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TEST REPORT

of

FCC Part 2 Subpart J, Part 22 Subpart C/H,
Part 24 Subpart E and Part 27 Subpart C
IC RSS-132 Issue 3, RSS-133 Issue 6,
RSS-139 Issue 3 and RSS-Gen Issue 5

FCC ID: BEJTM04ANNABM1
IC Certification: 2703H-TM04ANNABM1

Equipment Under Test	:	Telematics Module
Model Name	:	TM04ANNABM1
Variant Model Name(s)	:	-
Applicant	:	FCC: LG Electronics USA IC: LG ELECTRONICS INC.
Manufacturer	:	LG Electronics Inc.
Date of Receipt	:	2021.01.04
Date of Test(s)	:	2020.01.13 ~ 2021.02.05
Date of Issue	:	2021.03.05

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
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Tested by:  **Jinhyoung Cho**

Technical Manager:  **Jungmin Yang**

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

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1.2. Details of Applicant

FCC Applicant : LG Electronics USA
FCC Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, United States, 07632
IC Applicant : LG ELECTRONICS INC.
IC Address : 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyenggi-do, Korea (Republic of), 451-713
Contact Person : Kim, Dae-woong
Phone No. : +1 201 266 2215

1.3. Details of Manufacturer

Company : LG Electronics Inc.
Address : 10, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796

1.4. Description of EUT

Kind of Product	Telematics Module
Model Name	TM04ANNABM1
Serial Number	001, 002
Power Supply	DC 12.5 V
Rated Power	GSM 850: 33 ㏈m GSM 1 900: 30 ㏈m WCDMA Ⅱ, Ⅳ, Ⅴ: 24 ㏈m
Frequency Range	GSM 850: 824 ㎒ ~ 849 ㎒ GSM 1 900: 1 850 ㎒ ~ 1 910 ㎒ WCDMA Ⅱ: 1 850 ㎒ ~ 1 910 ㎒ WCDMA Ⅳ: 1 710 ㎒ ~ 1 755 ㎒ WCDMA Ⅴ: 824 ㎒ ~ 849 ㎒
Modulation Technique	QPSK, 16QAM, GMSK, 8PSK
Antenna Type	Planar Inverted F Antenna
Antenna Gain	824 ㎒ ~ 849 ㎒: -0.82 ㏈i 1 710 ㎒ ~ 1 780 ㎒: -0.48 ㏈i 1 850 ㎒ ~ 1 915 ㎒: -0.48 ㏈i
H/W Version	Rev.C
S/W Version	TN22XA01

1.5. Introduction of Test Data Reuse

This report referenced from the FCC ID: BEJ-TM04ANNABM0 and IC Certification: 2703H-TM04ANNABM0 GSM&WCDMA.
The applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID and IC Certification.

1.6. Difference

The FCC ID: BEJTM04ANNABM1 and IC Certification: 2703H-TM04ANNABM1 share the same enclosure as FCC ID: BEJ-TM04ANNABM0 and 2703H-TM04ANNABM0
Applicant as the manufacturer of the following products, declared that had changed the hardware of the EUT.

Band differences between TM04ANNABM0 and TM04ANNABM1

Band	Frequency (㎒)		FDD/TDD	Band	TM04ANNABM0	TM04ANNABM1
	Tx	Rx				
B2	1 850 ~ 1 910	1 930 ~ 1 990	FDD	Mid	G, W, L	G, W, L
B4	1 710 ~ 1 755	2 110 ~ 2 155	FDD	Mid	W, L	W, L
B5	824 ~ 849	869 ~ 894	FDD	Low	G, W, L	G, W, L
B7	2 500 ~ 2 570	2 620 ~ 2 690	FDD	High	L	L
B12(B17)	699 ~ 716	729 ~ 746	FDD	Low	L	L
B13	777 ~ 787	746 ~ 756	FDD	Low	L	
B25	1 850 ~ 1 915	1 930 ~ 1 995	FDD	Mid	L	
B26	814 ~ 849	859 ~ 894	FDD	Low	L	
B29	-	717 ~ 728	FDD	Low	L(RX only)	
B30	2 305 ~ 2 315	2 350 ~ 2 360	FDD	High	L(RX only)	
B41	2 496 ~ 2 690		TDD	High	L	
B66	1 710 ~ 1 780	2 110 ~ 2 200	FDD	Mid	L	L
B71	663 ~ 698	617 ~ 652	FDD	Low	L	

- G(GSM), W(WCDMA), T(TD-SCDMA), L(LTE)

After confirming through preliminary E.I.R.P. and conducted power that the performance of the FCC ID: BEJ-TM04ANNABM0 and IC Certification: 2703H-TM04ANNABM0 remain representative of FCC ID: BEJTM04ANNABM1 and IC Certification: 2703H-TM04ANNABM1.
The test data of FCC ID: BEJ-TM04ANNABM0 and IC Certification: 2703H-TM04ANNABM0 being submitted for this application to cover GSM&WCDMA features.

1.7. Spot Check Data

Band	Test item	Frequency (㎒)	Limit	Original model		Spot check model		Deviation (㏈)	Remark
				TM04ANNABM0		TM04ANNABM1			
				FCC ID: BEJ-TM04ANNABM0 IC Certification: 2703H-TM04ANNABM0		FCC ID: BEJTM04ANNABM1 IC Certification: 2703H-TM04ANNABM1			
				(㏈m)	(W)	(㏈m)	(W)		
GSM 850	Conducted power	824 ~ 849	7 W	33.08	2.032	32.91	1.954	-0.17	-
	E.R.P.			31.45	1.396	31.03	1.268	-0.42	-
GSM 1 900	Conducted power	1 850 ~ 1 910	2 W	29.56	0.904	29.58	0.908	0.02	-
	E.I.R.P.			33.00	1.995	30.52	1.127	-2.48	-
WCDMA Ⅱ	Conducted power	1 850 ~ 1 910	2 W	23.41	0.219	23.50	0.224	0.09	-
	E.I.R.P.			27.70	0.589	24.52	0.283	-3.18	-
WCDMA Ⅳ	Conducted power	1 710 ~ 1 755	1 W	23.72	0.236	23.47	0.222	-0.25	-
	E.I.R.P.			28.30	0.676	24.52	0.283	-3.78	-
WCDMA Ⅴ	Conducted power	824 ~ 849	7 W	23.77	0.238	23.21	0.209	-0.56	-
	E.R.P.			21.65	0.146	22.03	0.160	0.38	-

1.8. Reference Detail

Reference applicant that contains the reused reference data in the individual test reports:

Mode	Reference FCC ID / IC Certification	Application type	Reference test report number	Exhibit type	Variant test report number	Data reuse
GSM	FCC: BEJ-TM04ANNABM0 IC: 2703H-TM04ANNABM0	Original grant	F690501-RF-RTL000879 (GSM)	Test report	F690501-RF-RTL001766 (GSM&WCDMA)	All
WCDMA			F690501-RF-RTL000880 (WCDMA)			

1.9. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Nov. 21, 2020	Annual	Nov. 21, 2021
Spectrum Analyzer	R&S	FSV30	100768	Mar. 04, 2020	Annual	Mar. 04, 2021
Spectrum Analyzer	Agilent	N9030A	US51350132	Sep. 12, 2020	Annual	Sep. 12, 2021
Mobile Test Unit	R&S	CMW500	144034	Feb. 28, 2020	Annual	Feb. 28, 2021
Mobile Test Unit	R&S	CMW500	144032	May 08, 2020	Annual	May 08, 2021
Power Meter	Anritsu	ML2495A	1223004	Jun. 01, 2020	Annual	Jun. 01, 2021
Power Sensor	Anritsu	MA2411B	1207272	Jun. 01, 2020	Annual	Jun. 01, 2021
Temperature Chamber	ESPEC CORP.	PL-1J	15000796	Nov. 06, 2020	Annual	Nov. 06, 2021
Low Pass Filter	Mini-Circuits	NLP-1200+	V9500401023-2	Jun. 01, 2020	Annual	Jun. 01, 2021
High Pass Filter	Wainwright Instrument GmbH	WHKX10-900-1000-18000-40SS	7	Mar. 04, 2020	Annual	Mar. 04, 2021
High Pass Filter	Wainwright Instrument GmbH	WHKX2.2/12.75G-10SS	8	Mar. 04, 2020	Annual	Mar. 04, 2021
High Pass Filter	Wainwright Instrument GmbH	WHK3.0/18G-10SS	344	May 18, 2020	Annual	May 18, 2021
High Pass Filter	Wainwright Instrument GmbH	WHK7.5/26.5G-6SS	15	Jun. 05, 2020	Annual	Jun. 05, 2021
Directional Coupler	KRYTAR	152613	122660	Jun. 11, 2020	Annual	Jun. 11, 2021
DC Power Supply	Agilent	U8002A	MY54110041	Sep. 17, 2020	Annual	Sep. 17, 2021
Preamplifier	H.P.	8447F	2944A03909	Aug. 06, 2020	Annual	Aug. 06, 2021
Preamplifier	R&S	SCU 18	10117	Jun. 10, 2020	Annual	Jun. 10, 2021
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 08, 2020	Annual	May 08, 2021
Test Receiver	R&S	ESU26	100368	Nov. 05, 2020	Annual	Nov. 05, 2021
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	396	Mar. 21, 2019	Biennial	Mar. 21, 2021
Horn Antenna	R&S	HF906	100326	Feb. 04, 2021	Annual	Feb. 04, 2022
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA9170	BBHA9170431	Sep. 16, 2020	Annual	Sep. 16, 2021
Antenna Master	Innco systems GmbH	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	Innco systems GmbH	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/38330516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.4 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RFONE	MWX221-NMSNMS (4 m)	J1023142	Dec. 01, 2020	Semi-annual	Jun. 01, 2021
Coaxial Cable	RFONE	PL520-NMNM-10M (10 m)	20200324001	Dec. 01, 2020	Semi-annual	Jun. 01, 2021
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 01/20	Feb. 19, 2021	Semi-annual	Aug. 19, 2021
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 05/20	Feb. 19, 2021	Semi-annual	Aug. 19, 2021
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 10/20	Feb. 19, 2021	Semi-annual	Aug. 19, 2021

▶ Support Equipment

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

1.10. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 2, 22, 24 and 27 / IC part RSS-132 Issue 3, RSS-133 Issue 6, RSS-139 Issue 3 and RSS-Gen Issue 5			
Section in FCC	**Section in IC**	**Test Item**	**Result**
§2.1046 §22.913(a)(5) §24.232(c) §27.50(d)(4)	RSS-132 Issue 3 5.4 RSS-133 Issue 6 6.4 RSS-139 Issue 3 6.5	RF Radiated Output Power	Complied
§2.1053 §22.917(a) §24.238(a) §27.53(h)(1)	RSS-132 Issue 3 5.5 RSS-133 Issue 6 6.5 RSS-139 Issue 3 6.6	Spurious Radiated Emission	Complied
§2.1046	RSS-Gen Issue 5 6.12	Conducted Output Power	Complied
§2.1049	RSS-Gen Issue 5 6.7	Occupied Bandwidth	Complied
§22.913(d) §24.232(d) §27.50(d)(5)	RSS-132 Issue 3 5.4 RSS-133 Issue 6 6.4 RSS-139 Issue 3 6.5	Peak-Average Ratio	Complied
§2.1051 §22.917(a) §24.238(a) §27.53(h)(1)	RSS-132 Issue 3 5.5 RSS-133 Issue 6 6.5 RSS-139 Issue 3 6.6	Spurious Emission at Antenna Terminal	Complied
§22.917(a) §24.238(a) §27.53(h)(1)	RSS-132 Issue 3 5.5 RSS-133 Issue 6 6.5 RSS-139 Issue 3 6.6	Band Edge	Complied
§2.1055 §22.355 §24.235 §27.54	RSS-Gen Issue 5 6.11 RSS-132 Issue 3 5.3 RSS-133 Issue 6 6.3 RSS-139 Issue 3 6.4	Frequency Stability	Complied

1.11. Sample Calculation for Offset

Where relevant, the following sample calculation is provided:

1.11.1. Conducted Test

Offset value (㏈) = Directional Coupler (㏈) + Cable loss (㏈)

1.11.2. Radiation test

- E.I.R.P. (㏈ m) = Measured level (㏈㎶) + Antenna factor (㏈/m) + Cable loss (㏈) + 20 Log D - 104.5; where D is the measurement distance in meters.
- E.R.P (㏈ m) = E.I.R.P. (㏈ m) - 2.15 (㏈)

1.12. Worst Case Configuration and Mode

GSM
The worst-case is based on the average conducted output power measurement investigation results. Output power measurements were measured on GSM, GPRS, EDGE Mode. All testing was performed using GPRS mode to represent the worst case.

The radiation test of the EUT was investigated in three orthogonal orientations X, Y, and Z, and the worst case data is reported.

WCDMA
The worst-case is based on the average conducted output power measurement investigation results. Output power measurements were measured on RMC, HSDPA, HSUPA, HSPA+ and DC-HSDPA Modulation. All testing was performed using RMC modulations to represent the worst case.

The radiation test of the EUT was investigated in three orthogonal orientations X, Y, and Z, and the worst case data is reported.

1.13. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty	
Radiated Emission, 9 ㎑ to 30 ㎒	H	± 3.66 ㏈
	V	± 3.66 ㏈
Radiated Emission, below 1 ㎓	H	± 4.90 ㏈
	V	± 4.82 ㏈
Radiated Emission, above 1 ㎓	H	± 3.62 ㏈
	V	± 3.64 ㏈

Uncertainty figures are valid to a confidence level of 95 %.

1.14. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL001766	2021.03.05	Initial

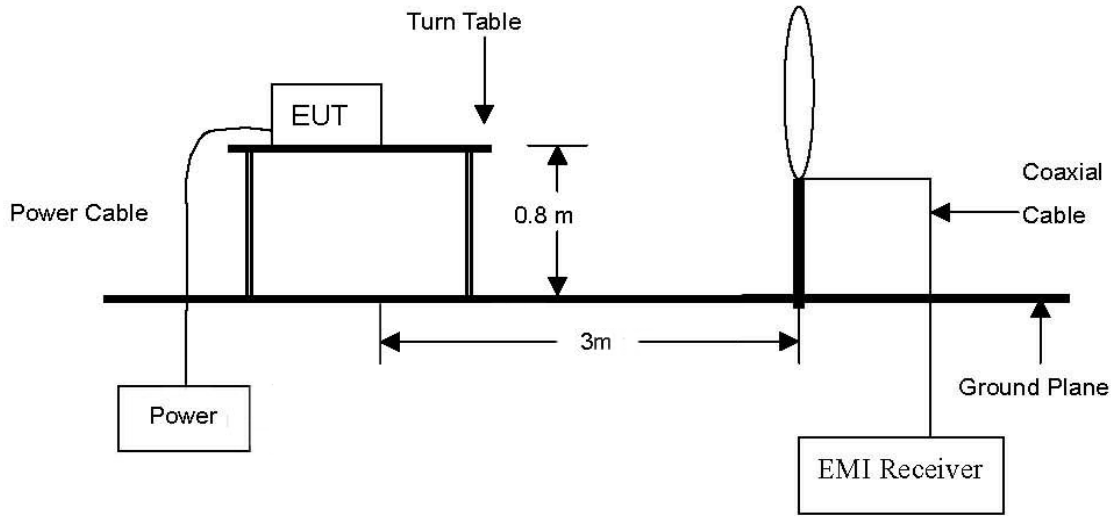
1.15. Emission Designator and Max Power

Band	Frequency Range (㎒)	Mode	Emission Designator	E.R.P. / E.I.R.P.	
				Max power (dB m)	Max power (W)
GSM 850	824.2 ~ 848.8	GPRS	241KGXW	31.03	1.268
		EDGE	246KG7W		
GSM 1900	1 850.2 ~ 1 909.8	GPRS	241KGXW	30.52	1.127
		EDGE	245KG7W		
WCDMA Ⅱ	1 852.4 ~ 1 907.6	RMC	4M15F9W	24.52	0.283
WCDMA Ⅳ	1 712.4 ~ 1 752.6	RMC	4M15F9W	24.52	0.283
WCDMA Ⅴ	826.4 ~ 846.6	RMC	4M14F9W	22.03	0.160

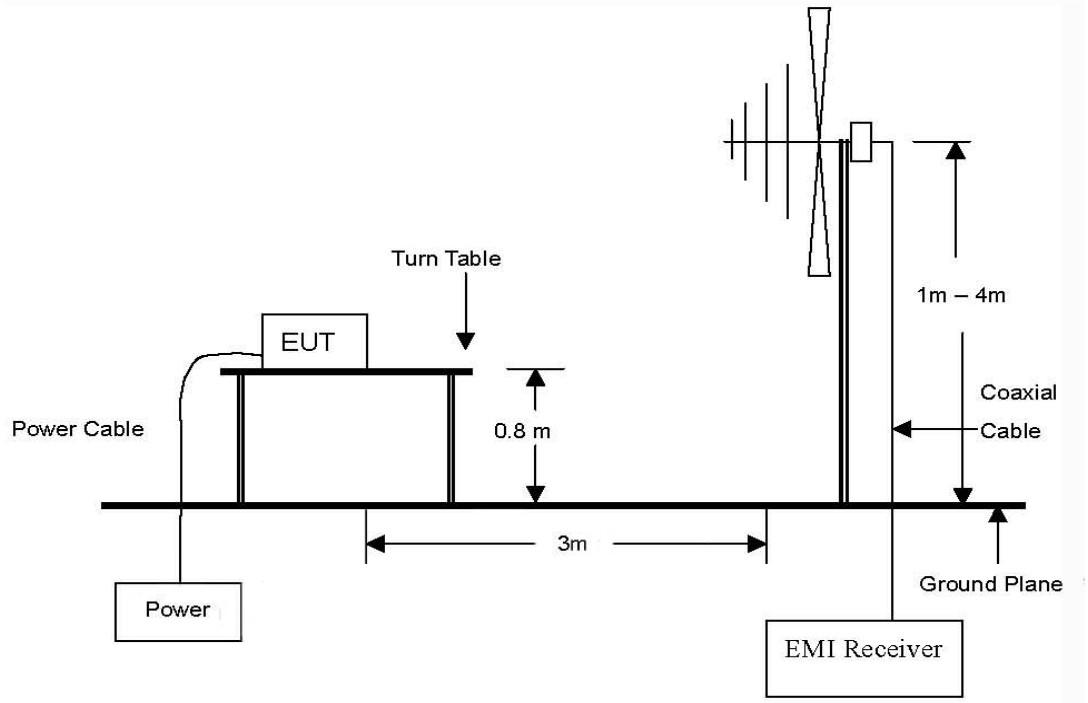
2. Radiated Output Power & Spurious Radiated Emission

2.1. Test setup

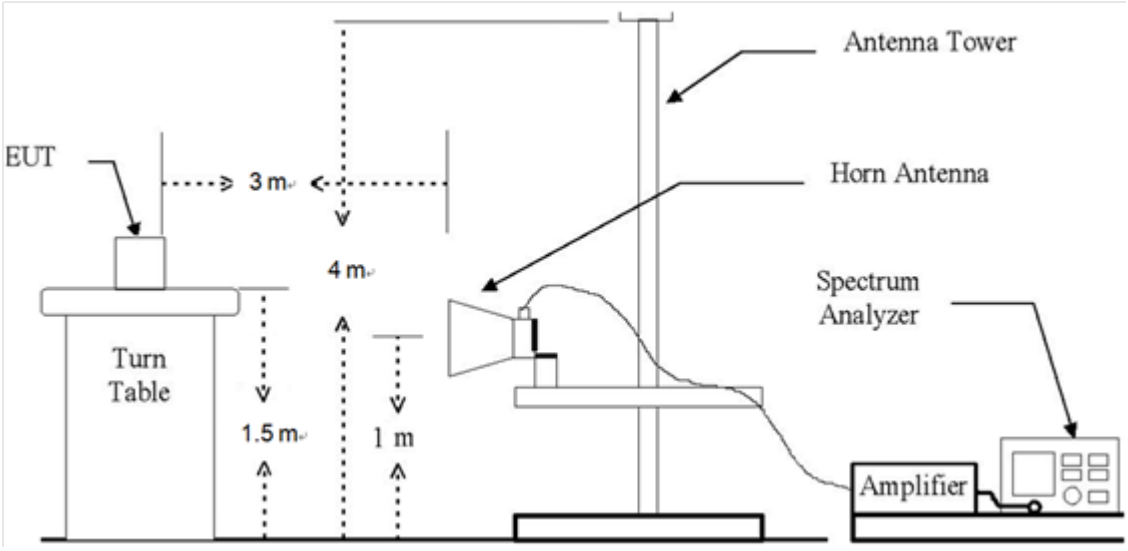
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒.



