

TEST REPORT

of

FCC Part 15 Subpart C §15.225

FCC ID: A3LSHVE210S

Equipment Under Test : Mobile Phone
Model Name : SHV-E210S(Alt : SHV-E210K)
Serial No. : N/A
Applicant : SAMSUNG ELECTRONICS CO., LTD.
Manufacturer : SAMSUNG ELECTRONICS CO., LTD.
Date of Test(s) : 2012.04.23 ~ 2012.05.02
Date of Issue : 2012.05.17

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

Tested By:



Date

2012.05.17

Alvin Kim

Approved By:



Date

2012.05.17

Feel Jeong

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1. General Information

1.1. Testing laboratory

SGS Korea Co., Ltd.(Gunpo Laboratory)

- 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

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1.2. Details of Applicant

Applicant : SAMSUNG ELECTRONICS CO., LTD.

Address : 94-1, Imsoo-dong, Gumi, Gyeongbuk, Korea

Contact Person : Lee, Ji-Young

Phone No. : +82 54 479 5806

1.3. Description of EUT

Kind of Product	Mobile Phone
Model Name	SHV-E210S(Alt : SHV-E210K)
Serial Number	N/A
Power Supply	DC 3.8 V (Li-Ion Battery)
Frequency Range	13.56 MHz
Modulation Technique	ASK
Number of Channels	1
Antenna Type	Internal type

1.4. Declaration by the manufacturer

- N/A

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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	R&S	SMR40	100272	Jul. 15, 2011	Annual	Jul. 15, 2012
Signal Generator	Agilent	8648D	3847M00534	Mar. 29, 2012	Annual	Mar. 29, 2013
Spectrum Analyzer	Agilent	E4440A	MY43362142	Mar. 29, 2012	Annual	Mar. 29, 2013
Test Receiver	R&S	ESU26	100109	Feb. 21, 2012	Annual	Feb. 21, 2013
Loop Antenna	R&S	HFH2-Z2	100118	Aug. 24, 2011	Biennial	Aug. 24, 2013
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	May 12, 2011	Biennial	May 12, 2013
High Pass Filter	Mini-Circuits	NHP-50+	VF7599000944-1	Mar. 30, 2012	Annual	Mar. 30, 2013
Preamplifier	H.P.	8447F	2944A03909	Jul. 04, 2011	Annual	Jul. 04, 2012
Two-Line V-Network	R&S	ENV216	100190	Jan. 09, 2012	Annual	Jan. 09, 2013
Test Receiver	R&S	ESHS10	863365/018	Jul. 07, 2011	Annual	Jul. 07, 2012
DC power Supply	Agilent	U8002A	MY49030063	Jan. 03, 2012	Annual	Jan. 03, 2013
Temperature Chamber	Hangil	HGTP-4050	HGTP-4050-04-01	Sep. 27, 2011	Annual	Sep. 27, 2012
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N/A	N/A	N.C.R.

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1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

Applied standard : FCC Part15 subpart C		
Standard section	Test item	Result
15.207	Transmitter AC Power Line Conducted Emission	Complied
15.225(a)(b)(c)(d) 15.209	Radiated emission	Complied
15.225(e)	Frequency Stability	Complied
15.215(c)	20 dB Bandwidth	-

1.7. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL005513	Initial
1	F690501/RF-RTL005513-1	Added Cal. Date of test equipment in section 1.5.

