TEST REPORT

1. Applicant

Name : Suntech International Ltd.

Address : Room 605, IT Mirae Tower, 60-21, Gasan-Dong, Geumcheon-Gu, Seoul, Korea

2. Products

Name : Quad band GSM/GPRS Vehicle Tracker

Model/Type : ST240

Manufacturer : Suntech International Ltd.

3. Test Standard : FCC CFR 47 Part 2, Part 22(H), Part 24(E)

4. Test Method : ANSI/TIA/EIA-603-C, ANSI C63.4-2009

5. Test Result : Positive

6. Date of Application : December 03, 2012

7. Date of Issue : April 04, 2013

Tested by

Sung-kyu Cho

Sung-kyu Cho
Telecommunication Center
Engineer

Approved by

Jeong-min Kim

Jeong-min Kim
Telecommunication Center
Manager

Korea Testing Laboratory

TABLE OF CONTENTS

1. GENERAL INFORMATIONS

1.1. Applicant (Client)

Name	Suntech International Ltd.
Address	Room 605, IT Mirae Tower, 60-21, Gasan-Dong, Geumcheon-Gu, Seoul, Korea
Contact Person	TSJUNG
Telephone No.	+82-2-2027-5656
Facsimile No.	+82-2-2027-5654
E-mail address	tsjung@suntechint.com
Manufacturer Name	Suntech International Ltd.
Manufacturer Address	Room 605, IT Mirae Tower, 60-21, Gasan-Dong, Geumcheon-Gu, Seoul, Korea

1.2. Equipment (EUT)

Type of equipment	Quad band GSM/GPRS Vehicle Tracker
Model Name	ST240
FCC ID	WA2ST240
FCC Classification	PCS Licensed Transmitter (PCB)
Tx frequency Band	824.2 ~ 848.8 MHz (GSM850) 1850.2 ~ 1909.8 MHz (GSM1900)
Rx frequency Band	869.2 ~ 893.8 MHz (GSM850) 1930.2 ~ 1989.8 MHz (GSM1900)
Max. Power Rating	28.55 dBm (GSM850) / 31.35 dBm (GSM1900)
Emission Designators	245K4GXW(GSM850) / 244K5GXW(GSM1900)
MODE	GSM / GPRS
Antenna Type	Intenna
Power class	Class 4 for GSM850, Class 1 for GSM1900
Class of GPRS	12
Hardware Version	Ver05
Software Version	Ver1.21

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	Sung-kyu Cho
Telephone number	+82 31 5000 132
Facsimile number	+82 31 5000 147
E-mail address	skcho@ktl.re.kr
Other Comments	-

1.4. Description of test mode

Band	Mode		Frequency (MHz)	Average Output Power (dBm)
GSM 850	GSM	Voice	824.2	31.66
			836.6	31.69
			848.8	31.68
	GPRS	1 Tx Slot	824.2	31.65
			836.6	31.66
			848.8	31.67
		2 Tx Slot	824.2	31.06
			836.6	31.10
			848.8	31.14
		3 Tx Slot	824.2	29.51
			836.6	29.56
			848.8	29.57
		4 Tx Slot	824.2	28.44
			836.6	28.48
			848.8	28.50

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

Band	Mode		Frequency (MHz)	Average Output Power (dBm)
GSM 1900	GSM	Voice	1850.2	28.45
			1880.0	28.70
			1909.8	28.90
	GPRS	1 Tx Slot	1850.2	28.41
			1880.0	28.65
			1909.8	28.87
		2 Tx Slot	1850.2	27.82
			1880.0	28.10
			1909.8	28.28
		3 Tx Slot	1850.2	26.26
			1880.0	26.53
			1909.8	26.76
		4 Tx Slot	1850.2	25.17
			1880.0	25.53
			1909.8	25.70

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

2. SUMMARY OF TEST RESULTS

Testing performed for : Suntech International Ltd.

Equipment Under Test : ST240

Receipt of Test Sample : 2012. 11. 30.

Test Start Date : 2012. 12. 03.

Test End Date : 2013. 01. 11.

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	Voice	824.2	31.66
		836.6	31.69
		848.8	31.68

Mode		Frequency (MHz)	Average Output Power (dBm)
GSM 1900	Voice	1850.2	28.45
		1880.0	28.70
		1909.8	28.90

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	28.91	-1.02	H	27.89
836.6	27.91	-0.65	H	27.26
848.8	29.26	-0.71	H	28.55

• GSM 1900 Test Data

Frequency(MHz)	Substitute Level [dBm]	Substitute Antenna Gain [dBd]	Polarization [H/V]	ERP [dBm]
824.2	21.31	10.04	H	31.35
836.6	20.70	10.04	H	30.74
848.8	20.47	10.05	H	30.52

3.3. Field Strength of Spurious Radiation

3.3.1. Test Results (GSM850 test data)

Operating Frequency : 824.2 MHz
Measured Output Power : 27.89 dBm = 0.615 W
Limit : 43 + 10 log 10 (W) = 40.89 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Correction Factor [dB]	E.R.P [dBm]	Polarization [H/V]	Result (dBc)
1648.1	- 40.24	- 0.40	- 40.64	H	- 68.53
2472.8	- 48.01	6.40	- 41.61	H	- 69.50
4120.5	- 43.89	5.00	- 38.89	H	- 66.78
5769.8	- 48.27	8.10	- 40.17	H	- 68.06

Operating Frequency : 836.60 MHz
Measured Output Power : 27.26 dBm = 0.532 W
Limit : 43 + 10 log 10 (W) = 40.26 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Correction Factor [dB]	E.R.P [dBm]	Polarization [H/V]	Result (dBc)
1672.8	- 43.69	- 0.70	- 44.39	H	- 71.65
5019.0	- 44.54	6.80	- 37.74	H	- 65.00
5856.8	- 44.30	8.40	- 35.90	H	- 63.16
7528.9	- 53.73	16.10	- 37.63	H	- 64.89

Operating Frequency : 848.80 MHz
Measured Output Power : 28.55 dBm = 0.716 W
Limit : 43 + 10 log 10 (W) = 41.55 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Correction Factor [dB]	E.R.P [dBm]	Polarization [H/V]	Result (dBc)
4243.5	- 41.22	5.00	- 36.22	H	- 64.77
5942.3	- 46.59	9.00	- 37.59	H	- 66.14
10186.7	- 59.51	22.10	- 37.41	H	- 65.96

3.3.2. Test Results (GSM1900 test data)

Operating Frequency : 1850.2 MHz
Measured Output Power : 31.35 dBm = 1.36 W
Limit : 43 + 10 log 10 (W) = 44.35 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Correction Factor [dB]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
3700.5	- 50.27	3.80	- 46.47	H	- 77.82
5550.8	- 43.15	7.20	- 35.95	H	- 67.30
11629.5	- 62.05	24.30	- 37.75	V	- 69.10