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 20 ㎓ Emissions.



2.2. Limit

2.2.1. Limit of E.R.P. / E.I.R.P

FCC

- §22.913(a)(5), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

- §24.232(c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

- §27.50(d)(4), fixed, mobile, and portable (hand-held) stations operating in the 1 710-1 755 ㎒ band and mobile and portable stations operating in the 1 695-1 710 ㎒ and 1 755-1 780 ㎒ bands are limited to 1 watt EIRP.

IC

- RSS-132 Issue 3

5.4, the transmitter output power shall be measured in terms of average power.
The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts.
Refer to SRSP-503 for base station e.i.r.p. limits.

- RSS-133 Issue 6

6.4, the equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p. The equipment shall employ means to limit the power to the minimum necessary for successful communication.

- RSS-139 Issue 3

6.5, the equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1 710-1 780 ㎒ shall not exceed one watt.

2.2.2. Limit of Spurious Radiated Emission

FCC

- §22.917(a), 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) ㏈.

- §24.238(a), 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 + 10 log(P) ㏈.

- §27.53(h)(1), for operations in the 1 695-1 710 ㎒, 1 710-1 755 ㎒, 1 755-1 780 ㎒, 1 915-1 920 ㎒, 1 995-2 000 ㎒, 2 000-2 020 ㎒, 2 110-2 155 ㎒, 2 155-2 180 ㎒, and 2 180-2 200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) ㏈.

IC

- RSS-132 Issue 3

5.5, Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 ㎒ band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1 % of the occupied bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p (watts).

(ii) After the first 1.0 ㎒ immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 ㎑ bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p (watts). If the measurement is performed using 1 % of the occupied bandwidth, power integration over 100 ㎑ is required.

- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 ㎒ bands immediately outside and adjacent to the equipment’s operating frequency block, the emission power per any 1 % of the emission bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts).

(ii) After the first 1.0 ㎒, the emission power in any 1 ㎒ bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts). If the measurement is performed using 1 % of the emission bandwidth, power integration over 1.0 ㎒ is required.

- RSS-139 Issue 3

6.6, (i) In the first 1.0 ㎒ bands immediately outside and adjacent to the equipment’s smallest operating frequency block, which can contain the equipment’s occupied bandwidth, the emission power per any 1 % of the emission bandwidth shall be attenuated below the transmitter output power P (in ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

(ii) After the first 1.0 ㎒ outside the equipment’s smallest operating frequency block, which can contain the equipment’s occupied bandwidth, the emission power in any 1 ㎒ bandwidth shall be attenuated below the transmitter output power P (in ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

2.3. Test Procedure: Based on ANSI/TIA 603E: 2016 and ANSI C63.26-2015 and KDB 971168 D01 Power Meas License Digital Systems v03r01.

1. On a test site, the EUT shall be placed at 0.8 m or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental 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. Radiated spurious emissions measurement method was set as follows:
   RBW = 100 ㎑ for emissions below 1 ㎓ and 1 ㎒ for emissions above 1 ㎓, VBW ≥ 3 x RBW,
   Detector = RMS, trace mode = max hold.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
11. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
12. The measurement shall be repeated with the test antenna orientated for horizontal polarization.

2.4. Test result for E.R.P. / E.I.R.P.

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

GSM

Band	Frequency (㎒)	Maximum Conducted Power (dB m)	Maximum Conducted Power (W)	Antenna Gain (dB i)	Maximum E.I.R.P. (dB m)	Maximum E.I.R.P. (W)	Maximum E.R.P. (dB m)	Maximum E.R.P. (W)	Output Power Limit
850	824 ~ 849	34	2.512	-0.82	33.18	2.080	31.03	1.268	7 W E.R.P.
1 900	1 850 ~ 1 910	31	2.512	-0.48	30.52	1.127			2 W E.I.R.P.

WCDMA

Band	Frequency (㎒)	Maximum Conducted Power (dB m)	Maximum Conducted Power (W)	Antenna Gain (dB i)	Maximum E.I.R.P. (dB m)	Maximum E.I.R.P. (W)	Maximum E.R.P. (dB m)	Maximum E.R.P. (W)	Output Power Limit
Ⅱ	1 850 ~ 1 910	25	0.316	-0.48	24.52	0.283			2 W E.I.R.P.
Ⅳ	1 710 ~ 1 755	25	0.316	-0.48	24.52	0.283			1 W E.I.R.P.
Ⅴ	824 ~ 849	25	0.316	-0.82	24.18	0.262	22.03	0.160	7 W E.R.P.

Remark;

1. E.I.R.P. (dB m) = Maximum Conducted Power (dB m) + Maximum Antenna Gain (dB i)
2. E.R.P. (dB m) = E.I.R.P. (dB m) - 2.15 (dB); where E.R.P. and E.I.R.P. are expressed in consistent units.

2.5. Spurious Radiated Emission

GSM 850

Frequency (㎒)	Measured Level (dB㎶)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dB㎶/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (824.2 ㎒)									
1 648.56	55.92	H	25.78	-40.48	41.22	-97.41	-56.19	-13	43.19
1 648.12	51.59	V	25.77	-40.48	36.88	-97.41	-60.53	-13	47.53
2 472.86	56.43	H	28.41	-38.54	46.30	-97.41	-51.11	-13	38.11
2 472.69	60.13	V	28.41	-38.54	50.00	-97.41	**-47.41**	-13	34.41
Middle Channel (836.6 ㎒)									
1 673.91	56.23	H	26.37	-40.41	42.19	-97.41	-55.22	-13	42.22
1 673.22	51.87	V	26.36	-40.41	37.82	-97.41	-59.59	-13	46.59
2 509.73	56.30	H	28.30	-38.83	45.77	-97.41	-51.64	-13	38.64
2 509.93	56.07	V	28.30	-38.83	45.54	-97.41	-51.87	-13	38.87
High Channel (848.8 ㎒)									
1 697.89	56.22	H	26.95	-40.39	42.78	-97.41	-54.63	-13	41.63
1 697.86	49.92	V	26.95	-40.39	36.48	-97.41	-60.93	-13	47.93
2 546.53	58.07	H	28.30	-38.79	47.58	-97.41	-49.83	-13	36.83
2 546.22	59.17	V	28.30	-38.79	48.68	-97.41	-48.73	-13	35.73

EDGE 850

Frequency (㎒)	Measured Level (dB㎶)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dB㎶/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (824.2 ㎒)									
1 648.23	57.19	H	25.77	-40.48	42.48	-97.41	-54.93	-13	41.93
1 648.41	51.77	V	25.77	-40.48	37.06	-97.41	-60.35	-13	47.35
2 472.37	54.81	H	28.41	-38.54	44.68	-97.41	-52.73	-13	39.73
2 472.43	56.86	V	28.41	-38.54	46.73	-97.41	**-50.68**	-13	37.68
Middle Channel (836.6 ㎒)									
1 673.12	57.52	H	26.35	-40.41	43.46	-97.41	-53.95	-13	40.95
1 673.18	50.57	V	26.36	-40.41	36.52	-97.41	-60.89	-13	47.89
2 509.93	54.66	H	28.30	-38.83	44.13	-97.41	-53.28	-13	40.28
2 509.80	56.64	V	28.30	-38.83	46.11	-97.41	-51.30	-13	38.30
High Channel (848.8 ㎒)									
1 697.66	58.43	H	26.94	-40.39	44.98	-97.41	-52.43	-13	39.43
1 697.59	51.92	V	26.94	-40.39	38.47	-97.41	-58.94	-13	45.94
2 546.21	55.31	H	28.30	-38.79	44.82	-97.41	-52.59	-13	39.59
2 546.50	54.33	V	28.30	-38.79	43.84	-97.41	-53.57	-13	40.57

GSM 1 900

Frequency (㎒)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (1 850.2 ㎒)									
Above 0.009	Not Detected		-	-	-	-	-	-	-
Middle Channel (1 880.0 ㎒)									
Above 0.009	Not Detected		-	-	-	-	-	-	-
High Channel (1 909.8 ㎒)									
Above 0.009	Not Detected		-	-	-	-	-	-	-

EDGE 1 900

Frequency (㎒)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (1 850.2 ㎒)									
Above 0.009	Not Detected		-	-	-	-	-	-	-
Middle Channel (1 880.0 ㎒)									
Above 0.009	Not Detected		-	-	-	-	-	-	-
High Channel (1 909.8 ㎒)									
Above 0.009	Not Detected		-	-	-	-	-	-	-

WCDMA Ⅱ

Frequency (㎒)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (1 852.4 ㎒)									
9 257.10	63.58	H	37.03	-38.82	61.79	-95.26	**-33.47**	-13	20.47
9 258.24	62.98	V	37.03	-38.82	61.19	-95.26	-34.07	-13	21.07
12 960.29	47.48	H	39.18	-36.17	50.49	-95.26	-44.77	-13	31.77
12 960.00	47.75	V	39.18	-36.17	50.76	-95.26	-44.50	-13	31.50
18 537.10	48.82	H	46.03	-37.79	57.06	-104.80	-47.74	-13	34.74
18 511.70	40.80	V	45.97	-37.72	49.05	-104.80	-55.75	-13	42.75
Middle Channel (1 880.0 ㎒)									
9 396.21	54.24	H	37.40	-38.78	52.86	-95.26	-42.40	-13	29.40
9 403.89	54.92	V	37.42	-38.78	53.56	-95.26	-41.70	-13	28.70
13 166.54	46.05	H	39.27	-36.13	49.19	-95.26	-46.07	-13	33.07
13 153.41	40.59	V	39.21	-36.15	43.65	-95.26	-51.61	-13	38.61
18 790.50	43.74	H	46.66	-38.46	51.94	-104.80	-52.86	-13	39.86
18 813.70	38.00	V	46.72	-38.52	46.20	-104.80	-58.60	-13	45.60
High Channel (1 907.6 ㎒)									
9 533.15	49.12	H	37.53	-38.67	47.98	-95.26	-47.28	-13	34.28
9 532.04	46.95	V	37.54	-38.67	45.82	-95.26	-49.44	-13	36.44
13 346.49	41.82	H	39.69	-36.03	45.48	-95.26	-49.78	-13	36.78
13 359.79	37.63	V	39.74	-36.03	41.34	-95.26	-53.92	-13	40.92
19 085.70	41.04	H	47.40	-39.22	49.22	-104.80	-55.58	-13	42.58
19 065.20	38.59	V	47.35	-39.17	46.77	-104.80	-58.03	-13	45.03

WCDMA Ⅳ

Frequency (㎒)	Measured Level (dB㎶)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dB㎶/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (1 712.4 ㎒)									
3 422.61	47.87	H	31.04	-39.85	39.06	-95.26	-56.20	-13	43.20
3 427.11	46.26	V	31.06	-39.85	37.47	-95.26	-57.79	-13	44.79
5 134.31	48.72	H	33.47	-38.74	43.45	-95.26	-51.81	-13	38.81
5 140.31	48.34	V	33.48	-38.72	43.10	-95.26	-52.16	-13	39.16
8 556.21	41.89	V	36.50	-38.93	39.46	-95.26	-55.80	-13	42.80
10 274.78	41.11	H	37.70	-37.99	40.82	-95.26	-54.44	-13	41.44
10 277.15	43.31	V	37.70	-37.99	43.02	-95.26	-52.24	-13	39.24
Middle Channel (1 732.6 ㎒)									
3 467.61	46.83	H	31.20	-39.83	38.20	-95.26	-57.06	-13	44.06
3 467.36	44.66	V	31.20	-39.83	36.03	-95.26	-59.23	-13	46.23
5 194.56	44.61	H	33.59	-38.58	39.62	-95.26	-55.64	-13	42.64
5 194.81	45.51	V	33.59	-38.58	40.52	-95.26	-54.74	-13	41.74
8 660.20	41.39	V	36.62	-38.92	39.09	-95.26	-56.17	-13	43.17
10 402.64	39.85	V	37.69	-37.86	39.68	-95.26	-55.58	-13	42.58
High Channel (1 752.6 ㎒)									
3 503.90	46.55	H	31.19	-39.81	37.93	-95.26	-57.33	-13	44.33
3 506.75	46.98	V	31.19	-39.80	38.37	-95.26	-56.89	-13	43.89
5 260.64	48.31	H	33.72	-38.49	43.54	-95.26	-51.72	-13	38.72
5 254.78	49.14	V	33.71	-38.49	44.36	-95.26	**-50.90**	-13	37.90
8 766.52	40.61	V	36.93	-38.92	38.62	-95.26	-56.64	-13	43.64

WCDMA V

Frequency (㎒)	Measured Level (dB㎶)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dB㎶/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (826.4 ㎒)									
Above 0.009	Not Detected	-	-	-	-	-	-	-	-
Middle Channel (836.6 ㎒)									
Above 0.009	Not Detected	-	-	-	-	-	-	-	-
High Channel (846.6 ㎒)									
Above 0.009	Not Detected	-	-	-	-	-	-	-	-

Remark;

1. AF = Antenna Factor, CL = Cable Loss, CF = Conversion Factor.
2. E (dB㎶/m) = Measured Level (dB㎶) + Antenna Factor (dB/m) + Cable Loss (dB).
3. E.I.R.P. (dB m) = E (dB㎶/m) + CF (dB).
4. E.R.P. (dB m) = E (dB㎶/m) + CF (dB) - 2.15 (dB); where E.R.P. and E.I.R.P. are expressed in consistent units.
5. CF (dB) = 20 log D - 104.8; where D is the measurement distance in meters, According to ANSI C63.26-2015 5.2.7 and KDB 971168 D01 v03r01 5.8.4
6. The frequency spectrum is examined from 9 ㎑ to the 10th harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.

3. Conducted Output Power

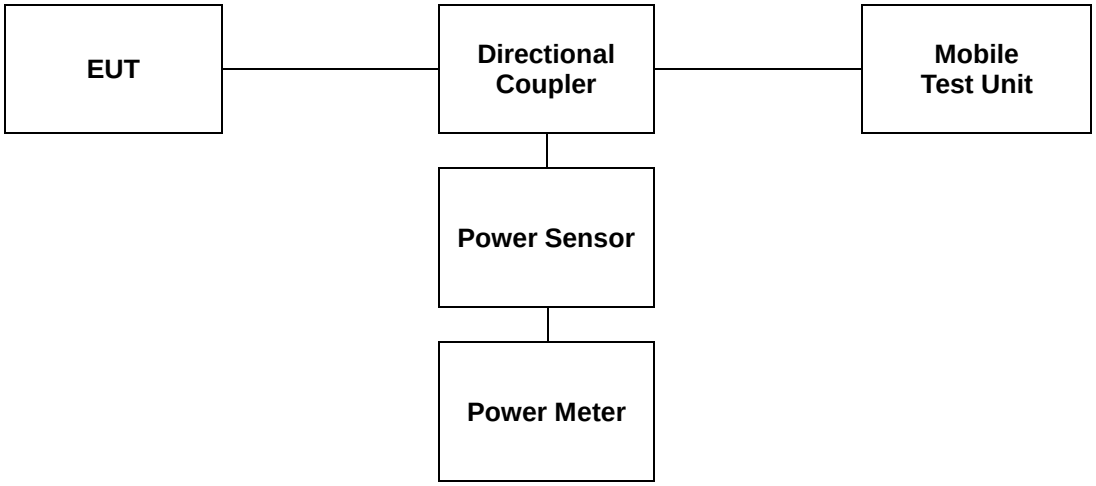
3.1. Limit

CFR 47, Section FCC §2.1046 and IC RSS-Gen Issue 5 6.12.

3.2. Test Procedure

Output power shall be measured at the RF output terminals for all configurations.

1. The RF output of the transmitter was connected to the input of the mobile test unit in order to establish communication with the EUT.
2. The EUT was set up for the max. output power with pseudo random data modulation by using mobile test unit parameters.
3. The measurement performed using a wideband RF power meter.
4. This EUT was tested under all configurations and the highest power was investigated and reported.



