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TEST REPORT

of

FCC Part 2 Subpart J, Part 22 Subpart C/H

FCC ID: YZP-OA1000

Equipment Under Test	:	Telematics Module
Model Name	:	LTD-OA1000
Applicant	:	LG Innotek Co., Ltd.
Manufacturer	:	LG Innotek Co., Ltd.
Date of Receipt	:	2024.05.09
Date of Test(s)	:	2024.05.13 ~ 2024.07.05
Date of Issue	:	2024.07.11

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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4) The data marked ※ in this report was provided by the customer and may affect the validity of the test results.
We are responsible for all the information of this test report except for the data(※) provided by the customer.

Tested by: **Youngbin Kim**

Technical Manager: **Jinhyoung Cho**

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

Applicant : LG Innotek Co., Ltd.
Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796
Contact Person : Jeong, In-chang
Phone No. : +82 62 950 0332

1.3. Details of Manufacturer

Company : LG Innotek Co., Ltd.
Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796
Factory 1 : LG Innotek Co., Ltd.
Factory 1 Address : 26, Hanamsandan 5beon-ro, Gwangsan-gu, Gwangju, Republic of Korea, 62229
Factory 2 : PT. LG INNOTEK INDONESIA
Factory 2 Address : Bekasi International Industrial Estate, Blok C8 No.12 & 12A, Desa Cibatu, Cikarang Selatan, Bekasi 17750, Jawa Barat - Indonesia

1.4. Description of EUT

Kind of Product	Telematics Module
Model Name	LTD-OA1000
Serial Number	Conducted: C-01 Radiated: R-01
Power Supply	DC 4.0 V
Rated Power	GSM 850: 33 ㏈m WCDMA Ⅴ: 24 ㏈m
Frequency Range	GSM 850 : 824 ㎒ ~ 849 ㎒ WCDMA Ⅴ: 824 ㎒ ~ 849 ㎒
Modulation Technique	QPSK, 16QAM, GMSK, 8PSK
Antenna Type	Dipole Antenna
Antenna Gain※	824 ㎒ ~ 849 ㎒: 2.18 ㏈i
H/W Version	0
S/W Version	01C_D20SKUS
FVIN	N/A

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMA100B	106887	Oct. 06, 2023	Annual	Oct. 06, 2024
Spectrum Analyzer	R&S	FSV30	103454	Dec. 01, 2023	Annual	Dec. 01, 2024
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 01, 2023	Annual	Sep. 01, 2024
Communication Analyzer	R&S	CMW 500	144035	Dec. 28, 2023	Annual	Dec. 28, 2024
Power Meter	Anritsu	ML2495A	1223004	May 29, 2024	Annual	May 29, 2025
Power Sensor	Anritsu	MA2411B	1207272	May 29, 2024	Annual	May 29, 2025
Temperature Chamber	ESPEC CORP.	PL-1J	15000796	Dec. 01, 2023	Annual	Dec. 01, 2024
High Pass Filter	Wainwright Instrument GmbH	WHKX10-900-1000-18000-40SS	7	Feb. 27, 2024	Annual	Feb. 27, 2025
High Pass Filter	Wainwright Instrument GmbH	WHKX3.0/18G-10SS	21	Jun. 07, 2024	Annual	Jun. 07, 2025
Directional Coupler	KRYTAR	152613	122661	Feb. 27, 2024	Annual	Feb. 27, 2025
BRIDGE Coupler	MARK MICROWAVE INC	CBR16-0012	1542	May 13, 2024	Annual	May 13, 2025
DC Power Supply	R&S	HMP2020	102133	Apr. 23, 2024	Annual	Apr. 23, 2025
Preamplifier	H.P.	8447F	2944A03909	Aug. 04, 2023	Annual	Aug. 04, 2024
Preamplifier	R&S	SCU18F	101058	Dec. 07, 2023	Annual	Dec. 07, 2024
Test Receiver	R&S	ESU26	100109	Jan. 16, 2024	Annual	Jan. 16, 2025
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 21, 2023	Biennial	Aug. 21, 2025
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	9163-437	May 29, 2024	Biennial	May 29, 2026
Horn Antenna	R&S	HF906	100326	Feb. 19, 2024	Annual	Feb. 19, 2025
Antenna Master	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	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	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RADIALL	TESTPRO 3	182287	Apr. 12, 2024	Semi-Annual	Oct. 12, 2024
Coaxial Cable	RADIALL	TESTPRO 3	182288	Apr. 12, 2024	Semi-Annual	Oct. 12, 2024
Coaxial Cable	RADIALL	TESTPRO 3	182291	Apr. 12, 2024	Semi-Annual	Oct. 12, 2024
Coaxial Cable	RF ONE	NMST-13A26-NMST-5m	TPC2402190004	Apr. 03, 2024	Semi-Annual	Oct. 03, 2024
Coaxial Cable	RF ONE	NMST-13A26-NMST-10m	TPC2402190001	Apr. 03, 2024	Semi-Annual	Oct. 03, 2024