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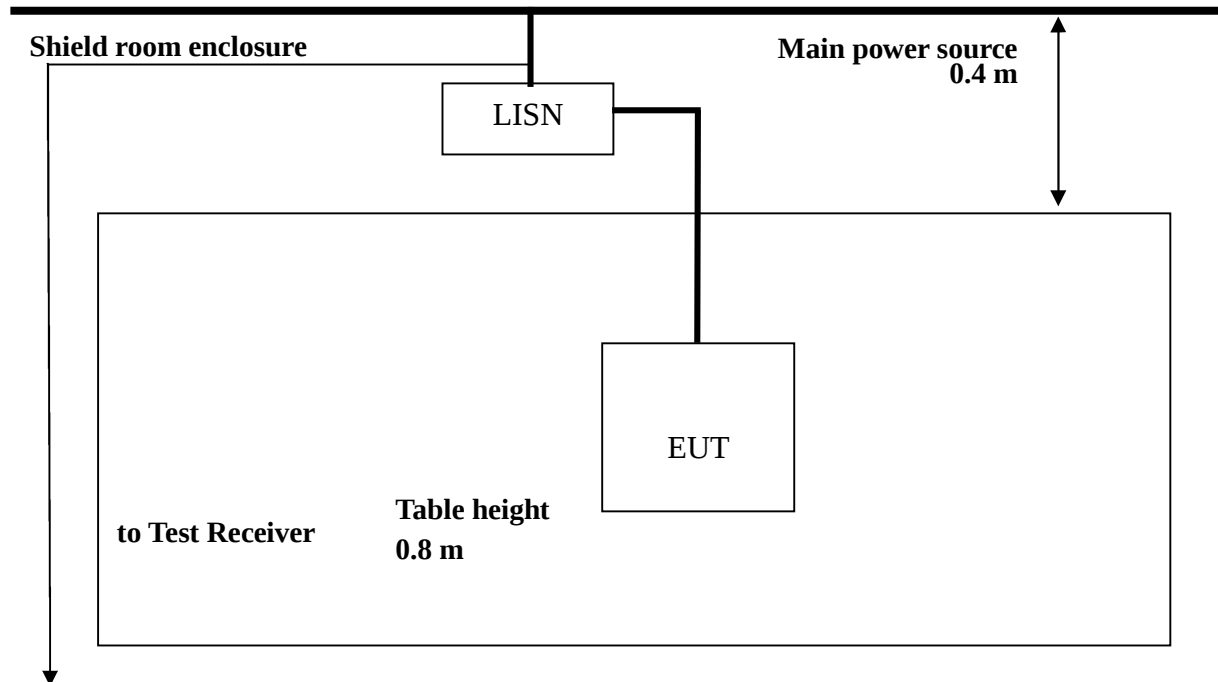
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2. Transmitter AC power line conducted emission

2.1. Test Setup



2.2. Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dB µV)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

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2.3. Test Procedures

AC power line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5 m × 3.6 m × 3.6 m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

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2.4. Test Results

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

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth : 9 kHz

FREQ. (MHz)	LEVEL(dB uV)		LINE	LIMIT(dB uV)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.40	28.70	20.20	H	57.96	47.96	29.26	27.76
1.09	30.90	22.70	H	56.00	46.00	25.10	23.30
2.52	27.90	19.20	H	56.00	46.00	28.10	26.80
3.90	27.60	19.80	H	56.00	46.00	28.40	26.20
13.66	24.70	25.70	H	60.00	50.00	35.30	24.30
18.07	27.90	18.50	H	60.00	50.00	32.10	31.50
0.20	26.70	14.10	N	63.61	53.61	36.91	39.51
0.40	25.60	18.30	N	57.96	47.96	32.36	29.66
1.22	27.80	18.40	N	56.00	46.00	28.20	27.60
2.32	24.10	15.70	N	56.00	46.00	31.90	30.30
3.90	25.80	16.80	N	56.00	46.00	30.20	29.20
18.08	24.30	17.00	N	60.00	50.00	35.70	33.00

Note ;