3.3. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- GSM

Band	Channel	Frequency (㎒)	GSM		GPRS				EDGE			
			Voice		1 Tx slot		2 Tx slot		1 Tx slot		2 Tx slot	
			(dB m)	(W)	(dB m)	(W)	(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
850	128	824.2	32.21	1.663	32.69	1.858	32.47	1.766	26.00	0.398	25.79	0.379
	190	836.6	32.61	1.824	**33.08**	**2.032**	32.84	1.923	25.95	0.394	25.69	0.371
	251	848.8	32.51	1.782	33.06	2.023	32.72	1.871	25.85	0.385	25.61	0.364
1 900	512	1 850.2	28.64	0.731	29.36	0.863	29.15	0.822	24.47	0.280	24.21	0.264
	661	1 880.0	28.74	0.748	**29.56**	**0.904**	29.32	0.855	24.37	0.274	24.13	0.259
	810	1 909.8	28.73	0.746	29.52	0.895	29.40	0.871	24.46	0.279	24.18	0.262

- WCDMA

Band	3GPP Release Version	Channel		9262		9400		9538	
		Frequency (㎒)		1 852.4		1 880.0		1 907.6	
				(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Ⅱ	99	WCDMA	GPRS	**23.41**	**0.219**	23.31	0.214	23.23	0.210
	5	HSDPA	Subtest 1	22.44	0.175	22.37	0.173	22.54	0.179
	5		Subtest 2	22.44	0.175	22.33	0.171	22.51	0.178
	5		Subtest 3	21.91	0.155	21.84	0.153	22.04	0.160
	5		Subtest 4	21.89	0.155	21.84	0.153	22.04	0.160
	6	HSUPA	Subtest 1	22.35	0.172	22.31	0.170	22.46	0.176
	6		Subtest 2	20.34	0.108	20.26	0.106	20.45	0.111
	6		Subtest 3	21.35	0.136	21.28	0.134	21.43	0.139
	6		Subtest 4	20.37	0.109	20.29	0.107	20.45	0.111
	6		Subtest 5	22.38	0.173	22.30	0.170	22.45	0.176
	7	HSPA+		21.84	0.153	21.79	0.151	21.58	0.144
	8	DC-HSDPA	Subtest 1	22.30	0.170	22.29	0.169	21.99	0.158
	8		Subtest 2	22.31	0.170	22.30	0.170	22.01	0.159
	8		Subtest 3	21.71	0.148	21.80	0.151	21.13	0.130
	8		Subtest 4	21.69	0.148	21.79	0.151	21.11	0.129

Band	3GPP Release Version	Channel		1312		1413		1513	
		Frequency (㎒)		1 712.4		1 732.6		1 752.6	
				(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Ⅳ	99	WCDMA	GPRS	**23.72**	**0.236**	23.68	0.233	23.52	0.225
	5	HSDPA	Subtest 1	22.75	0.188	22.66	0.185	22.67	0.185
	5		Subtest 2	22.75	0.188	22.64	0.184	22.65	0.184
	5		Subtest 3	22.25	0.168	22.16	0.164	22.14	0.164
	5		Subtest 4	22.14	0.164	22.13	0.163	22.12	0.163
	6	HSUPA	Subtest 1	22.66	0.185	22.59	0.182	22.57	0.181
	6		Subtest 2	20.64	0.116	20.55	0.114	20.57	0.114
	6		Subtest 3	21.67	0.147	21.55	0.143	21.58	0.144
	6		Subtest 4	20.70	0.117	20.60	0.115	20.61	0.115
	6		Subtest 5	22.69	0.186	22.56	0.180	22.56	0.180
	7	HSPA+		22.08	0.161	21.86	0.153	21.70	0.148
	8	DC-HSDPA	Subtest 1	21.35	0.136	21.51	0.142	21.49	0.141
	8		Subtest 2	21.37	0.137	21.52	0.142	21.49	0.141
	8		Subtest 3	20.87	0.122	21.01	0.126	21.00	0.126
	8		Subtest 4	20.88	0.122	21.00	0.126	20.98	0.125

Band	3GPP Release Version	Channel		4132		4182		4233	
		Frequency (㎒)		826.4		836.6		846.6	
				(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Ⅴ	99	WCDMA	GPRS	23.49	0.223	23.62	0.230	**23.77**	**0.238**
	5	HSDPA	Subtest 1	22.73	0.187	22.75	0.188	22.88	0.194
	5		Subtest 2	22.76	0.189	22.68	0.185	22.88	0.194
	5		Subtest 3	22.21	0.166	22.22	0.167	22.35	0.172
	5		Subtest 4	22.14	0.164	22.22	0.167	22.35	0.172
	6	HSUPA	Subtest 1	22.69	0.186	22.66	0.185	22.82	0.191
	6		Subtest 2	20.69	0.117	20.71	0.118	20.79	0.120
	6		Subtest 3	21.66	0.147	21.66	0.147	21.76	0.150
	6		Subtest 4	20.71	0.118	20.71	0.118	20.82	0.121
	6		Subtest 5	22.68	0.185	22.66	0.185	22.79	0.190
	7	HSPA+		21.84	0.153	21.67	0.147	21.62	0.145
	8	DC-HSDPA	Subtest 1	21.88	0.154	21.71	0.148	22.01	0.159
	8		Subtest 2	21.89	0.155	21.70	0.148	22.04	0.160
	8		Subtest 3	21.31	0.135	21.21	0.132	21.53	0.142
	8		Subtest 4	21.38	0.137	21.20	0.132	21.54	0.143

4. Occupied Bandwidth

4.1. Limit

CFR 47, Section FCC §2.1049 and IC RSS-Gen Issue 5 6.7.

4.2. Test Procedure

FCC
The test follows section 5.4.4 of ANSI C63.26-2015.

a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation. Products including the emission skirts (typically a span of 1.5 × OBW is sufficient).
b. The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
d. Set the detection mode to peak, and the trace mode to max-hold.
e. If the instrument does not have a 99 % OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5 % of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5 % of the total is reached and record that frequency as the upper OBW frequency. The 99 % power OBW can be determined by computing the difference these two frequencies.
f. The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

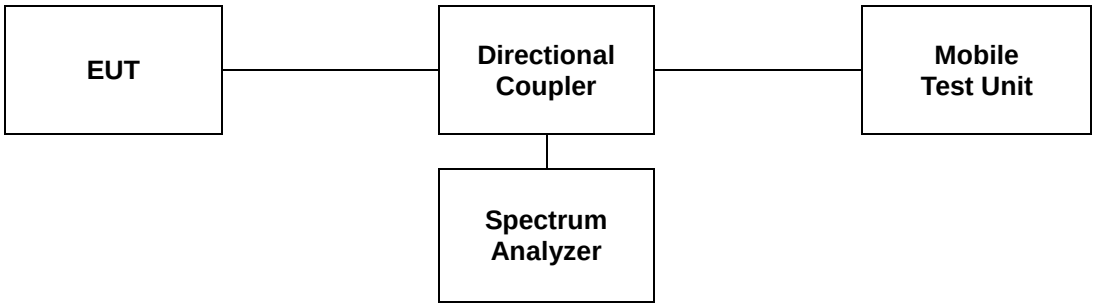
IC

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
• The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
• The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).



4.3 Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- GSM

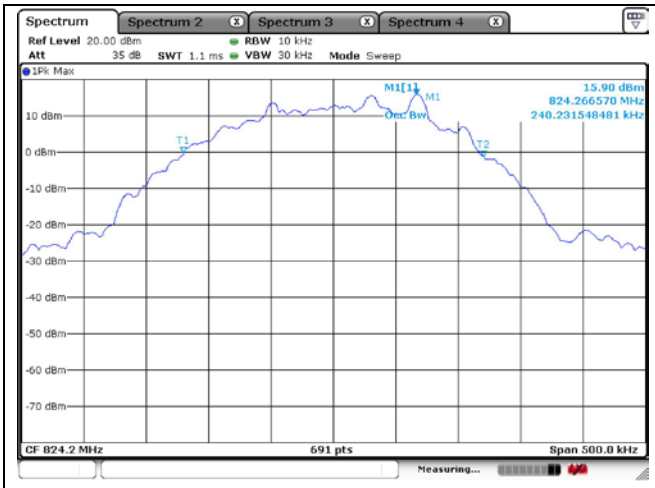
Band	Frequency (㎒)	Occupied Bandwidth (㎒)	
		GPRS	EDGE
850	824.2	0.240	0.246
	836.6	0.240	0.244
	848.8	0.241	0.245
1 900	1 850.2	0.240	0.245
	1 880.0	0.241	0.244
	1 909.8	0.240	0.241

- WCDMA

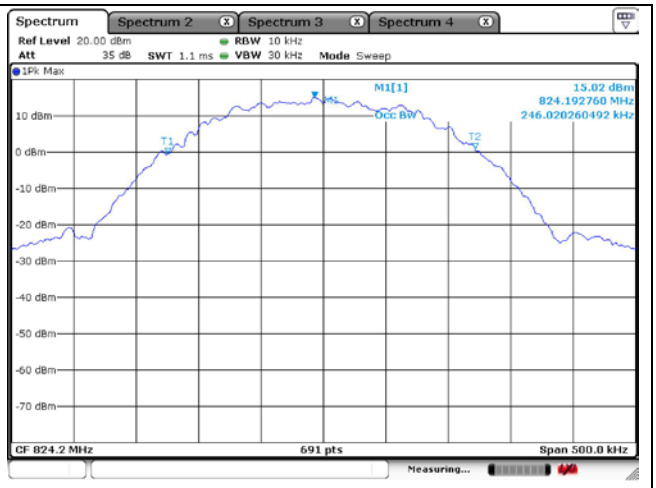
Band	Frequency (㎒)	Occupied Bandwidth (㎒)
Ⅱ	1 852.4	4.146
	1 880.0	4.136
	1 907.6	4.146
Ⅳ	1 712.4	4.146
	1 732.6	4.146
	1 752.6	4.126
Ⅴ	826.4	4.126
	836.6	4.116
	846.6	4.136

- Test plots

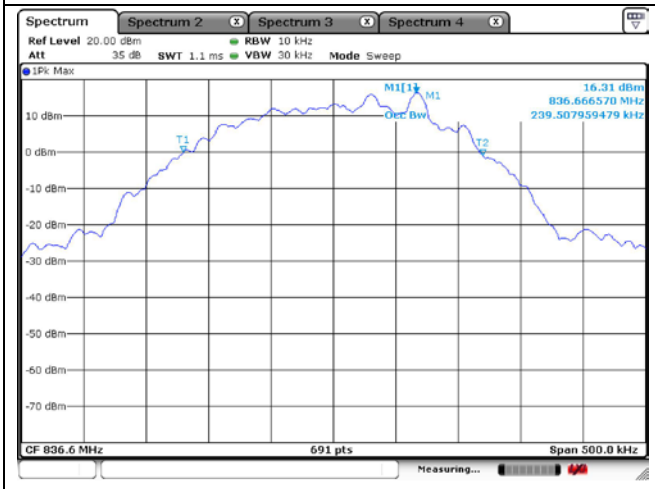
GSM



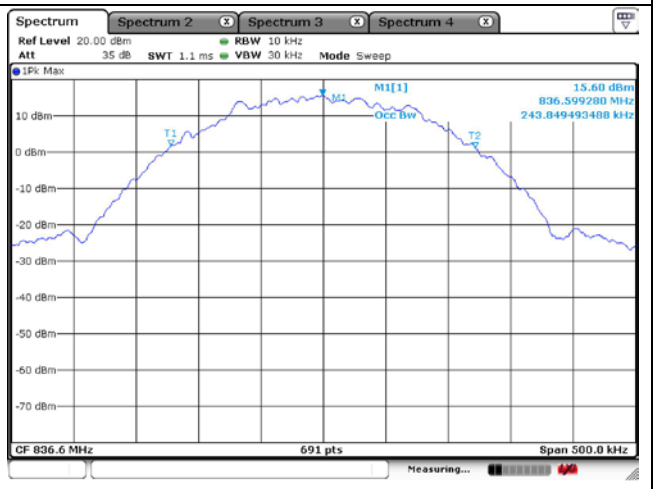
GSM 850 GPRS Low Channel



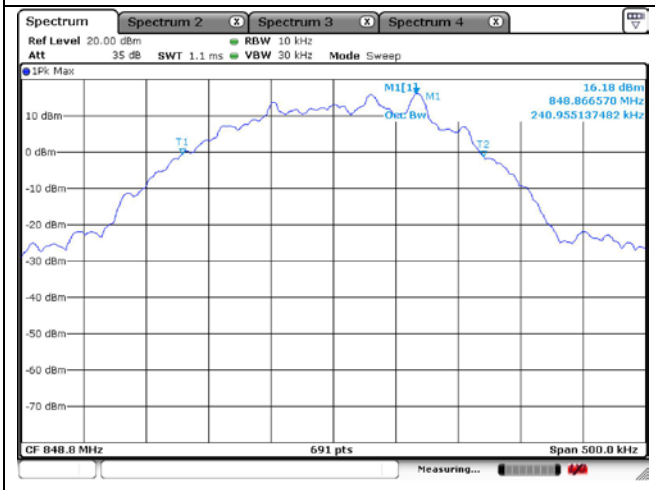
GSM 850 EDGE Low Channel



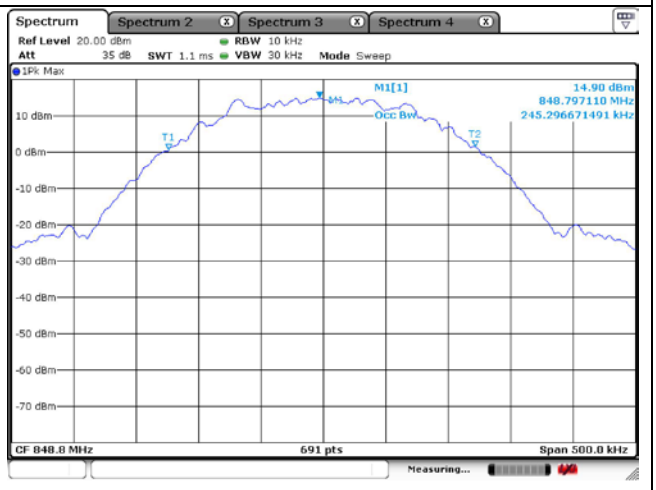
GSM 850 GPRS Middle Channel



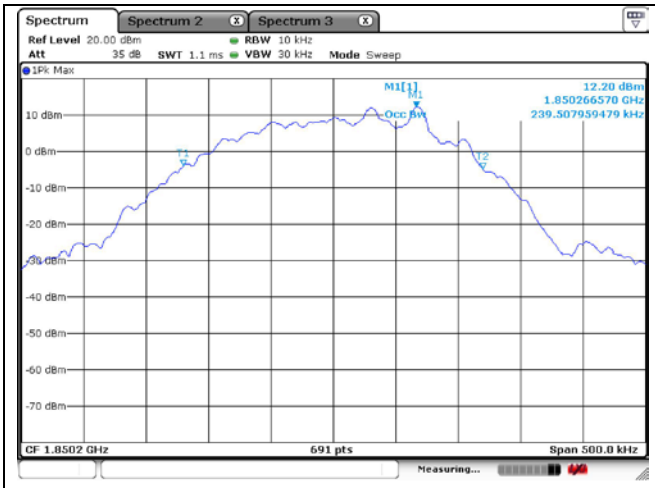
GSM 850 EDGE Middle Channel



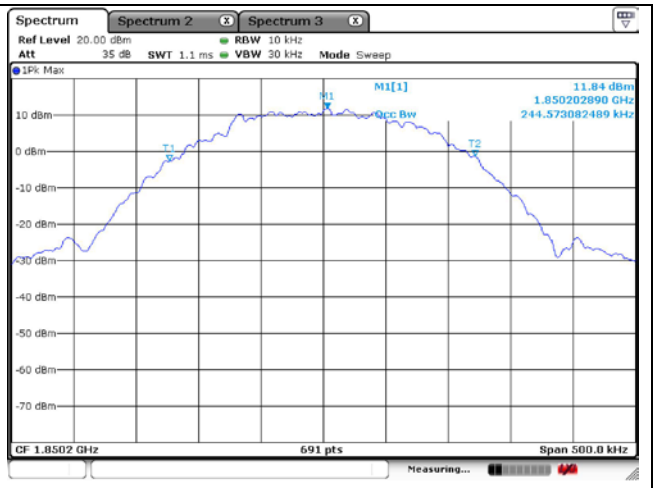
GSM 850 GPRS High Channel



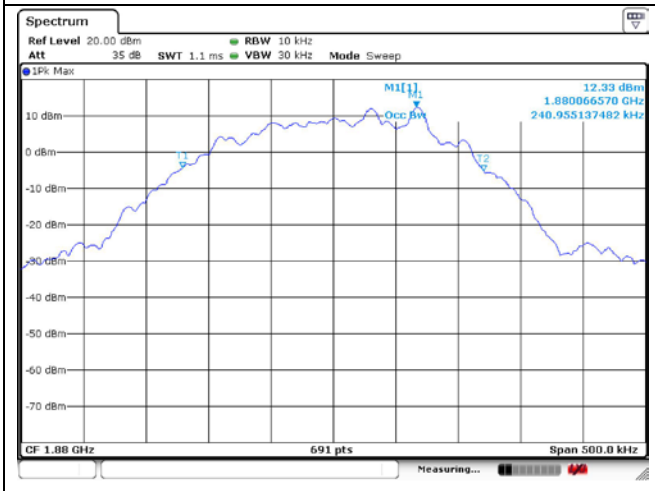
GSM 850 EDGE High Channel



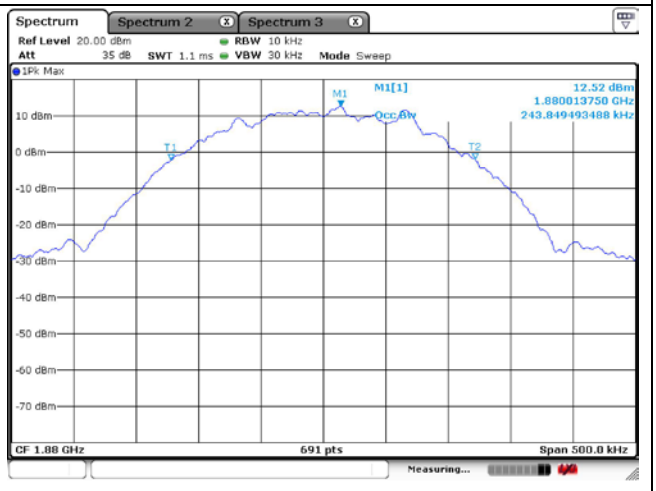
GSM 1 900 GPRS Low Channel



GSM 1 900 EDGE Low Channel



GSM 1 900 GPRS Middle Channel



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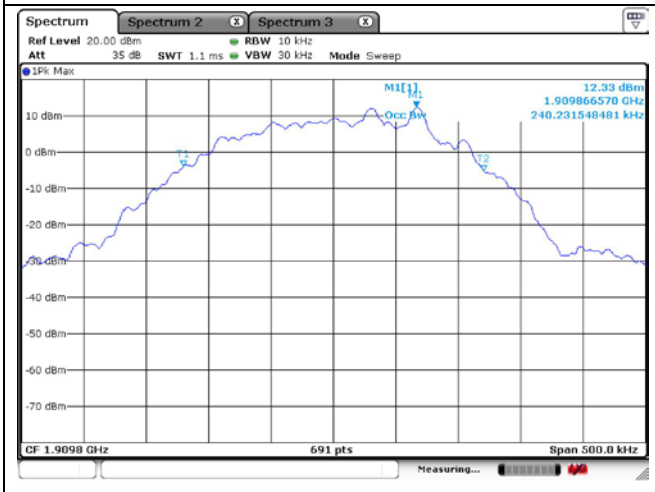
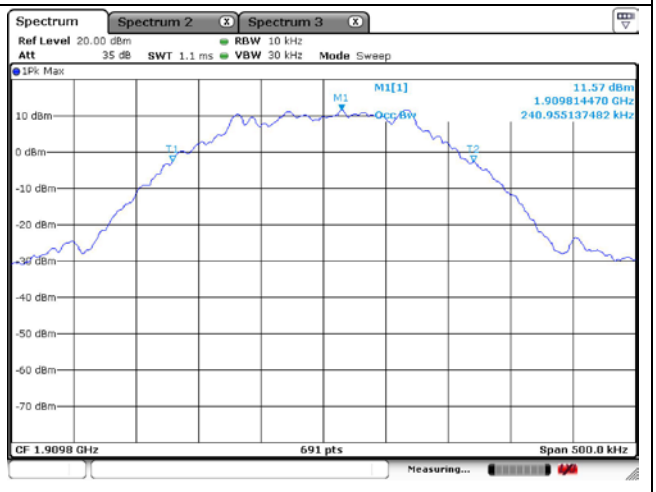
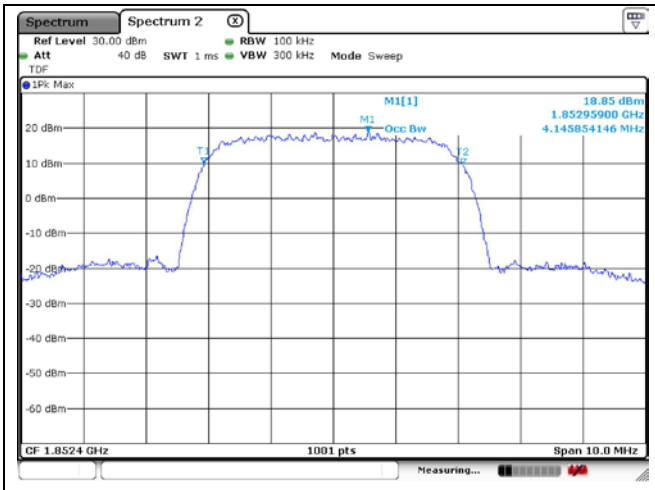


