



SAMSUNG ELECTRONICS Co., Ltd.,
Regulatory Compliance Team
IT R&D Center
416, Maetan-3dong,
Youngtong-Gu, Suwon-city,
Gyeonggi-do, Korea 442-600

FCC CFR47 PART 24 SUBPART CERTIFICATION REPORT

Model Tested: **SGH-D415**
FCC ID (Requested): **A3LSGHD415**
Report No: **FA-034-R1**
Date issued: **DECEMBER 9, 2003**

- Abstract -

All measurement reported herein accordance with FCC Rules, 47CFR Part2, Part24.

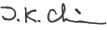
Prepared By	 _____	Date	2003.12.11 _____
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MEASUREMENT REPORT

1. FCC Certification Information

The following information is in accordance with FCC Rules, 47CFR Part 2, Subpart J, Sections 2.1033 – 2.1055.

1.1 §2.1033 General Information

- Applicant Name: SAMSUNG ELECTRONICS CO., LTD.
- Address: 416, Maetan-3Dong, Youngtong-Gu, Suwon City
Gyeonggi-Do, KOREA 442-600

- Attention: Wallace Oh, Engineering Manager (QA Lab)

- FCC ID: A3LSGHD415

- Quantity: Quantity production is planned
- Emission Designators: 270KGXW
- Tx Freq. Range: 1850.2MHz -1909.8MHz
- Rx Freq. Range: 1930.2MHz – 1989.8MHz
- Max. Power Rating: 1.858W EIRP GSM1900 (32.69dBm)
- FCC Classification(s): Licensed Portable Tx Held to Ear (PCE)
- Equipment (EUT) Type: Single modulation PCS GSM Phone
- Frequency Tolerance: $\pm 0.00025\%$ (2.5ppm)
- FCC Rule Part(s): §2. §24(E)
- Dates of Test: Dec. 4, 8-9, 2003
- Place of Test: SAMSUNG Lab,
- Test Report S/N: FA - 034 - R1

2. INTRODUCTION

2.1 General

These measurement test were conducted at **SAMSUNG ELECTRONICS CO., LTD(SUWON)**.

The site address is 416, Maetan-3Dong, Youngtong-Gu, Suwon City, Gyeonggi-Do, KOREA 442-600 The site have 1 Fully-anechoic chamber and measurement facility.

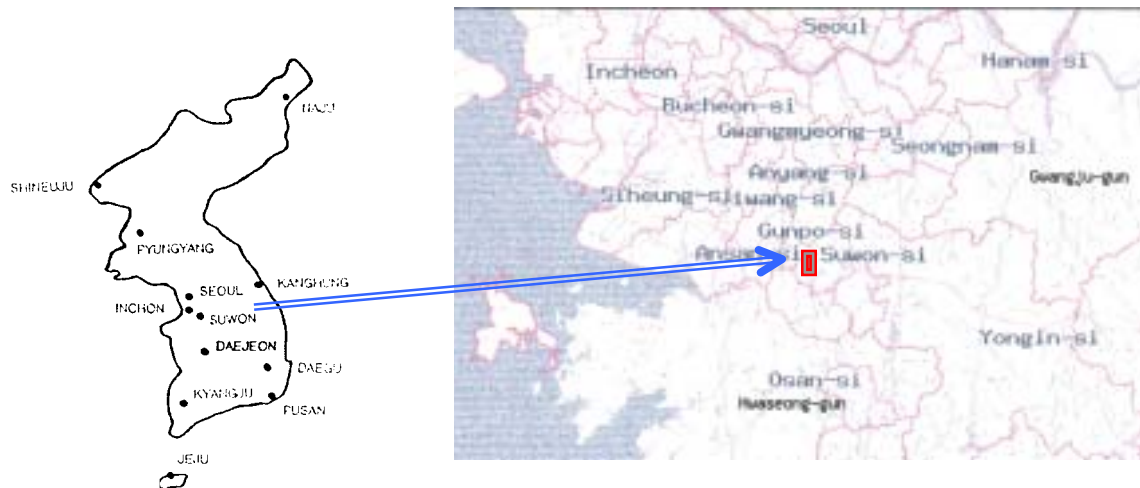


Figure1. Map of the Suwon City area.

Measurement Procedure

The radiated and spurious measurements were made Fully-anechoic chamber at a 3-meter test range (see Figure2). The equipment under testing was placed on a Non-conducted turntable.

3-meters from the receive antenna. The receive antenna height and turntable rotations was adjusted for the highest reading on the receive spectrum analyzer. 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 test antenna shall be raised and lowered, if necessary, to ensure that the maximum signal is still being received. 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 would be repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

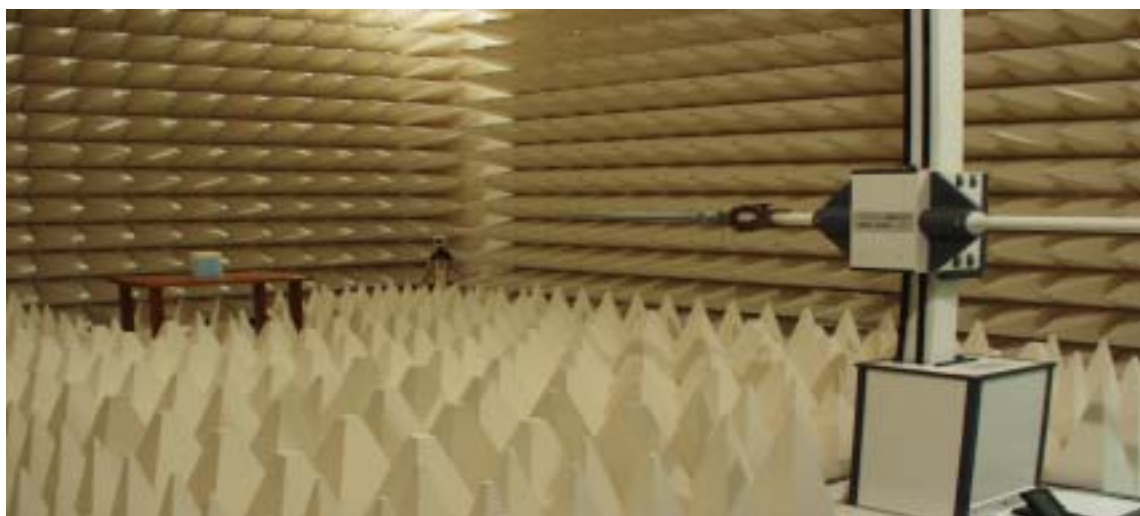


Figure2. Photograph of 3m Fully-Anechoic Chamber



3. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

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4. TEST EQUIPMENT LIST

Name of Equipment	Model	Serial No.	Due Date
Spectrum Analyzer	ESI26	100009	2004-09-15
	E4440A(3Hz~26.5GHz)	MY41000236	2004-11-07
	E4440A(3Hz~26.5GHz)	MY41000233	2004-11-14
Signal Generator	SMIQ03B	83824/021	2004-01-20
	SMR20	835197/030	2004-01-20
Power Meter	E4419B	GB41293846	2004-10-02
Power Sensor	8481B	3318A10325	2004-10-06
	8485A	3318A19924	2004-10-04
Amplifier	5S1G4	304866	2004-11-17
Pre-Amplifier	8449B	3008A00691	2004-01-21
Communication test set	8960	GB42230535	2004-11-17
	8960	GB42360886	2004-01-09
Antenna Master	MA0001	ANT0967	Not Required
Controller	HD100	100/756	Not Required
Environmental Chamber	PL-4S	13005454	2004-08-22
	SH-241	92000548	2004-12-04
	SH-241	92000549	2004-12-04
Horn Antenna	HF906	360306/011	2004-02-10
	HF906	100134	2004-03-31
Dipole Antenna	3121C-DB4	9007-587	2004-03-21
	3121C-DB4	9007-588	2004-03-21
Receive Antenna	HO040	353255/019	2004-07-14
Attenuator	8494A	3308A31997	2004-01-20
	8496A	3308A14426	2004-01-20
Directional Coupler	4278-311-2	B3679637	2004-01-22
	4278-111-2	B103DC8722	2004-01-22
High Pass Filter	WHK1.0/15G-10SS	1	Not Required
	WHK1.0/15G-10SS	1	Not Required
	WHK/3.5/18G-10SS	3	Not Required
	WHK/3.5/18G-10SS	4	Not Required
Shielded Semi-Anechoic Chamber	RF0002	ANT0001	2004-01-21