Note;

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 2 and 22		
Section(s) in FCC	**Test Item**	**Result**
§2.1046 §22.913(a)(5)	E.R.P. / E.I.R.P.	Complied
§2.1053 §22.917(a)	Radiated Spurious Emissions	Complied
§2.1046	Conducted Output Power	Complied
§2.1049	Occupied Bandwidth	Complied
§22.913(d)	Peak-Average Ratio	Complied
§2.1051 §22.917(a)	Spurious Emission at Antenna Terminal	Complied
§22.917(a)	Band Edge	Complied
§2.1055 §22.355	Frequency Stability	Complied

1.7. Sample Calculation for Offset

Where relevant, the following sample calculation is provided:

1.7.1. Conducted Test

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

1.7.2. Radiation test

- E.I.R.P. (dB m) = Measured level (dBμV) + Antenna factor (dB/m) + Cable loss (dB) + 20 Log D - 104.8; where D is the measurement distance in meters.
- E.R.P. (dB m) = E.I.R.P. (dB m) - 2.15 (dB)

1.8. 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 GSM and EDGE mode, except frequency stability, spurious radiated emission spurious and emission at antenna terminal were tested only GSM mode as worst case.

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

WCDMA

WCDMA mode, Output power measurements were measured on RMC, HSDPA, HSUPA, DC-HSDPA and HSPA+ Modulation. All testing was performed using RMC and HSDPA modulations, except radiated spurious emission and emission at antenna terminal were tested only RMC modulation as worst case. The worst-case is based on the average conducted output power measurement investigation results.

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

1.9. Measurement Configuration

Test Items	Band	Test Channel			Modulation		
		Low	Mid	High	VOICE	GPRS	EGPRS
Conducted Output Power	GSM 850	V	V	V	V	V	V
Frequency Stability	GSM 850	-	V	-	V	-	-
Occupied Bandwidth	GSM 850	-	V	-	V	-	V
Peak to Average Ratio	GSM 850	V	V	V	V	-	V
Band Edge	GSM 850	V	-	V	V	-	V
Spurious Emission at Antenna Terminal & Radiated Spurious Emissions	GSM 850	V	V	V	Worst case		

Test Items	Band	Test Channel			Modulation			
		Low	Mid	High	RMC	HSUPA	HSDPA	HSPA+
Conducted Output Power	WCDMA Ⅴ	V	V	V	V	V	V	V
Frequency Stability	WCDMA Ⅴ	-	V	-	V	-	-	-
Occupied Bandwidth	WCDMA Ⅴ	-	V	-	V	-	V	-
Peak to Average Ratio	WCDMA Ⅴ	V	V	V	V	-	V	-
Band Edge	WCDMA Ⅴ	V	-	V	V	-	V	-
Spurious Emission at Antenna Terminal & Radiated Spurious Emissions	WCDMA Ⅴ	V	V	V	Worst case			

1.10. Measurement Uncertainty

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

Parameter	Uncertainty	
Conducted Output Power	0.33 dB	
Occupied Bandwidth	0.05 MHz	
Conducted Spurious Emissions	0.99 dB	
Peak to Average Ratio	0.66 dB	
Frequency Stability	116 Hz	
Radiated Emission, 9 kHz to 30 MHz	H	3.60 dB
	V	3.60 dB
Radiated Emission, below 1 GHz	H	4.60 dB
	V	4.90 dB
Radiated Emission, above 1 GHz	H	3.90 dB
	V	3.80 dB

All measurement uncertainty values are shown with a coverage factor of *k*=2 to indicate a 95 % level of confidence.