GSM 1 900 GPRS High Channel

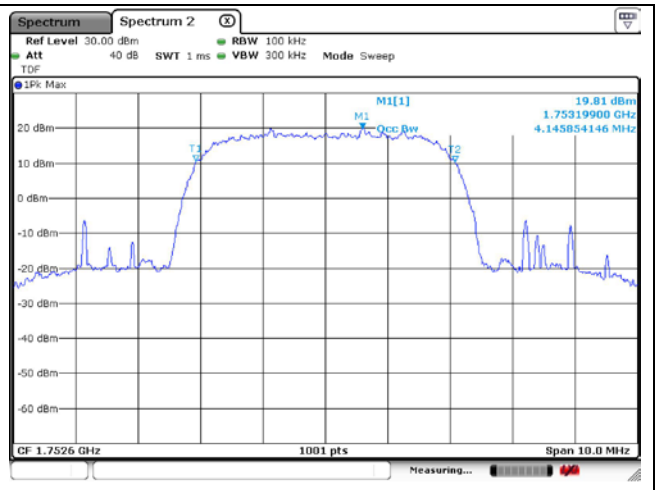


GSM 1 900 EDGE High Channel

WCDMA



WCDMA BAND Ⅱ Low Channel



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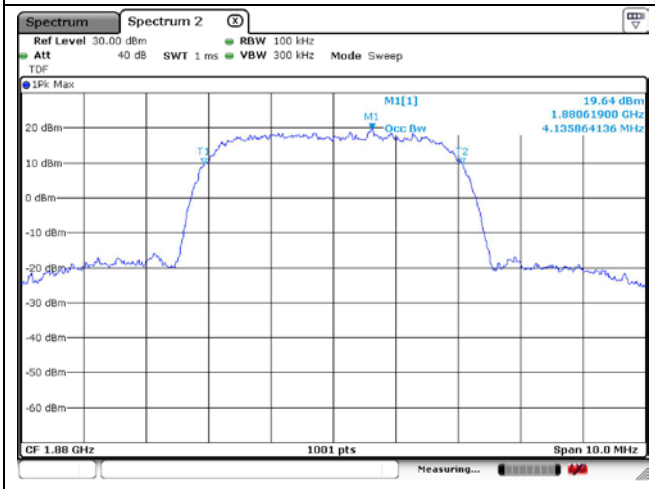

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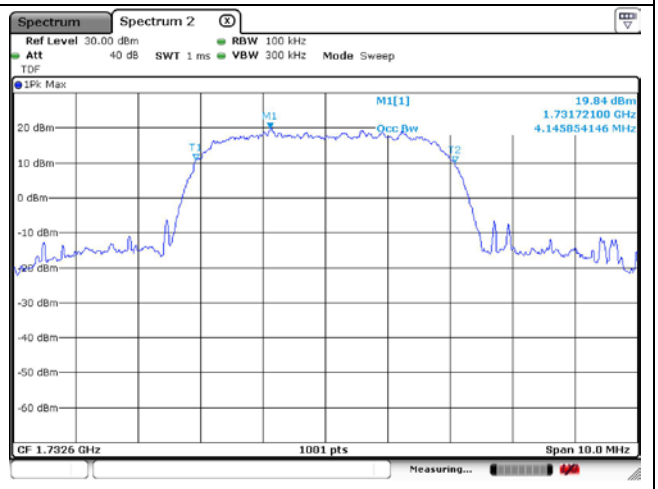

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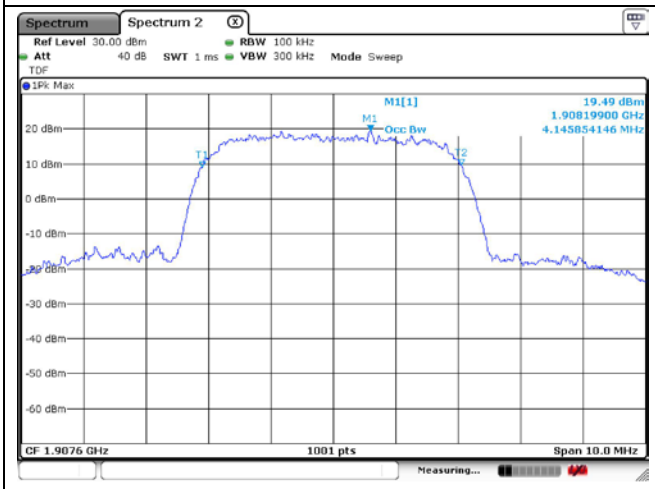

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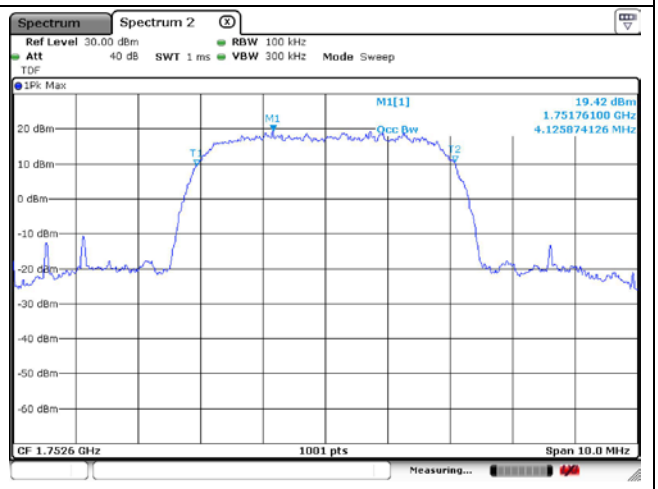
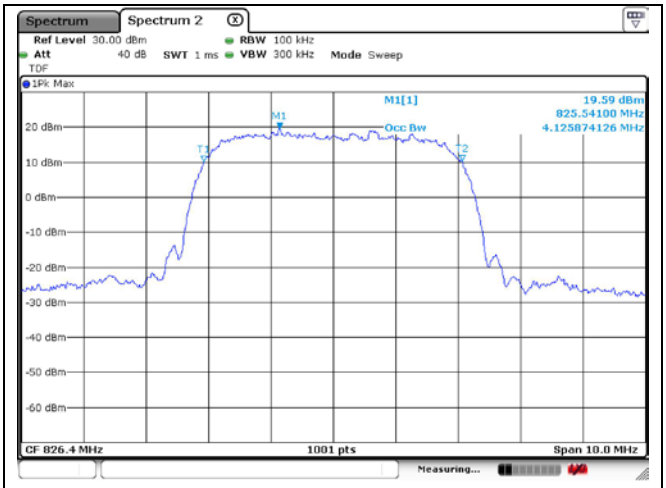
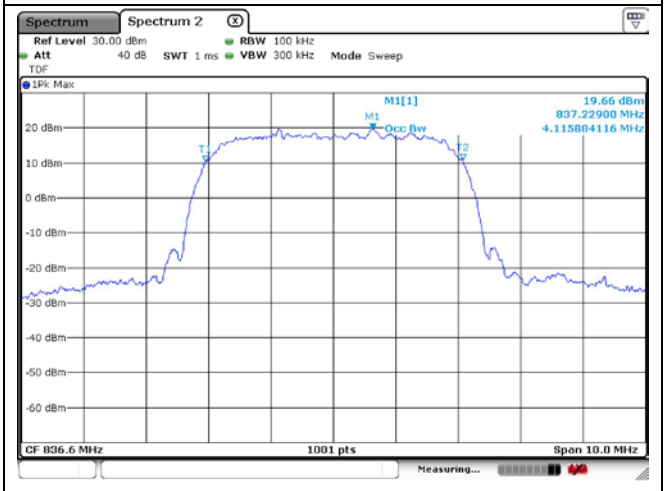


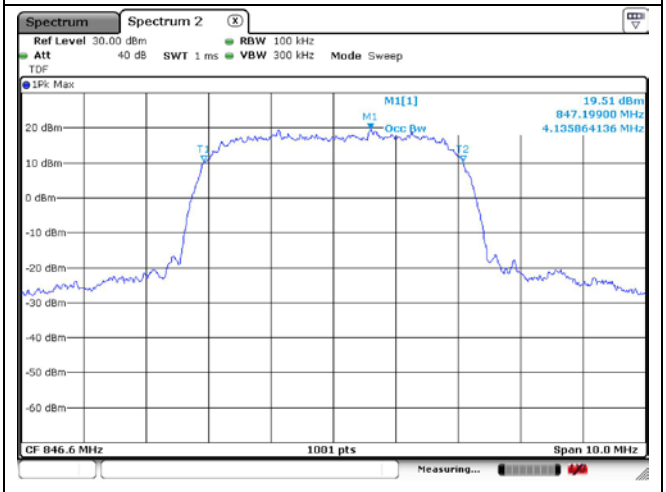
WCDMA BAND Ⅳ High Channel



WCDMA BAND Ⅴ Low Channel



WCDMA BAND Ⅴ Middle Channel



WCDMA BAND Ⅴ High Channel

5. Peak-Average Ratio

5.1. Limit

FCC

- §22.913(d) Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 ㏈.

- §24.232(d), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 ㏈.

- §27.50(d)(5), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 ㏈.

IC

- RSS-132 Issue 3

5.4, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 ㏈ for more than 0.1 % of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

- RSS-133 Issue 6

6.4, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 ㏈ for more than 0.1 % of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

- RSS-139 Issue 3

6.5, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 ㏈ for more than 0.1 % of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

5.2. Test Procedure

The test follows section 5.2.3.4 of ANSI C63.26-2015.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

a. Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth.

b. Set the number of counts to a value that stabilizes the measured CCDF curve.

c. Set the measurement interval as follows:

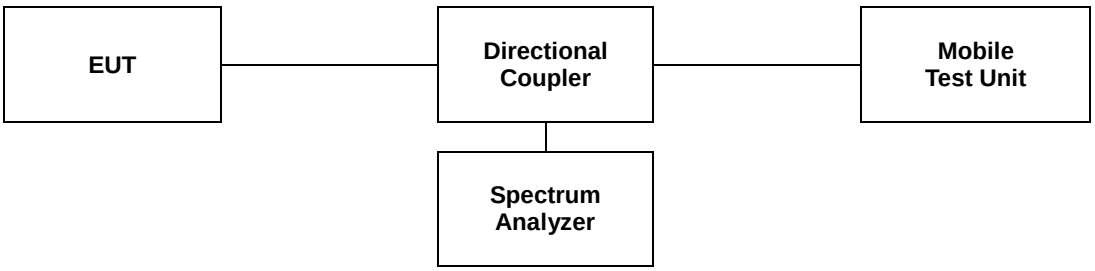
1) For continuous transmissions, set to greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ㎳.

2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.

3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.

d. Record the maximum PAPR level associated with a probability of 0.1 %.

e. The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.



5.3 Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- GSM

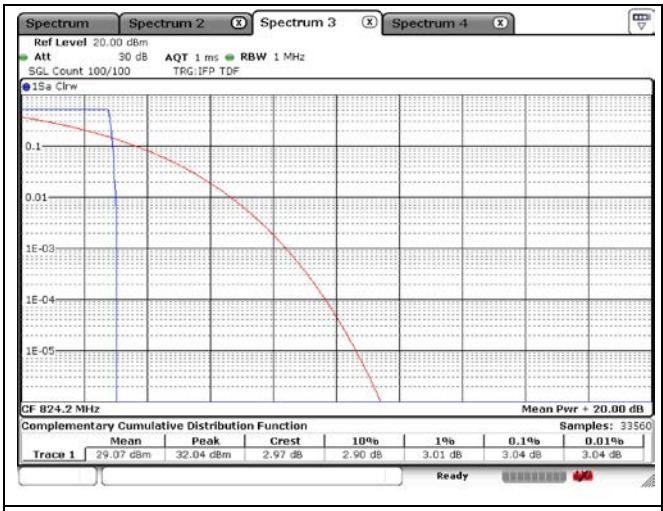
Band	Frequency (㎒)	PAR (dB)	
		GPRS	EDGE
850	824.2	3.04	3.04
	836.6	3.01	3.04
	848.8	3.01	3.01
1 900	1 850.2	3.04	3.04
	1 880.0	3.04	3.10
	1 909.8	3.04	3.04

- WCDMA

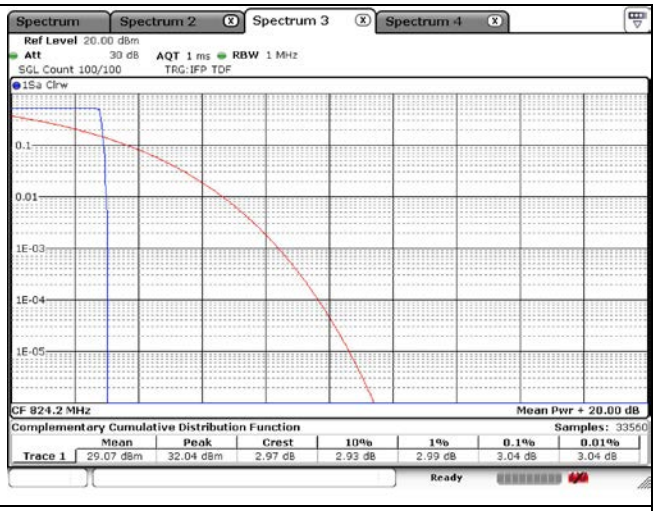
Band	Frequency (㎒)	PAR (dB)
Ⅱ	1 852.4	2.81
	1 880.0	2.67
	1 907.6	2.67
Ⅳ	1 712.4	2.78
	1 732.6	2.41
	1 752.6	2.84
Ⅴ	826.4	3.10
	836.6	3.16
	846.6	2.93

