TEST REPORT

FCC ID: ZC8S321NETWORK

Applicant : Hemisphere GNSS Inc.

Address : 8515 E Anderson Dr, Scottsdale, AZ 85255, USA

Equipment under Test (EUT):

Name : GNSS Survey Receiver

Model : S321 Network, BRx6 Network

In Accordance with: FCC PART 2; FCC PART 22H; FCC PART 24E

Report No : T1851403 07
Date of Test : September 22- November 16, 2015
Date of Issue : November 16, 2015

Test Result : PASS

Test Result: **PASS**

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

Authorized Signature

(Mark Zhu)

General Manager

The manufacture should ensure that all the products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of Shenzhen Alpha Product Testing Co., Ltd. Or test done by Shenzhen Alpha Product Testing Co., Ltd. Approvals in connection with, distribution or use of the product described in this report must be approved by Shenzhen Alpha Product Testing Co., Ltd. Approvals in writing.

Contents

TEST REPORT VERIFICATION

Applicant	:	Hemisphere GNSS Inc.
Manufacturer	:	Hemisphere GNSS Inc.
EUT Description	:	GNSS Survey Receiver

(A) Model No. : S321 Network , BRx6 Network
(B) Trademark : N/A
(C) Ratings Supply : DC 10.8V from internal battery or external battery
(D)Test Voltage : DC 10.8V from internal battery

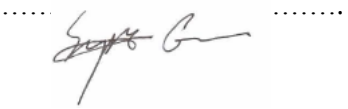
Measurement Standard Used:

FCC Rules and Regulations Part 22H & Part 24E, ANSI C63.10-2013

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the Part 22H & Part 24E limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....…..:	Eric Huang Test Engineer	
Approved by (name + signature)…....:	Simple Guan Project Manager	
Date of issue…… ……..:	November 16, 2015	

1. General Information

1.1. Description of Device (EUT)

EUT	:	GNSS Survey Receiver
Trade Name	:	N/A
Model No.	:	S321 Network , BRx6 Network
DIFF.	:	Only differ in model number.
Power supply	:	DC 10.8V from internal battery or external battery
Adapter	:	Manufacturer: NIL Model No.: PSAA30R-150
Radio Technology	:	GSM/GPRS 850 GSM/GPRS 1900
Operation frequency	:	GSM/GPRS 850: 824.2MHz—848.8MHz GSM/GPRS 1900: 1850.2MHz—1909.8MHz
Modulation	:	GSM/GPRS: GMSK
Antenna Type	:	PCB Antenna, max gain 2 dBi
Applicant	:	Hemisphere GNSS Inc.
Address	:	8515 E Anderson Dr, Scottsdale, AZ 85255, USA
Manufacturer	:	Hemisphere GNSS Inc.
Address	:	8515 E Anderson Dr, Scottsdale, AZ 85255, USA

1.2. Test Lab information

Shenzhen Alpha Product Testing Co., Ltd
Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road,
Bao'an, Shenzhen, China

August 11, 2014 File on Federal Communication Commission
Registration Number: 203110

July 18, 2014 Certificated by IC
Registration Number: 12135A

2. Summary of test

2.1. Summary of test result

Description of Test Item	Standard	Results
Conducted Output power	FCC PART 2: 2.1046 FCC PART 22H: 22.913 (a) FCC PART 24E: 24.232 (c)	PASS
Radiated Output power(erp/eirp)	FCC PART 22H:22.913 (a) FCC PART 24E:24.232(c)	PASS
Occupied bandwidth	FCC PART 2: 2.1049 FCC PART 22H: 22.917 (b) FCC PART 24E: 24.238 (b)	PASS
Frequency stability	FCC PART 2: 2.1055 FCC PART 22H: 22.355 FCC PART 24E: 24.235	PASS
Conducted spurious emission (Antenna terminal)	FCC PART 2: 2.1051 FCC PART 22H: 22.917 FCC PART 24E: 24.238	PASS
Radiated spurious emissions	FCC PART 2: 2.1053 FCC PART 22H: 22.917 FCC PART 24E: 24.238	PASS
Band edge compliance	FCC PART 22H: 22.917 (b) FCC PART 24E: 24.238 (b)	PASS
Power Line Conducted Emission Test	FCC Part 15: 15.207	PASS

2.2. Assistant equipment used for test

Description	:	Adapter
Manufacturer	:	NIL
Model No.	:	PSAA30R-150
Input	:	AC 100-240V, 50-60Hz, 0.8A
Output	:	DC 15V, 2A

2.3. Test mode

During all testing, EUT is in link mode with base station emulator at maximum power level in each test mode and channel as below:

Mode	Channel	Frequency(MHz)
GSM 850	128	824.2
	190	836.6
	251	848.8
PCS 1900	512	1850.2
	661	1880.0
	810	1909.8

2.4. Test Environment Conditions

Temperature range	21-25℃
Humidity range	40-75%
Pressure range	86-106kPa

2.5. Measurement Uncertainty (95% confidence levels, k=2)

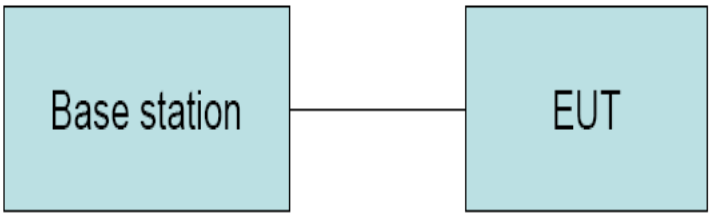
Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.42dB	
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.1dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	2.08dB	Polarize: H
	2.56dB	Polarize: V
Uncertainty for radio frequency	1×10-9	
Uncertainty for conducted RF Power	0.65dB	
Uncertainty for temperature	0.2℃	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.06%	

2.6. Test Equipment

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
3m Semi-Anechoic	ETS-LINDGREN	N/A	SEL0017	2015.01.19	1Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2015.01.19	1Year
Receiver	R&S	ESCI	1166.5950K03-1011	2015.01.19	1Year
Receiver	R&S	ESCI	101202	2015.01.19	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2015.01.21	1Year
Horn Antenna	EMCO	3115	640201028-06	2015.01.21	1Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2015.01.21	1Year
Cable	Resenberger	N/A	No.1	2015.01.19	1Year
Cable	SCHWARZBECK	N/A	No.2	2015.01.19	1Year
Cable	SCHWARZBECK	N/A	No.3	2015.01.19	1Year
Pre-amplifier	Schwarzbeck	BBV9743	9743-019	2015.01.19	1Year
Pre-amplifier	R&S	AFS33-18002650-30-8P-44	SEL0080	2015.01.19	1Year
Base station	Agilent	E5515C	GB44300243	2015.01.19	1 Year
Temperature controller	Terchy	MHQ	120	2015.01.19	1Year
Power divider	Anritsu	K240C	020346	2015.01.19	1 Year
Signal Generator	HP	83732B	VS3449051	2015.01.19	1 Year
Power Meter	Anritsu	ML2487A	6K00001491	2015.01.19	1Year
Power sensor	Anritsu	ML2491A	32516	2015.01.19	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2016.01.19	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2016.01.19	1 Year

3. Conducted Output power

3.1. Block Diagram of Test Setup



3.2. Limit

Cellular Telephone 850MHz	PCS 1900MHz
38.5dBm(ERP)	33dBm(EIRP)

3.3. Test Procedure

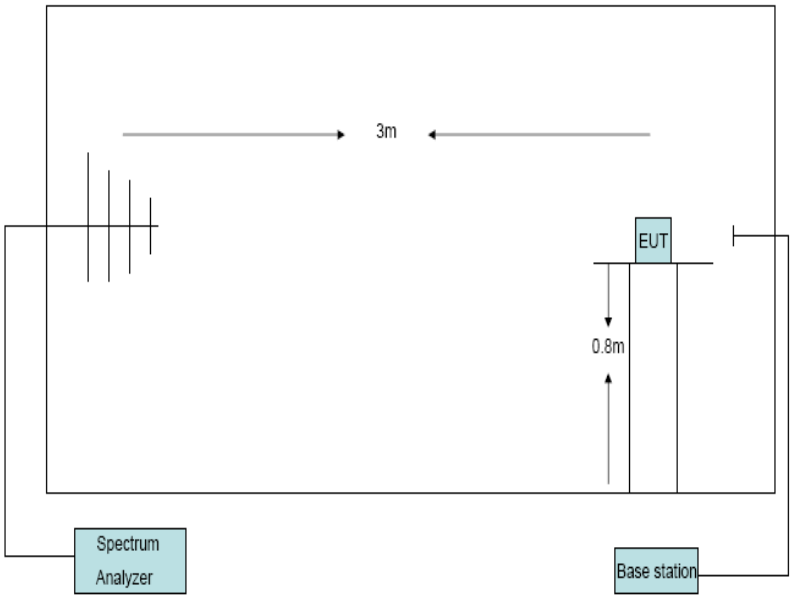
(1) The EUT's RF output port was connected to base station.
(2) A call is set up by the SS according to the generic call set up procedure
(3) Set EUT at maximum power level through base station by power level command
(4) Measure the maximum output power of EUT at each frequency band and mode by base station.

