TEST REPORT

Part 22 Subpart H, Part 24 Subpart E

Equipment under test Vehicle Security Gateway

Model name ST-900-CF

FCC ID KL7ST-900-CF

Applicant Savi Technology Inc.

Manufacturer Dae Kyung Philippines, Inc.

Date of test(s) 2016.10.04 ~ 2016.10.16

Date of issue 2016.10.17

Issued to
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Test and report completed by :	Report approval by :
	
Hyeon-su Jang Test engineer	Jeff Do Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2016.10.17	KES-RF-16T0095	Initial

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1. General information

Applicant:	Savi Technology Inc.
Applicant address:	3601 Eisenhower Avenue, STE 280, Alexandria VA 22304
Test site:	KES Co., Ltd.
Test site address:	C-3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
FCC rule part(s):	Part 22 Subpart H, Part 24 Subpart E
FCC ID:	KL7ST-900-CF
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	Vehicle Security Gateway
Frequency range	Tx :433.92 ㎒ Rx :433.92 ㎒ GSM 850 : 824.2 ㎒ ~ 848.8 ㎒ GSM 1900 : 1850.2 ㎒ ~ 1909.8 ㎒
Modulation technique	433.92 ㎒ : FSK GSM : GMSK
Number of channels	433.92 ㎒ : 1ch GSM 850 : 125ch, GSM 1900 : 300ch
Antenna specification	433.92 UHF Antenna type: PCB, Peak gain: -0.97 dBi GSM 850 Antenna type: PCB, Peak gain: -0.30 dBi GSM 1900 Antenna type: PCB, Peak gain: -1.70 dBi
Power source	External Power : DC 24.0 V / 2A Backup Battery : DC 3.7 V / 1400 mAh Li-polymer battery

Note:
1. Certificated GSM/GPRS module is mounted in the EUT as following
   - Applicant: Shanghai Simcom Ltd.
   - FCC Identifier : UDV-20160416
   - Model: SIM808
2. The installed module is completed identical as original.

1.2. Test configuration

The **Savi Technology, Inc. Vehicle Security Gateway FCC ID: KL7ST-900-CF** was tested per the guidance of ANSI/TIA 603-D:2010 was used to reference the appropriate EUT setup for radiated spurious emissions.

1.3. Device modifications

N/A

1.4. Derivation model information

N/A

1.5. Frequency/channel operations

Band	Ch.	Frequency (㎒)	Mode
GSM800	128	824.2	GSM, GPRS
	.	.	.
	190	836.6	GSM, GPRS
	.	.	.
	251	848.8	GSM, GPRS

Band	Ch.	Frequency (㎒)	Mode
GSM1900	512	1850.2	GSM, GPRS
	.	.	.
	661	1880.0	GSM, GPRS
	.	.	.
	810	1909.8	GSM, GPRS

1.6. Worst case configuration

The EUT was investigated in each of its External power mode and Battery mode. All radiated test and power line conducted test was performed with the EUT set to transmit mode. The test results shown in the following sections represent the worst case emissions for External power mode and middle channel.

2. Summary of tests

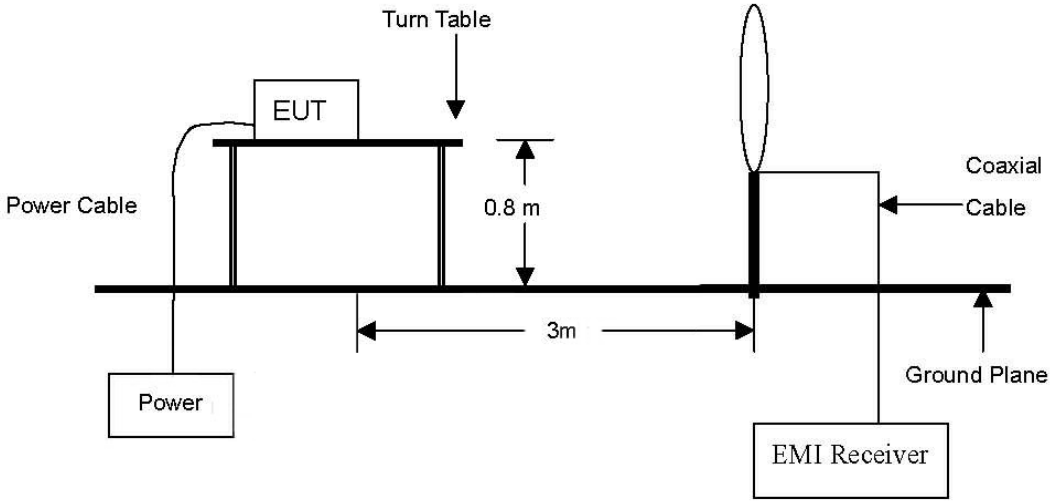
Reference	Parameter	Test results
22.917(a) 24.238(a)	Radiated spurious emission	Pass