- Test plots

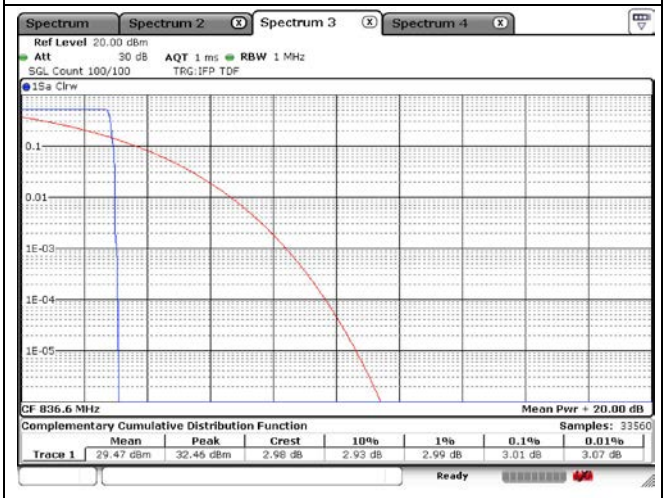
GSM



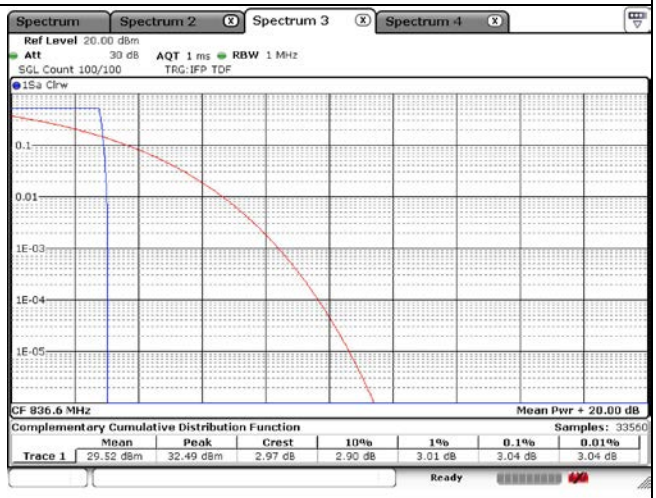
GSM 850 GPRS Low Channel



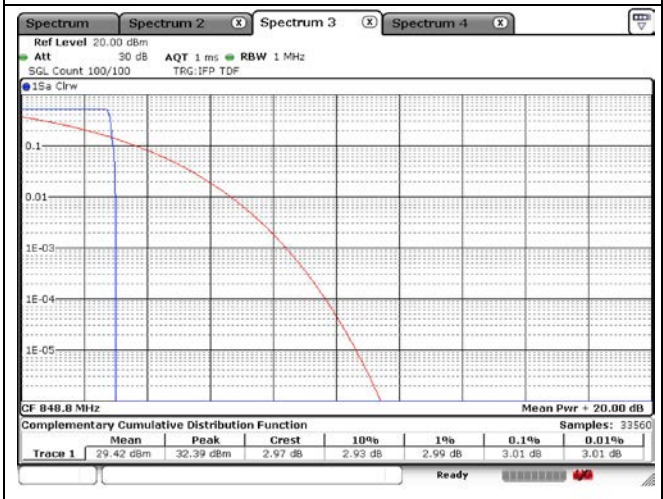
GSM 850 EDGE Low Channel



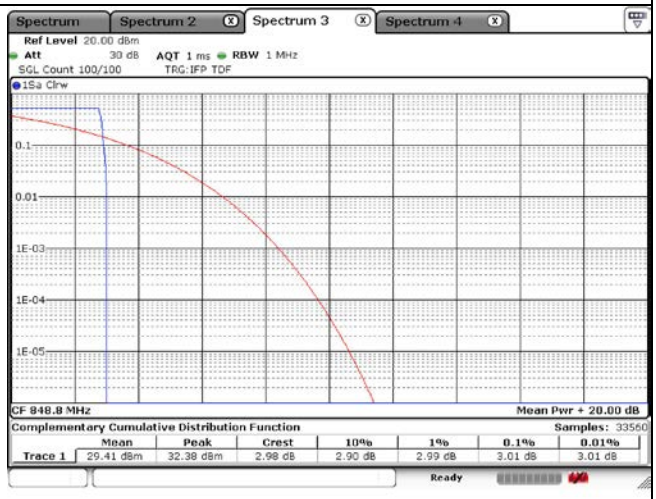
GSM 850 GPRS Middle Channel



GSM 850 EDGE Middle Channel

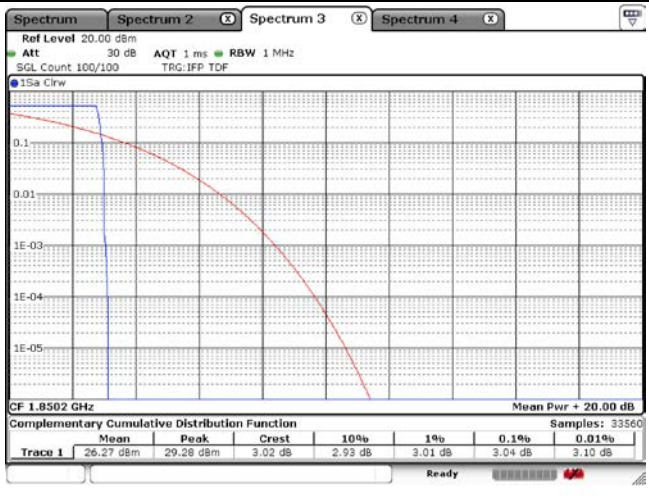


GSM 850 GPRS High Channel

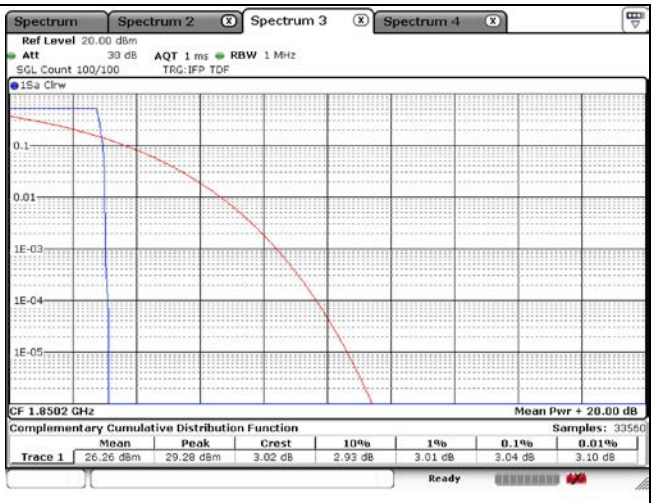


GSM 850 EDGE High Channel

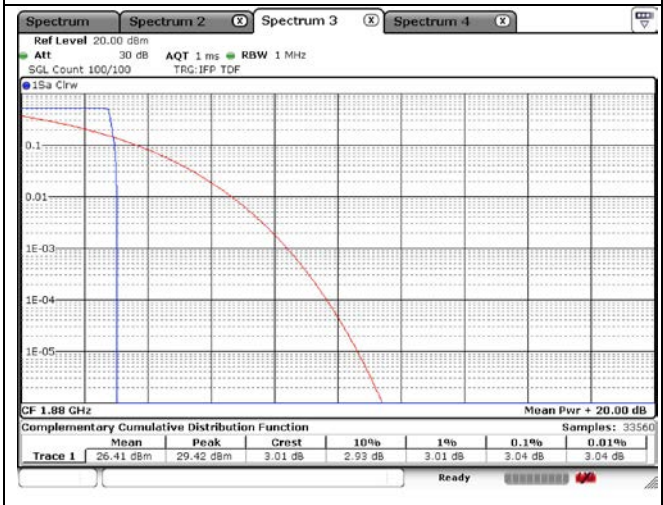
GSM



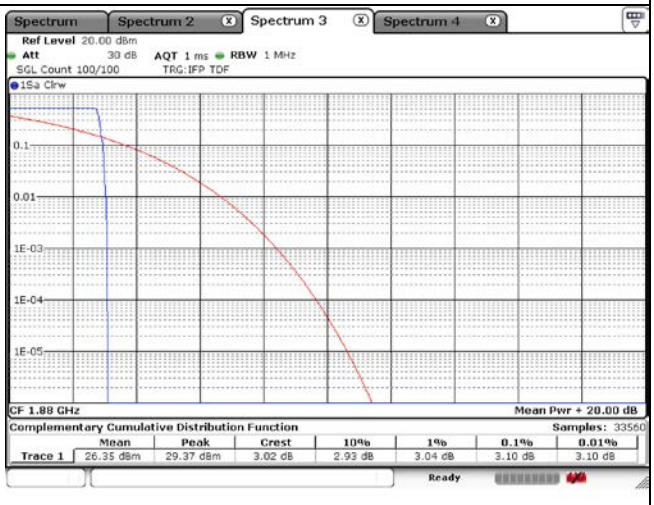
GSM 1 900 GPRS Low Channel



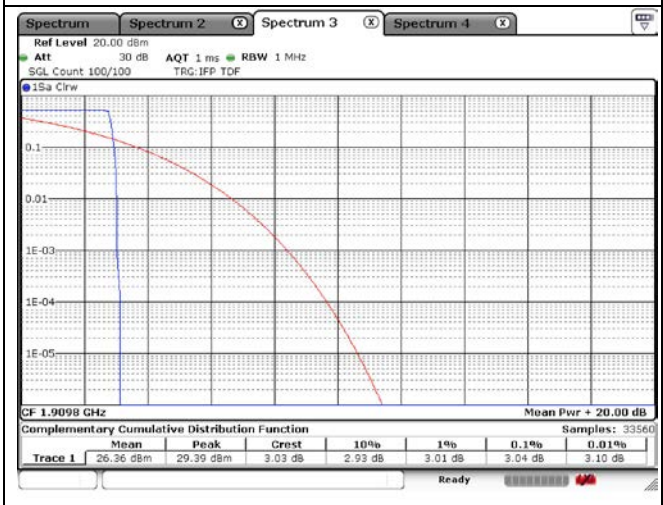
GSM 1 900 EDGE Low Channel



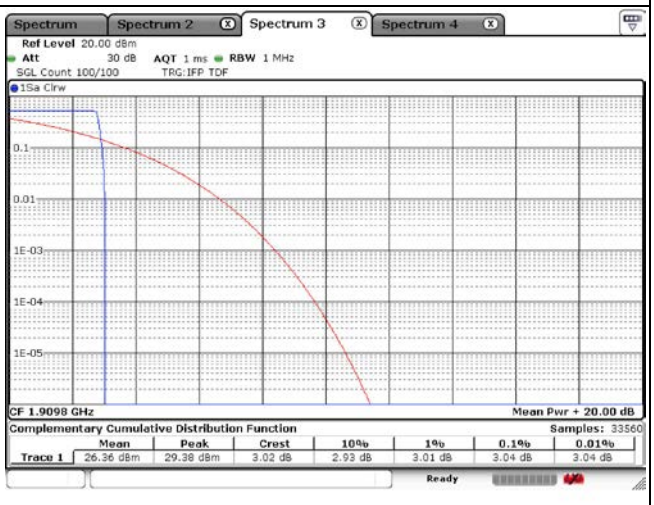
GSM 1 900 GPRS Middle Channel



GSM 1 900 EDGE Middle Channel

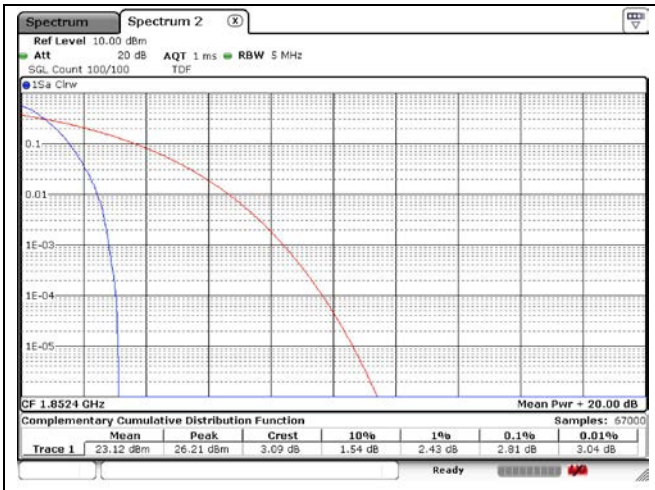


GSM 1 900 GPRS High Channel

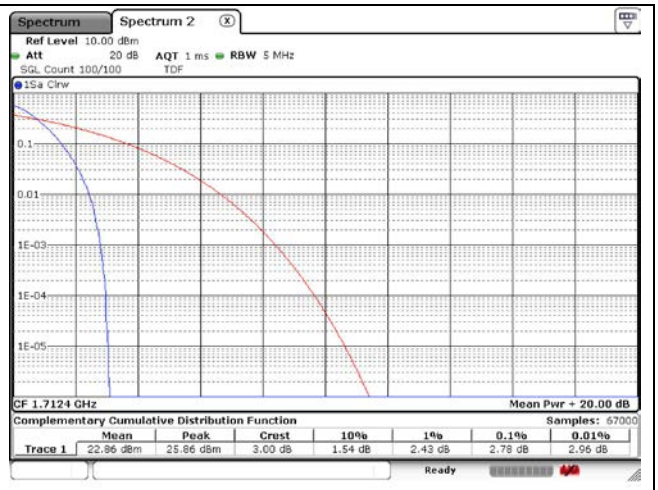


GSM 1 900 EDGE High Channel

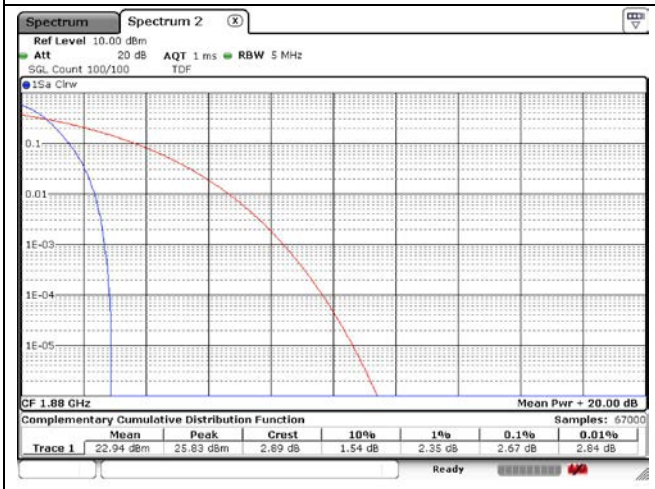
WCDMA



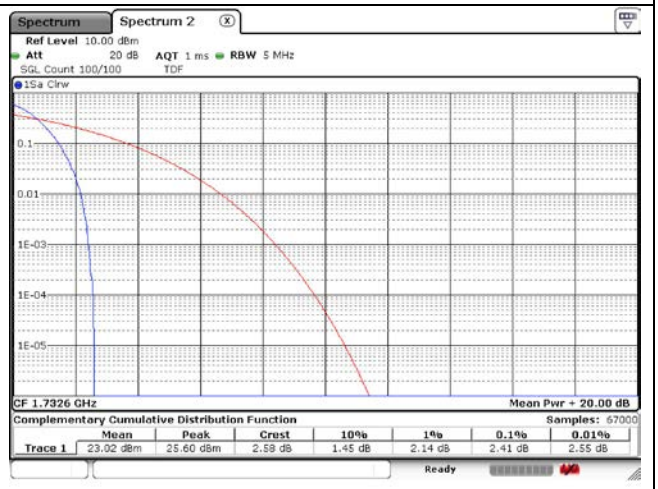
WCDMA BAND Ⅱ Low Channel



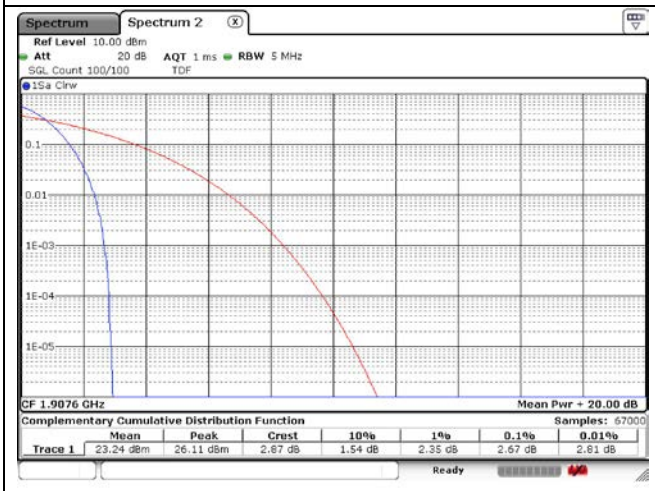
WCDMA BAND Ⅳ Low Channel



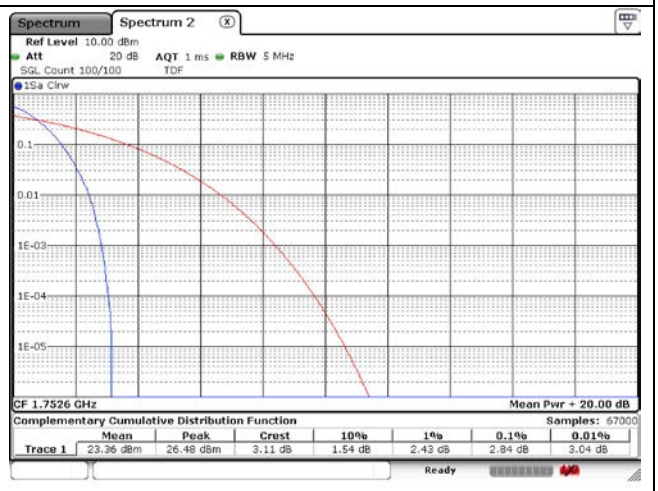
WCDMA BAND Ⅱ Middle Channel



WCDMA BAND Ⅳ Middle Channel

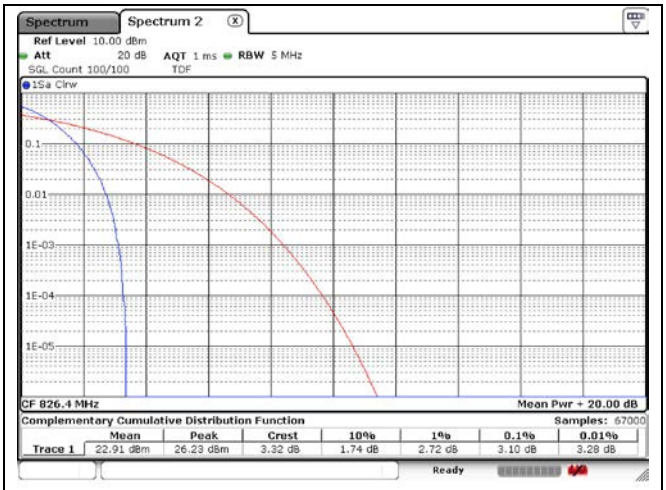


WCDMA BAND Ⅱ High Channel

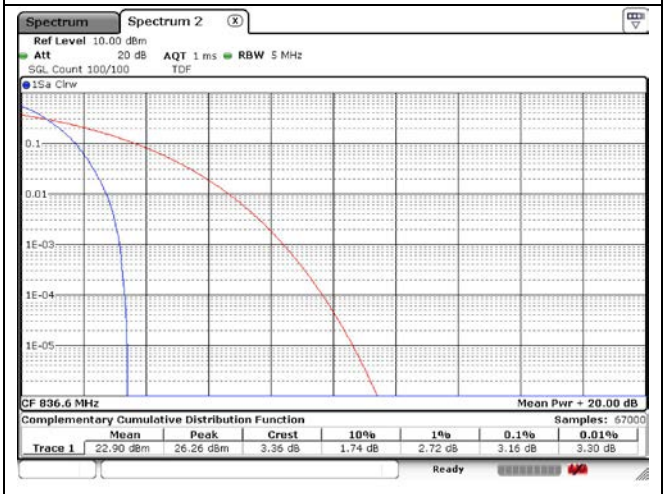


WCDMA BAND Ⅳ igh Channel

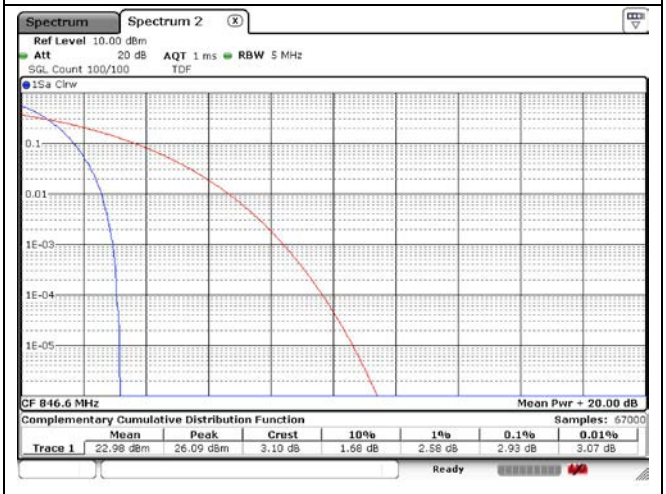
WCDMA



WCDMA BAND Ⅴ Low Channel



WCDMA BAND Ⅴ Middle Channel



WCDMA BAND Ⅴ High Channel

6. Spurious Emissions at Antenna Terminal

6.1. Limit

FCC

- §22.917(a), 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) ㏈.

- §24.238(a), 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 + 10 log(P) ㏈.

- §27.53(h)(1), for operations in the 1 695-1 710 ㎒, 1 710-1 755 ㎒, 1 755-1 780 ㎒, 1 915-1 920 ㎒, 1 995-2 000 ㎒, 2 000-2 020 ㎒, 2 110-2 155 ㎒, 2 155-2 180 ㎒, and 2 180-2 200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) ㏈.

IC

- RSS-132 Issue 3

5.5, Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 ㎒ band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1 % of the occupied bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p (watts).

(ii) After the first 1.0 ㎒ immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 ㎑ bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p (watts). If the measurement is performed using 1 % of the occupied bandwidth, power integration over 100 ㎑ is required.

- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 ㎒ bands immediately outside and adjacent to the equipment’s operating frequency block, the emission power per any 1 % of the emission bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts).

(ii) After the first 1.0 ㎒, the emission power in any 1 ㎒ bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts). If the measurement is performed using 1 % of the emission bandwidth, power integration over 1.0 ㎒ is required.

- RSS-139 Issue 3

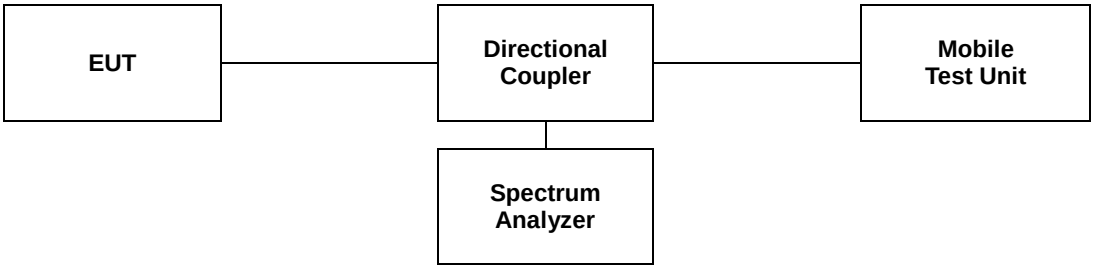
6.6, (i) In the first 1.0 ㎒ bands immediately outside and adjacent to the equipment’s smallest operating frequency block, which can contain the equipment’s occupied bandwidth, the emission power per any 1 % of the emission bandwidth shall be attenuated below the transmitter output power P (in ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

(ii) After the first 1.0 ㎒ outside the equipment’s smallest operating frequency block, which can contain the equipment’s occupied bandwidth, the emission power in any 1 ㎒ bandwidth shall be attenuated below the transmitter output power P (in ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

6.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

1. Start frequency was set to 9 ㎑ and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = Peak.
3. Trace mode = Max hold.
4. Sweep time = Auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 9 ㎑ to 20 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



Note;

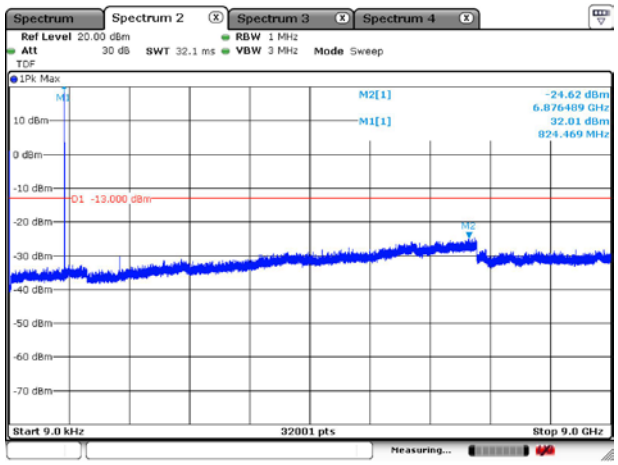
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and frequencies greater than 1 ㎓. However, in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution 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 point, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 ㏈ below the transmitter power.