Operating Frequency : 1880.0 MHz
Measured Output Power : 30.74 dBm = 1.19 W
Limit : 43 + 10 log 10 (W) = 43.74 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Correction Factor [dB]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
3759.8	- 49.42	4.60	- 44.82	H	- 75.56
5640.0	- 43.99	7.50	- 36.49	H	- 67.23
9400.3	- 55.07	18.50	- 36.57	H	- 67.31

Operating Frequency : 1909.8 MHz
Measured Output Power : 30.52 dBm = 1.13 W
Limit : 43 + 10 log 10 (W) = 43.52 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Correction Factor [dB]	E.I.R.P [dBm]	Polarization [H/V]	Result (dBc)
3819.8	- 48.52	4.80	- 43.72	H	- 74.46
5730.0	- 42.65	7.90	- 34.75	H	- 65.49

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*)

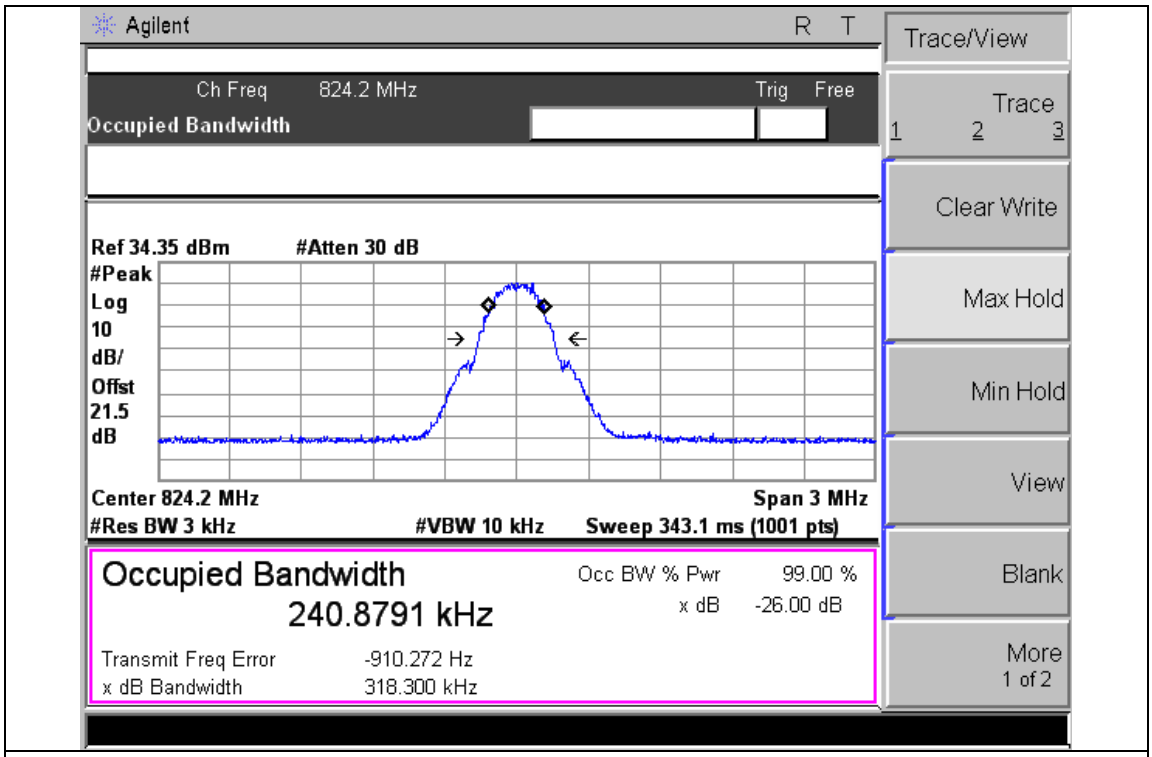
- Cellular Service Frequency Blocks -

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)

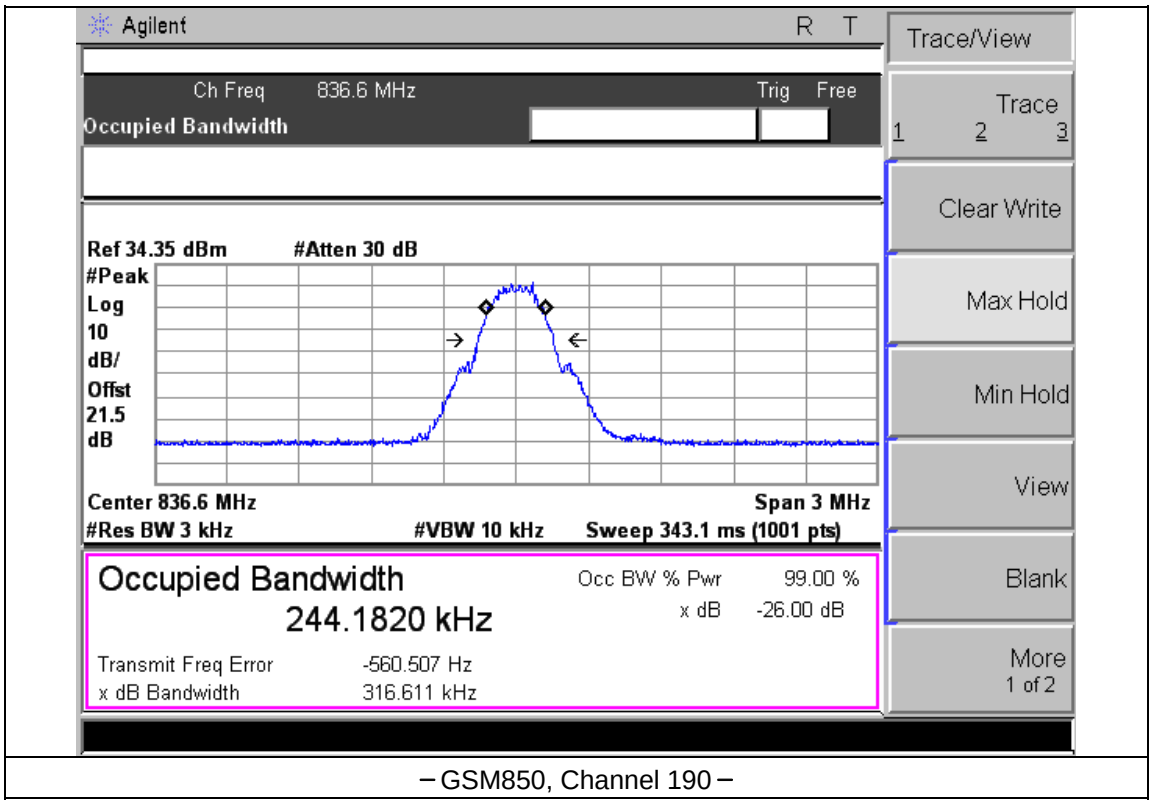
- Broadband PCS Service Frequency Blocks -