5. DESCRIPTION OF TESTS

5.1 Equivalent Isotropic Radiated Power

Test Set-up for the EIRP TEST

Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

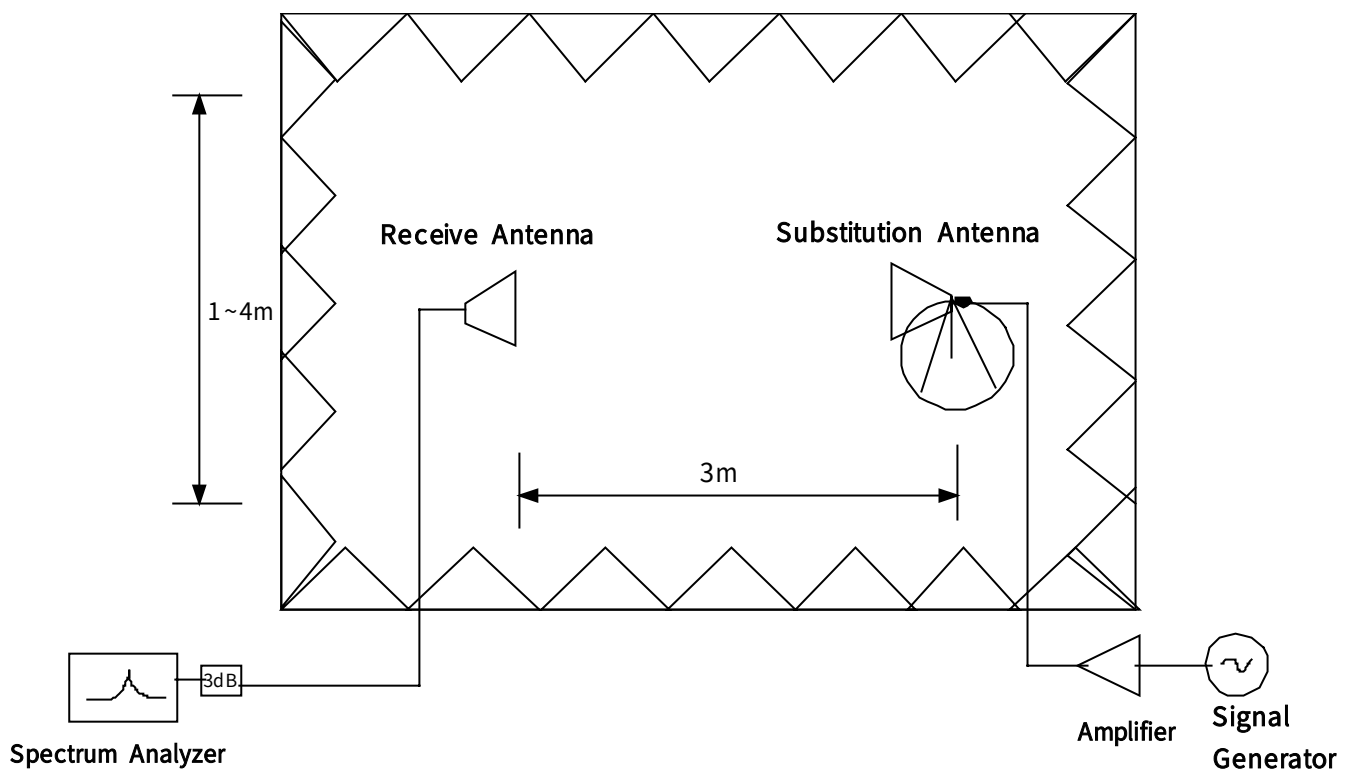


Figure 3. Diagram of EIRP test Set-up

The EUT was placed on a Non-conducted turntable 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. A Horn antenna (for readings above 1GHz) was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of Horn is measured. The EIRP is recorded. Between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

5.2 Radiated Spurious & Harmonic Emission

Test Set-up for the Radiated Emission TEST

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001

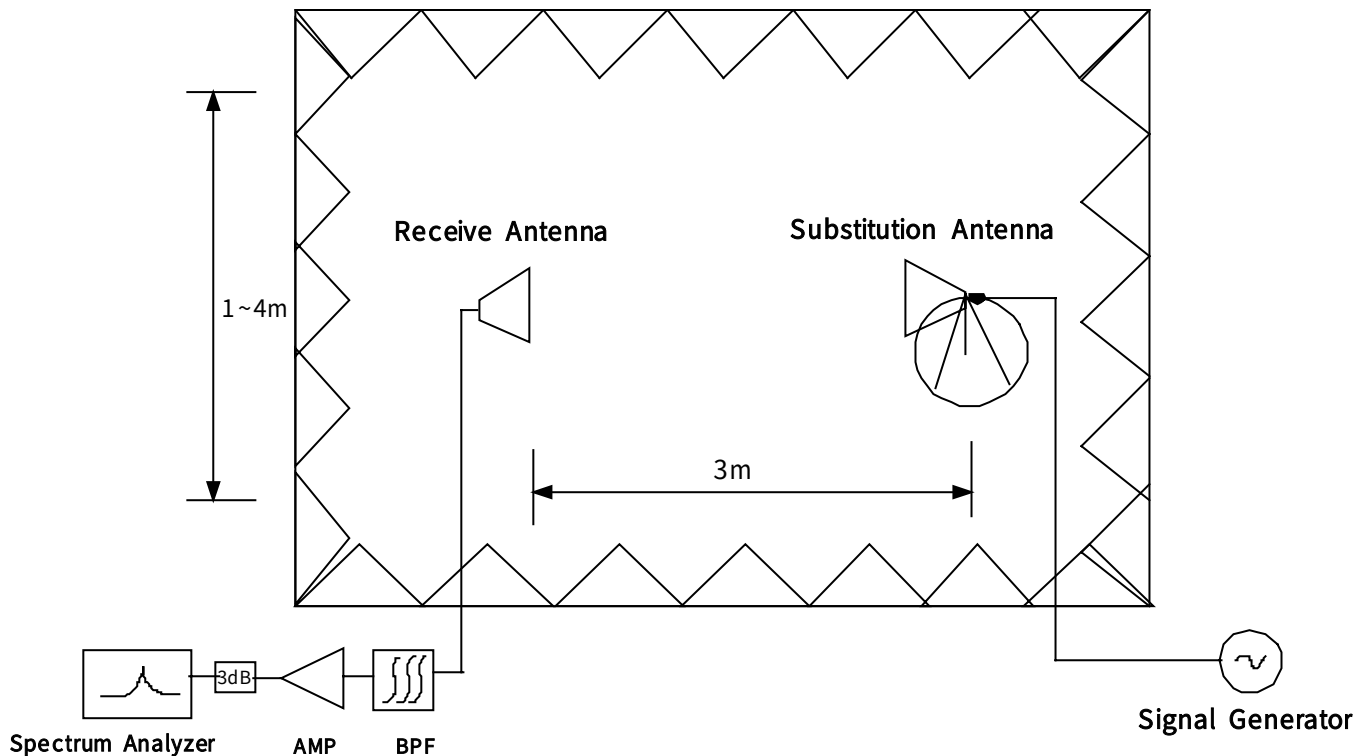


Figure 4. Diagram of Radiated Spurious & Harmonic test Set-up

The EUT was placed on a Non-conducted turntable 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. A Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. Between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

SAMPLE CALCULATION

Example: Channel 512 , Second Harmonic(3700.00MHz)

The receive analyzer reading at 3meters with the EUT on the turntable was -81.0dBm . The gain of the substituted antenna is 8.1dBi . The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0dBm of the receive analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0dB at 3700.00MHz . So 6.1dB is added to the signal generator reading of -30.9dBm yielding -24.80dBm . The fundamental EIRP was 25.501dBm so this harmonic was $25.501\text{dBm} - (-24.80) = 50.3\text{dBc}$.