3.4. Test Result

EUT: GNSS Survey Receiver M/N:S321 Network							
Power: DC 10.8V from battery							
Ambient Temperature:23℃		Relative Humidity: 60%					
Test date: 2015-10-23		Test site: RF site Tested by: Simple Guan					
Conclusion: PASS							
Mode	Channel	PK Output Power(dBm)					Limit (dBm)
		GSM850	GPRS -1 Slot up	GPRS -2 Slot up	GPRS -3 Slot up	GPRS -4 Slot up	
GSM 850	128	33.19	32.37	31.43	29.36	28.67	38.5
	190	33.05	32.25	31.28	29.48	28.56	38.5
	251	33.24	32.14	31.54	29.71	28.59	38.5
PCS 1900	512	29.37	29.02	28.05	26.24	25.12	33
	661	29.92	29.11	28.24	26.36	25.24	33
	810	29.86	29.08	28.43	26.53	25.35	33

4. Radiated Output power

4.1. Block Diagram of Test Setup



4.2. Limit

Cellular Telephone 850MHz	PCS 1900MHz
38.5dBm(ERP)	33dBm(EIRP)

4.3. Test Procedure

1. The EUT was placed on a non-conductive rotating platform with 0.8 meter height in an anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer with RBW= 3MHz, VBW= 3MHz and peak detector settings.
2. During the measurement, the EUT was enforced in maximum power and linked with a base station. The highest emission was recorded from analyzer power level (LVL) from the 360 degrees rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations
3. Effective Isotropic Radiated Power (EIRP) was measured by substitution method according to TIA/EIA-603-C. The EUT was replaced by dipole antenna (for frequency below 1GHz) or Horn antenna (for frequency above 1GHz) at same location with same polarize of receiver antenna and then a known power of each measure frequency from

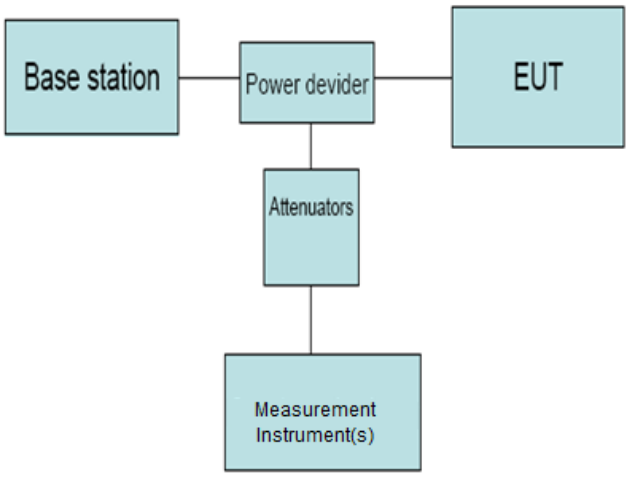
S.G. was applied into the dipole antenna or Horn antenna through a Tx cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna. The correction factor (in dB) = S.G. - Tx Cable loss + Substitution antenna gain –Substitution antenna Loss (only for Dipole antenna) - Analyzer reading. Then the EUT's EIRP was calculated with the correction factor, EIRP= LVL + Correction factor and ERP = EIRP – 2.15

4.4. Test Result

EUT: GNSS Survey Receiver M/N:S321 Network					
Power: DC 10.8V from battery					
Ambient Temperature:23℃			Relative Humidity: 60%		
Test date: 2015-10-23			Test site: RF site	Tested by: Simple Guan	
Conclusion: PASS					
Mode	Channel	LVL (dBm)	Correction factor(dB)	ERP (dBm)	EIRP (dBm)
GSM 850	128	4.3	26.61	28.76	/
	190	4.4	26.86	29.11	/
	251	4.3	26.49	28.64	/
PCS 1900	512	4.2	22.27	/	26.47
	661	4.2	22.66	/	26.86
	810	4.1	22.37	/	26.47
ERP=LVL + Correction factor -2.15 EIRP=LVL+ Correction factor					

5. Peak-to-Average Ratio

5.1. Block Diagram of Test Setup



5.2. Limit

In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

5.3. Test Procedure

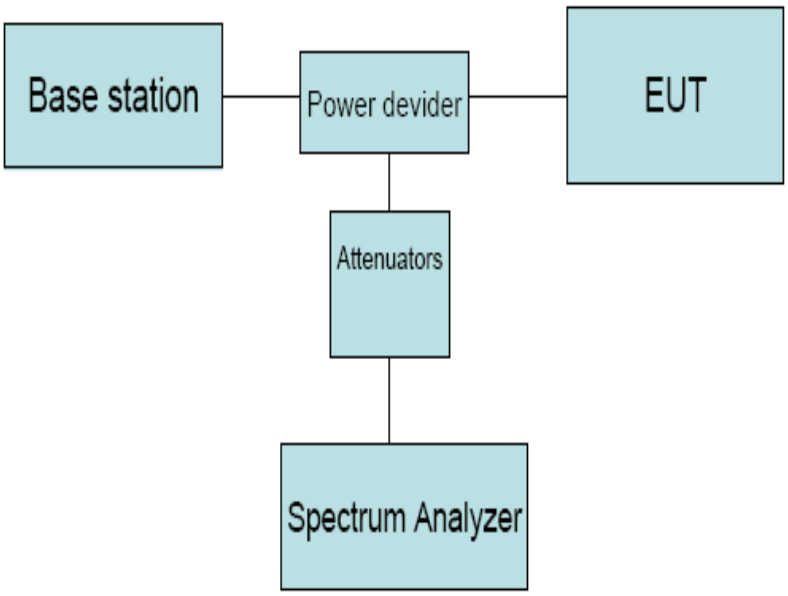
The EUT' RF output port was connected to Measurement Instrument(s) and Base Station Via power divider, and then measure the test data.

5.4. Test Result

Test Band	Test Mode	Test Channel	Measured[dB]	Limit [dB]	Verdict
GSM1900	GSM	LCH	0.35	13	PASS
		MCH	0.22	13	PASS
		HCH	0.19	13	PASS
	GPRS	LCH	3.19	13	PASS
		MCH	3.22	13	PASS
		HCH	3.14	13	PASS

6. Occupied Bandwidth

6.1. B lock Diagram of Test Setup



6.2. Limit

N/A

6.3. Test Procedure

1. The EUT' RF output port was connected to Spectrum Analyzer and Base Station via power divider.

2. Spectrum analyzer's occupied bandwidth measure function was used to measure 99% bandwidth and -26dBc bandwidth

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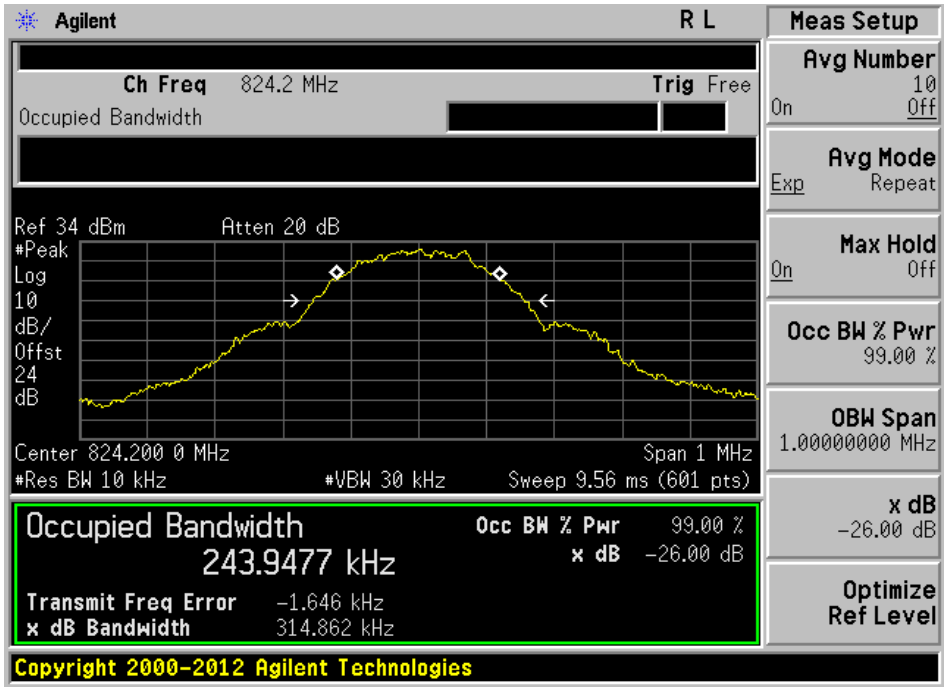
6.4. Test Result

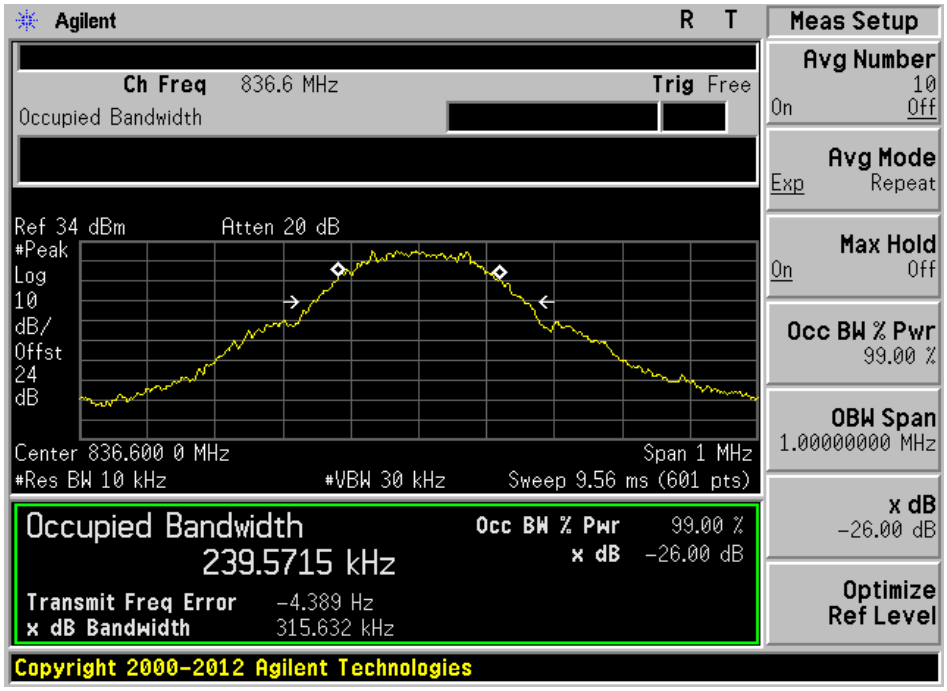
EUT: GNSS Survey Receiver M/N:S321 Network			
Power: DC 10.8V from battery			
Ambient Temperature:23℃		Relative Humidity: 60%	
Test date: 2015-10-23		Test site: RF site	Tested by: Simple Guan
Mode	Channel	99% bandwidth (KHz)	-26dBc bandwidth (KHz)
GSM 850	128	243.95	314.86
	190	239.57	315.63
	251	247.96	324.42
PCS 1900	512	243.68	316.13
	661	245.72	315.04
	810	243.19	319.24