3.4.3. Test Results

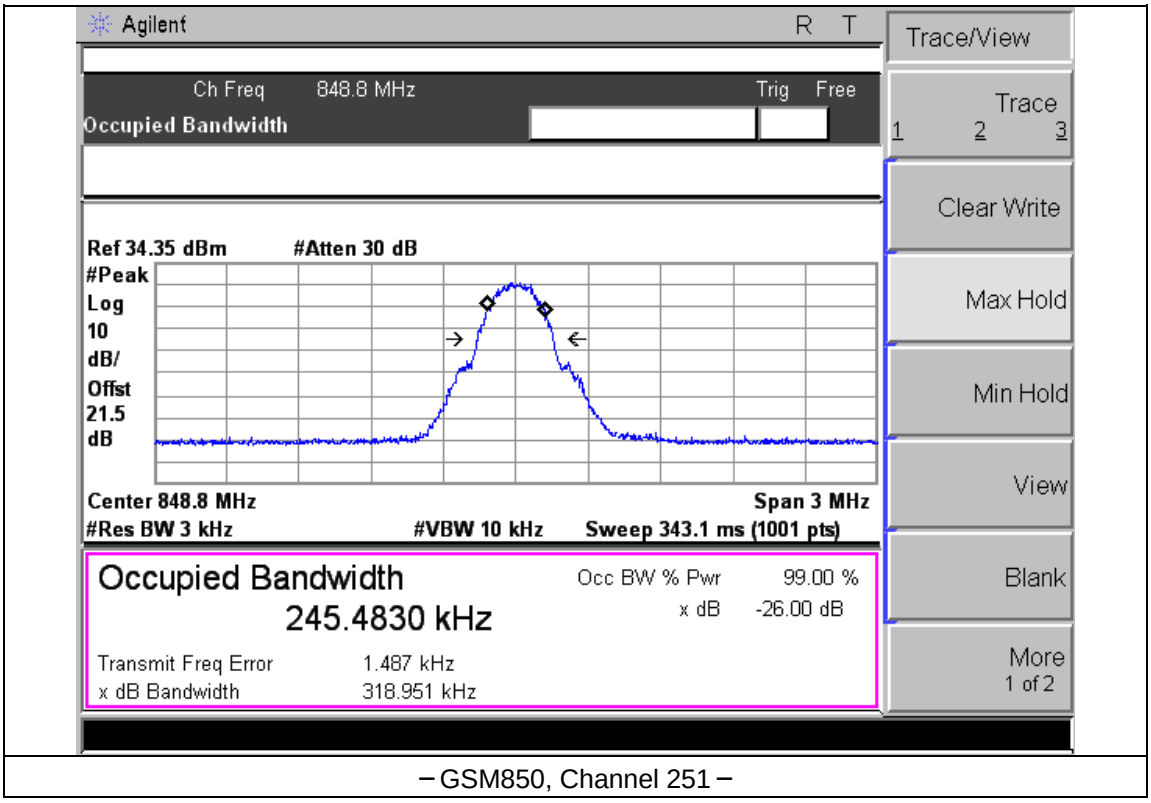
- *GSM 850 Test Data*



– GSM850, Channel 128 –

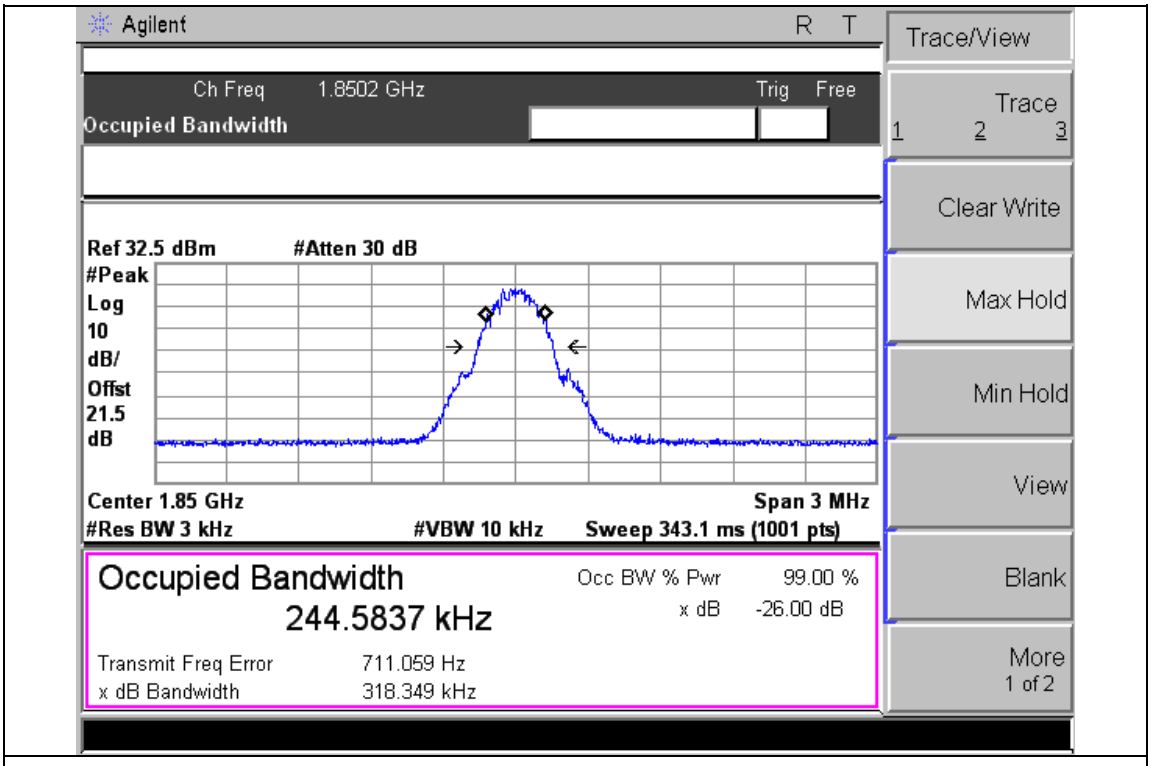


– GSM850, Channel 190 –

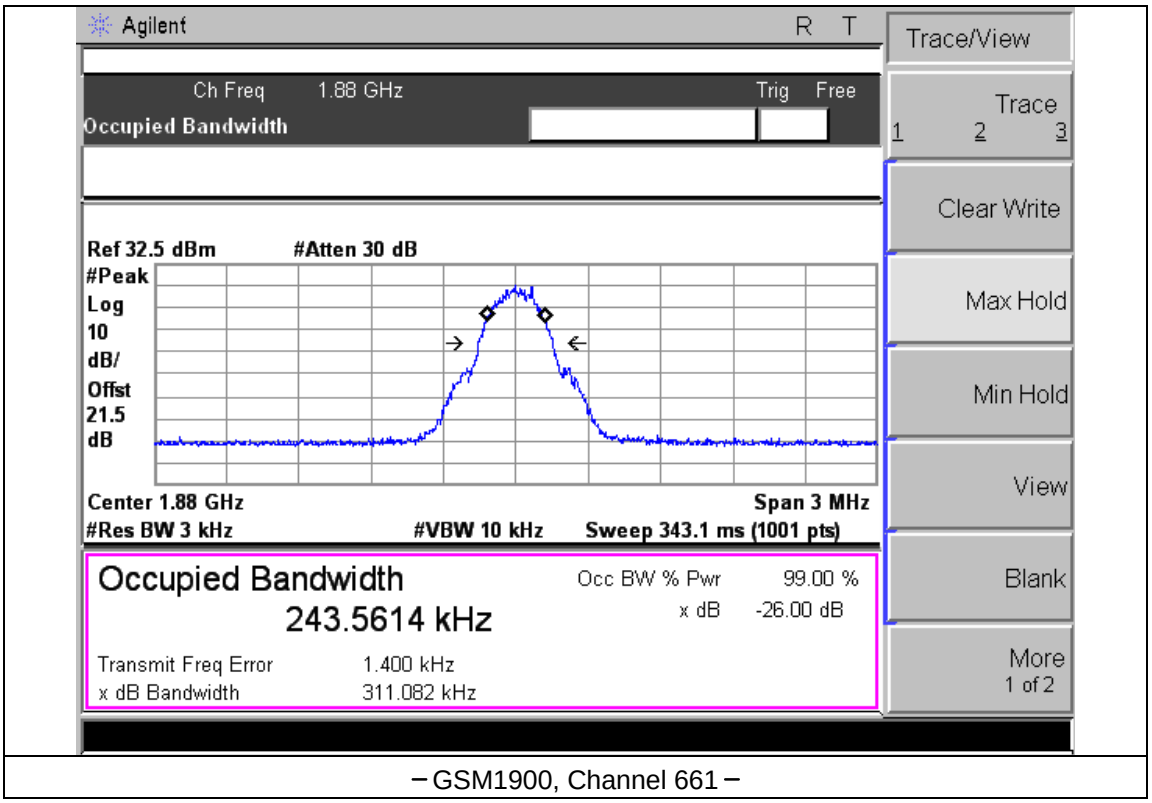


– GSM850, Channel 251 –

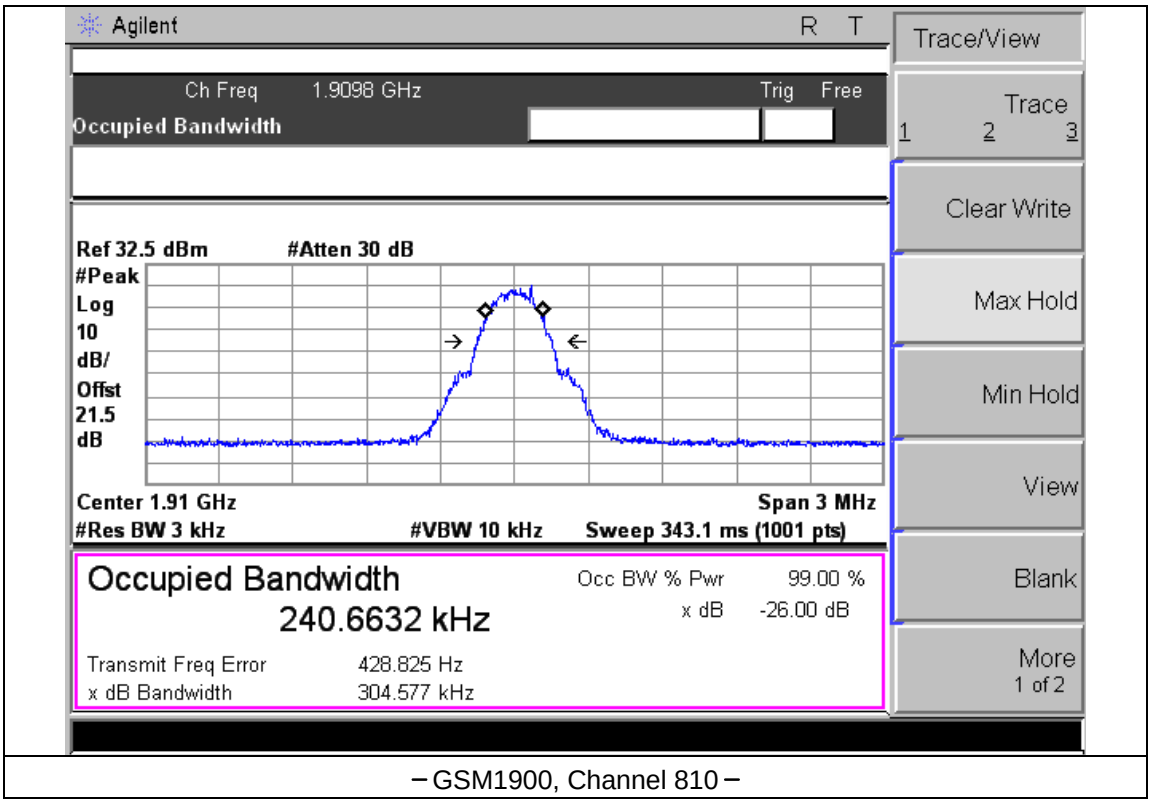
• *GSM 1900 Test Data*



– GSM1900, Channel 512 –



– GSM1900, Channel 661 –



– GSM1900, Channel 810 –