5.3 Occupied Bandwidth

Test Procedure

The EUT was setup to maximum output power at its lowest channel. The occupied bandwidth was measured using a spectrum analyzer. The measurements are repeated for the highest and a middle channel. 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 26dB below the transmitter power.

Plots of the EUT's occupied bandwidth are shown herein.

5.4 Spurious and Harmonic Emissions at Antenna Terminal

5.4.1 Occupied Bandwidth Emission Limits

- (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 1MHz 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 licensee'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	Freq. Range (MHz) Transmitter (Tx)	Freq. Range (MHz) Receiver (Rx)
A	1850 – 1865	1930 – 1945
B	1870 – 1885	1950 – 1965
C	1895 – 1910	1975 – 1990
D	1865 – 1870	1945 – 1950
E	1885 – 1890	1965 – 1970
F	1890 – 1895	1970 – 1975

Table 1. Broadband PCS Service Frequency Blocks.



5.4.2 Conducted Spurious Emission

Minimum standard:

On any frequency outside a license frequency block, the power of any emission shall be attenuated below the transmitter power(P) by at least $43+10\log(P)$ dB. Limit equivalent to -13dBm, calculation shown below.

$$43 + 10\log(1.858W) = 45.69\text{dB}$$

$$32.69\text{dBm} - 45.69\text{dB} = -13\text{dBm}$$

Compliance with the out-of-band emissions requirement is based on test being performed with an analyzer resolution bandwidth of 1MHz. However in the 1MHz band immediately outside and adjacent to the frequency block a resolution bandwidth of at least 1% of the fundamental emissions bandwidth may be employed.

In case of GSM : $0.01 * 273\text{KHz} = 2.73\text{KHz}$
A Resolution BW of 3KHz was used for measurement at the band edges.

Test Procedure:

The EUT was setup to maximum output power at its lowest channel. The Resolution BW of the analyzer is set to 1% of the emission bandwidth to show compliance with the -13dBm limit, in the 1MHz bands immediately outside and adjacent to the edge of the frequency block. The measurements are repeated for the EUT's highest channel. For the Out-of-Band measurements a 1MHz RBW was used to scan from 10MHz to 20GHz. A display line was placed at -13dBm to show compliance. The high, lowest and a middle channel were tested for out of band measurements.

Plots are shown herein.



5.5 Frequency Stability / Temperature Variation

The frequency stability of the transmitter is measured by:

- a.) Temperature: The temperature is carried from -30°C to +60°C using an environmental chamber.
- b.) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification- 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 ± 0.0001 (± 1 ppm) of the center frequency.

Time Period and Procedure:

1. The carrier frequency of the transmitter and the individual oscillators is measured at room
2. temperature (25°C to 27°C to provide a reference).
3. The equipment is subjected to an overnight "soak" at -30°C without any power applied.
4. After the overnight "soak" at 30°C (Usually 14~16 hours), the equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within a three minute interval after applying to the transmitter.
5. Frequency measurements are made at 10°C interval up to room temperature. At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
6. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
7. Frequency measurements are at 10 intervals starting at 30°C up to +50°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after re-applying power to the transmitter.
8. The artificial load is mounted external to the temperature chamber.

NOTE : The EUT is tested down to the battery endpoint.



6. TEST DATA

6.1 Equivalent Isotropic Radiated Power (E.I.R.P.)

Supply Voltage : 3.7VDC

Modulation : PCS GSM

■ Reference level

Frequency (MHz)	Output (dBm)	Polarization	S/A (dBm)	Ant gain (dBi)	Ref level (dBm)
1880.00	27.00	H	-13.40	8.18	-21.58
		V	-13.02	8.18	-21.20

■ Result

Frequency (MHz)	From EUT Tested level (dBm)	Polarization (H/V)	Azimuth (angle)	EIRP (dBm)	EIRP (W)	Battery
1850.20	-15.89	H1	127	32.69	1.858	Standard
1880.00	-16.61	H1	130	31.97	1.574	Standard
1909.80	-18.73	H1	123	29.85	0.966	Standard

NOTE : Standard batteries are the only battery options for this phone

Radiated measurements at 3 meters by Substitution Method



6.2 Radiated Spurious & Harmonic measurement

Field Strength of SPURIOUS Radiation

Operating Frequency : 1850.2 MHz(Low), 1880.00 MHz(Middle), 1909.80 MHz(High)

Measured Output Power : 32.69 dBm = 1.858 W

Modulation Signal : PCS GSM

$$\text{Limit : } 43 + 10\log_{10}(w) = 45.69 \text{ dBc}$$

■ Result

Channel	Harmonic	Frequency (MHz)	From EUT Tested level (dBm)	POL (H/V)	Result (dBc)
512	2	3700.40	-48.82	H2	58.66
	3	5550.60	-53.11	H2	57.89
	4	7400.80	-67.02	H2	68.01
	5	9251.00	-	-	-
	6	11101.20	-	-	-
	7	12951.40	-	-	-
	8	14801.60	-	-	-
661	2	3760.00	-50.97	H1	60.46
	3	5640.00	-54.32	H2	59.29
	4	7520.00	-64.14	H1	65.20
	5	9400.00	-	-	-
	6	11280.00	-	-	-
	7	13160.00	-	-	-
	8	15040.00	-	-	-
810	2	3819.60	-53.39	H1	62.91
	3	5729.40	-53.73	H2	58.74
	4	7639.20	-71.89	V	73.72
	5	9549.00	-	-	-
	6	11458.80	-	-	-
	7	13368.60	-	-	-
	8	15278.40	-	-	-

Radiated Spurious Emission measurements at 3 meters by Substitution Method



6.3 Radiated Spurious & Harmonic Conversion Table

Date : 03. 12. 08 ~ 12. 09

Test Engineer : J.H. Nam

- ① Tx Cable loss
- ② Tx Horn Ant Gain
- ③ Rx Cable loss + HPF Insertion loss + Attenuator
- ④ Pre- Amp gain
- ⑤ Air loss
- ⑥ Tested Level from EUT
- ⑦ = ⑥ + ⑤ + ③ - ④
- ⑧ = EIRP - ⑦

CH	Har	Frequency (MHz)	① Tx CL (dB)	② Horn Gain (dB)	Tx Level @ (S/G 10dBm)	⑥ Tested Level EUT : H (dBm)	⑥ Tested Level EUT : V (dBm)	⑦ Amplitude of Emission EUT : H (dBm)	⑦ Amplitude of Emission EUT : V (dBm)	⑧ Result EUT : H (dBc)	⑧ Result EUT : V (dBc)
512	2	3700.40	11.36	8.87	7.51	-48.82	-50.51	-25.97	-36.43	58.66	59.78
	3	5550.60	13.74	10.60	6.86	-53.11	-54.81	-25.20	-26.79	57.89	59.48
	4	7400.80	16.59	10.83	4.24	-67.02	-69.25	-35.32	-38.29	68.01	70.98
	5	9251.00	19.04	11.56	2.52	-	-	-	-	-	-
	6	11101.20	21.40	12.79	1.39	-	-	-	-	-	-
	7	12951.40	23.26	12.66	-0.60	-	-	-	-	-	-
	8	14801.60	25.53	12.69	-2.84	-	-	-	-	-	-
661	2	3760.00	11.49	8.98	7.49	-50.97	-53.78	-27.77	-30.62	60.46	63.31
	3	5640.00	13.96	10.60	6.64	-54.32	-58.49	-26.60	-30.51	59.29	63.20
	4	7520.00	17.00	10.83	3.83	-64.14	-66.74	-32.51	-35.55	65.20	68.24
	5	9400.00	19.44	11.60	2.16	-	-	-	-	-	-
	6	11280.00	21.46	12.93	1.47	-	-	-	-	-	-
	7	13160.00	23.51	12.64	-0.87	-	-	-	-	-	-
	8	15040.00	26.12	12.70	-3.42	-	-	-	-	-	-
810	2	3819.60	11.37	8.98	7.61	-53.39	-56.93	-30.22	-33.46	62.91	66.15
	3	5729.40	14.05	10.73	6.68	-53.73	-58.35	-26.05	-30.13	58.74	62.82
	4	7639.20	17.19	10.87	3.68	-	-71.89	-	-41.03	-	73.72
	5	9549.00	19.47	11.67	2.20	-	-	-	-	-	-
	6	11458.80	21.66	12.90	1.24	-	-	-	-	-	-
	7	13368.60	24.57	12.65	-1.92	-	-	-	-	-	-
	8	15278.40	26.37	12.73	-3.64	-	-	-	-	-	-