1.11. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL005249	2024.07.11	Initial

1.12. Emission Designator and Max Power

WCDMA

Band	Modulation	Low Freq. (㎒)	Upper Freq. (㎒)	Conducted Power (㏈m)	Ant. Gain (㏈i)	E.R.P. / E.I.R.P. Average (㏈m)	E.R.P. / E.I.R.P. Average (W)	Emission Designator
WCDMA Ⅴ	RMC	826.4	846.6	23.87	2.18	23.90	0.245	4M15F9W
	HSDPA			22.82		23.85	0.243	4M14F9W

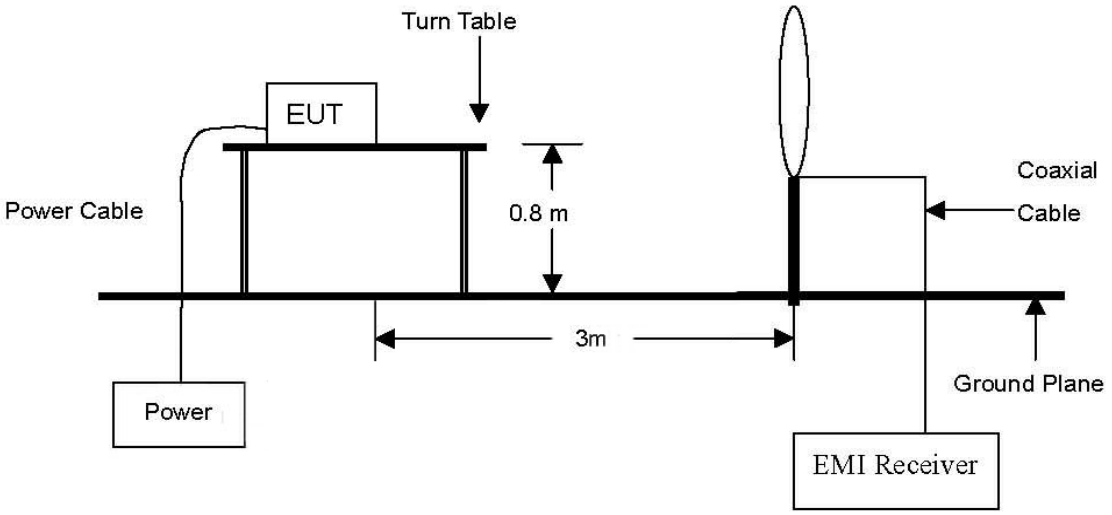
GSM

Band	Modulation	Low Freq. (㎒)	Upper Freq. (㎒)	Conducted Power (㏈m)	Duty Cycle (%)	Ant. Gain (㏈i)	E.R.P. / E.I.R.P. Average (㏈m)	E.R.P. / E.I.R.P. Average (W)	Emission Designator
GSM 850	VOICE	824.2	848.8	32.76	12.5	2.18	23.76	0.238	240KGXW
	EDGE			32.73			23.73	0.236	242KG7W