Line (H) : Hot

Line (N) : Neutral

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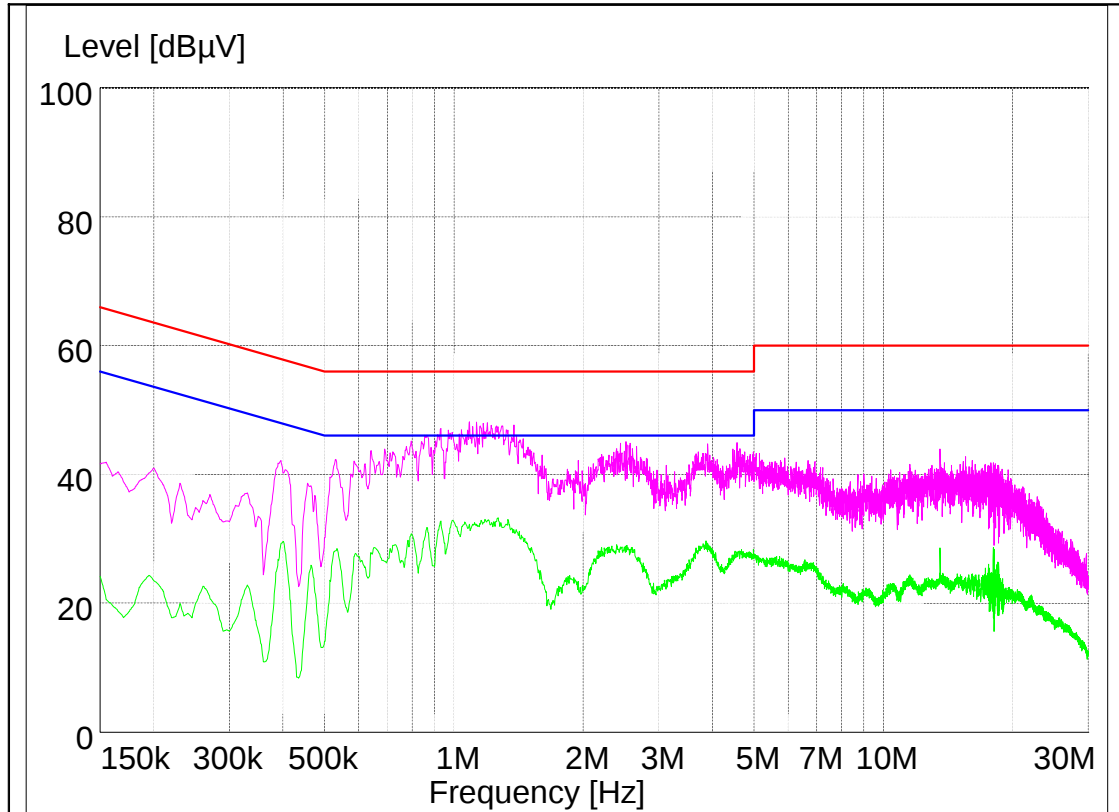
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Plot of Conducted Power line

Test mode : (Hot)



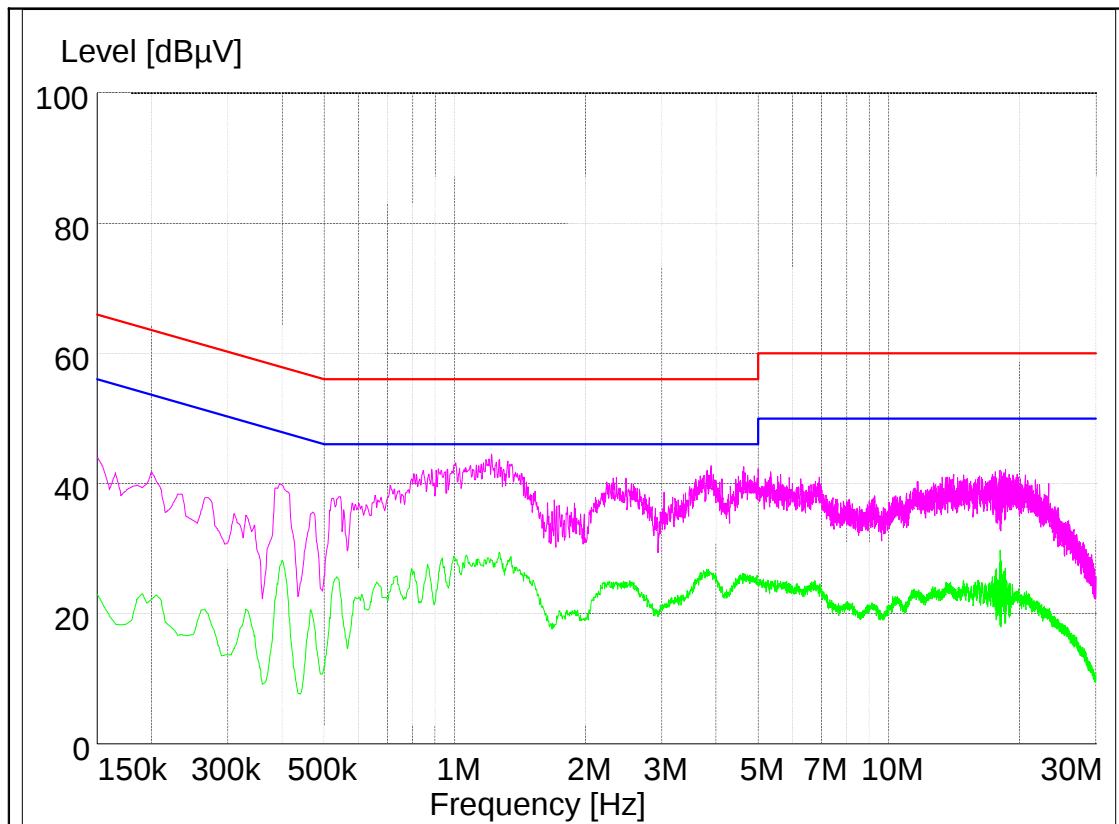
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Test mode : (Neutral)