3. Test results

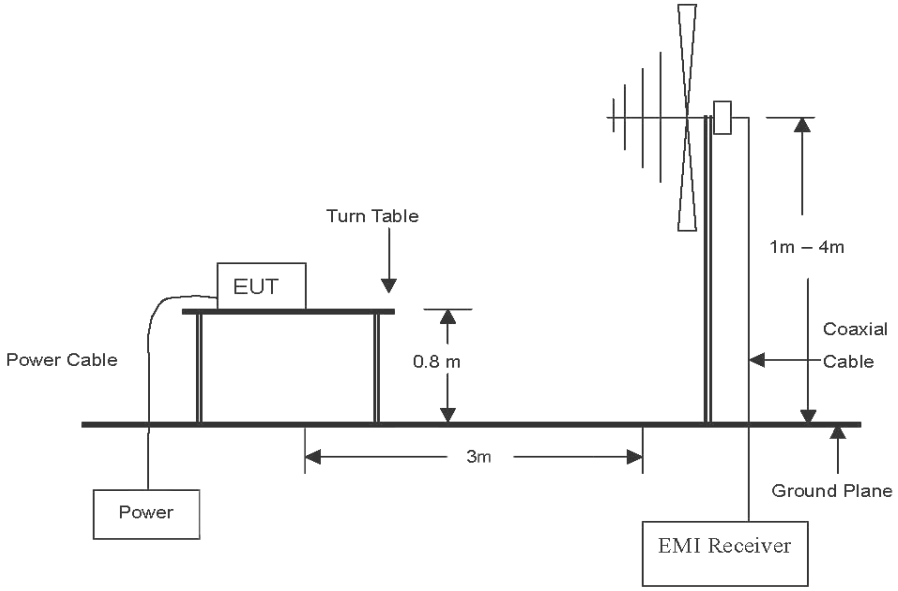
3.1. Radiated spurious emission

Test setup

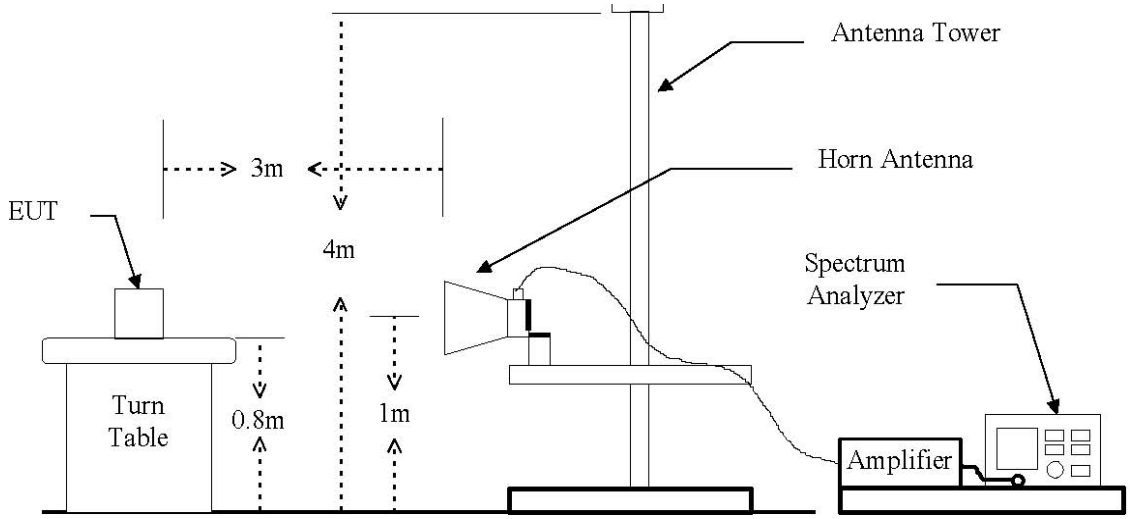
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



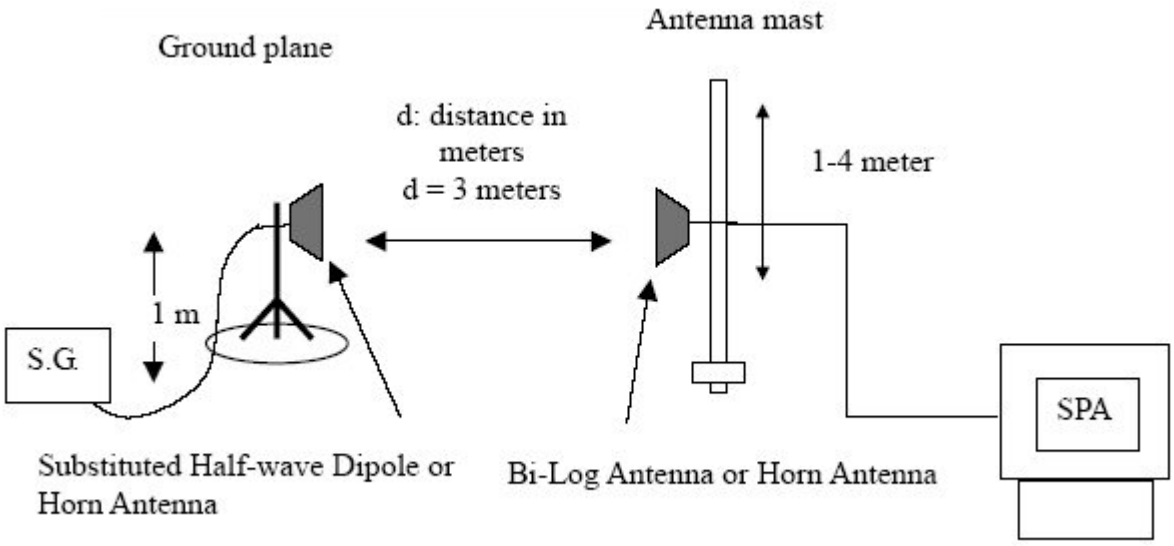
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



The diagram below shows the test setup for substituted method



Test procedure below 30 ㎒

1. 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.
2. 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.
3. 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.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 ㎒

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a horn (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase he sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

Limit

FCC §22.913(a), the ERP of mobile transmitters must not exceed 7 watts. FCC §24.232(c) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