3.5. Conducted Spurious Emission

3.5.1. Test Procedure

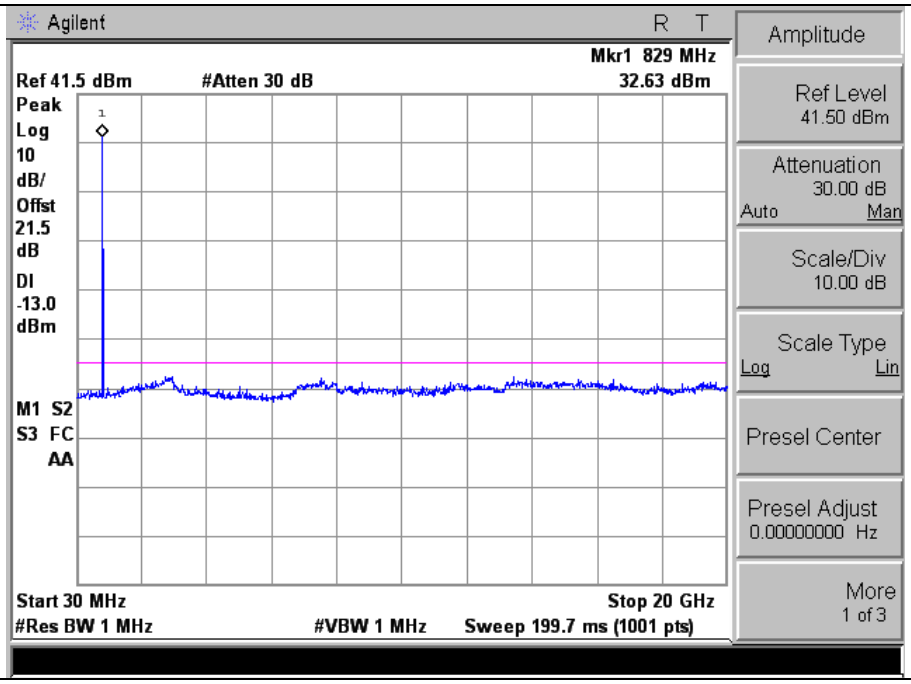
The EUT's output RF connector was connected with a short cable to spectrum analyzer. The EUT was setup to maximum output power. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. Compliance with the out-of-band emissions requirement 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