6.4 Frequency Stability

6.4.1 Frequency Stability Table

Operating Frequency : 1,880,000,000 Hz

Channel : 661

Reference Voltage : 3.7VDC

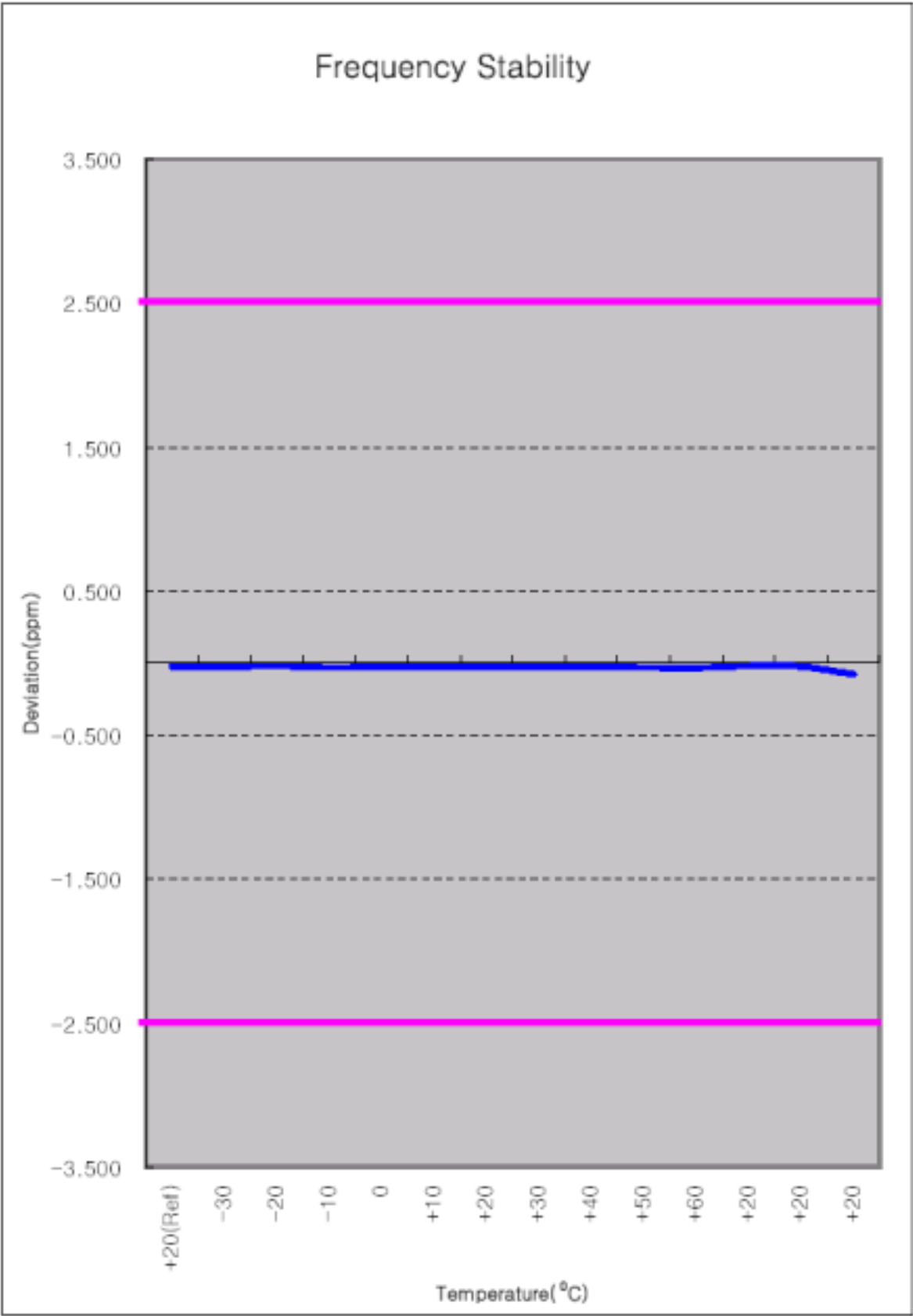
Deviation Limit : ± 0.00025 % or 2.5ppm

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency Error (Hz)	Frequency (Hz)	Deviation (%)	ppm
100%	3.70	+20(Ref)	-43	1,879,999,957	-0.000002	-0.023
100%		-30	-47	1,879,999,953	-0.000003	-0.025
100%		-20	-35	1,879,999,965	-0.000002	-0.019
100%		-10	-55	1,879,999,945	-0.000003	-0.029
100%		0	-47	1,879,999,953	-0.000003	-0.025
100%		+10	-49	1,879,999,951	-0.000003	-0.026
100%		+20	-51	1,879,999,949	-0.000003	-0.027
100%		+30	-42	1,879,999,958	-0.000002	-0.022
100%		+40	-42	1,879,999,958	-0.000002	-0.022
100%		+50	-56	1,879,999,944	-0.000003	-0.030
100%		+60	-58	1,879,999,942	-0.000003	-0.031
85%	3.15	+20	-37	1,879,999,963	-0.000002	-0.020
115%	4.26	+20	-42	1,879,999,958	-0.000002	-0.022
Batt.Endpoint	2.94	+20	-143	1,879,999,857	-0.000008	-0.076

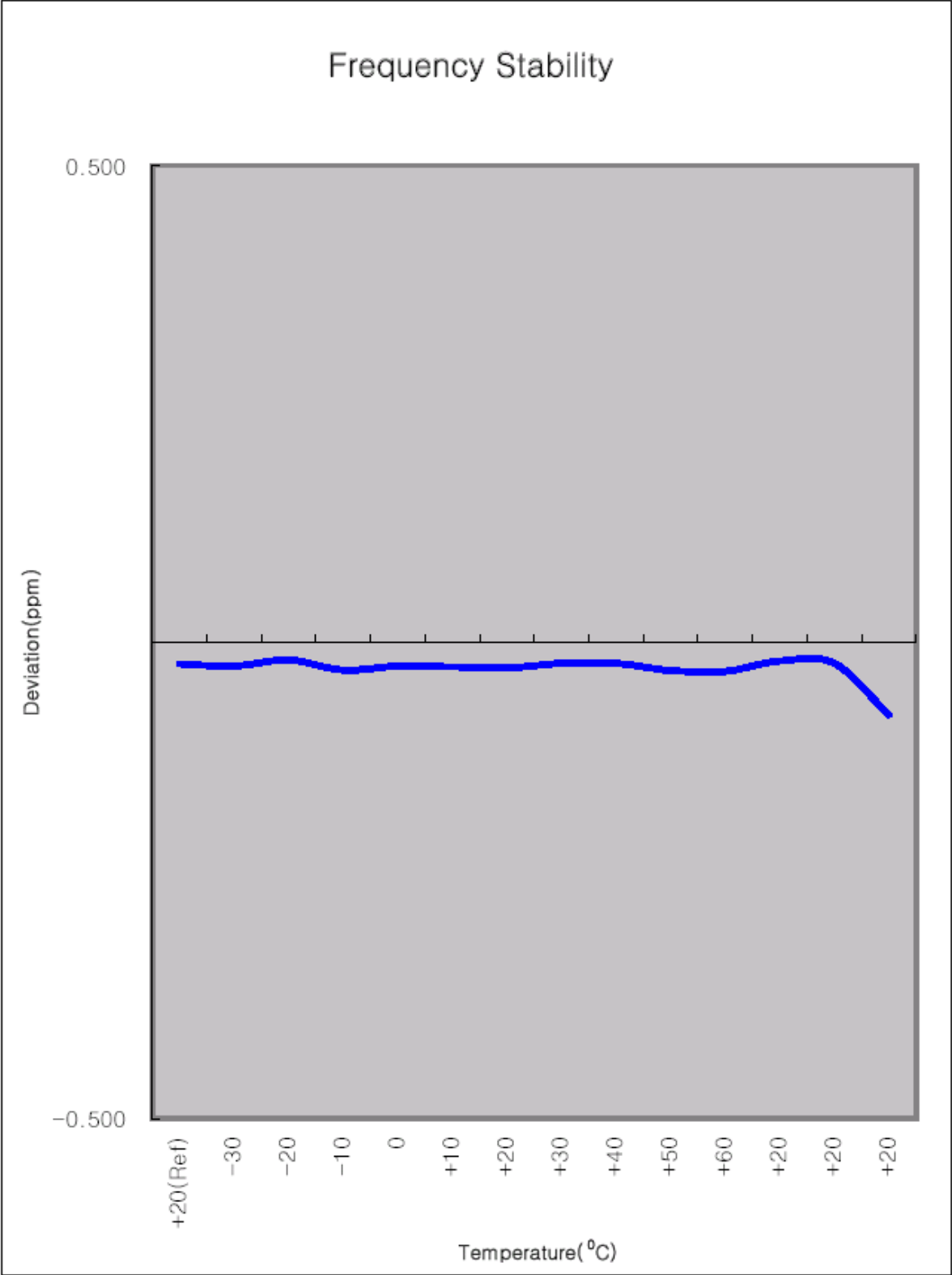
Note : The temperature is varied from -30 °C to +60 °C using an environmental chamber.