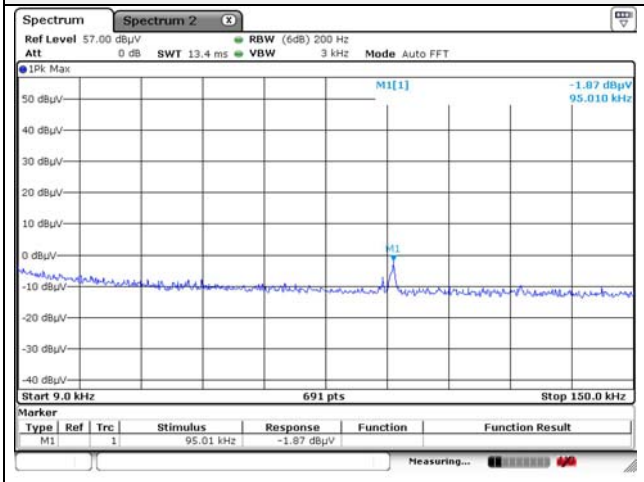
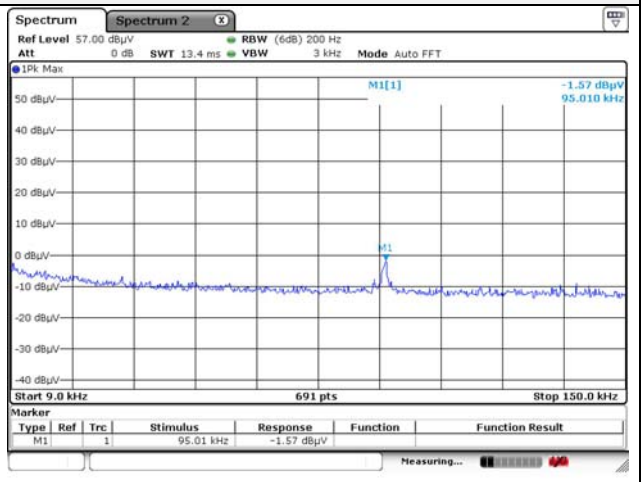
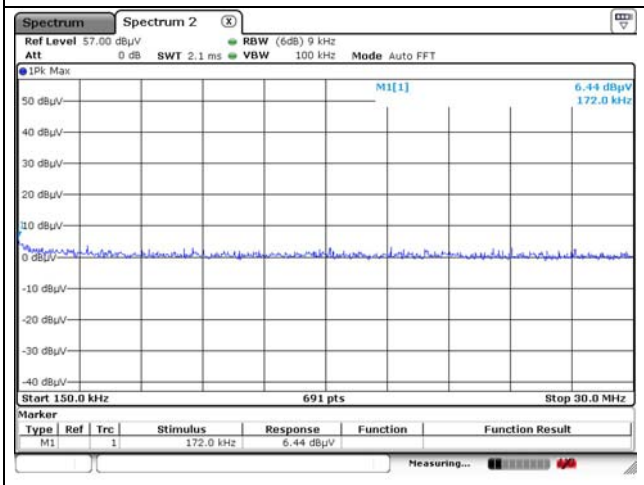
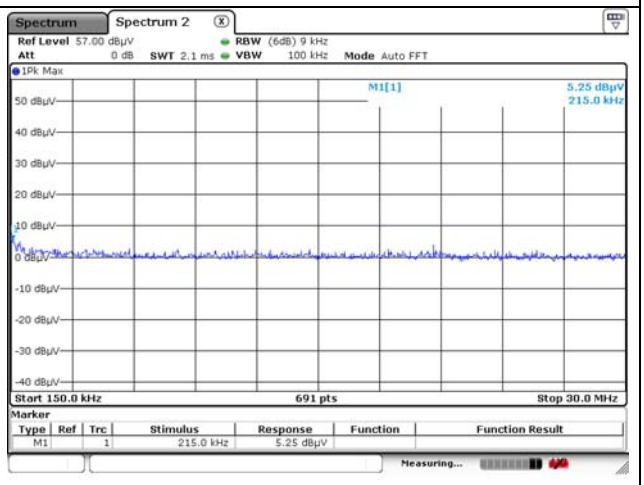
Test results (Below 30 ㎒)

Mode: GPRS 850

Distance of measurement: 3 meter

Channel: 190

Frequency (㎒)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
No spurious emissions were detected below 30 ㎒				

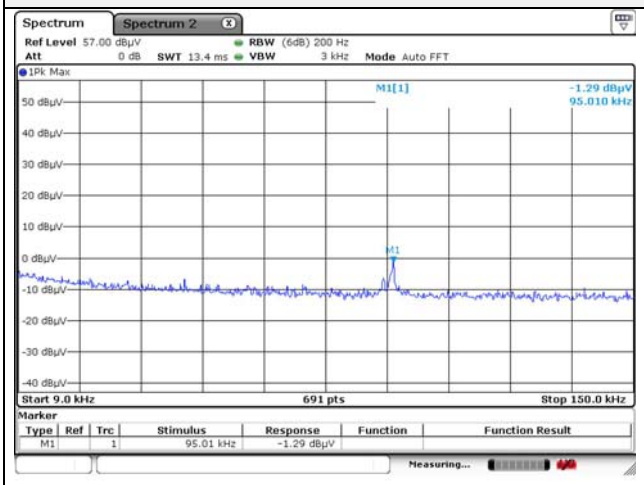
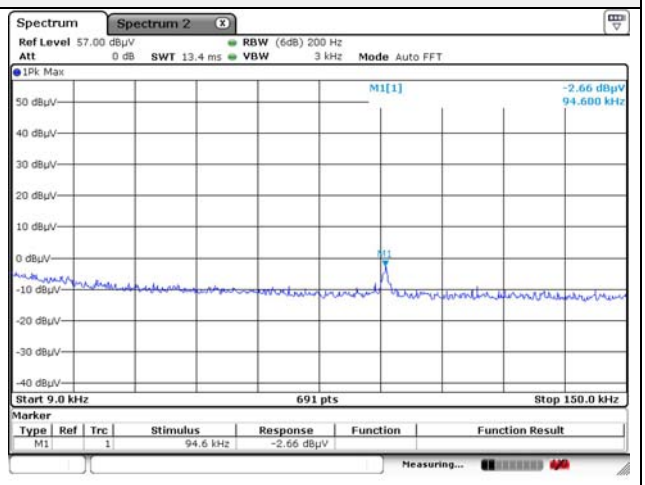
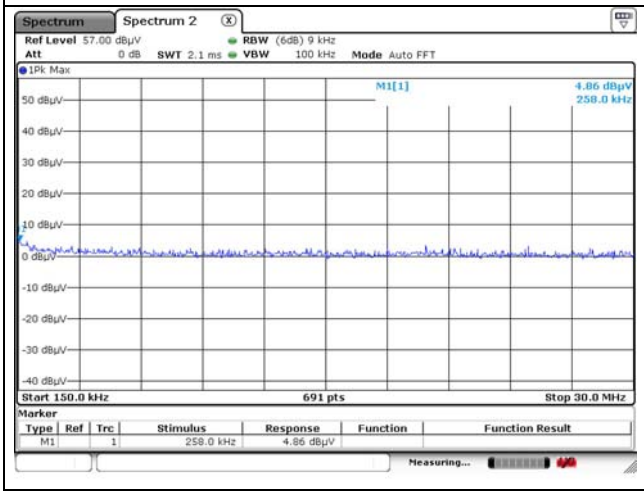
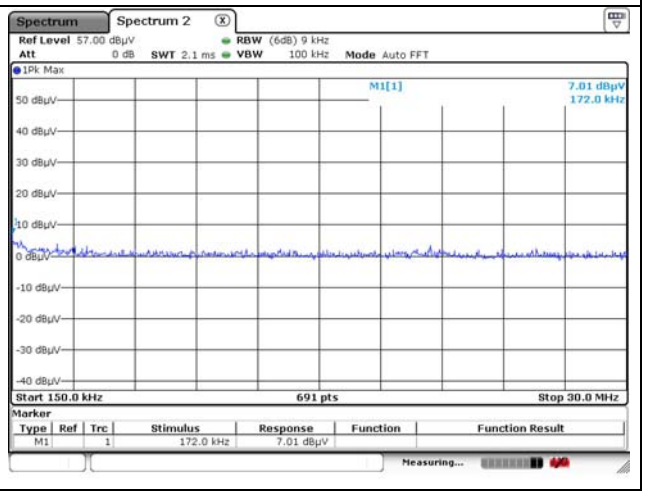
Horizontal	Vertical
	