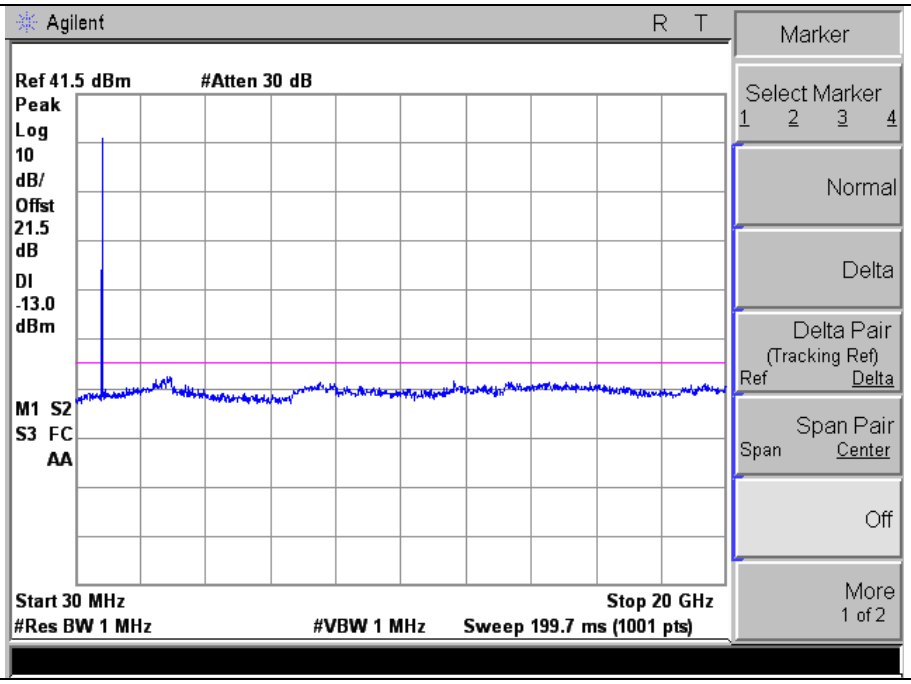
On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