The EUT is tested down to the battery end point.

6.4.2 Frequency Stability Graph



Zoom In

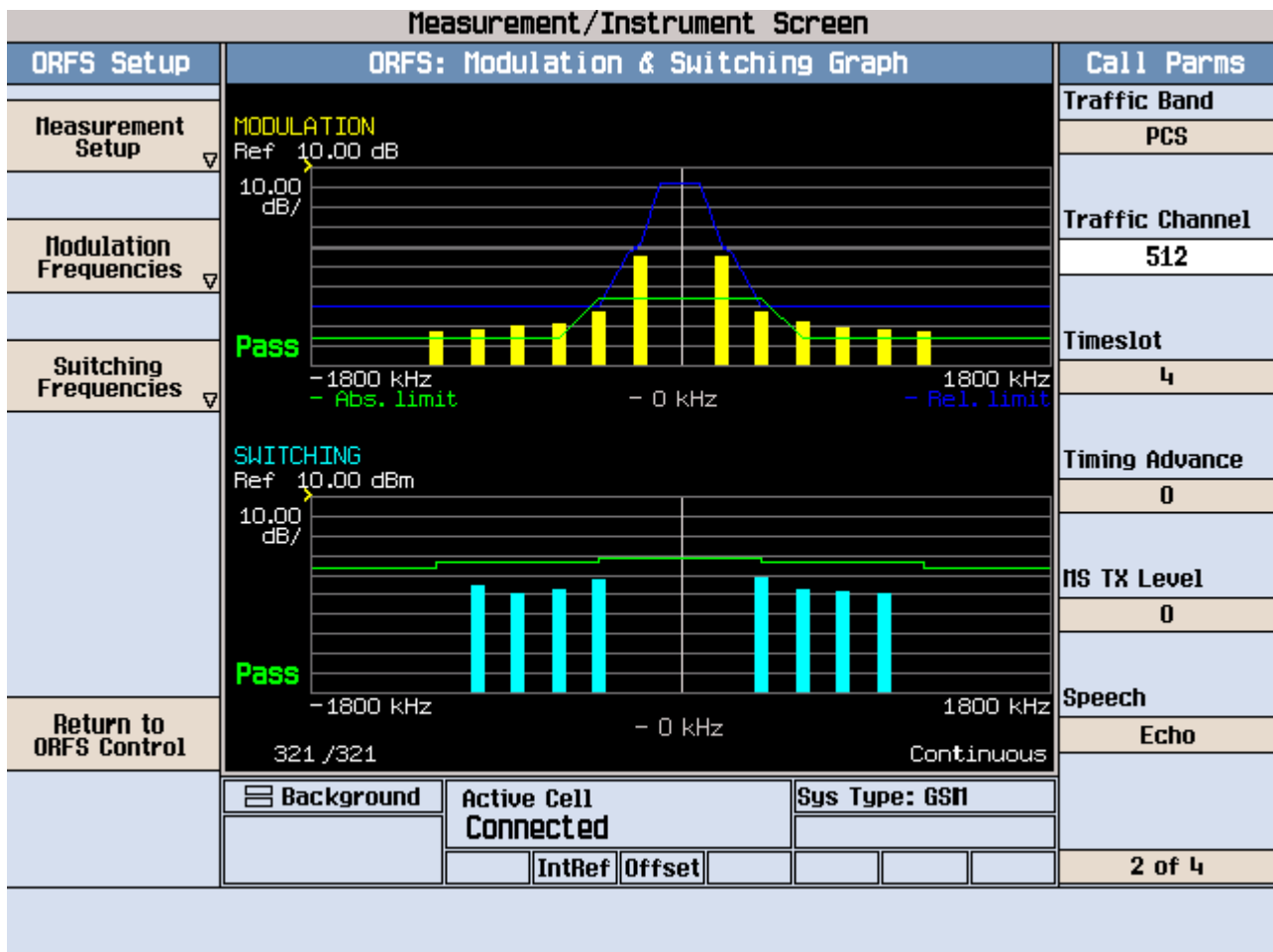


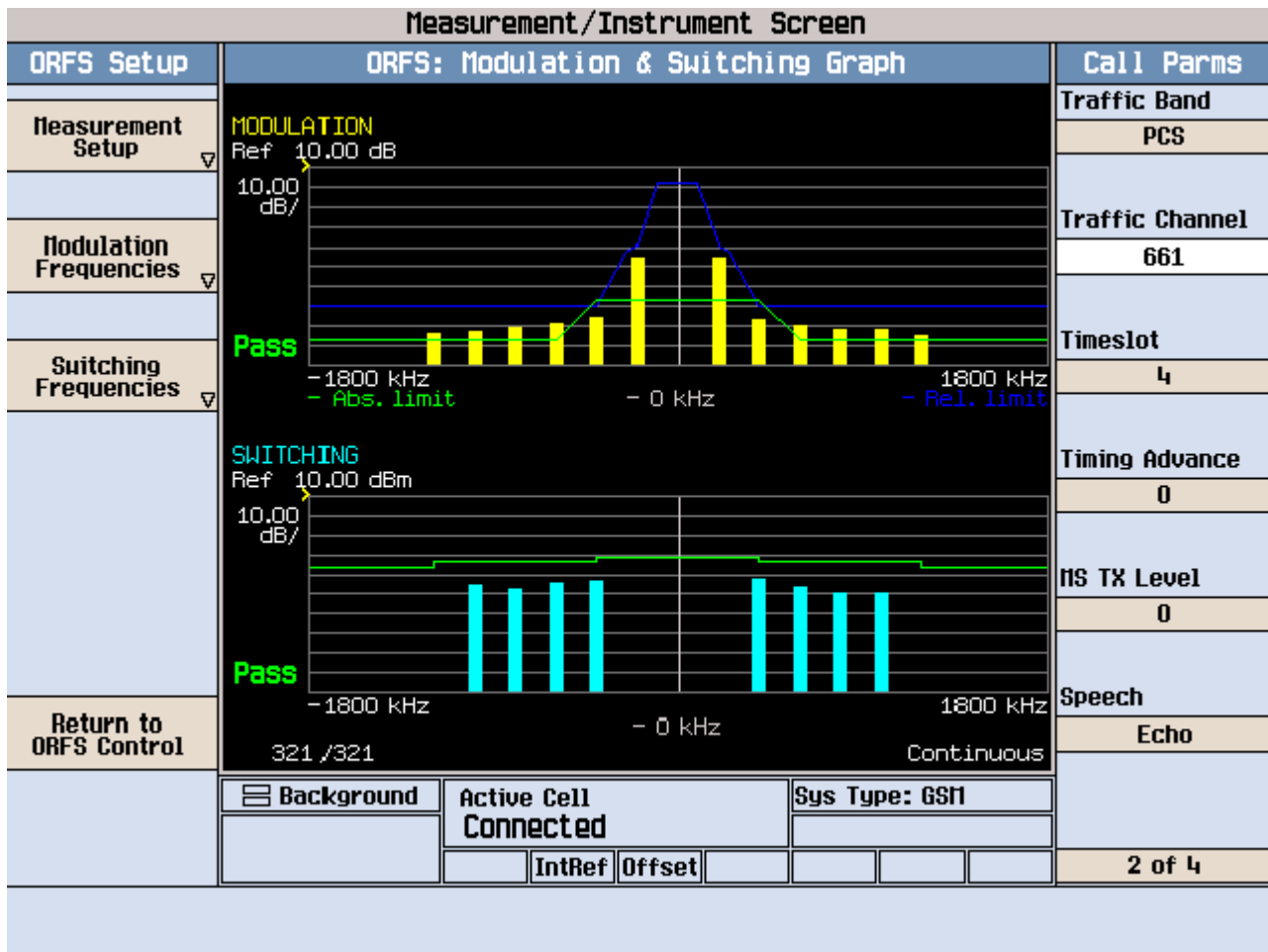