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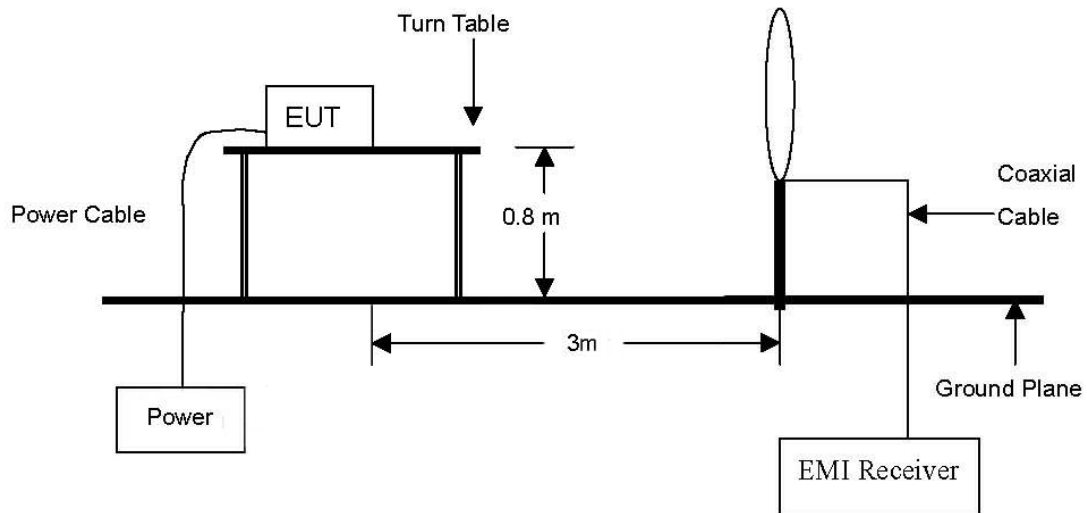
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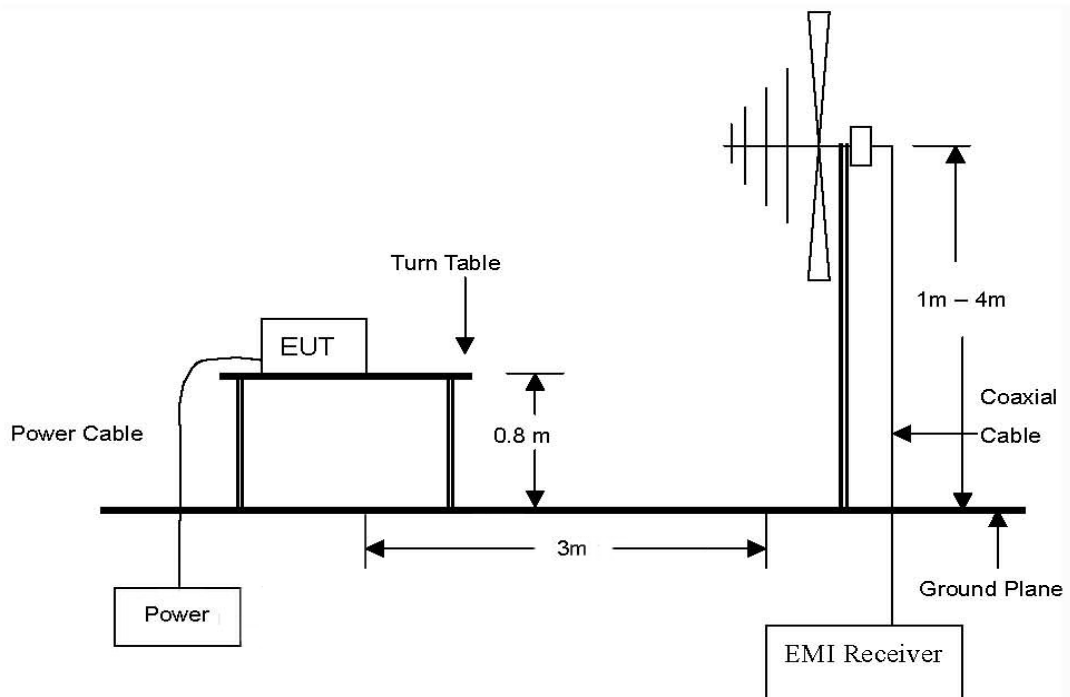
3. Radiated Emissions