	

Mode: GPRS 1900

Distance of measurement: 3 meter

Channel: 661

Frequency (㎒)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
No spurious emissions were detected below 30 ㎒				

Horizontal	Vertical
	
	

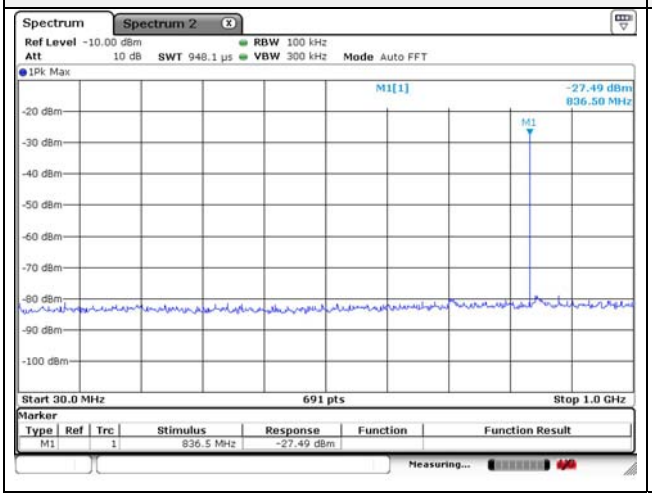
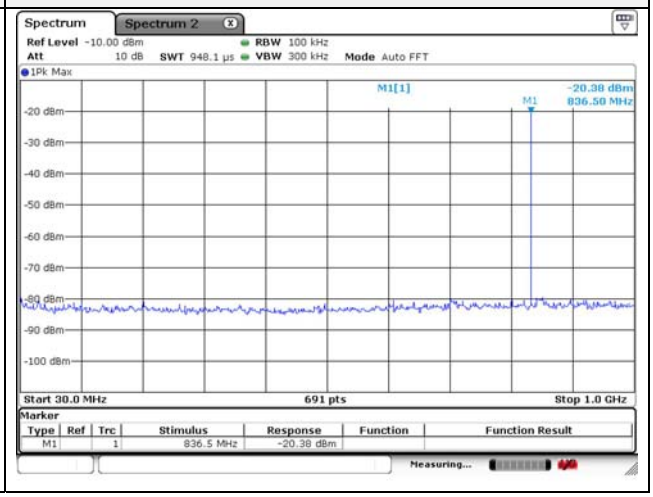
Test results (Below 1 ㎓)

Mode: GSM 850

Distance of measurement: 3 meter

Channel: 190

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
836.50	H	1.68	0.001
836.50	V	10.35	0.108

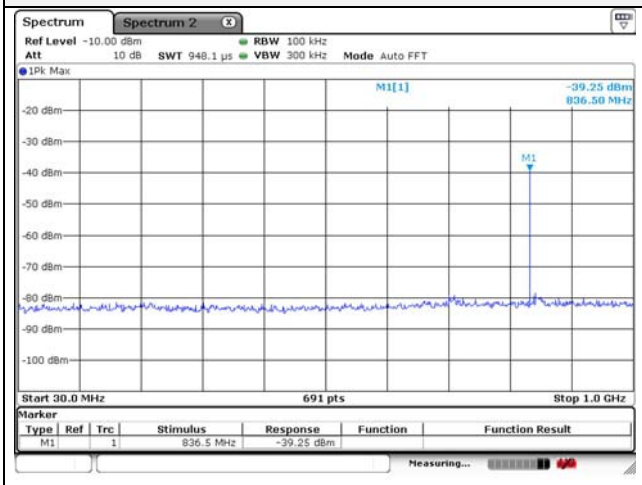
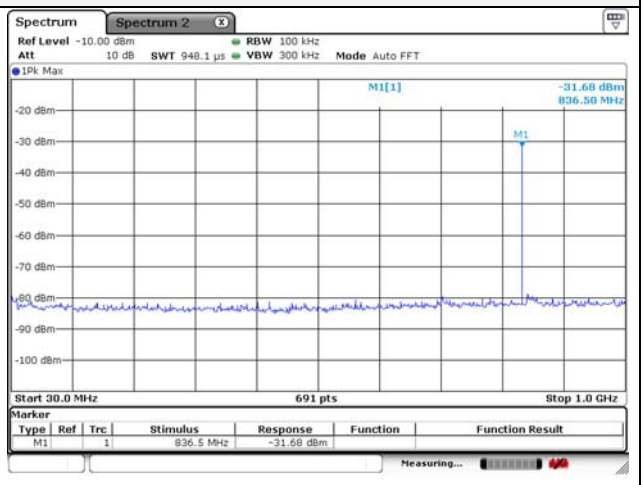
Horizontal	Vertical
	