6.5. Orginal test data

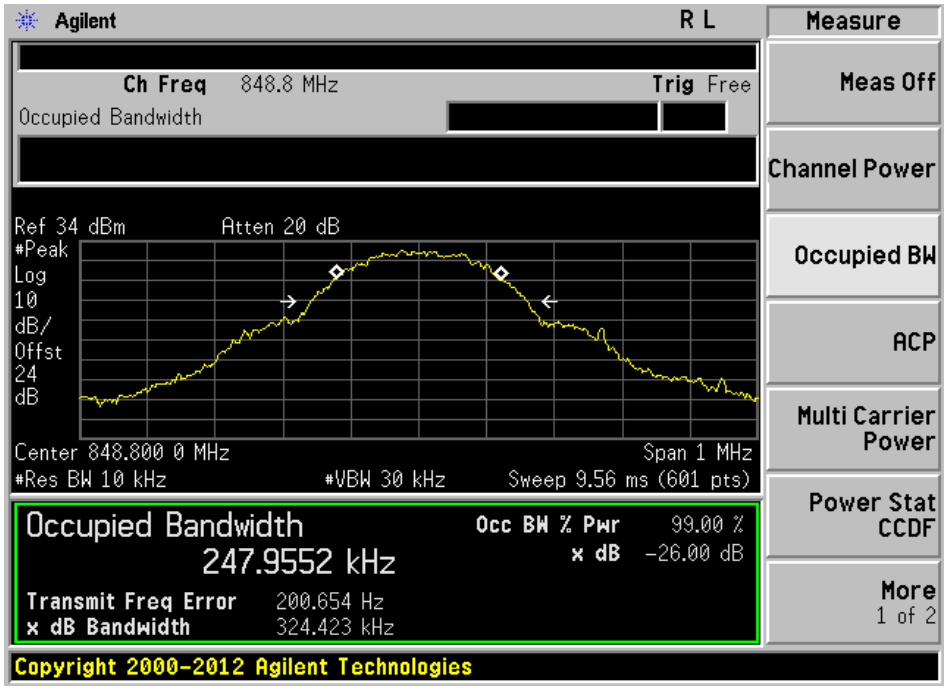
GSM 850 CH128



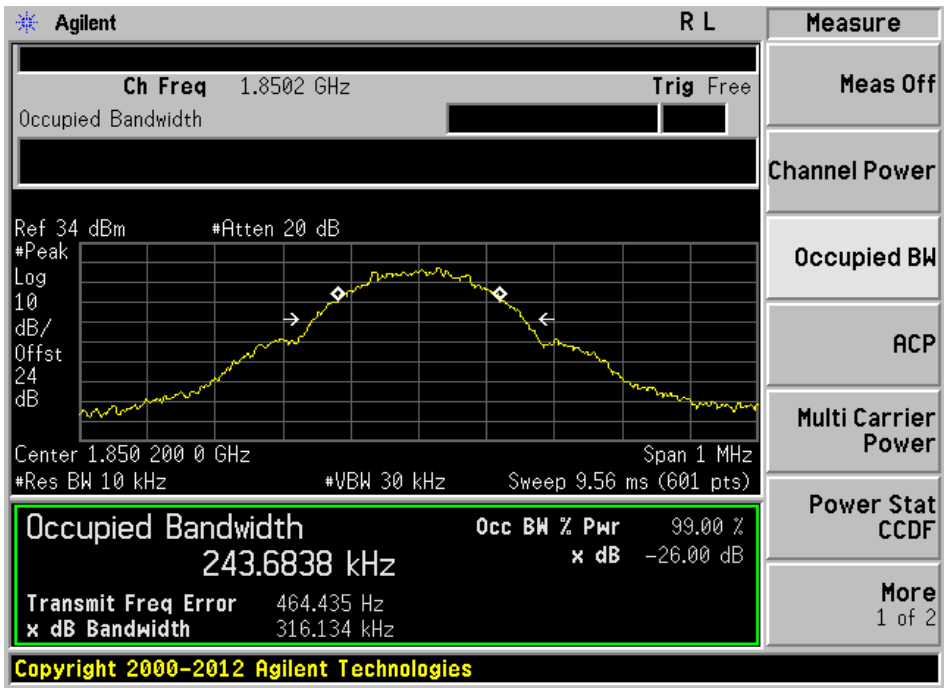
GSM 850 CH190



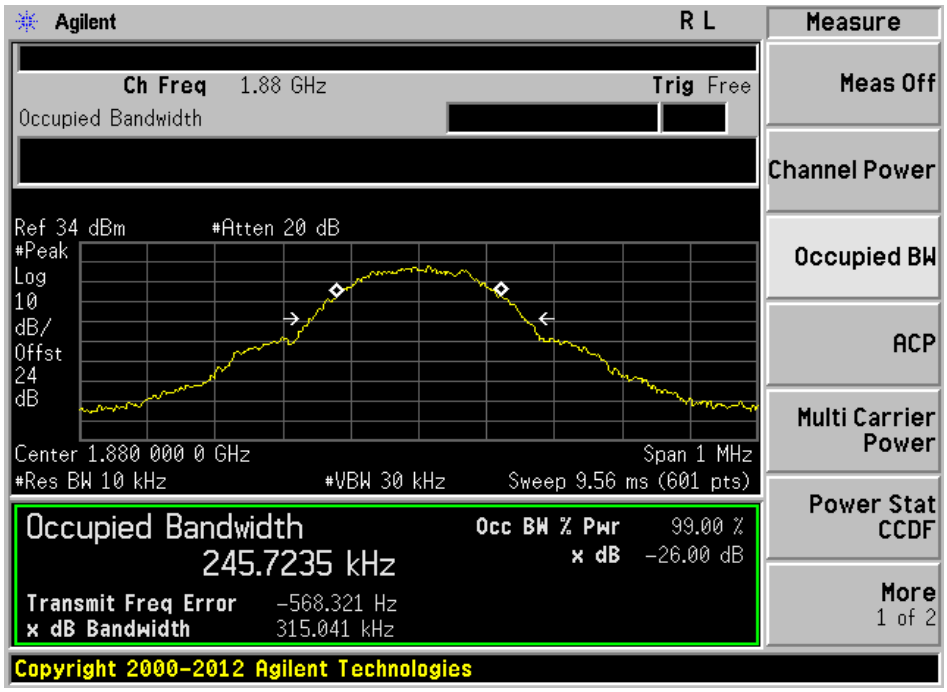
GSM 850 CH251



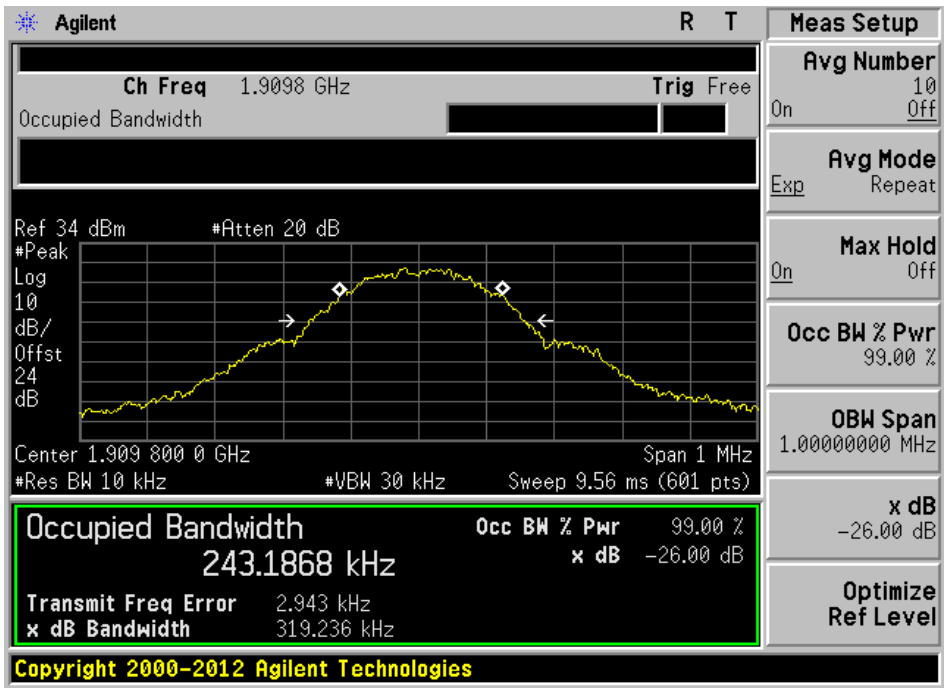
PCS 1900 CH512



PCS 1900 CH661

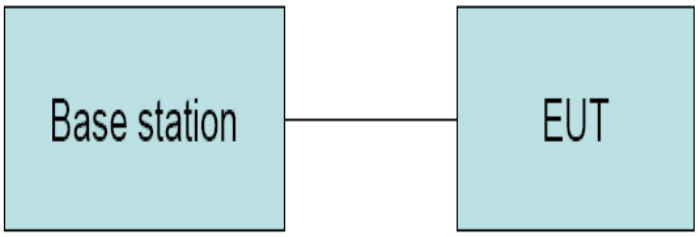


PCS 1900 CH810



7. Frequency stability

7.1. Block Diagram of Test Setup



7.2. Limit

Cellular Telephone 850MHz	PCS 1900MHz
± 2.5 ppm	Must stay within the authorized frequency block

7.3. Test Procedure

Test Procedures for Temperature Variation:

1. The EUT was set up in the thermal chamber and connected with the base station.
2. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

Test Procedures for Voltage Variation

1. The EUT was placed in a temperature chamber at 25±5° C and connected with the base station.
2. The power supply voltage to the EUT was varied from DC 10.8 V to 9 V
3. The variation in frequency was measured for the worst case.