6.3. Test Results

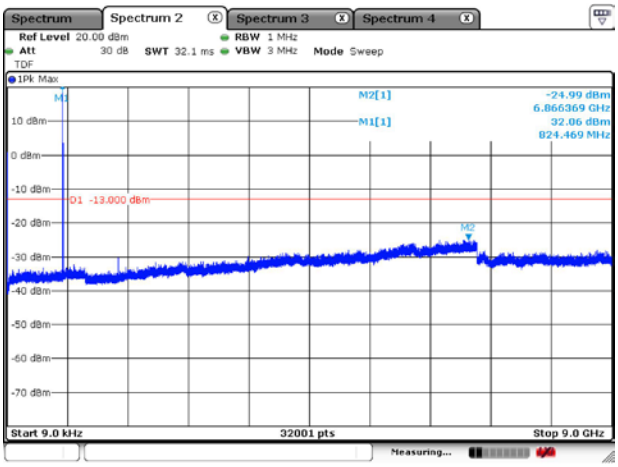
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- Test plots

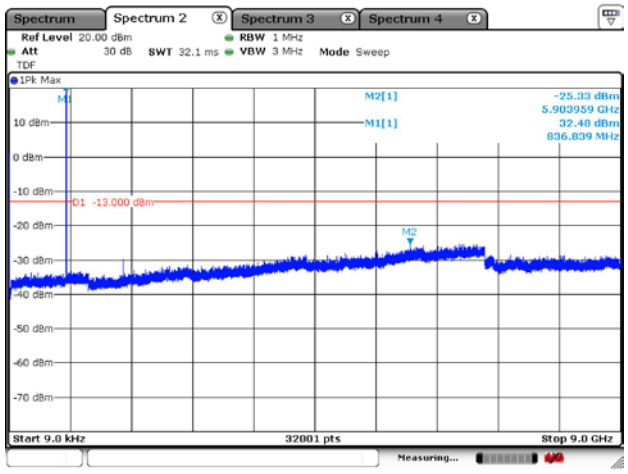
GSM



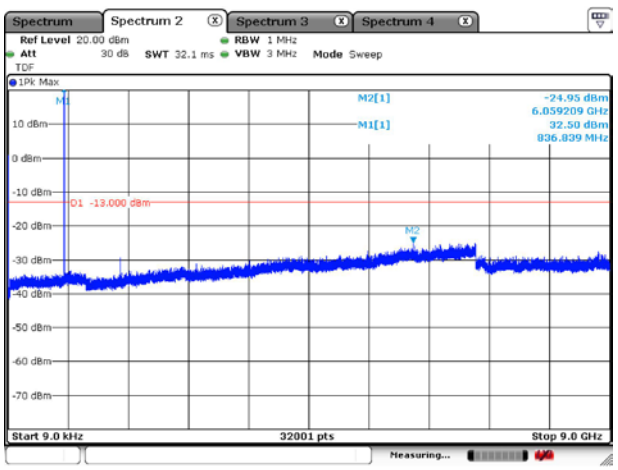
GSM 850 GPRS Low Channel



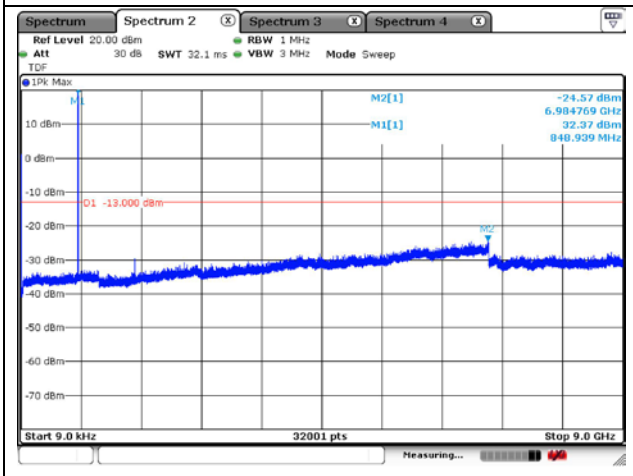
GSM 850 EDGE Low Channel



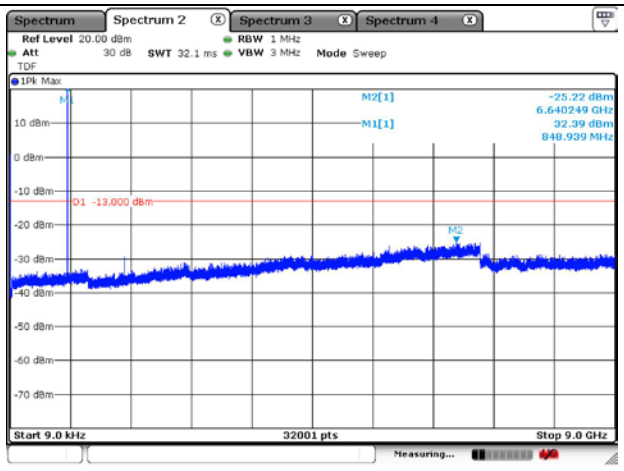
GSM 850 GPRS Middle Channel



GSM 850 EDGE Middle Channel

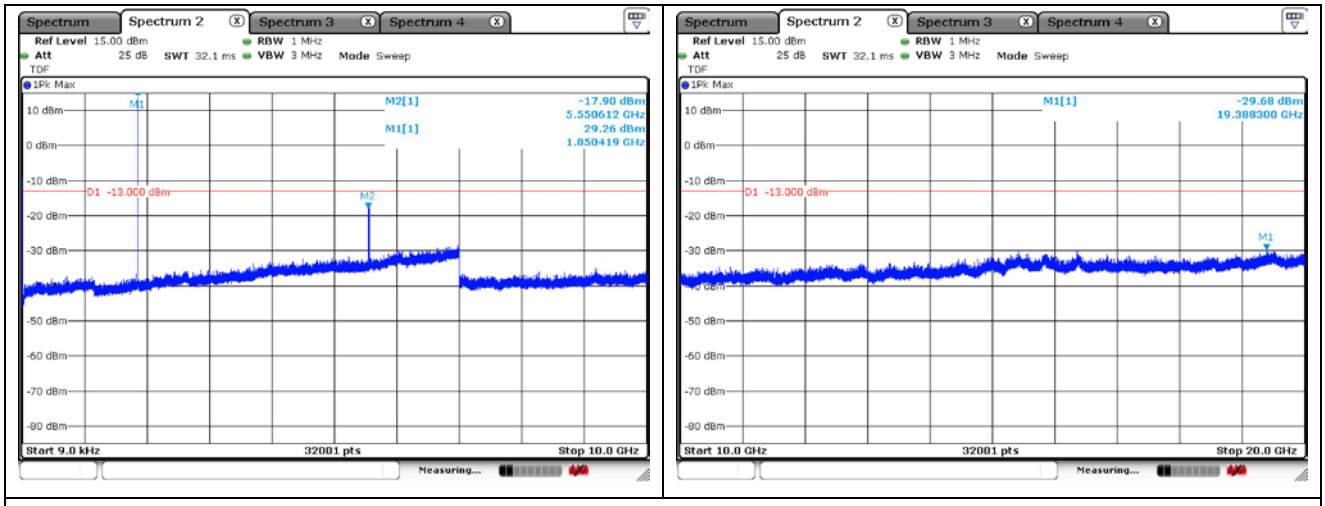


GSM 850 GPRS High Channel

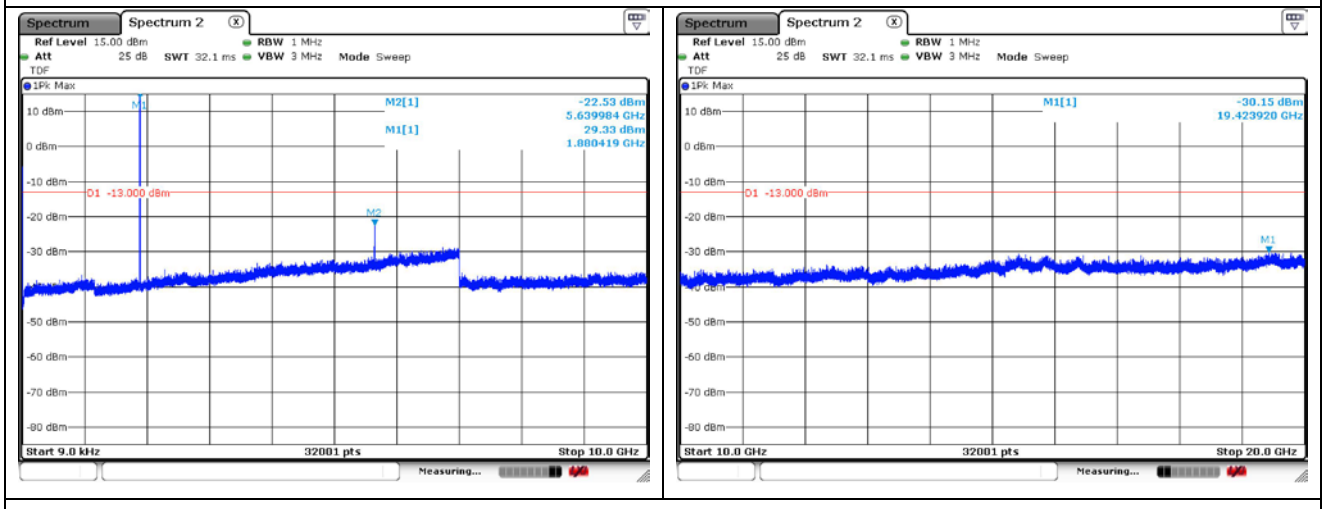


GSM 850 EDGE High Channel

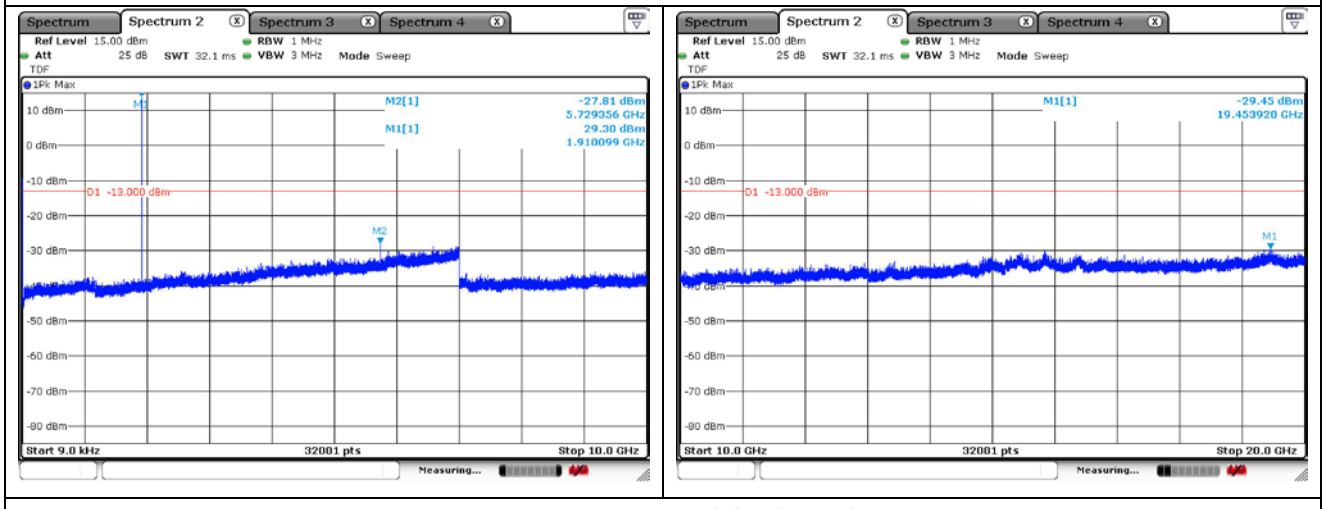
GSM



GSM 1 900 GPRS Low Channel

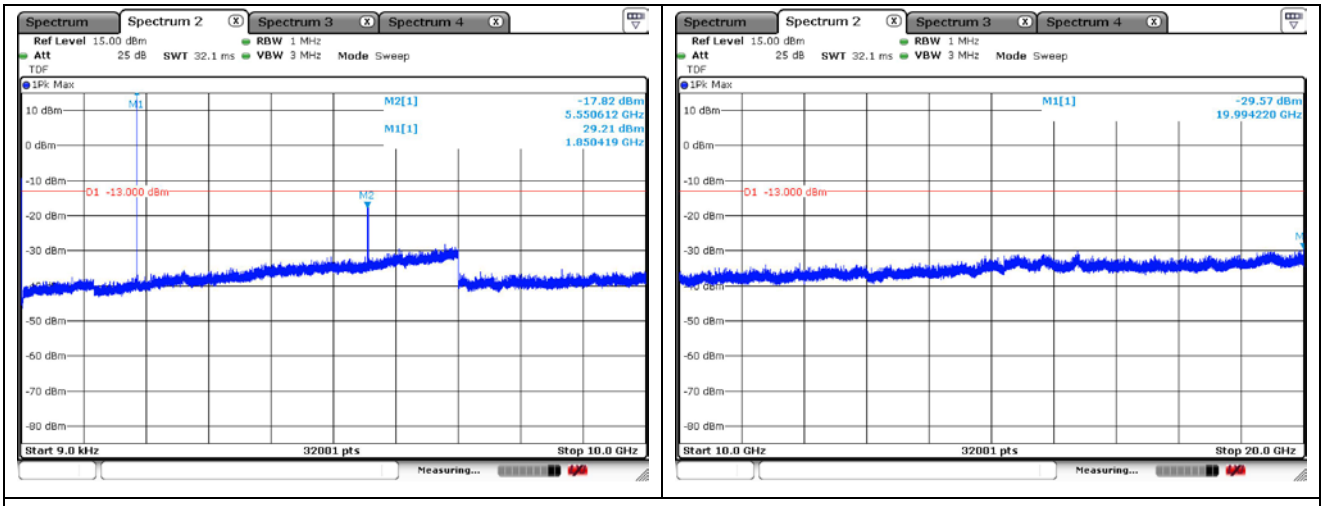


GSM 1 900 GPRS Middle Channel

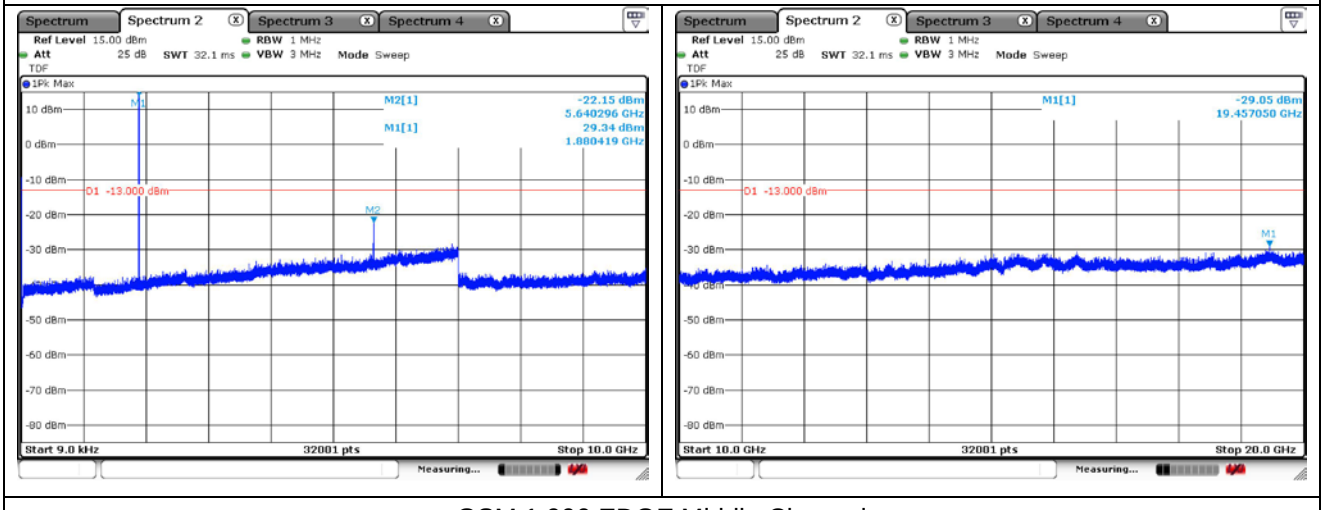


GSM 1 900 GPRS High Channel

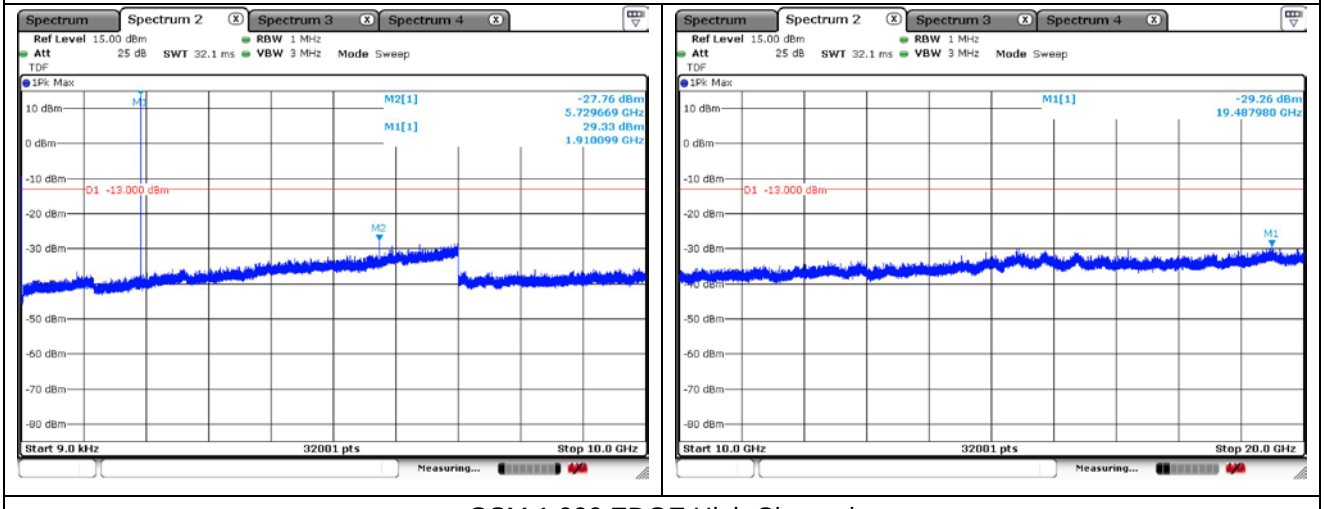
GSM



GSM 1 900 EDGE Low Channel

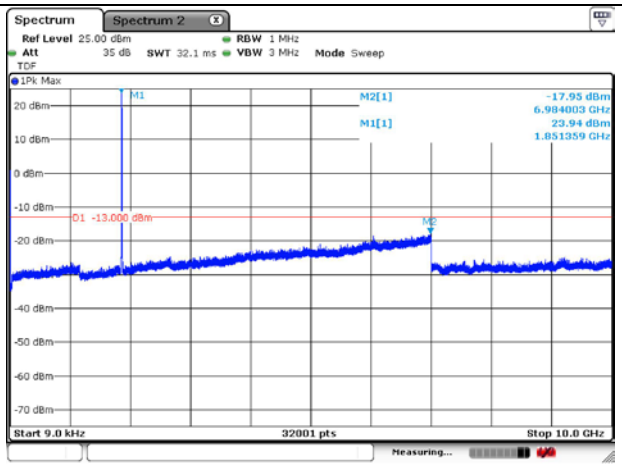


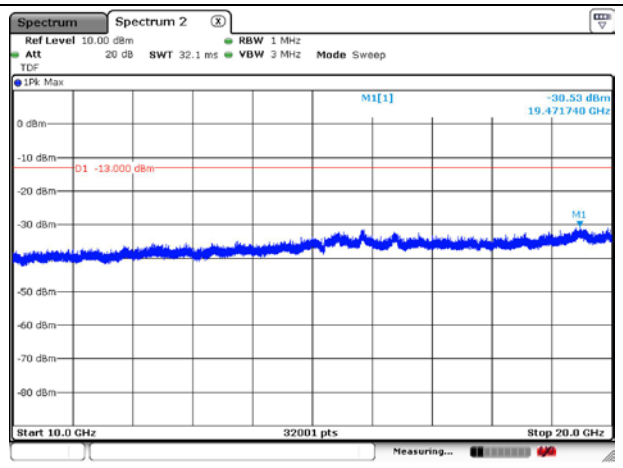
GSM 1 900 EDGE Middle Channel



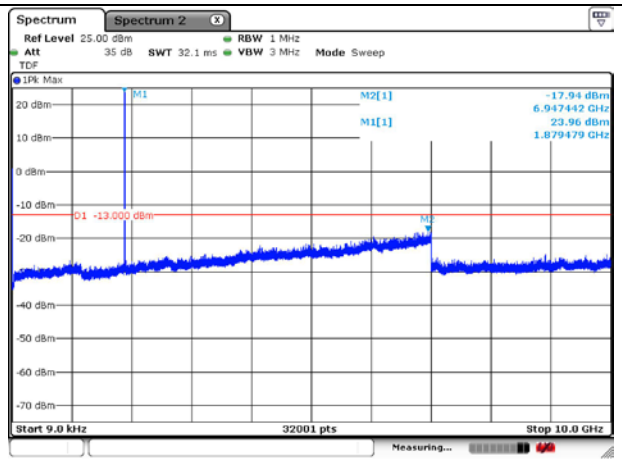
GSM 1 900 EDGE High Channel

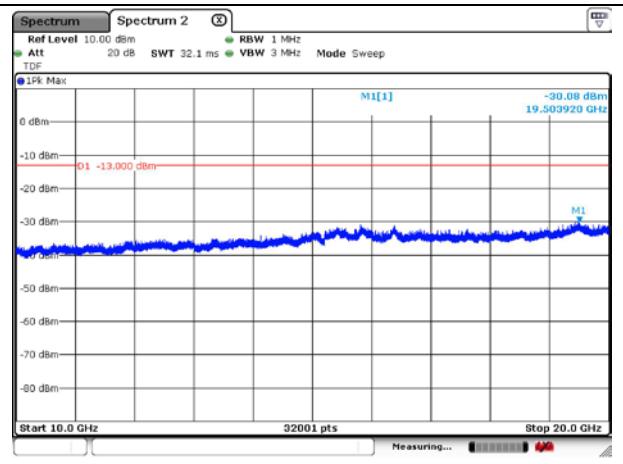
WCDMA



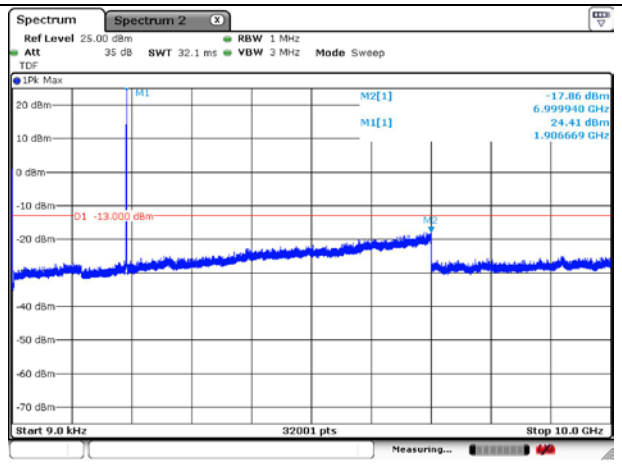


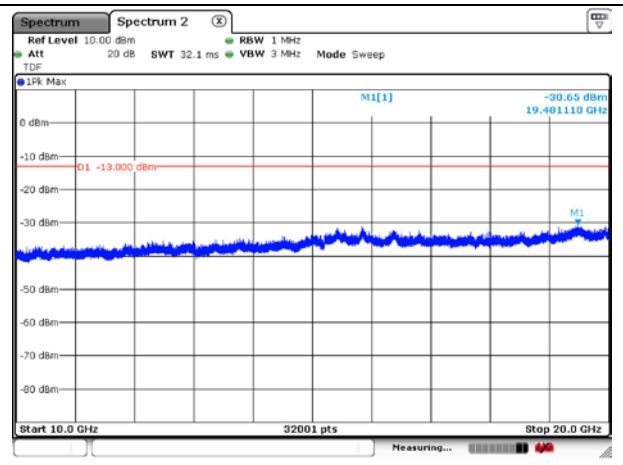
WCDMA Ⅱ Low Channel





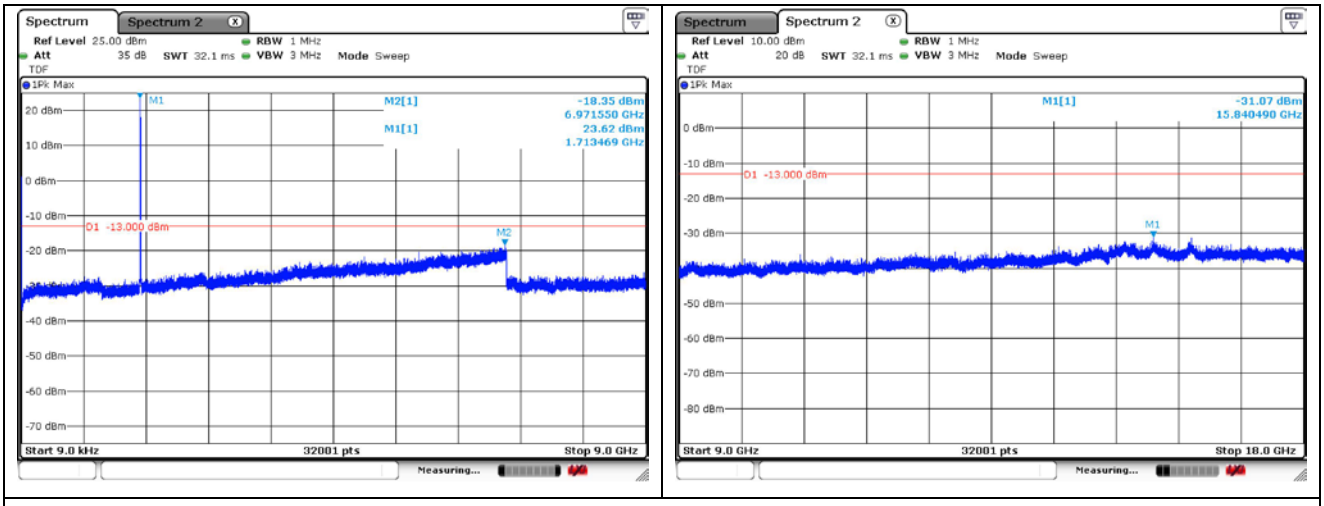
WCDMA Ⅱ Middle Channel



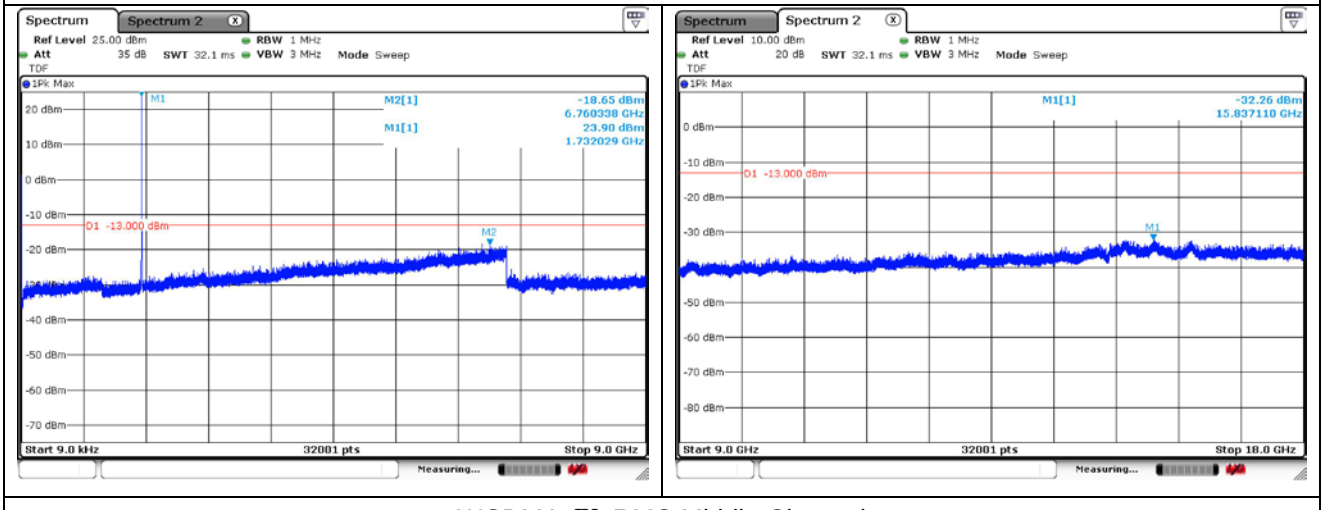


WCDMA Ⅱ High Channel

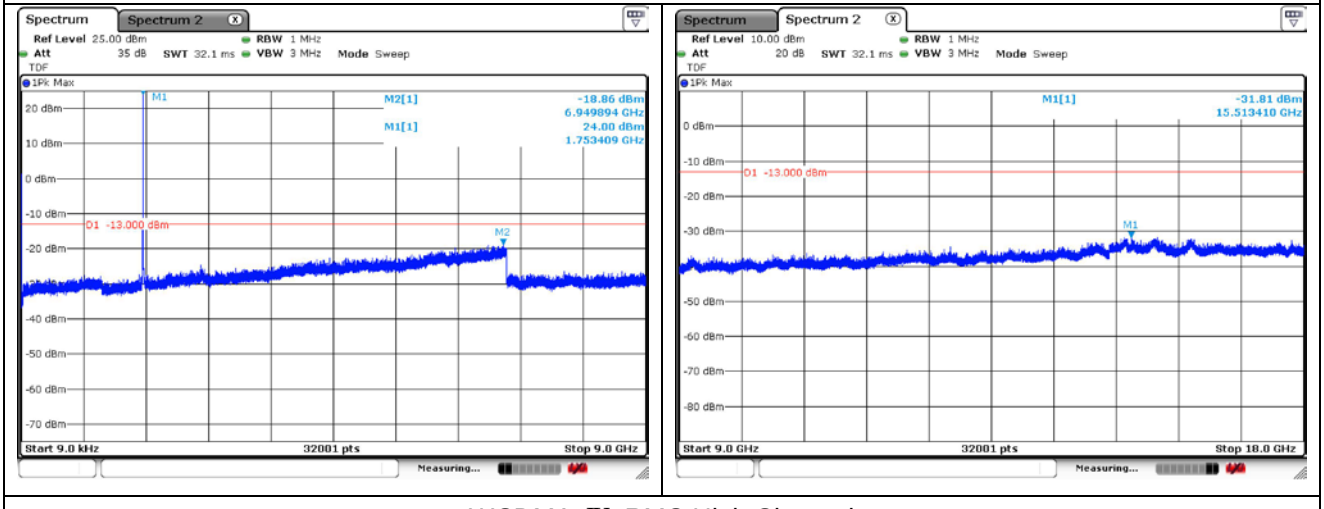
WCDMA



WCDMA Ⅳ Low Channel

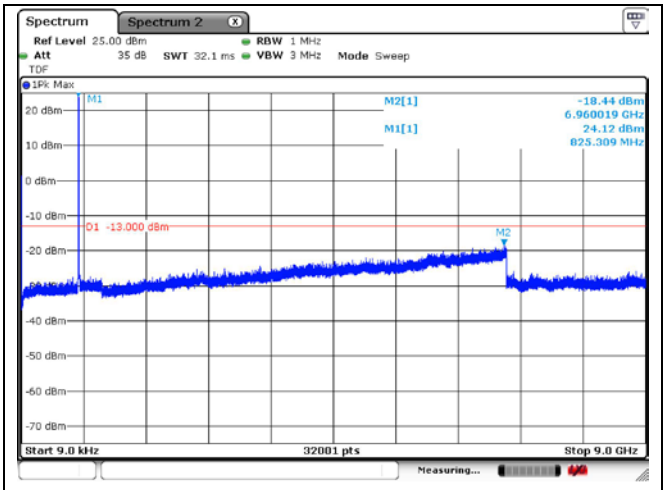


WCDMA Ⅳ RMC Middle Channel

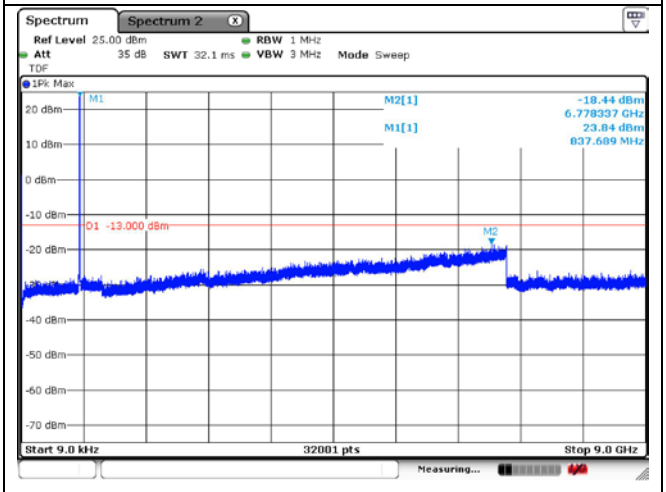


WCDMA Ⅳ RMC High Channel

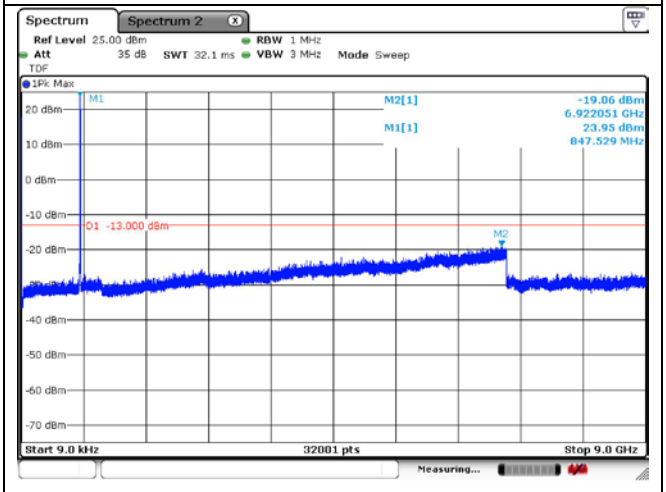
WCDMA



WCDMA Ⅴ RMC Low Channel



WCDMA Ⅴ RMC Middle Channel



WCDMA Ⅴ RMC High Channel

7. Band Edge

7.1. Limit

FCC

- §22.917(a), 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) ㏈.

- §24.238(a), 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 + 10 log(P) ㏈.

- §27.53(h)(1), for operations in the 1 695-1 710 ㎒, 1 710-1 755 ㎒, 1 755-1 780 ㎒, 1 915-1 920 ㎒, 1 995-2 000 ㎒, 2 000-2 020 ㎒, 2 110-2 155 ㎒, 2 155-2 180 ㎒, and 2 180-2 200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) ㏈.