Mode: GPRS 850

Distance of measurement: 3 meter

Channel: 190

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
836.50	H	-10.08	0.0001
836.50	V	-0.95	0.0008

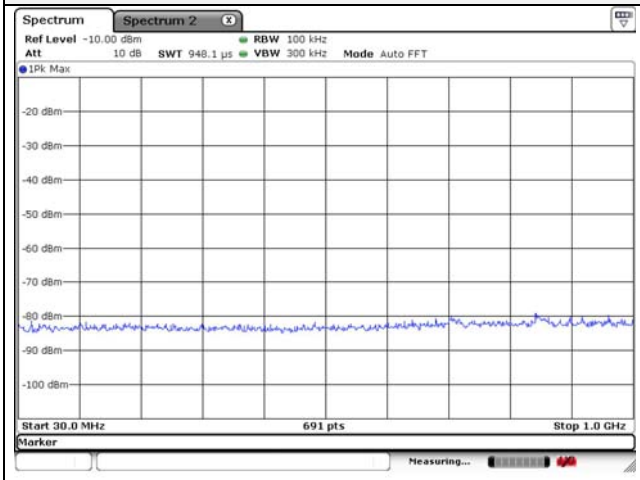
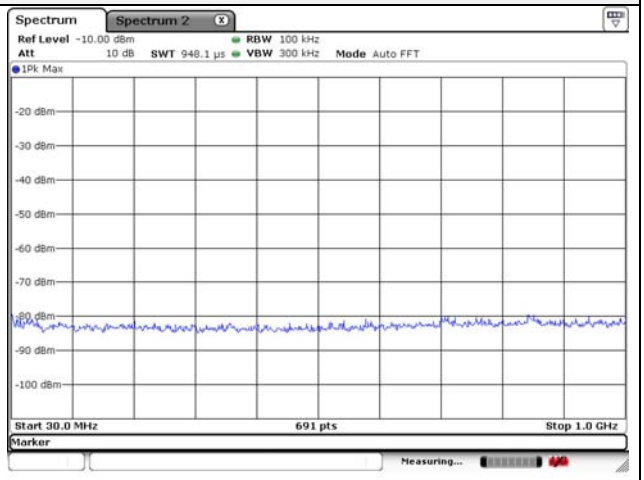
Horizontal	Vertical
	

Mode: GSM 1900

Distance of measurement: 3 meter

Channel: 661

Frequency (㎒)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
No spurious emissions were detected below 1 ㎓				

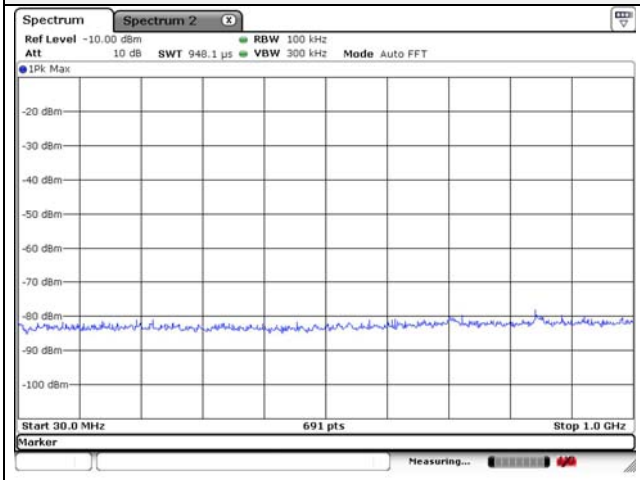
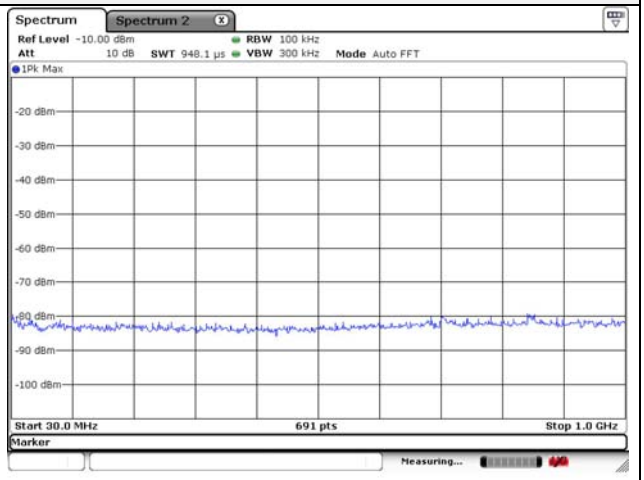
Horizontal	Vertical
	

Mode: GPRS 1900

Distance of measurement: 3 meter

Channel: 661

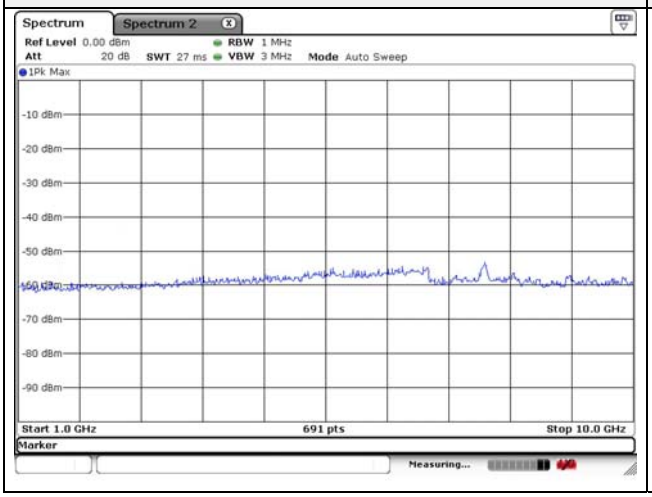
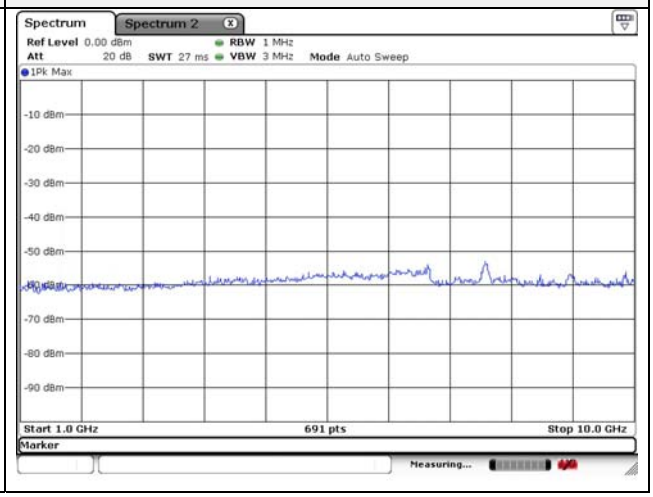
Frequency (㎒)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
No spurious emissions were detected below 1 ㎓				