3.5.3. Test Results

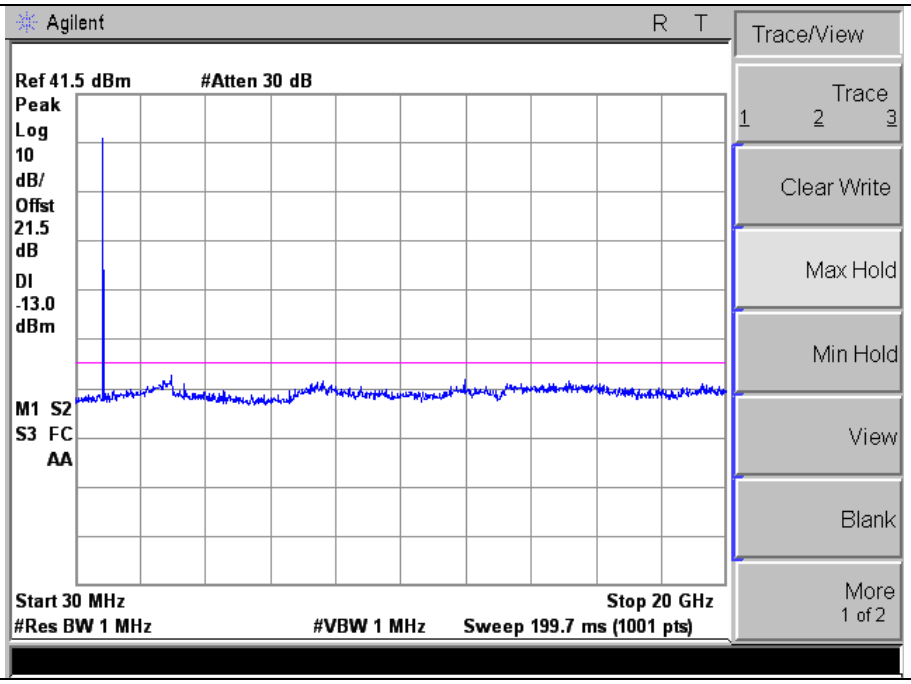
- *GSM 850 Test Data*



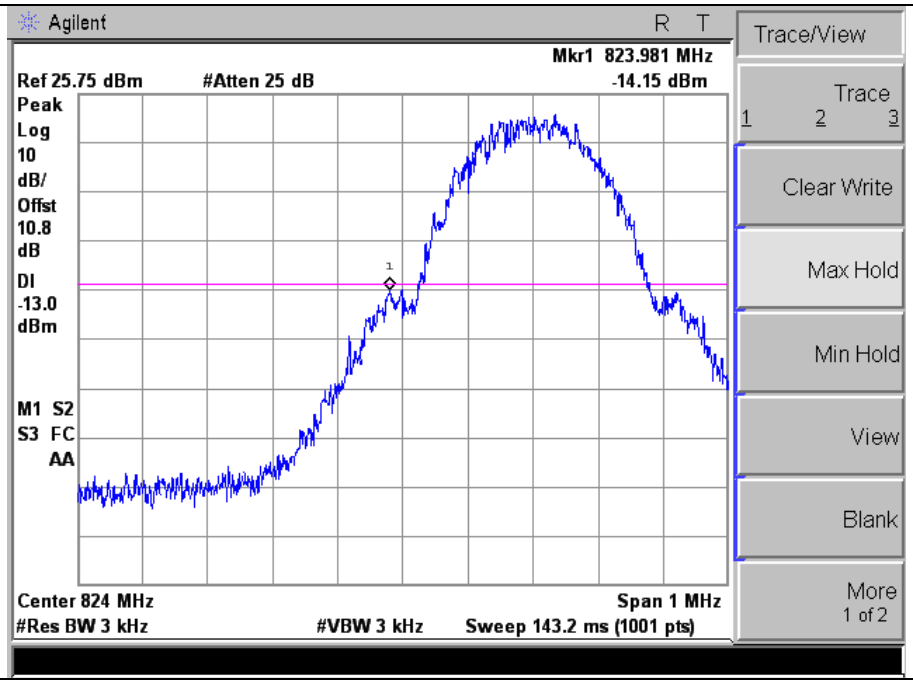
- GSM850, Channel 128 -



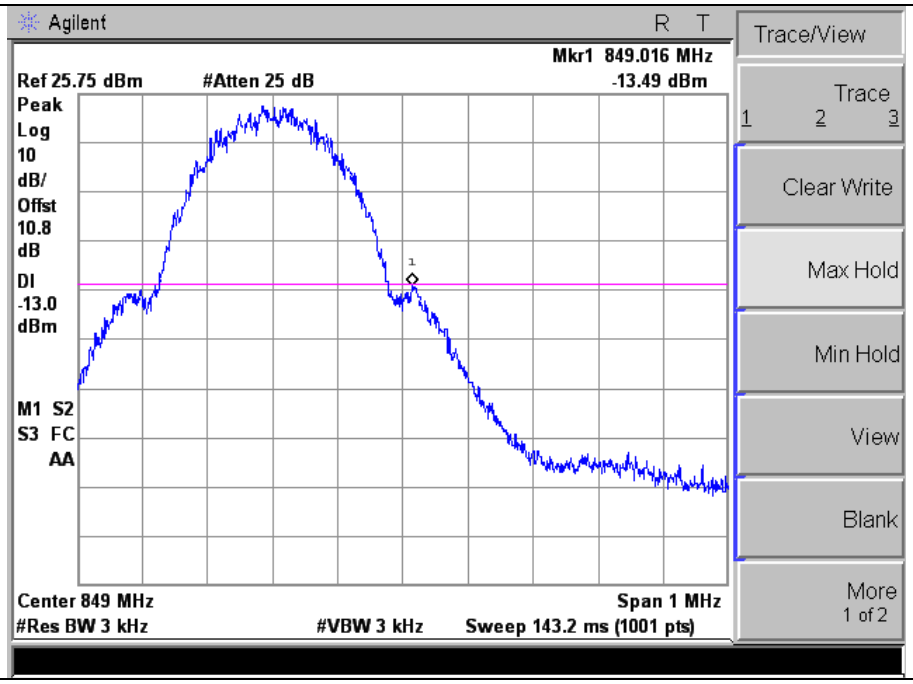
- GSM850, Channel 190 -



- GSM850, Channel 251 -

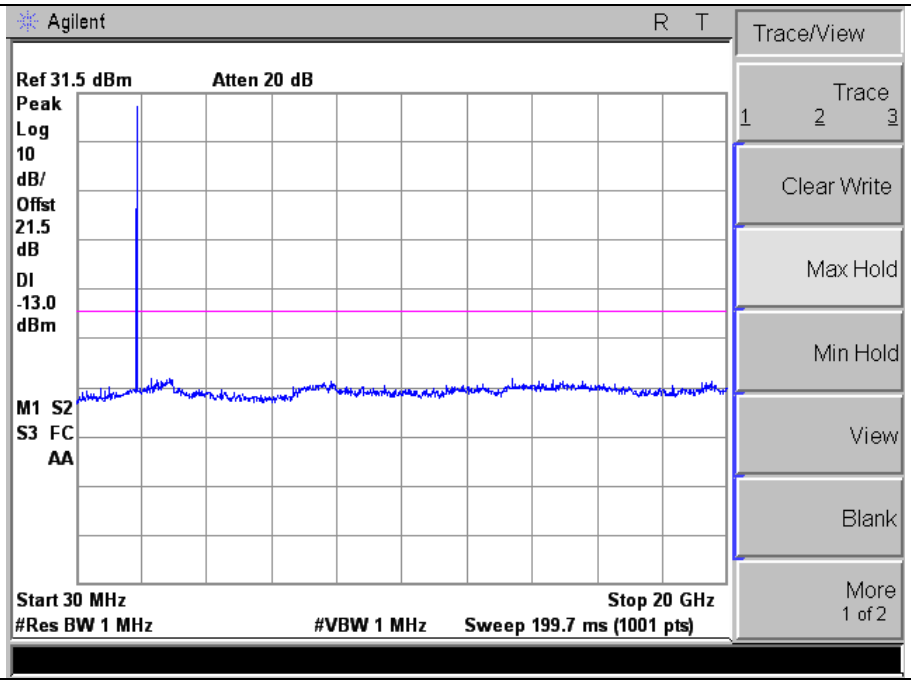


- Lower band Edge emissions, GSM850 -