3.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



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



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3.2. Limit

According to §15.225,

- (a) The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15.848 microvolts / meter at 30 meters.
- (b) Within the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts / meter at 30 meters.
- (c) Within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz the field strength of any emissions shall not exceed 106 microvolts / meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz and shall not exceed the general radiated emission limits in §15.209.

3.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4-2003

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to Average Detect Function and Specified Bandwidth with Maximum Hold Mode.

To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.

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3.4. Test Result

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

The following table shows the highest levels of radiated emissions.

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Freq. (MHz)	Reading (dB uV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB uV/m) at 3 m	Actual (dB uV/m) at 30 m	Limit (dB uV/m) at 30 m	Margin (dB)
13.560 00	26.80	Q-Peak	H	17.32	0.23	44.35	4.35	84.00	79.65

Radiated Emissions			Ant.	Correction Factors		Total		FCC Limit	
Freq. (MHz)	Reading (dB uV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB uV/m) at 3 m	Actual (dB uV/m) at 30 m	Limit (dB uV/m) at 30 m	Margin (dB)
12.577 25	5.10	Q-Peak	H	17.39	0.21	22.70	-17.30	29.54	46.84
13.110 00	5.20	Q-Peak	H	17.35	0.22	22.77	-17.23	29.54	46.77
14.010 00	5.60	Q-Peak	H	17.28	0.23	23.11	-16.89	29.54	46.43
16.420 00	5.60	Q-Peak	H	17.17	0.25	23.02	-16.98	29.54	46.52

Radiated Emissions			Ant.	Correction Factors			Total		FCC Limit	
Freq. (MHz)	Reading (dB uV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Amp. (dB)	Actual (dB uV/m) at 3 m	Actual (dB uV/m) at 30 m	Limit (dB uV/m) at 30 m	Margin (dB)
27.152 05	5.40	Q-Peak	H	17.20	0.30	N/A	22.90	-17.10	29.54	46.64

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Radiated Emissions			Ant.	Correction Factors			Total		FCC Limit	
Freq. (MHz)	Reading (dB uV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Amp. (dB)	Actual (dB uV/m) at 3 m	Actual (dB uV/m) at 30 m	Limit (dB uV/m) at 3 m	Margin (dB)
40.684 87	23.20	Q-Peak	H	13.80	0.68	-27.10	10.58	N/A	40.00	29.42
54.240 00	21.90	Q-Peak	H	13.40	0.77	-27.10	8.97	N/A	40.00	31.03
549.257 21	30.50	Q-Peak	H	16.80	2.49	-27.90	21.89	N/A	46.00	24.11
Above 600.000 00	Not detected	-	-	-	-	-	-	-	-	-

Note:

- 30 m Limit (uV/m) = $20\log(15848) = 84.00 \text{ dB}\mu\text{V/m}$
- 3 m distance compensation = $40\log(3/30) = -40 \text{ dB}\mu\text{V/m}$
= $44.35 - 40 = 4.35 \text{ dB}\mu\text{V/m}$
- Other Spurious Emission Frequencies were not detected up to 1 000 MHz.