Horizontal	Vertical
	

Test results (above 1 ㎓)

Mode:	GSM 850
Distance of measurement:	3 meter
Channel:	190

Frequency (㎒)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
No spurious emissions were detected above 1 ㎓				

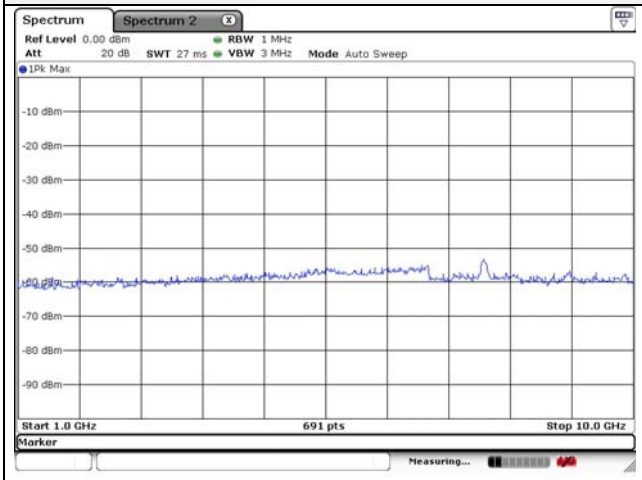
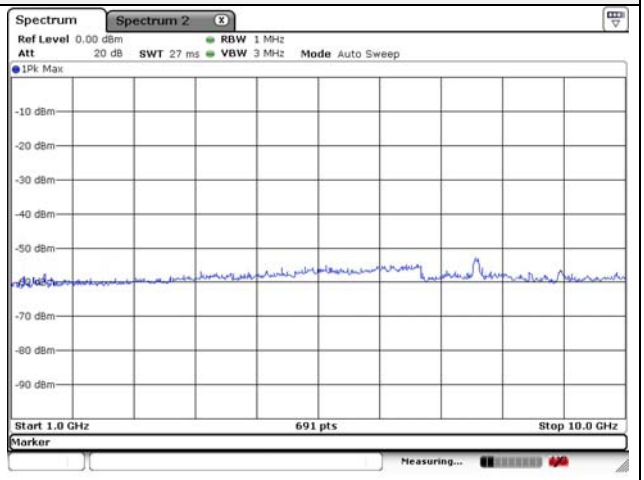
Horizontal	Vertical
	

Mode: GPRS 850

Distance of measurement: 3 meter

Channel: 190

Frequency (㎒)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
No spurious emissions were detected above 1 ㎓				

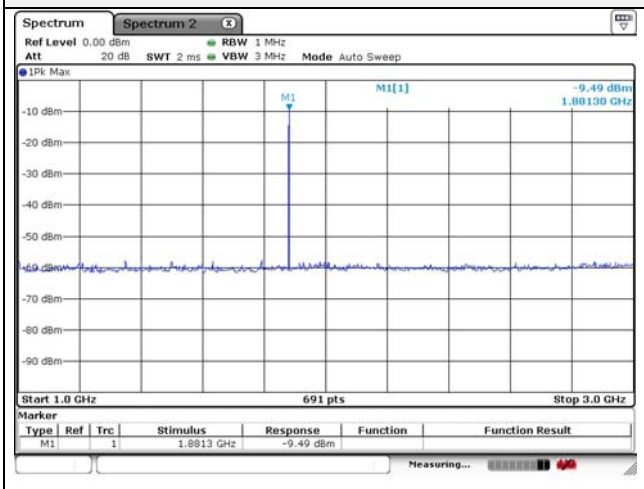
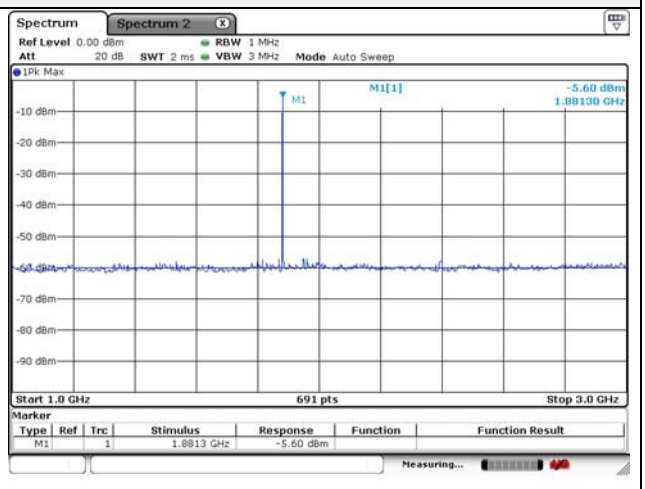
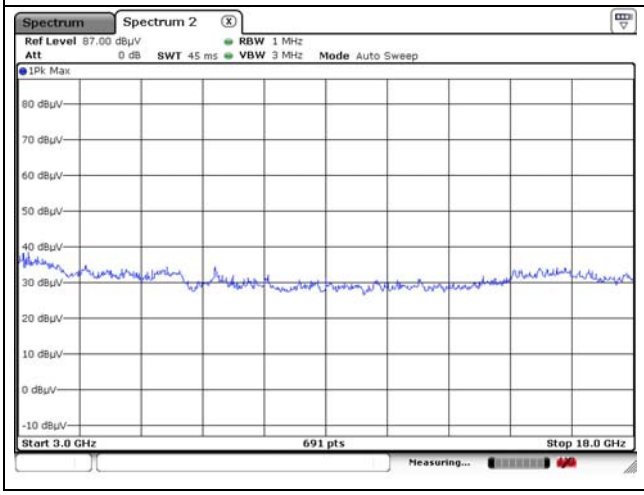
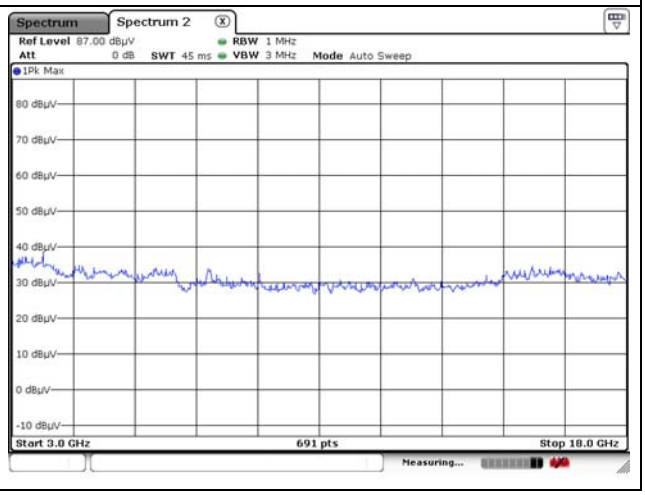
Horizontal	Vertical
	