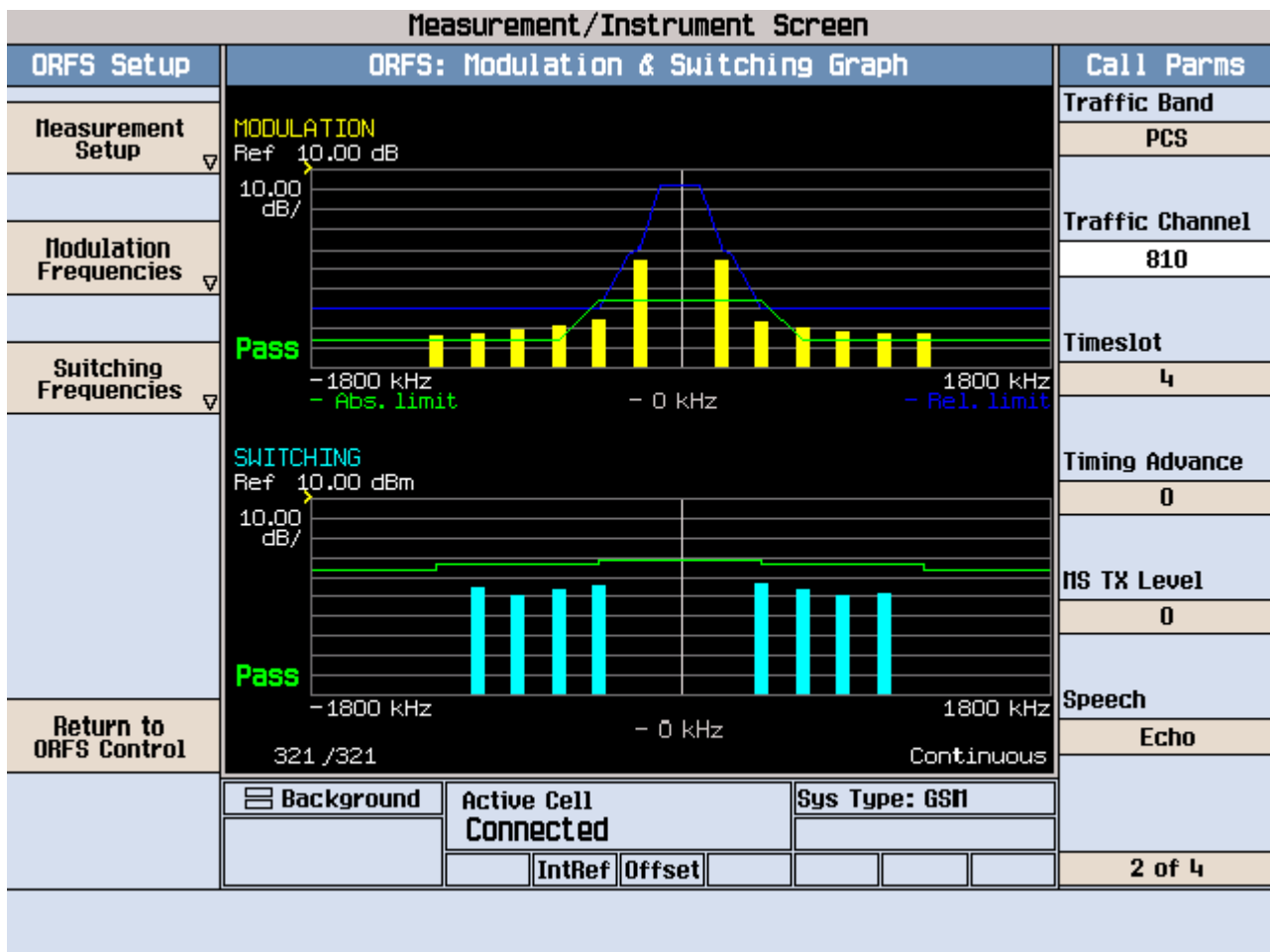
7. CONCLUSION

The data collected shows that the SAMSUNG GSM1900 PCS Phone FCC ID : A3LSGHD415 complies with all the requirements of Parts 2,24 of the FCC Rules.

