biconi-Log Antenna	Schwarzbeck	VULB9168	9168-181	05-14-2015
24	Double Ridge Wave Guide	ETS-Lindgren	3115	9012-3595	06-12-2016
25	Universal Radio Communication Tester	R&S	CMU200	110019	02-07-2015