Mode: GSM 1900

Distance of measurement: 3 meter

Channel: 661

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
1 881.30	H	19.62	0.092
1 881.30	V	25.07	0.321

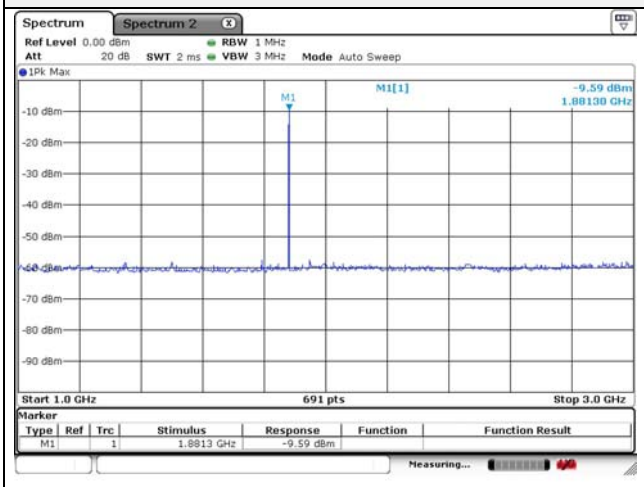
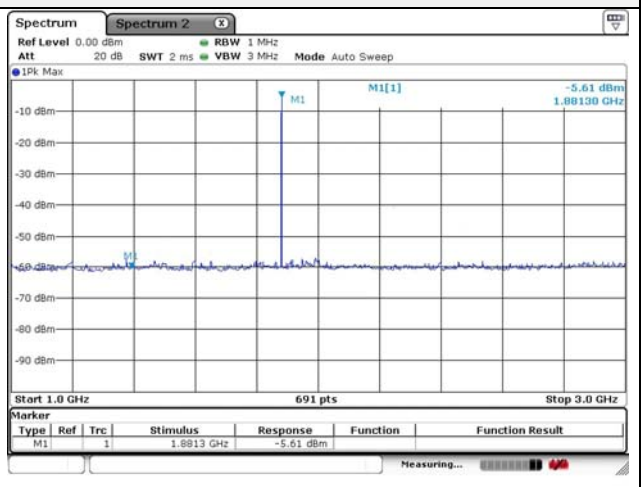
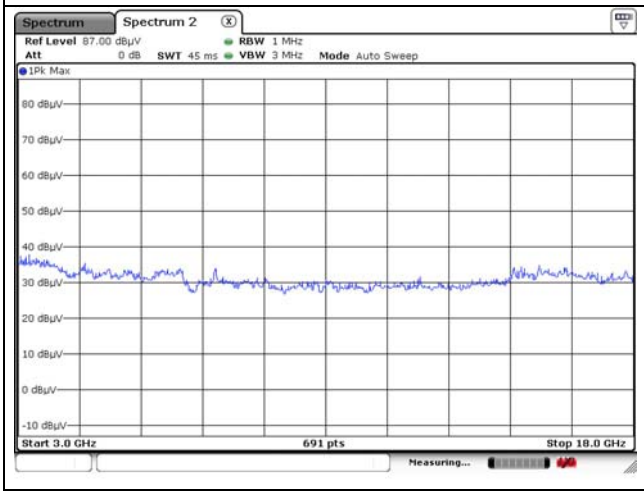
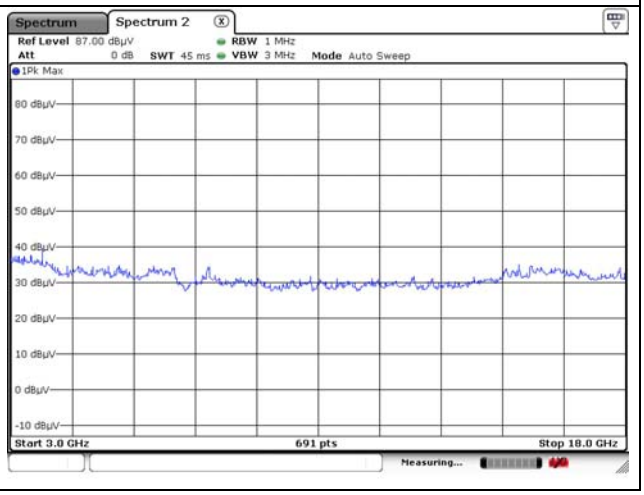
Horizontal	Vertical
	
	