8. TEST PLOTS



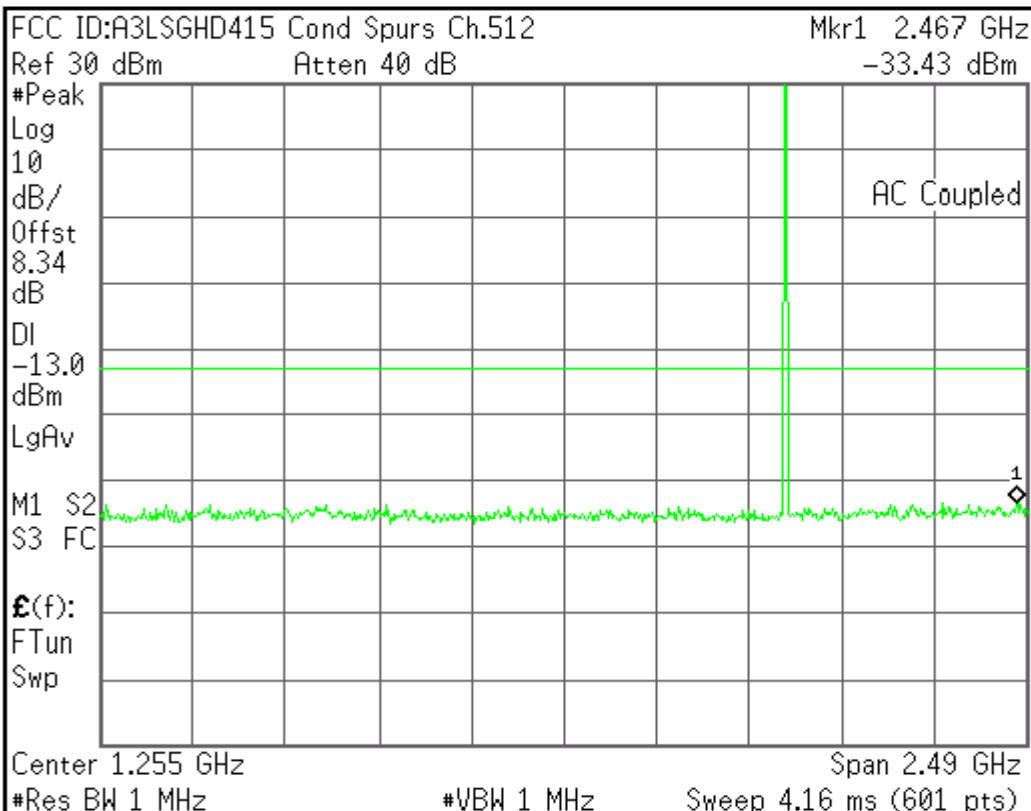




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Freq/Channel



Center Freq
1.25500000 GHz

Start Freq
10.00000000 MHz

Stop Freq
2.50000000 GHz

CF Step
249.0000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

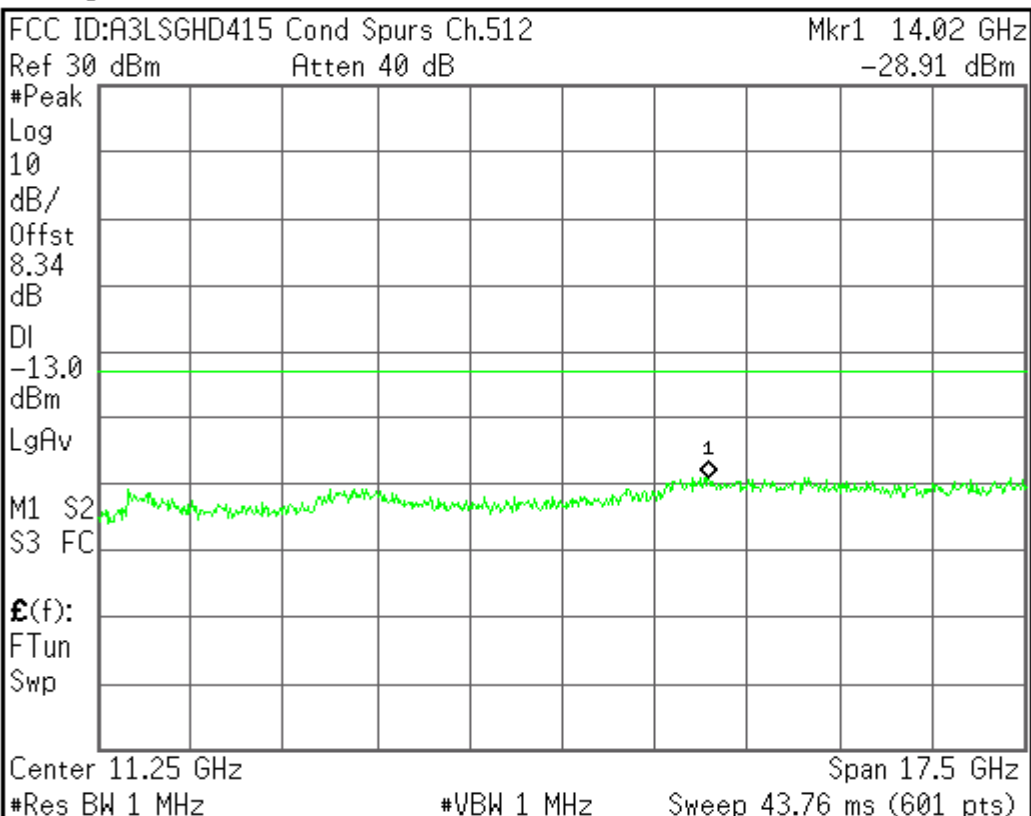
Signal Track
On Off

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Freq/Channel



Center Freq
11.25000000 GHz

Start Freq
2.50000000 GHz

Stop Freq
20.00000000 GHz

CF Step
1.75000000 GHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

Copyright 2000-2002 Agilent Technologies

Agilent

L

FCC ID:A3LSGHD415 Cond Spurs Ch.661

Mkr1 1.218 GHz

Ref 30 dBm

Atten 40 dB

-33.71 dBm

#Peak

Log

10

dB/

Offst

8.34

dB

DI

-13.0

dBm

LgAv

M1 S2

S3 FC

£(f):

FTun

Swp

AC Coupled

Center 1.255 GHz

Span 2.49 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 4.16 ms (601 pts)

Freq/Channel

Center Freq

1.25500000 GHz

Start Freq

10.0000000 MHz

Stop Freq

2.50000000 GHz

CF Step

249.000000 MHz

Auto

Man

Freq Offset

0.00000000 Hz

Signal Track

On

Off

Copyright 2000-2002 Agilent Technologies

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L

FCC ID:A3LSGHD415 Cond Spurs Ch.661

Mkr1 14.22 GHz

Ref 30 dBm

Atten 40 dB

-28.18 dBm

#Peak

Log

10

dB/

Offst

8.34

dB

DI

-13.0

dBm

LgAv

M1 S2

S3 FC

£(f):

FTun

Swp

Center 11.25 GHz

Span 17.5 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 43.76 ms (601 pts)

Freq/Channel

Center Freq

11.2500000 GHz

Start Freq

2.50000000 GHz

Stop Freq

20.0000000 GHz

CF Step

1.75000000 GHz

Auto

Man

Freq Offset

0.00000000 Hz

Signal Track

On

Off

Copyright 2000-2002 Agilent Technologies

Agilent

L

Freq/Channel

FCC ID:A3LSGHD415 Cond Spurs Ch.810
Ref 30 dBm Atten 40 dB

Mkr1 2.110 GHz
-33.23 dBm

Center Freq
1.25500000 GHz

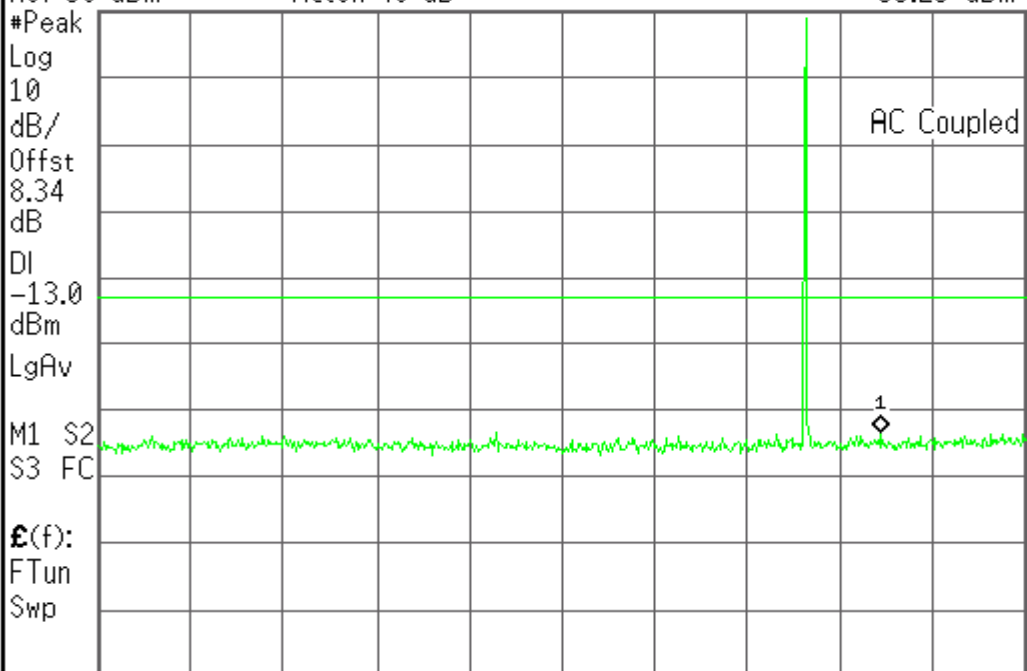
Start Freq
10.0000000 MHz

Stop Freq
2.50000000 GHz

CF Step
249.000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off



Center 1.255 GHz Span 2.49 GHz
#Res BW 1 MHz #VBW 1 MHz Sweep 4.16 ms (601 pts)