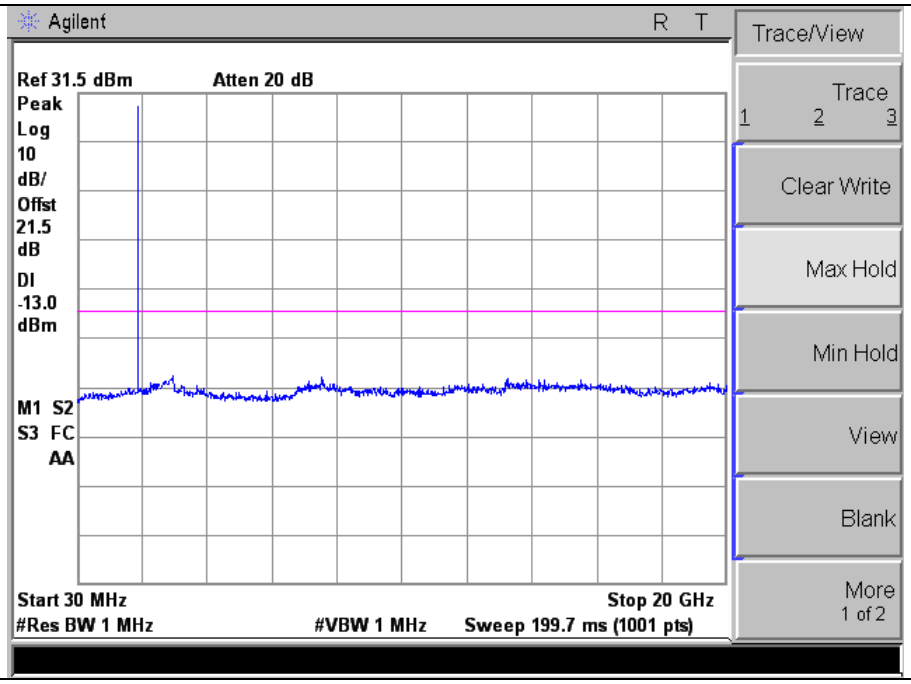


- Upper band Edge emissions, GSM850 -

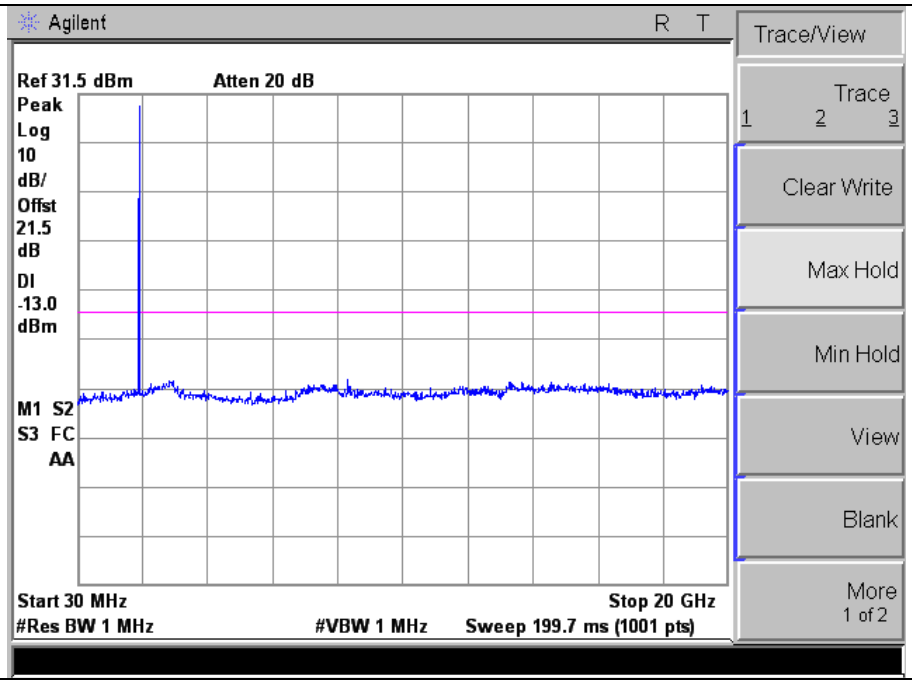
- *GSM 1900 Test Data*



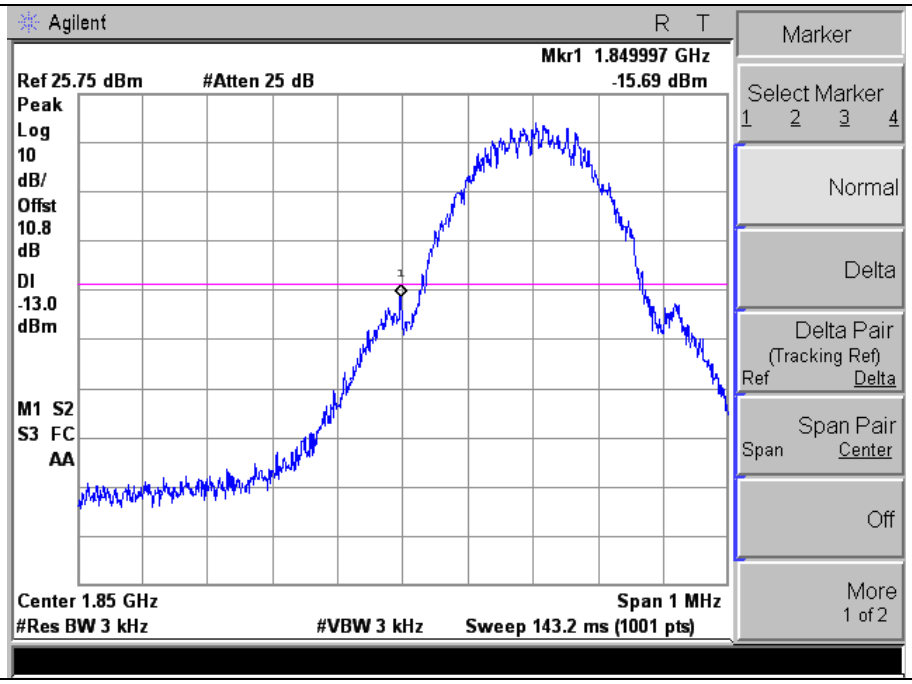
- GSM1900, Channel 512 -



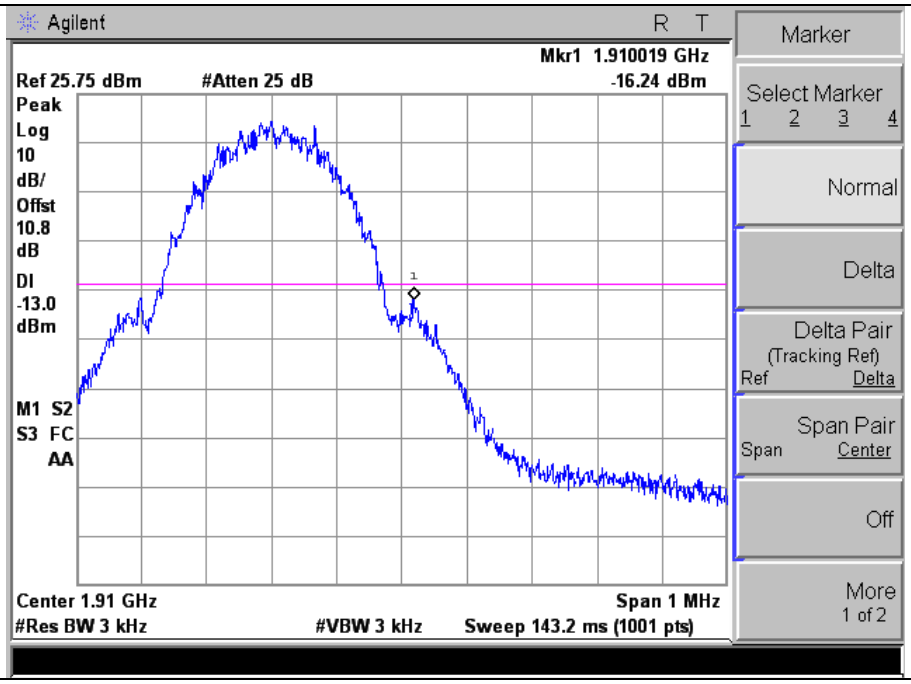
- GSM1900, Channel 661 -



- 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.