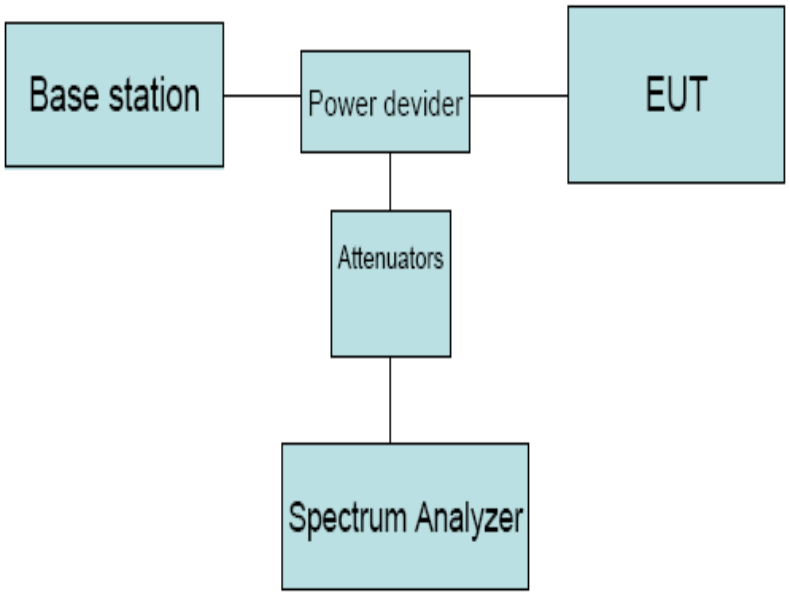
7.4. Test Result

EUT: GNSS Survey Receiver M/N: S321 Network			
Power: DC 10.8V from battery			
Ambient Temperature:23C		Relative Humidity: 60%	
Test date: 2015-10-23		Test site: RF site	Tested by: Simple Guan
Conclusion: PASS			
Mode	Voltage (V)	Frequency error (Hz)	frequency error (ppm)
GSM 850 CH 190	10.8V	17.57	0.02
	10.0V	-18.35	-0.02
	9.5V	15.43	0.02
	9.0V	-16.56	-0.02
PCS 1900 CH661	10.8V	-26.32	-0.02
	10.0V	36.43	0.02
	9.5V	-31.05	-0.02
	9.0V	31.62	0.02

Mode	Temperature (℃)	Frequency error (Hz)	frequency error (ppm)
GSM 850 CH190	-30	23.35	0.02
	-20	22.58	0.02
	-10	23.37	0.02
	0	23.68	0.02
	10	-15.43	-0.02
	20	18.38	0.02
	30	-12.63	-0.02
	40	-13.42	-0.02
	50	-21.71	-0.01
PCS 1900 CH661	-30	37.58	0.02
	-20	37.56	0.02
	-10	37.21	0.02
	0	37.43	0.02
	10	-24.35	-0.02
	20	31.28	0.02
	30	-24.63	-0.02
	40	21.71	0.02
	50	-11.46	-0.01

8. Conducted spurious emissions

8.1. Block Diagram of Test Setup



8.2. Limit

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB, in this case, -13dBm.

8.3. Test Procedure

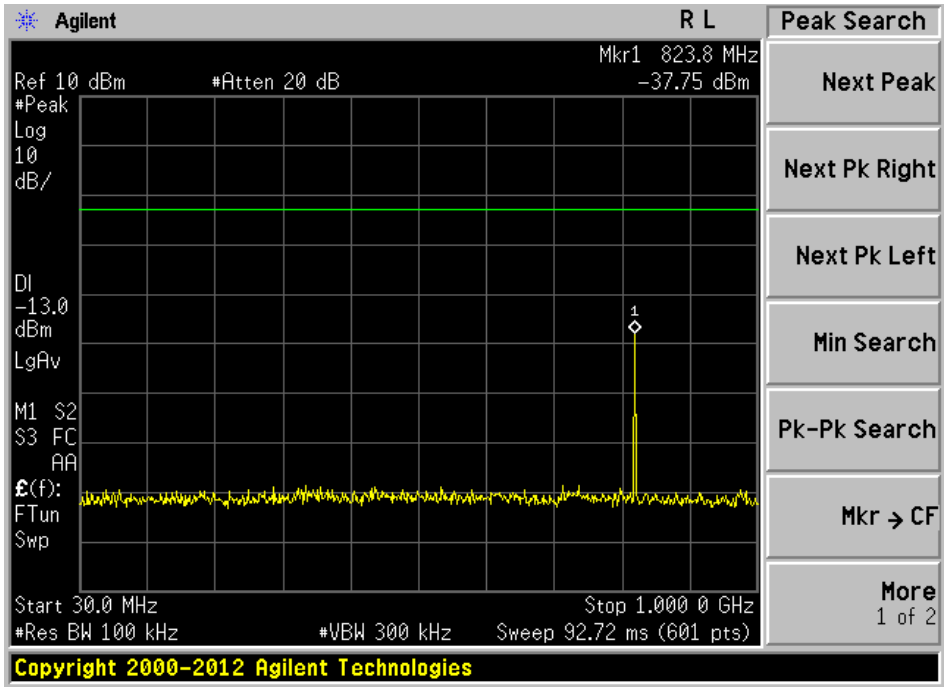
1. The EUT was connected to spectrum analyzer and base station via power divider.

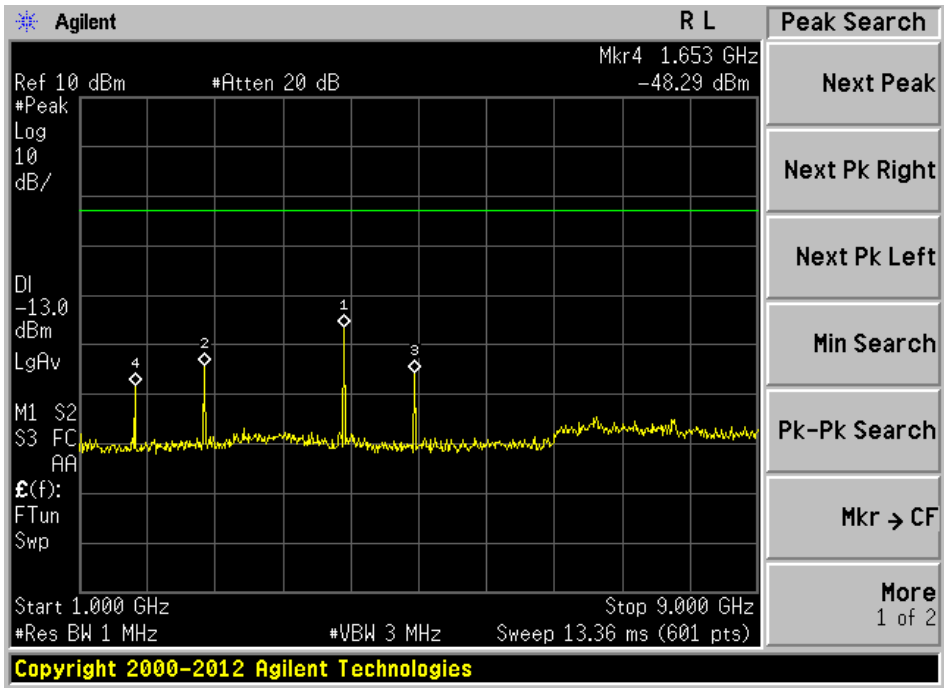
2. The low, middle and high channels of each band and mode's spurious emissions for 30MHz to 10th Harmonic were measured by Spectrum analyzer.