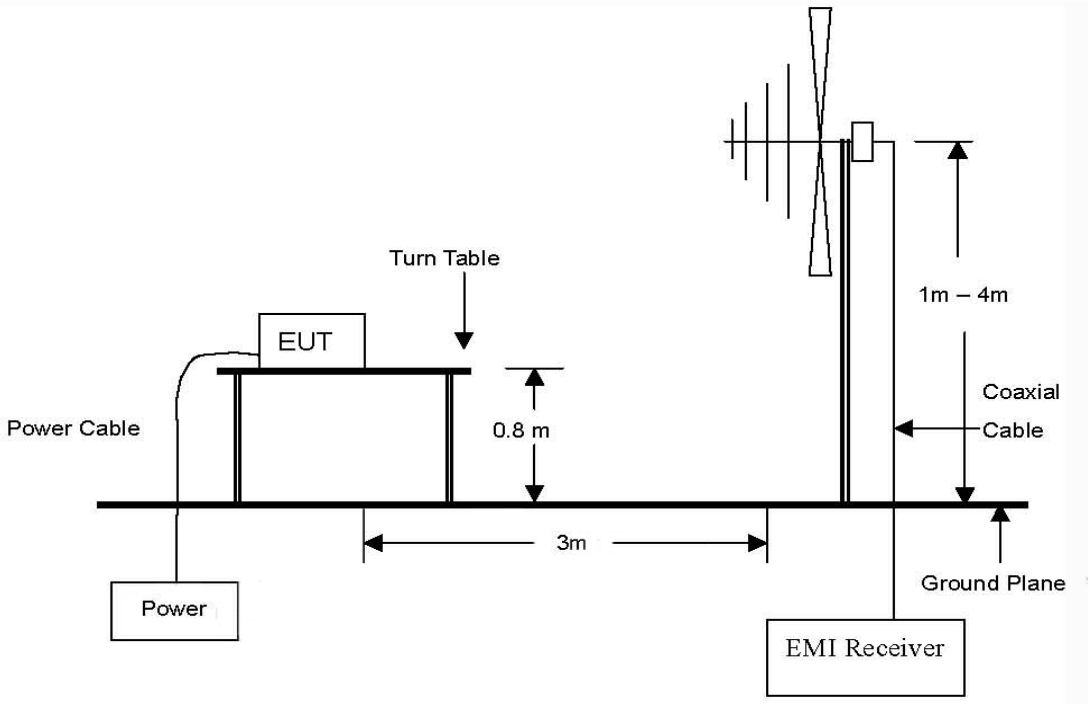
2. E.R.P. / E.I.R.P. & Radiated Spurious Emissions

2.1. Test setup

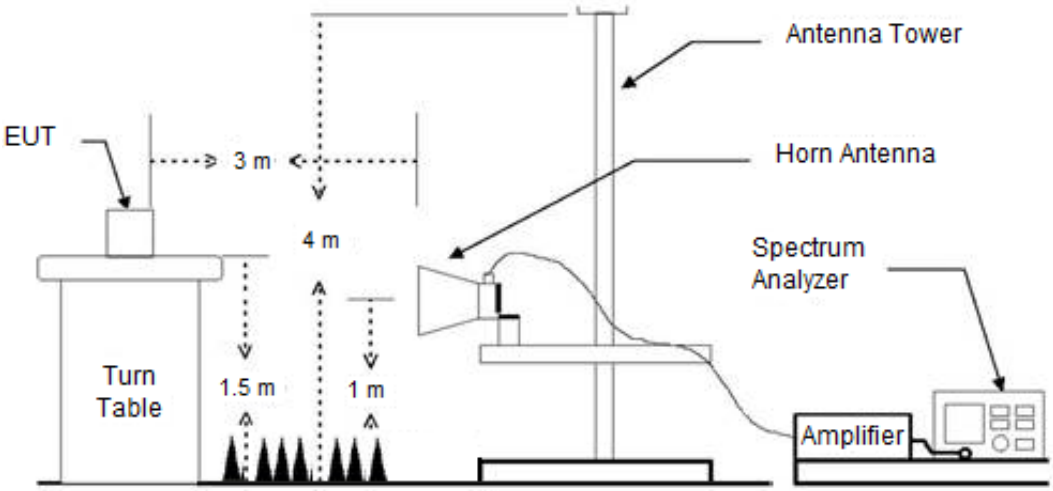
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒.



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 10 ㎓ Emissions.



2.2. Limit

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

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

2.2.2. Limit of Radiated Spurious Emissions

- §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) ㏈.

2.3. Test Procedure

2.3.1. E.R.P. or E.I.R.P. from conducted RF output power

According to subclause 5.2.5.5 of ANSI C63.26-2015 E.R.P. and E.I.R.P. are defined as the product of the power supplied to the antenna and its gain.