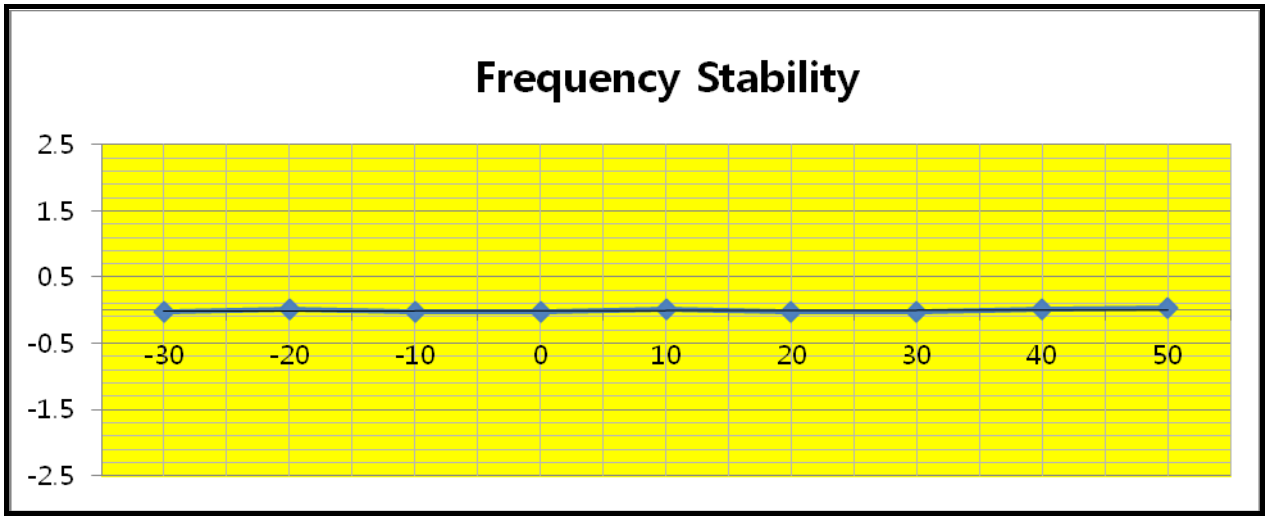
3.6.2. Limit

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

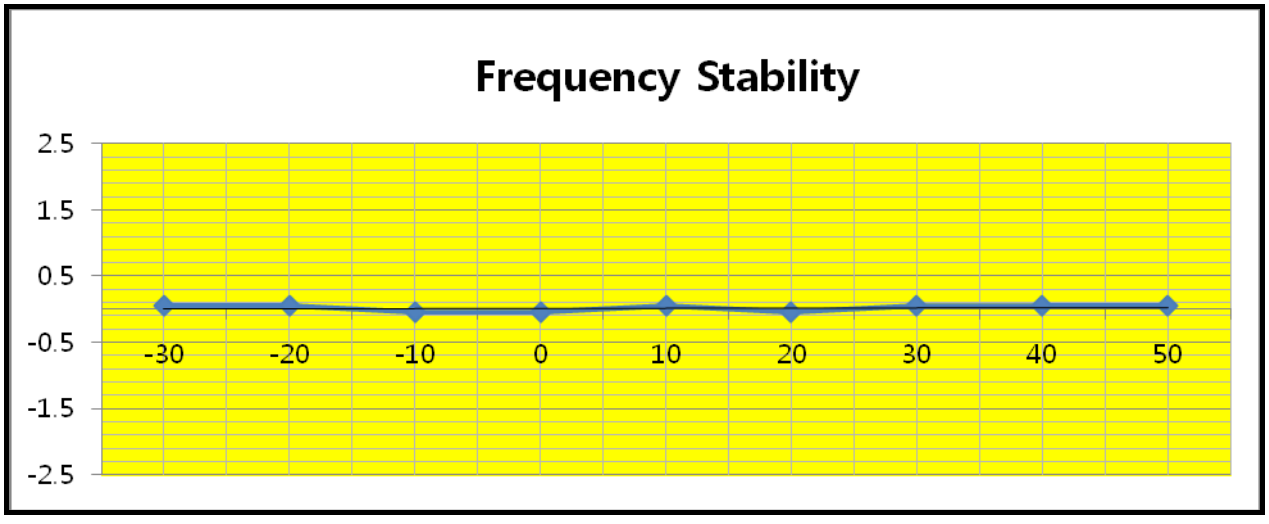
- GSM 850 Test Data

Voltage (%)	Power (VDC)	Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	+ 12.0	+ 20	- 17	- 0.021
100 %		- 30	- 15	- 0.016
100 %		- 20	+ 18	+ 0.019
100 %		- 10	- 16	- 0.017
100 %		0	- 14	- 0.02
100 %		+ 10	+ 15	+ 0.019
100 %		+ 20	- 17	- 0.021
100 %		+ 30	- 16	- 0.022
100 %		+ 40	+ 18	+ 0.023
100 %		+ 50	+ 21	+ 0.029
Battery End Point	+ 7.3	+ 20	+ 14	+ 0.022
115 %	+ 13.8	+ 20	- 15	- 0.022



• GSM 1900 Test Data

Voltage(%)	Power (VDC)	Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	+ 12.0	+ 20	- 39	- 0.016
100 %		- 30	+ 40	+ 0.016
100 %		- 20	+ 46	+ 0.019
100 %		- 10	- 39	- 0.017
100 %		0	- 41	- 0.02
100 %		+ 10	+ 38	+ 0.019
100 %		+ 20	- 39	- 0.021
100 %		+ 30	+ 37	+ 0.022
100 %		+ 40	+ 37	+ 0.023
100 %		+ 50	+ 44	+ 0.029
Battery End Point	+ 7.3	+ 20	+ 32	+ 0.022
115 %	+ 13.8	+ 20	- 34	+ 0.022



4. TEST EQUIPMENTS

No.	Equipment	Manufacturer	Model	S/N	Effective Cal.Duration
1	Spectrum Analyzer (100 Hz ~ 26.5 GHz)	Agilent	E4407B	US41443316	2012.02.21~2013.02.21
2	Spectrum Analyzer (3 Hz ~ 50 GHz)	Agilent	E4448A	MY43360322	2012.02.25~2013.02.25
3	Pre-Amplifier (10 MHz ~ 18 GHz)	R&S	SCU18	137144	2012.02.04~2013.02.04
4	Pre-Amplifier (0.5 GHz ~ 26.5 GHz)	Agilent	83017A	MY39500982	2012.03.18~2013.03.18
5	Biconi-Log Ant. (30 MHz ~ 1000 MHz)	Schwarzbeck	UBAA9114	9114-201	2012.07.12~2014.07.12
6	Horn Ant. (1 GHz ~ 18 GHz)	Schwarzbeck	BRHA 9120D	9120D-653	2011.11.21~2013.11.21
7	Horn Ant. (18 GHz ~ 40 GHz)	EMCO	3116	2664	2011.10.10~2013.10.10
8	Tuned Dipole Antenna	Schwarzbeck	VHA 9103	--	2012.09.09~2014.09.09
9	Dipole Antenna	ETS-Lindgren	3126-880	00052703	2011.12.27~2013.12.27
10	DC Power Supply	Agilent	E4356A	MY41000296	2012.02.04~2013.02.04
11	Power Meter	Agilent	E4417A	GB4129075	2012.02.20~2013.02.20
12	Power sensor	Agilent	8482A	MY41092389	2012.03.19~2013.03.19
13	Universal Radio Communication tester	R&S	CMU200	317	2012.02.12~2013.02.12
14	Highpass Filter	Wainwright	WHK1.0/15G	6	2012.03.27~2013.03.27
15	Highpass Filter	Wainwright	WHK3.5/18G	8	2012.03.27~2013.03.27