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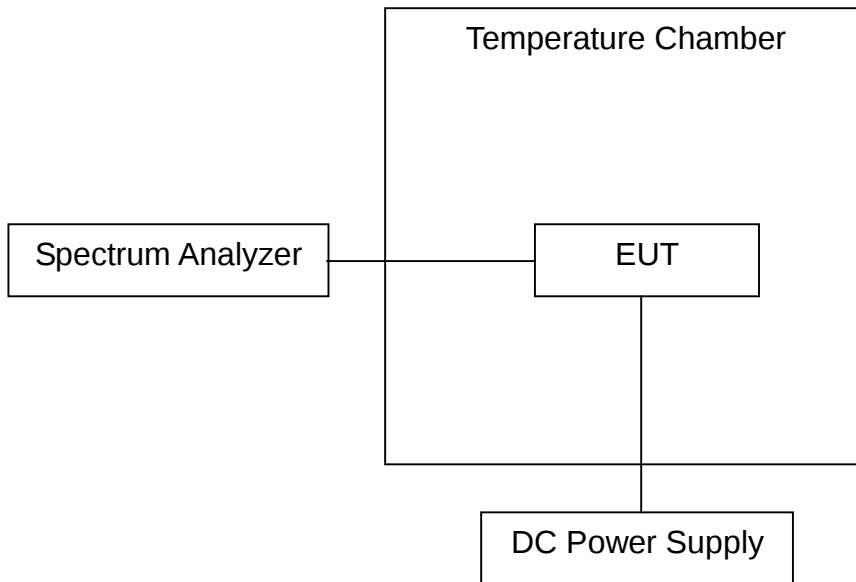
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4. Frequency Stability

4.1. Test Setup



4.2. Limit

According to §15.225(e), the frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.3. Test Procedures

- Place the EUT on the table and set it in the transmitting mode.
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- Set the environment into appropriate environment.
- Set the spectrum analyzer as RBW=100 Hz, VBW = RBW, Span = 10 kHz, Sweep = auto.
- Mark the peak frequency and measure the frequency tolerance using frequency counter function.
- Repeat until all the results are investigated.

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4.4. Test Result

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

Operating Frequency: 13.56 MHz

Reference Voltage: 3.8 V_{DC}

Temperature Variations

Power (V _{DC})	Temperature (°C)	Frequency (MHz)	Deviation (%)
3.80	-20	13.560 183	0.001 3
	-10	13.560 213	0.001 6
	0	13.560 193	0.001 4
	10	13.560 173	0.001 3
	20(Ref)	13.560 113	0.000 8
	30	13.560 083	0.000 6
	40	13.560 019	0.000 1
	50	13.560 023	0.000 2

Voltage Variations

Power (V _{DC})	Temperature (°C)	Frequency (MHz)	Deviation (%)
3.23	20	13.560 063	0.000 5
3.80	20	13.560 123	0.000 9
4.37	20	13.560 103	0.000 8

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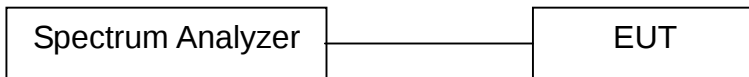
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5. 20 dB Bandwidth

5.1. Test Setup



5.2. Limit

None; for reporting purposes only.

5.3. Test Procedures

- Place the EUT on the table and set it in the transmitting mode.
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- Set the spectrum analyzer as RBW=1 kHz, VBW = RBW, Span = 100 kHz, Sweep = sweep.
- Mark the peak frequency and 20 dB (upper and lower) frequency.
- Repeat until all the rest channels are investigated.