Mode: GPRS 1900

Distance of measurement: 3 meter

Channel: 661

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
1 881.30	H	19.52	0.090
1 881.30	V	25.06	0.321

Horizontal	Vertical
	
	

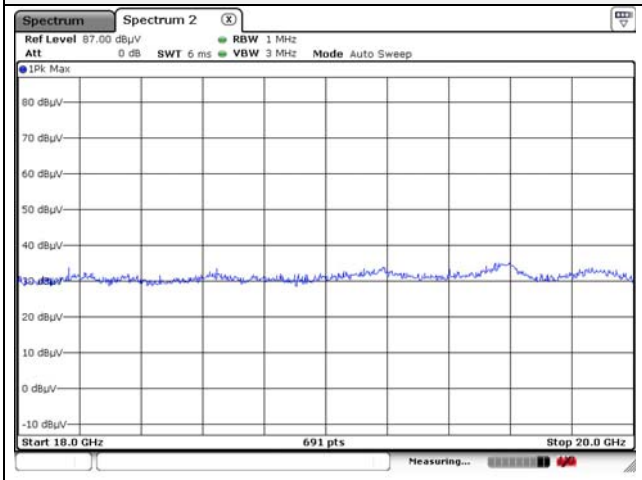
Mode: GSM 1900 // GPRS 1900

Distance of measurement: 3 meter

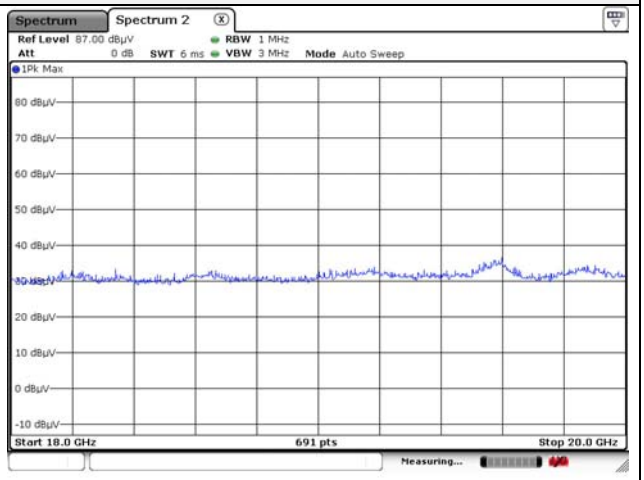
Channel: 661

Frequency (㎒)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
No spurious emissions were detected above 18 ㎓				

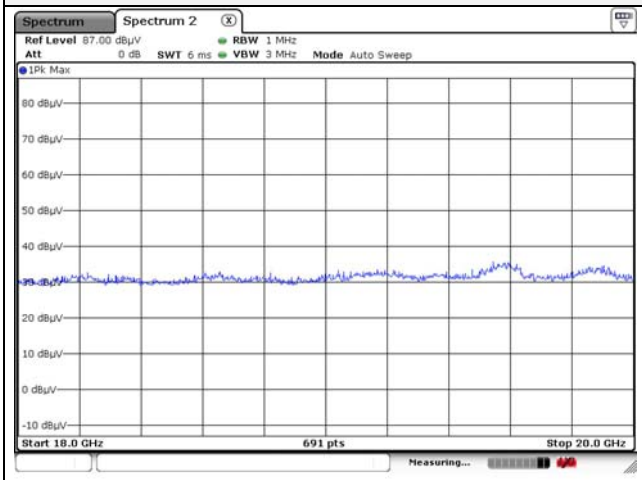
Horizontal // GSM



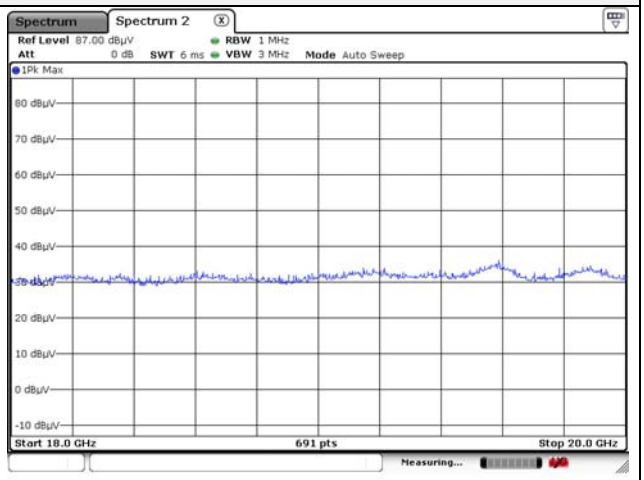
Vertical // GSM



Horizontal // GPRS



Vertical // GPRS



Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due
Spectrum Analyzer	R&S	FSV30	10076	1 year	2017.07.06
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2017.01.25
PSG Analog Signal Generator	AGILENT	E8257C	US42340237	1 year	2017.07.05
DC Power Supply	HP	6674A	US36370369	1 year	2017.07.04
Radio Communication Tester	R&S	CMW500	104198	1 year	2017.07.04
Attenuator	Agilent	8493C	51401	1 year	2017.07.05
Loop Antenna	R&S	HFH2-Z2.335.4711.52	826532	2 years	2017.03.03
Trilog-broadband antenna	SCHWARZBECK	VULB 9163	9168-713	2 years	2017.05.15
Horn Antenna	A.H.	SAS-571	781	2 years	2017.05.07
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170550	2 years	2017.04.30
High Pass Filter	WAINWRIGHT INSTRUMENT	WHJS3000-10TT	1	1 year	2017.07.04
Low Pass Filter	WEINSCHEL	WLK1.0/18G-10TT	1	1 year	2017.07.04
Preamplifier	SCHWARZBECK	BBV-9718	9718-246	1 year	2016.10.23
Broadband Amplifier	SCHWARZBECK	BBV-9721	PS9721-003	1 year	2017.01.25
EMI Test Receiver	R&S	ESR3	101781	1 year	2017.05.03
EMI Test Receiver	R&S	ESU26	100552	1 year	2017.04.24

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook	SAMSUNG	NT-R519-BA24J	ZKPA93ES900086Z