IC

- RSS-132 Issue 3

5.5, Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 ㎒ band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1 % of the occupied bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p (watts).

(ii) After the first 1.0 ㎒ immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 ㎑ bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p (watts). If the measurement is performed using 1 % of the occupied bandwidth, power integration over 100 ㎑ is required.

- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 ㎒ bands immediately outside and adjacent to the equipment’s operating frequency block, the emission power per any 1 % of the emission bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts).

(ii) After the first 1.0 ㎒, the emission power in any 1 ㎒ bandwidth shall be attenuated (in ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts). If the measurement is performed using 1 % of the emission bandwidth, power integration over 1.0 ㎒ is required.

- RSS-139 Issue 3

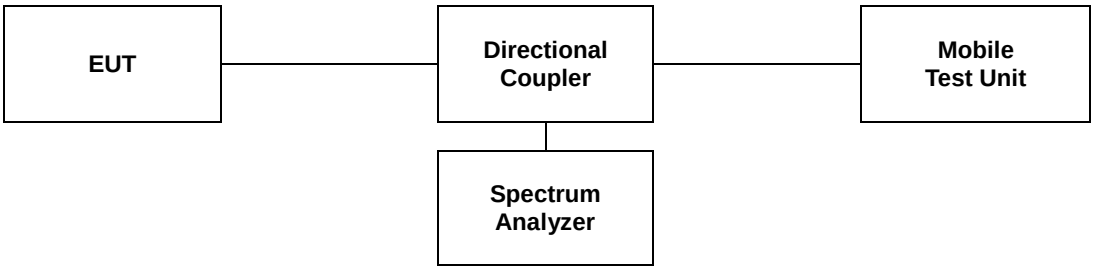
6.6, (i) In the first 1.0 ㎒ bands immediately outside and adjacent to the equipment’s smallest operating frequency block, which can contain the equipment’s occupied bandwidth, the emission power per any 1 % of the emission bandwidth shall be attenuated below the transmitter output power P (in ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

(ii) After the first 1.0 ㎒ outside the equipment’s smallest operating frequency block, which can contain the equipment’s occupied bandwidth, the emission power in any 1 ㎒ bandwidth shall be attenuated below the transmitter output power P (in ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

7.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

a. Span was set large enough so as to capture all out of band emissions near the band edge.
b. RBW ≥ 1 % of OBW
c. VBW ≥ 3 x RBW.
d. Detector = RMS.
e. Trace mode = Average.
f. Sweep time = Auto.
g. The trace was allowed to stabilize.
h. All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function.