8.4. Test Result

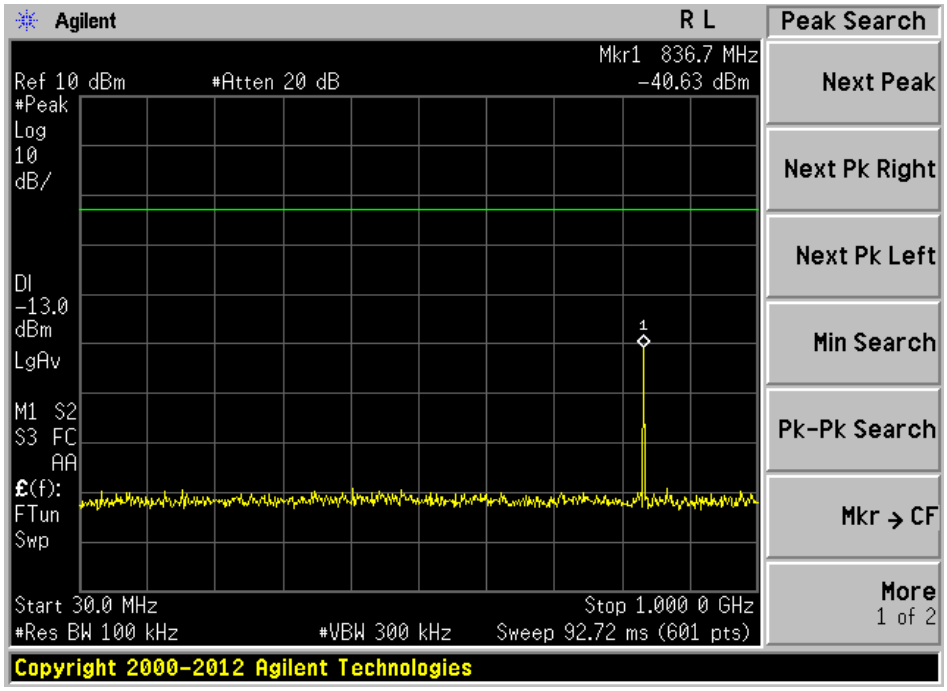
PASS

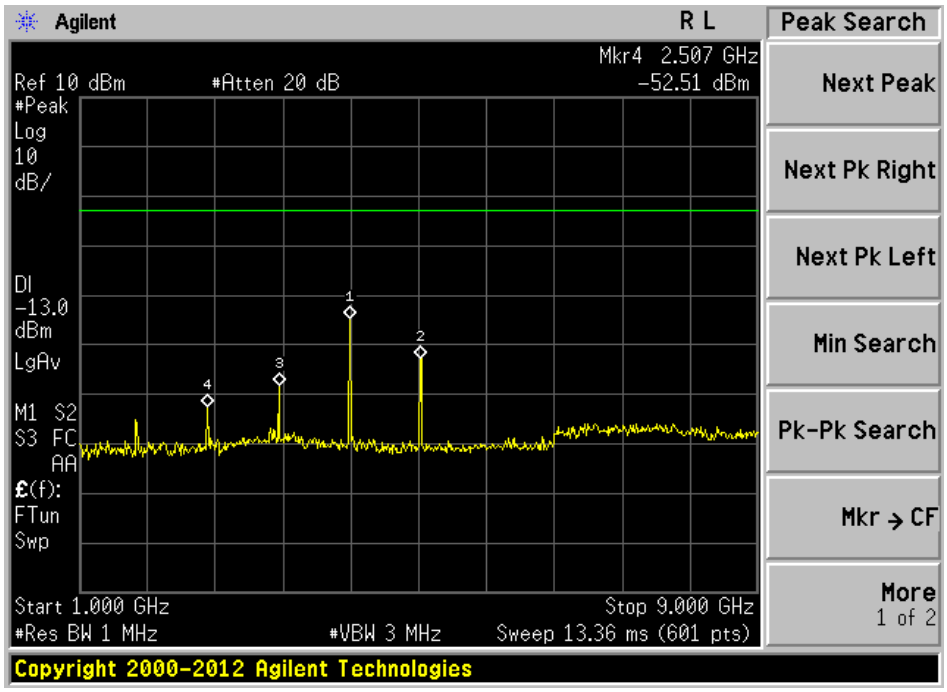
Test Mode: GSM 850 CH 128



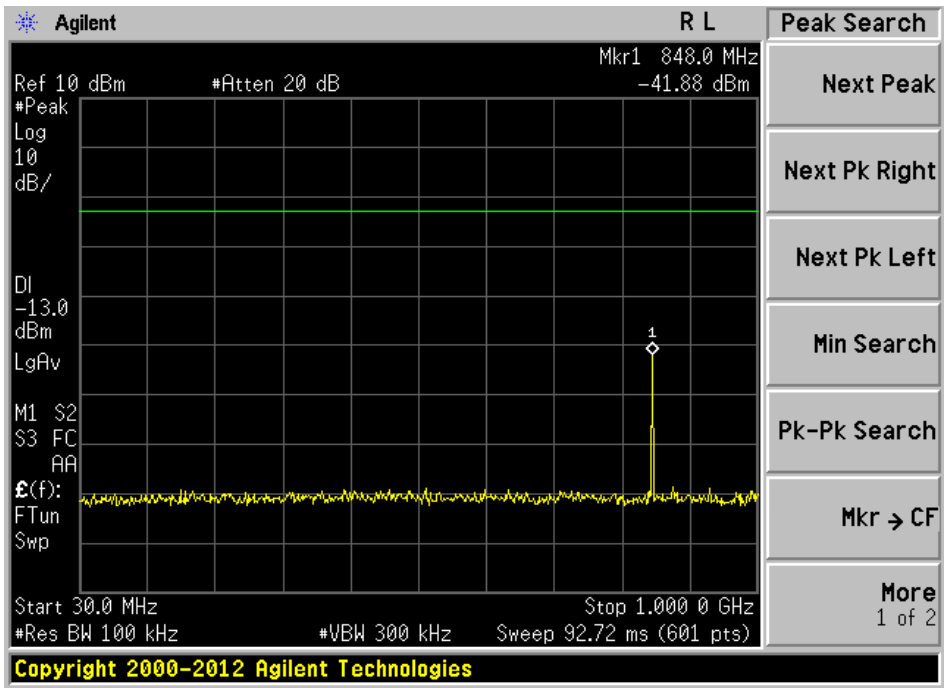


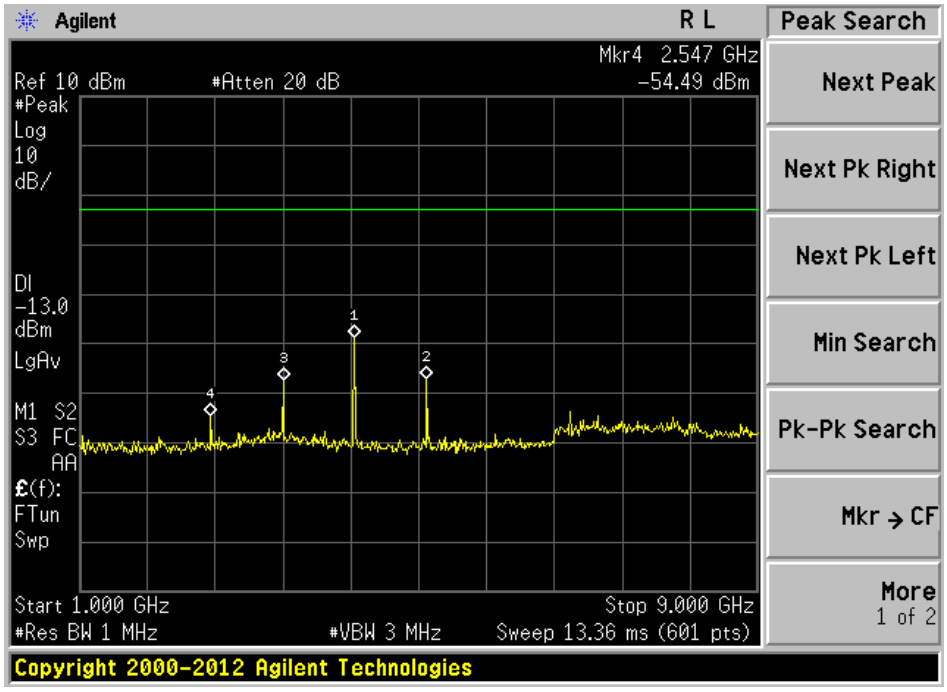
Test Mode: GSM 850 CH 190



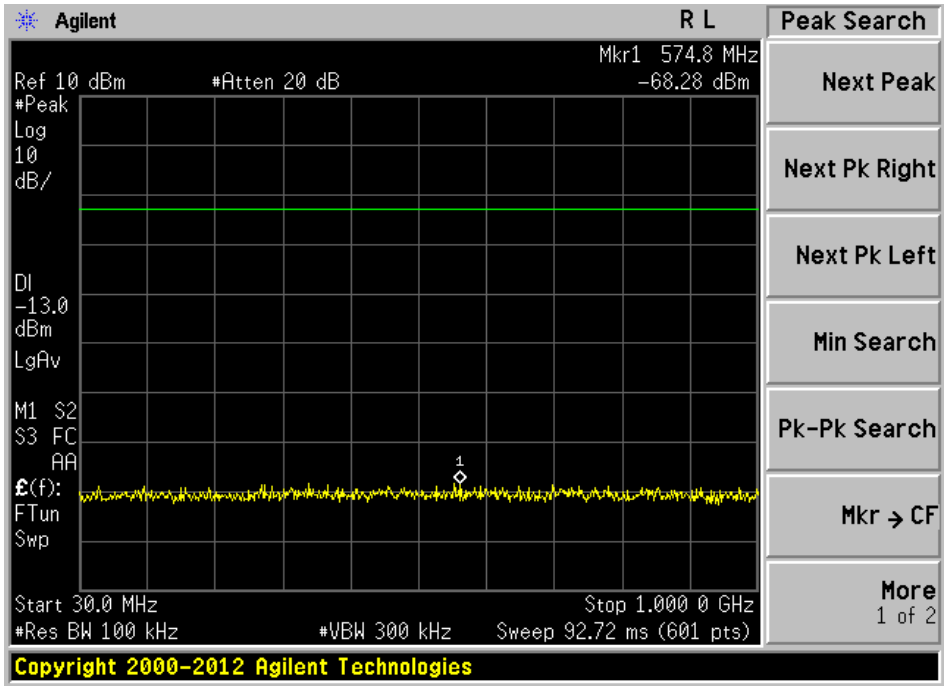


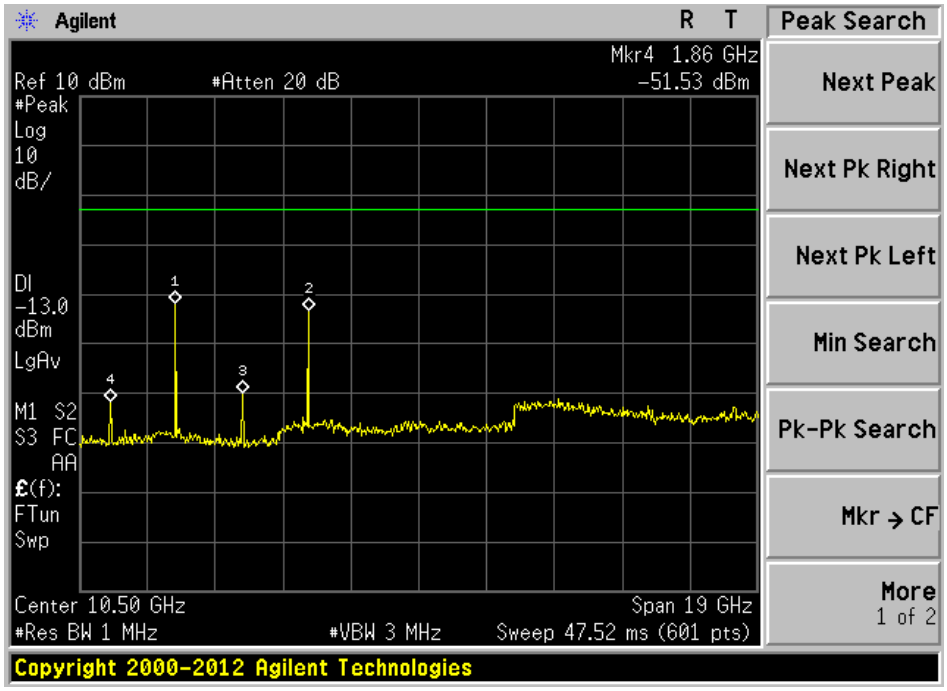
Test Mode: GSM 850 CH 251



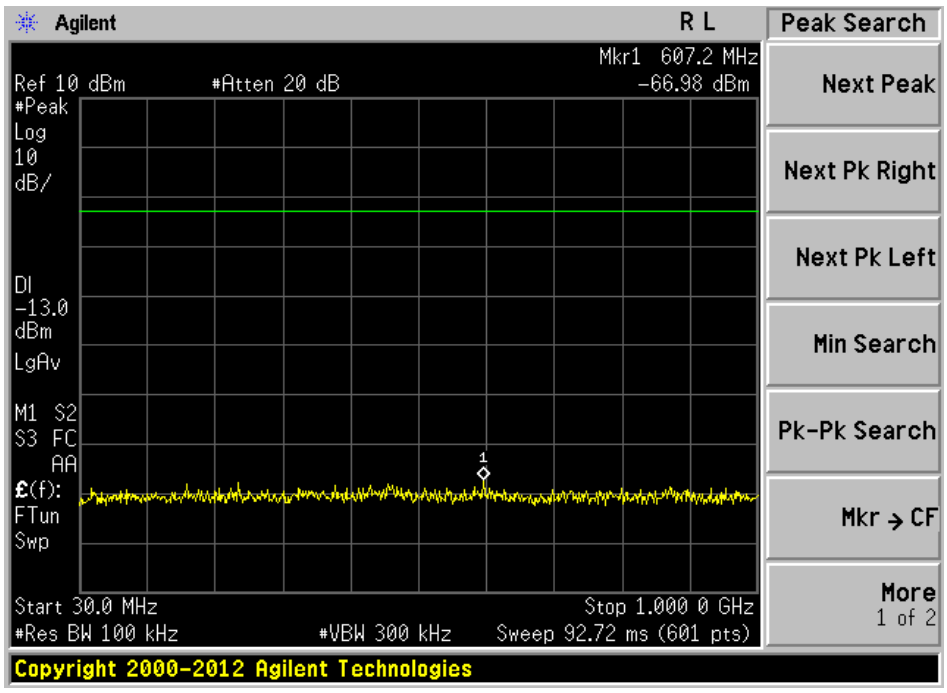


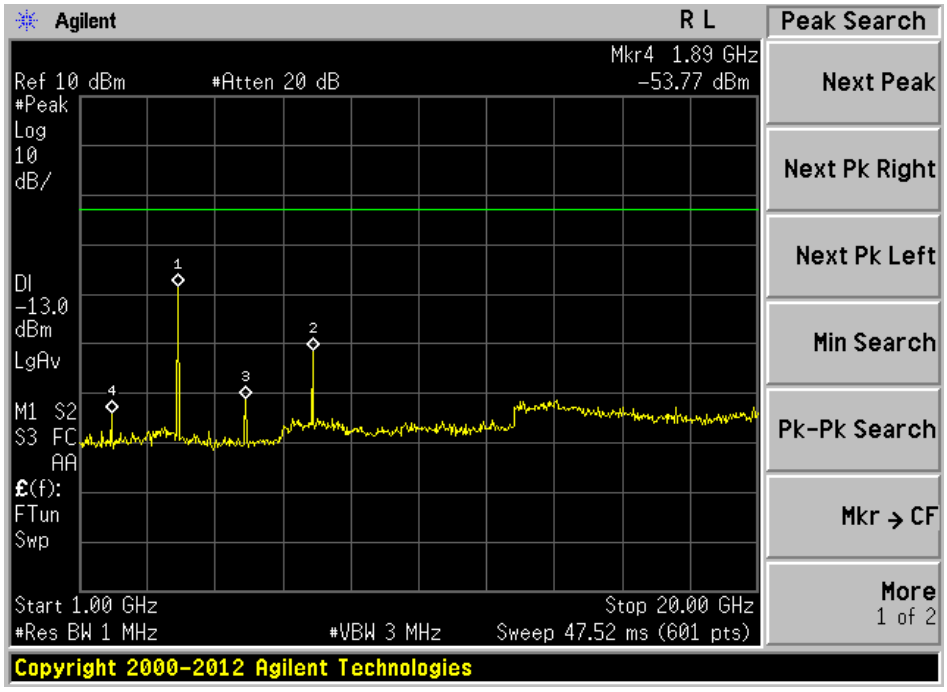
Test Mode: GSM 1900 CH 512



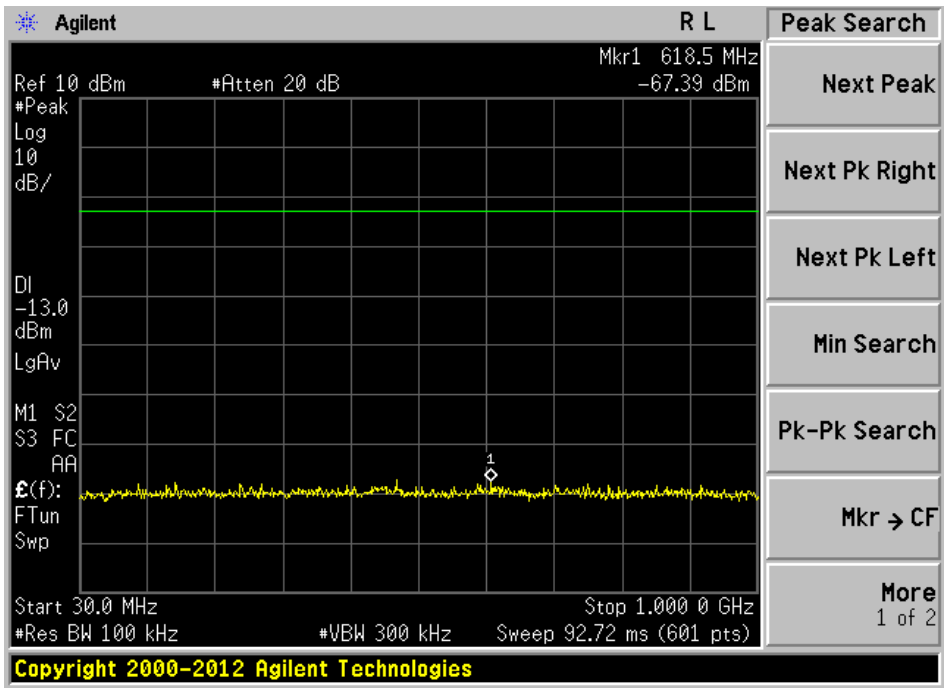


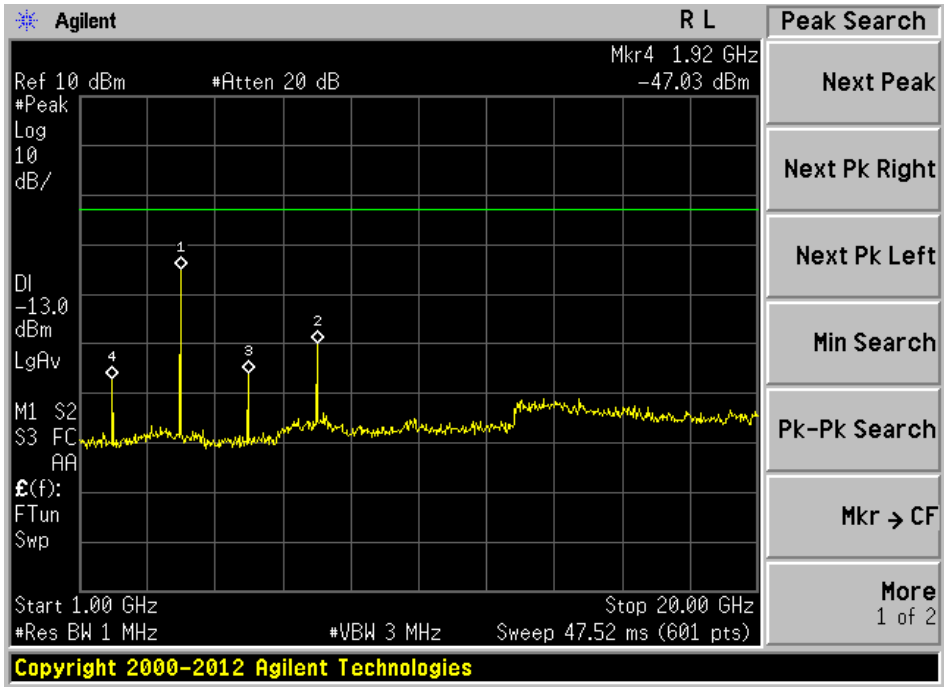
Test Mode: GSM 1900 CH 661





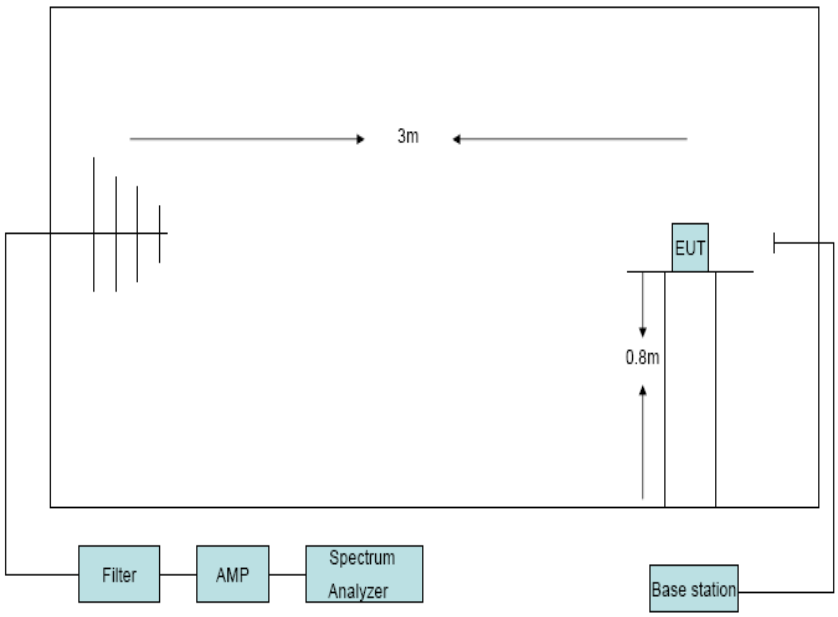
Test Mode: GSM 1900 CH 810





9. Radiated spurious emissions

9.1. Block Diagram of Test Setup



9.2. Limit

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB, in this case, -13dBm.

9.3. Test Procedure

1. The EUT was placed on a non-conductive rotating platform with 0.8 meter height in an anechoic chamber. The radiated spurious emissions from 30MHz to 10th harmonious of fundamental frequency were measured at 3m with a test antenna and a spectrum analyzer with RBW= 1MHz, VBW= 1MHz, peak detector settings.