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Freq/Channel

FCC ID:A3LSGHD415 Cond Spurs Ch.810
Ref 30 dBm Atten 40 dB

Mkr1 14.02 GHz
-27.78 dBm

Center Freq
11.2500000 GHz

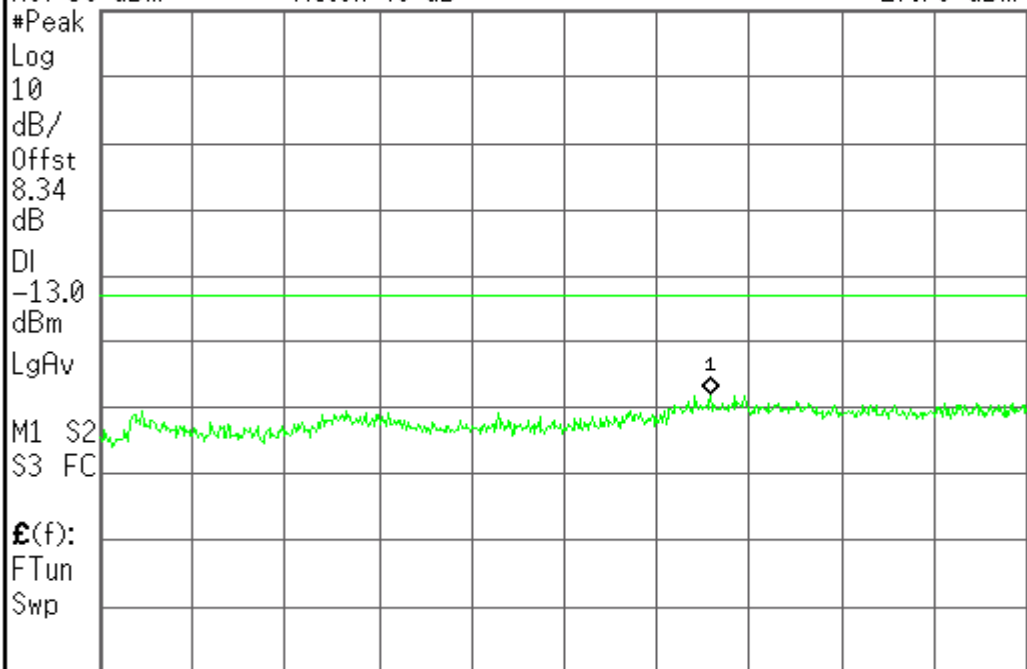
Start Freq
2.50000000 GHz

Stop Freq
20.0000000 GHz

CF Step
1.75000000 GHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off



Center 11.25 GHz Span 17.5 GHz
#Res BW 1 MHz #VBW 1 MHz Sweep 43.76 ms (601 pts)

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Freq/Channel

FCC ID:A3LSGHD415 Band Edge Ch.512

Mkr1 1.849 979 5 GHz

Ref 30 dBm

Atten 40 dB

-16.22 dBm

#Peak

Log

10

dB/

Offst

8.34

dB

DI

-13.0

dBm

LgAv

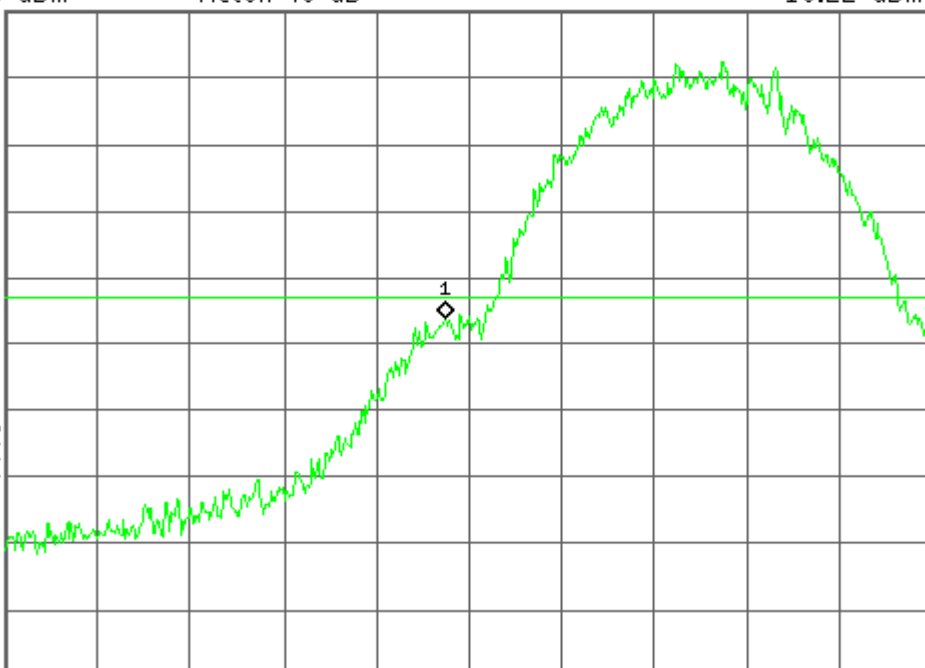
M1 S2

S3 FC

£(f):

f>50k

Swp



Center 1.850 000 0 GHz

Span 810 kHz

#Res BW 3 kHz

*VBW 3 kHz

Sweep 108.5 ms (601 pts)

Center Freq
1.85000000 GHz

Start Freq
1.84959500 GHz

Stop Freq
1.85040500 GHz

CF Step
81.0000000 kHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

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Marker

FCC ID:A3LSGHD415 Band Edge Ch.810

Mkr1 1.910 015 0 GHz

Ref 30 dBm

Atten 40 dB

-14.93 dBm

#Peak

Log

10

dB/

Offst

8.34

dB

DI

-13.0

dBm

LgAv

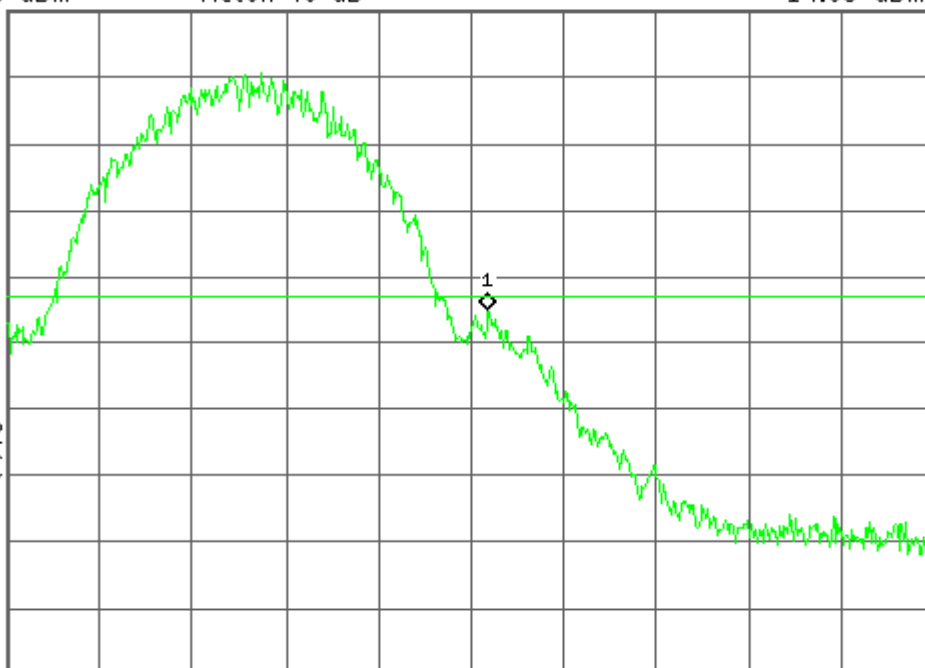
M1 S2

S3 FC

£(f):

f>50k

Swp



Center 1.910 000 0 GHz

Span 810 kHz

#Res BW 3 kHz

*VBW 3 kHz

Sweep 108.5 ms (601 pts)

Select Marker
1 2 3 4

Normal

Delta

Delta Pair
(Tracking Ref)
Ref ▲

Span Pair
Span Center

Off

More
1 of 2

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