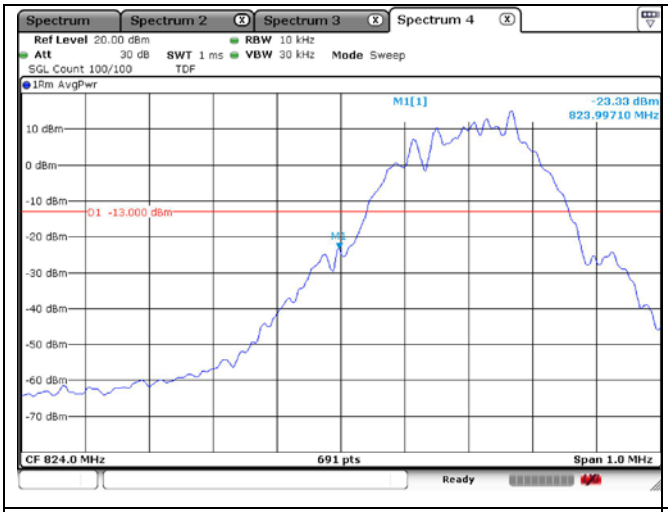


7.3. Test Results

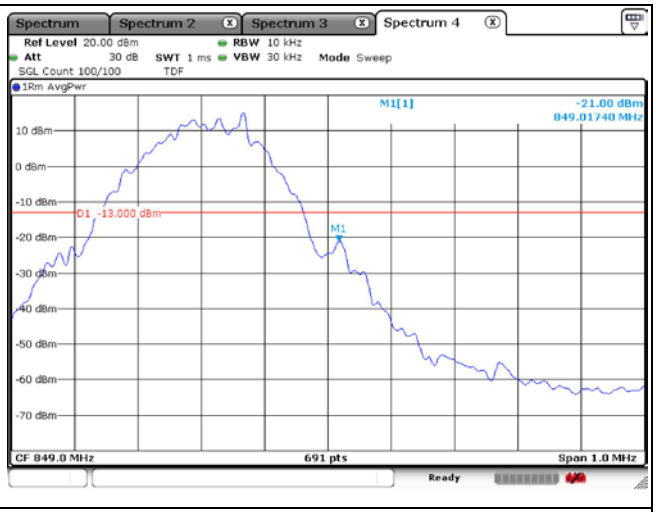
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- Test plots

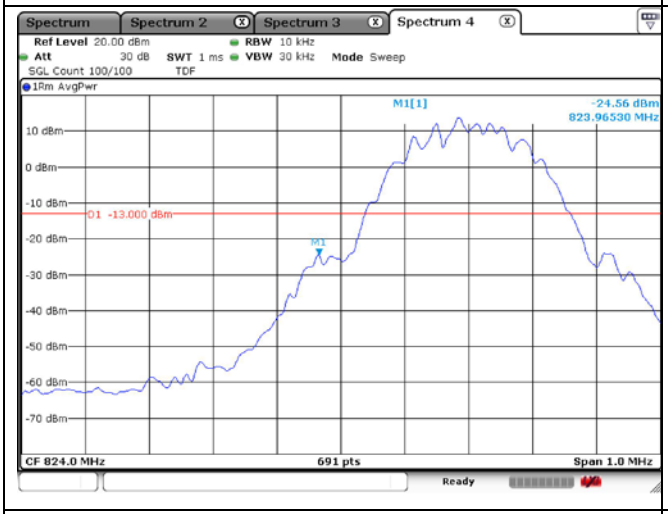
GSM 850



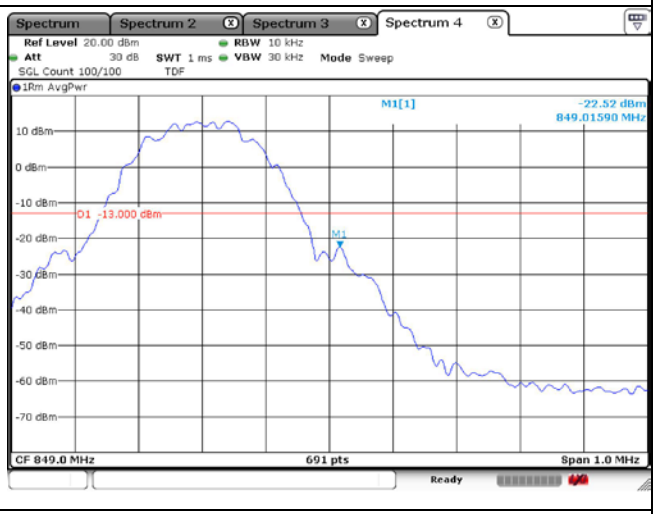
GSM 850 GPRS Low Channel



GSM 850 GPRS High Channel

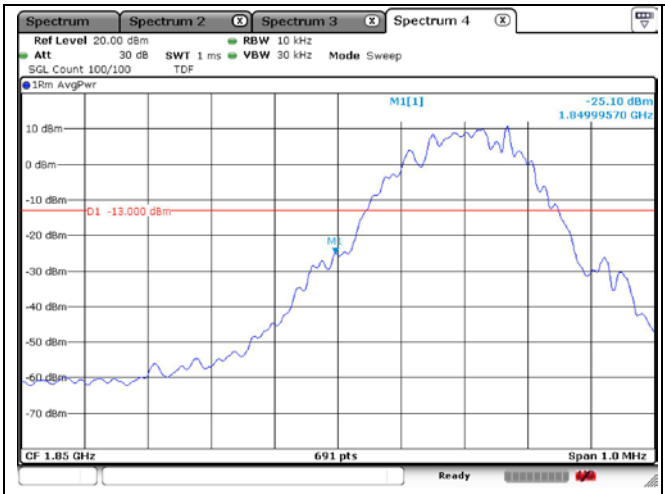


GSM 850 EDGE Low Channel

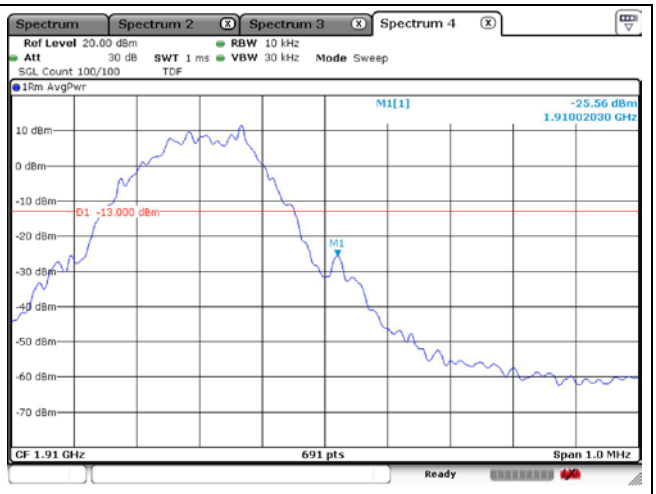


GSM 850 EDGE High Channel

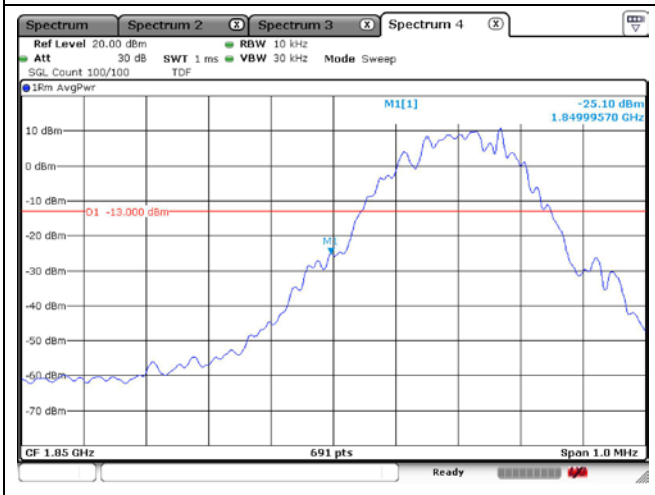
GSM 1 900



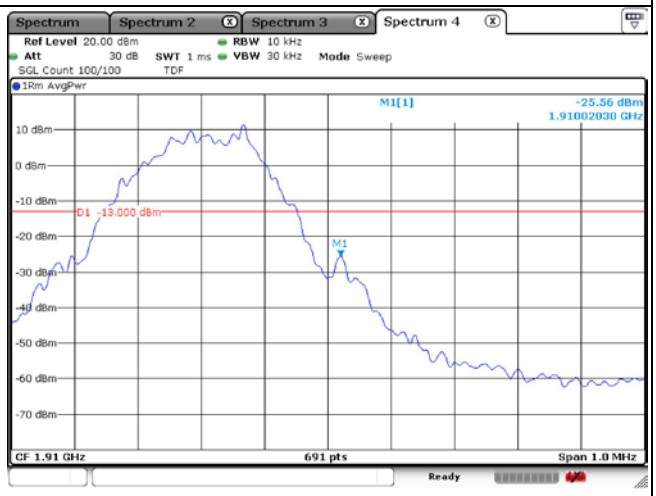
GSM 1 900 GPRS Low Channel



GSM 1 900 GPRS High Channel

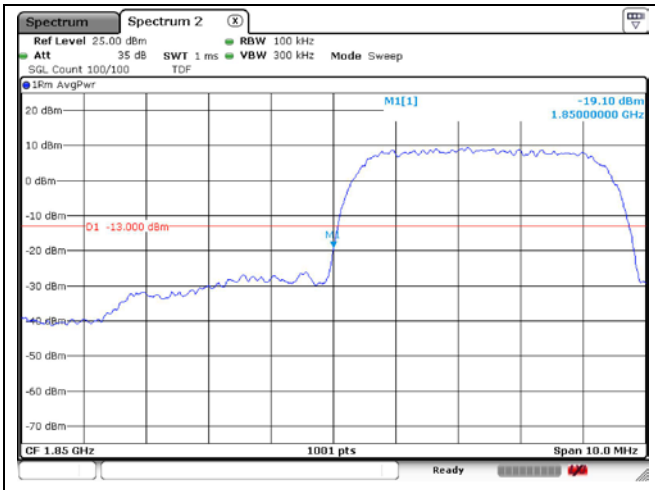


GSM 1 900 EDGE Low Channel

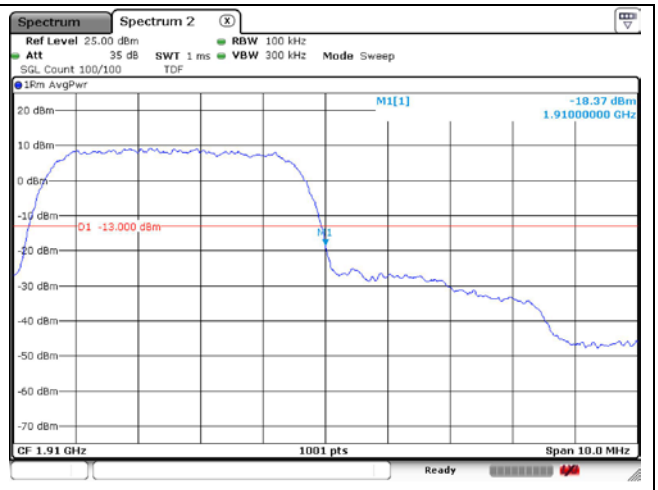


GSM 1 900 EDGE High Channel

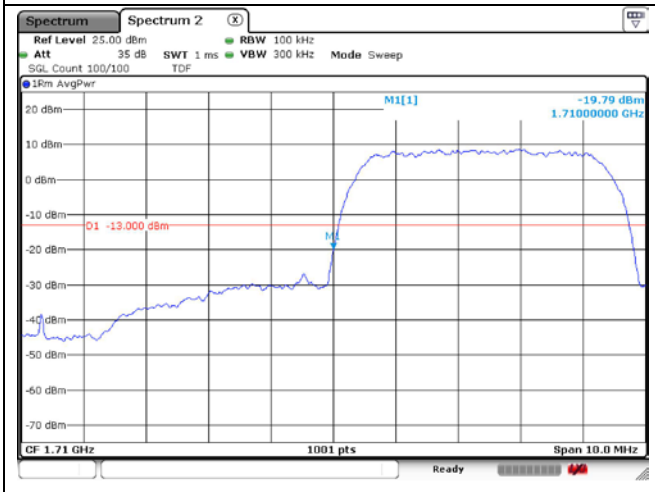
WCDMA



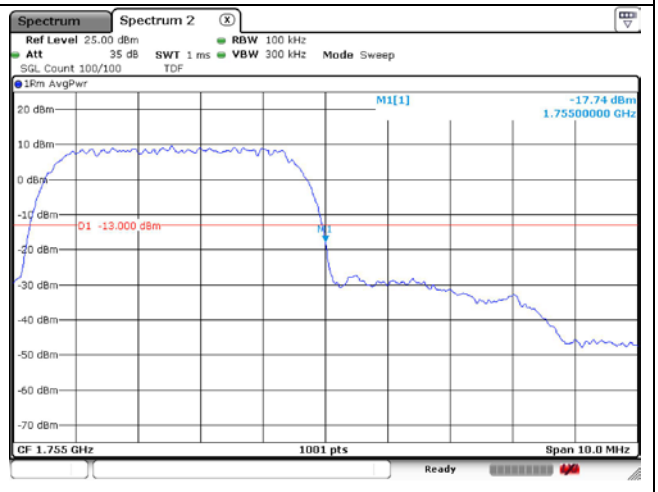
WCDMA Ⅱ Low Channel



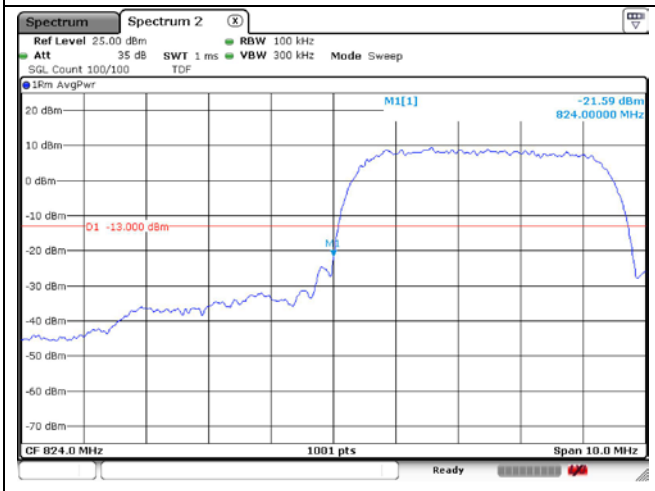
WCDMA Ⅱ High Channel



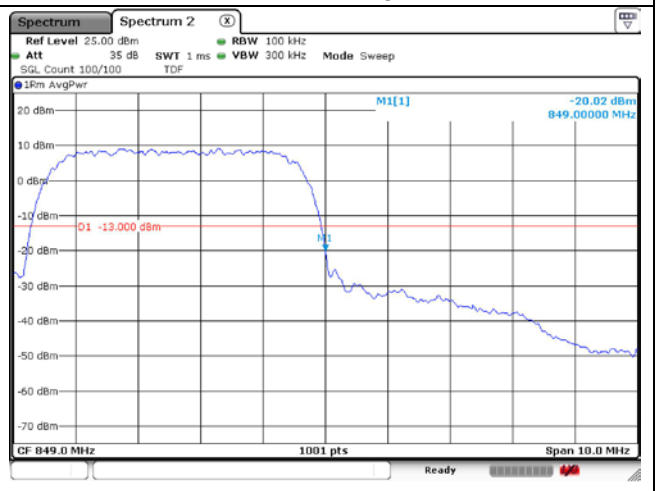
WCDMA Ⅳ RMC Low Channel



WCDMA Ⅳ RMC High Channel



WCDMA Ⅴ RMC Low Channel



WCDMA Ⅴ RMC High Channel

8. Frequency Stability

8.1. Limit

FCC
- § 2.1055 (a), § 2.1055 (d) & following:

- §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.
For Mobile devices operating in the 824 to 849 ㎒ band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

- §24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

- §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

IC
- RSS-Gen Issue 5
6.11, for licensed devices, the following measurement conditions apply:
a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage

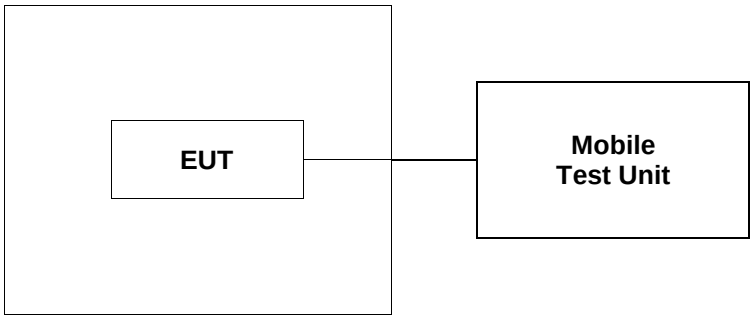
- RSS-132 Issue 3
5.3, The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

- RSS-133 Issue 6
6.3, the carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

- RSS-139 Issue 3
6.4, the frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.
the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Mobile Test Unit via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from Mobile Test Unit.



Temperature Chamber

8.3. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

GSM 850 mode at middle channel

Reference Frequency: 836.6 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	5.2	0.006 2
40		-4.1	-0.004 9
30		-1.6	-0.001 9
23		6.4	0.007 7
10		3.2	0.003 8
0		-2.4	-0.002 9
-10		-4.3	-0.005 1
-20		-5.3	-0.006 3
-30		3.1	0.003 7
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	14.375	3.1	0.001 6
	10.625	1.9	0.001 0

GSM 1 900 mode at middle channel

Reference Frequency: 1 880.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	5.3	0.002 8
40		2.4	0.001 3
30		1.5	0.000 8
23		3.2	0.001 7
10		-4.4	-0.002 3
0		-2.1	-0.001 1
-10		-2.8	-0.001 5
-20		3.2	0.001 7
-30		4.3	0.002 3
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	14.375	4.5	0.002 6
	10.625	1.6	0.000 9

WCDMA Ⅱ mode at middle channel

Reference Frequency: 1 880.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	5.4	0.002 9
40		1.5	0.000 8
30		-6.1	-0.003 2
23		-4.6	-0.002 4
10		2.3	0.001 2
0		4.2	0.002 2
-10		-3.4	-0.001 8
-20		-3.5	-0.001 9
-30		-1.3	-0.000 7
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	14.375	-1.3	-0.000 7
	10.625	2.3	0.001 2

WCDMA Ⅳ mode at middle channel

Reference Frequency: 1 732.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	3.5	0.002 0
40		4.2	0.002 4
30		-5.1	-0.002 9
23		2.3	0.001 3
10		4.4	0.002 5
0		1.2	0.000 7
-10		1.2	0.000 7
-20		2.3	0.001 3
-30		-3.4	-0.002 0
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	14.375	-3.4	-0.002 0
	10.625	-2.1	-0.001 2

WCDMA Ⅴ mode at middle channel

Reference Frequency: 836.6 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	3.1	0.003 7
40		-4.6	-0.005 5
30		1.5	0.001 8
23		-2.3	-0.002 7
10		-2.4	-0.002 9
0		2.4	0.002 9
-10		4.5	0.005 4
-20		3.1	0.003 7
-30		6.2	0.007 4
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	14.375	-3.8	-0.004 5
	10.625	2.5	0.003 0

- End of the Test Report -