2. During the measurement, the EUT was enforced in maximum power and linked with a base station. All the spurious emissions (record as LVL) at 3m were measured by rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
3. Final spurious emissions levels were measured by substitution method according to TIA/EIA-603-C. The EUT was replaced by dipole antenna (for frequency below 1GHz) or Horn antenna (for frequency above 1GHz) at same location with same polarize of receiver antenna and then a known power of each measure frequency from S.G. was

applied into the dipole antenna or Horn antenna through a Tx cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna. The correction factor (in dB) = S.G. - Tx Cable loss + Substitution antenna gain –Substitution antenna Loss(only for Dipole antenna) - Analyzer reading. Then final

spurious emissions were calculated with the correction factor, EIRP= LVL + Correction factor and ERP = EIRP – 2.15

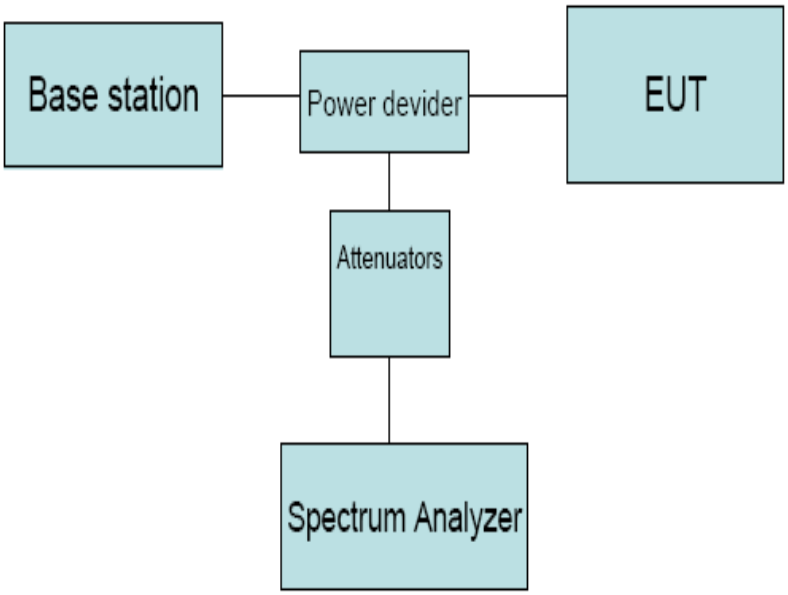
9.4. Test Result

EUT:GNSS Survey Receiver M/N:S321 Network						
Power: DC 10.8V from battery						
Test Date: 2015-10-23		Test site: RF Chamber		Tested by: Simple Guan		
Ambient Temperature: 24℃		Relative Humidity: 60%				
Conclusion: PASS						
Test result						
Test Mode： GSM 850 CH128						