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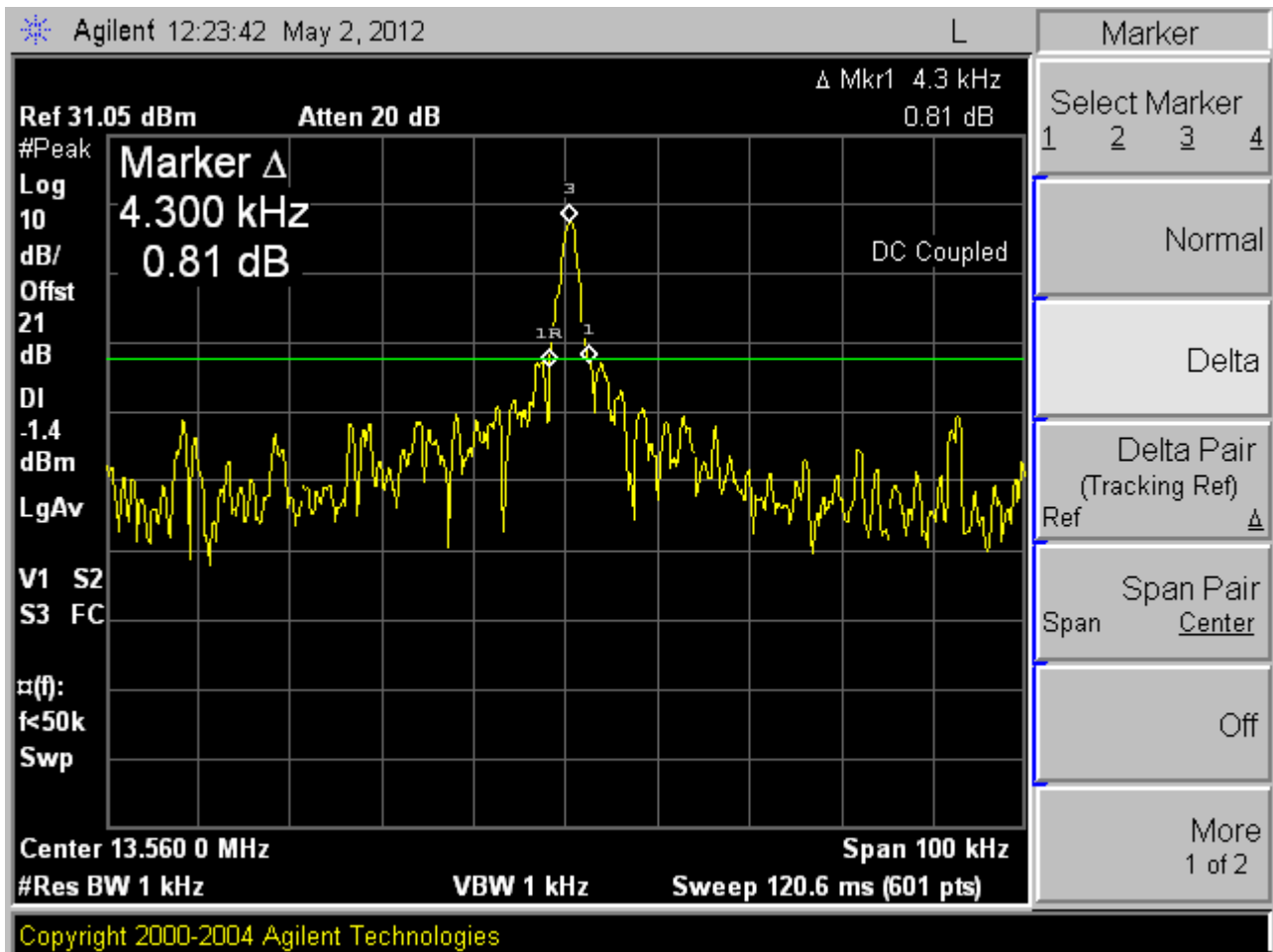
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5.4. Test Result

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

Frequency (MHz)	20 dB Bandwidth (kHz)
13.56	4.30



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