Frequency (MHz)	Antenna polarization	LVL (dBm)	Correction factor(dB)	Result (ERP)(dBm)	Limit (dBm)	Margin (dB)
537.31	H	-56.57	-6.53	-63.1	-13	50.1
537.31	V	-59.42	-6.53	-65.95	-13	52.95
1648.4	H	-54.79	11.5	-43.29	-13	30.29
1648.4	V	-44.79	10.56	-34.23	-13	21.23
Test Mode： GSM 850 CH190						
1673.2	H	-53.29	10.94	-42.35	-13	29.35
1673.2	V	-50.61	10.9	-39.71	-13	26.71
Test mode: GSM 850 CH251						
1697.6	H	-46.82	11.67	-35.15	-13	22.15
1697.6	V	-42.57	11.13	-31.44	-13	18.44

Test Mode：GSM 1900 CH512						
Frequency (MHz)	Antenna polarization	LVL (dBm)	Correction factor(dB)	Result (EIRP)(dBm)	Limit (dBm)	Margin (dB)
537.31	H	-56.75	-6.53	-63.28	-13	50.28
537.31	V	-55.81	-6.53	-62.34	-13	49.34
3700.4	H	-52.68	8.57	-44.11	-13	31.11
3700.4	V	-51.91	8.37	-43.54	-13	30.54
Test Mode： GSM 1900 CH661						
3760	H	-54.76	8.75	-46.01	-13	33.01
3760	V	-52.58	8.55	-44.03	-13	31.03
Test mode: GSM 1900 CH810						
3819.6	H	-54.27	8.94	-45.33	-13	32.33
3819.6	V	-52.42	8.72	-43.7	-13	30.7
Note: All the other emissions not recorded were too low to read, and deemed to comply with limit.						

10. Band Edge Compliance

10.1. Block Diagram of Test Setup



10.2. Limit

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB, in this case, -13dBm.

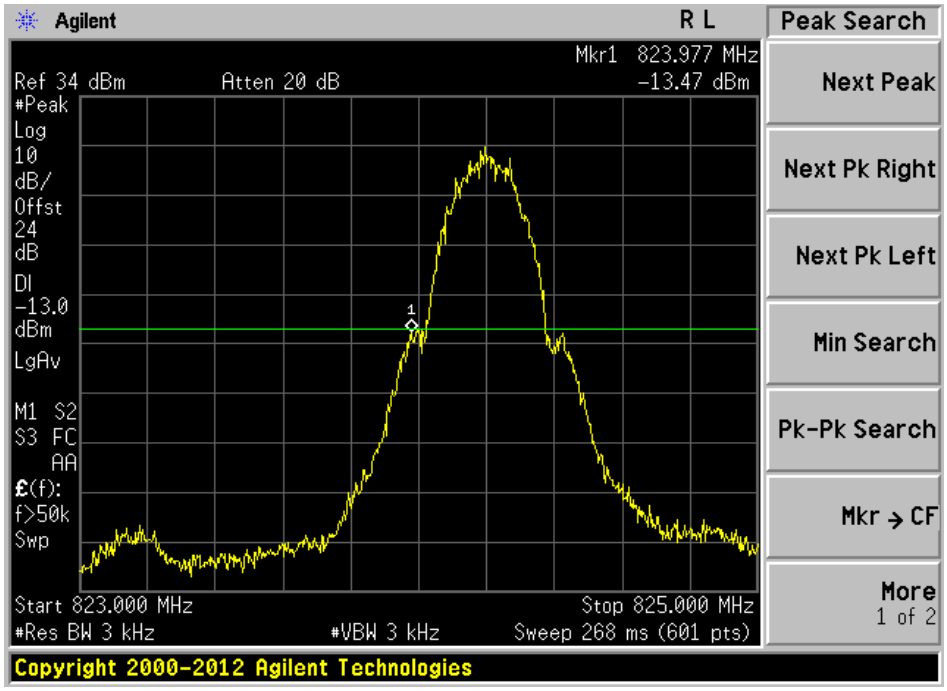
10.3. Test Procedure

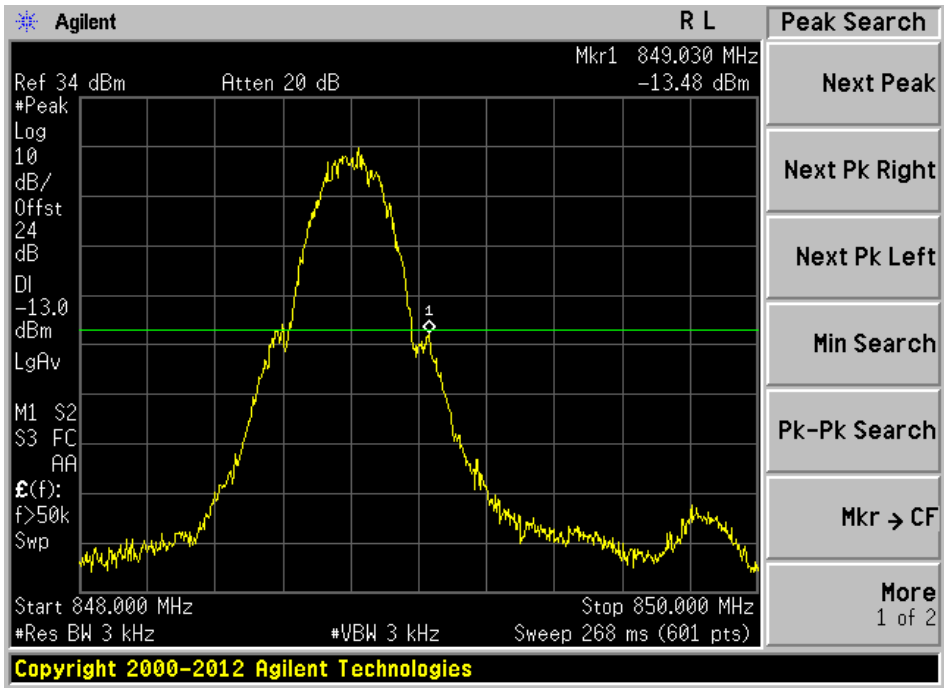
1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The band edges of low and high channels for the highest RF powers were measured.

10.4.Test Result

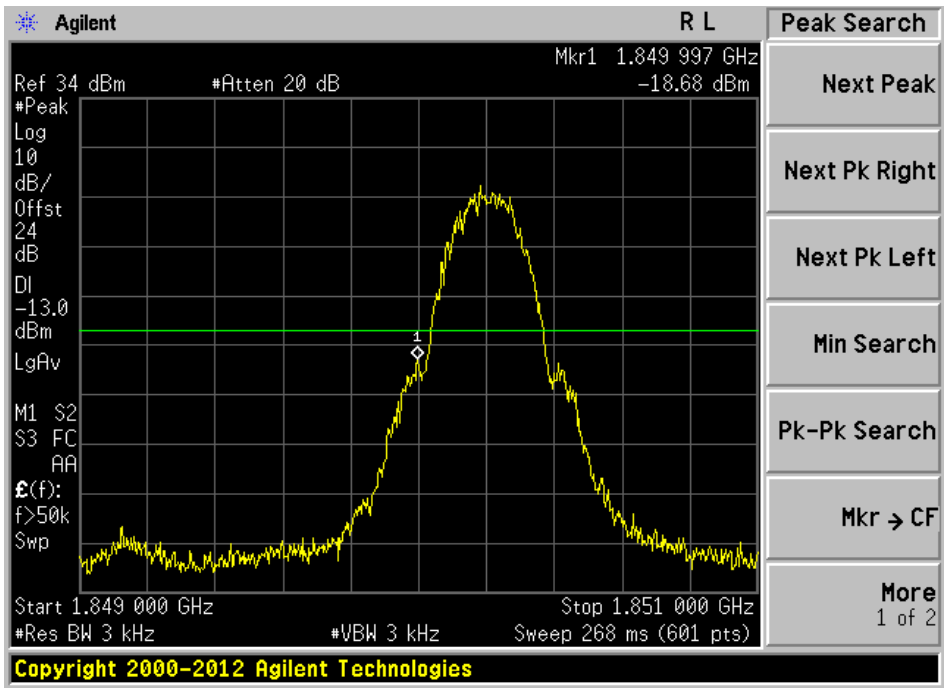
PASS

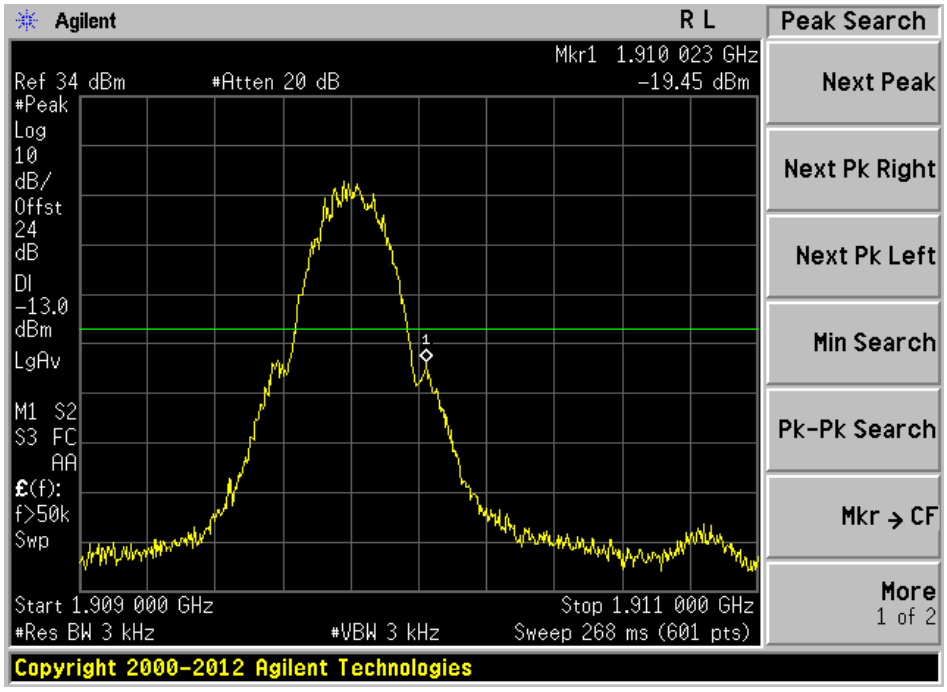
Test Mode: GSM 850





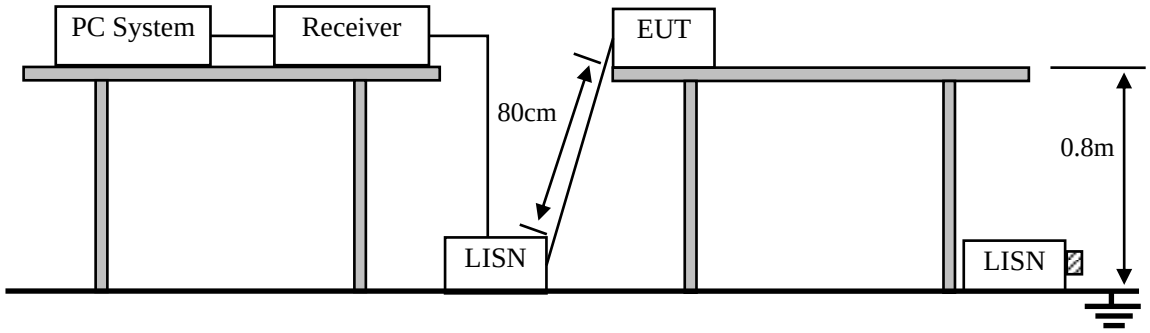
Test Mode: GSM 1900





11. Power line conducted emission

11.1. Block Diagram of Test Setup



11.2. Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

11.3. Test Procedure

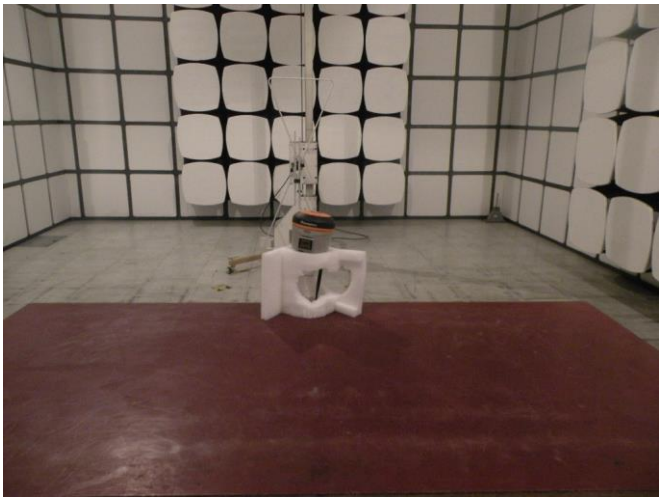
(1) The EUT was placed on a non-metallic table, 80cm above the ground plane.
(2) Setup the EUT and simulator as shown in 10.1
(3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C64.10:2013 on conducted Emission test.
(4) The bandwidth of test receiver is set at 10 kHz.
(5) The frequency range from 150 kHz to 30 MHz is checked.

11.4.Test Result

Not apply to battery operated product.

12. Test setup photo

Photographs-Radiated Emission Test Setup in Chamber



---------END OF THE REPORT-------