The relevant equation for determining the E.R.P. or E.I.R.P. from the conducted RF output power measured using the guidance provided above is:

E.R.P. or E.I.R.P. = $P_{Meas} + G_T$

where:
E.R.P. or E.I.R.P. = effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, typically dBW or dBm);
P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;
G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

2.3.2. Radiated Spurious Emissions

The test 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 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz, VBW ≥ 3 x RBW,
   Detector = RMS, trace mode = max hold, per the guidelines of KDB 971168 D01 Power Meas License Digital Systems v03r01.
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 results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

2.4.1. E.R.P. / E.I.R.P.

GSM

Band	Frequency (㎒)	Maximum Conducted Average Power (㏈m)	Maximum Conducted Average Power (W)	Duty Cycle (%)	Antenna Gain (㏈i)	Maximum E.I.R.P. (㏈m)	Maximum E.I.R.P. (W)	Maximum E.R.P. (㏈m)	Maximum E.R.P. (W)	Limit
GSM 850	824 ~ 849	32.76	1.888	12.5	2.18	25.91	0.390	23.76	0.238	7 W E.R.P.

WCDMA

Band	Frequency (㎒)	Maximum Conducted Power (㏈m)	Maximum Conducted Power (W)	Antenna Gain (㏈i)	Maximum E.I.R.P. (㏈m)	Maximum E.I.R.P. (W)	Maximum E.R.P. (㏈m)	Maximum E.R.P. (W)	Limit
WCDMA Ⅴ	824 ~ 849	23.87	0.244	2.18	26.05	0.403	23.90	0.245	7 W E.R.P.

Remark;

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

2.4.2. Radiated Spurious Emissions

GSM 850_VOICE

Frequency (㎒)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (824.2 ㎒)									
1 648.55	72.44	H	25.79	-36.60	61.63	-97.41	-35.78	-13	22.78
1 648.43	70.41	V	25.79	-36.60	59.60	-97.41	-37.81	-13	24.81
2 472.63	65.57	H	28.29	-33.09	60.77	-97.41	-36.64	-13	23.64
2 472.69	69.41	V	28.29	-33.09	64.61	-97.41	-32.80	-13	19.80
3 296.82	44.82	H	30.99	-32.90	42.91	-97.41	-54.50	-13	41.50
3 296.98	45.32	V	30.99	-32.89	43.42	-97.41	-53.99	-13	40.99
4 121.03	43.11	H	32.10	-29.24	45.97	-97.41	-51.44	-13	38.44
4 121.22	47.17	V	32.10	-29.24	50.03	-97.41	-47.38	-13	34.38
Above 4 200.00	Not Detected	-	-	-	-	-	-	-	-
Middle Channel (836.6 ㎒)									
1 673.32	70.24	H	26.22	-36.21	60.25	-97.41	-37.16	-13	24.16
1 673.26	69.71	V	26.22	-36.21	59.72	-97.41	-37.69	-13	24.69
2 509.86	68.84	H	28.44	-34.37	62.91	-97.41	-34.50	-13	21.50
2 509.83	69.53	V	28.44	-34.37	63.60	-97.41	-33.81	-13	20.81
3 346.28	48.14	H	31.00	-32.76	46.38	-97.41	-51.03	-13	38.03
3 346.61	48.50	V	31.00	-32.76	46.74	-97.41	-50.67	-13	37.67
4 182.82	46.94	H	32.10	-31.24	47.80	-97.41	-49.61	-13	36.61
4 183.29	48.71	V	32.10	-31.24	49.57	-97.41	-47.84	-13	34.84
Above 4 200.00	Not detected	–	–	–	–	–	–	–	–
High Channel (848.8 ㎒)									
1 697.63	68.76	H	26.66	-36.26	59.16	-97.41	-38.25	-13	25.25
1 697.71	67.58	V	26.66	-36.26	57.98	-97.41	-39.43	-13	26.43
2 546.57	71.68	H	28.59	-33.79	66.48	-97.41	**-30.93**	-13	17.93
2 546.62	69.45	V	28.59	-33.79	64.25	-97.41	-33.16	-13	20.16
3 395.26	49.74	H	31.00	-32.29	48.45	-97.41	-48.96	-13	35.96
3 394.92	49.95	V	31.00	-32.29	48.66	-97.41	-48.75	-13	35.75
4 244.43	47.17	H	32.10	-29.98	49.29	-97.41	-48.12	-13	35.12
4 244.28	47.87	V	32.10	-29.97	50.00	-97.41	-47.41	-13	34.41
Above 4 300.00	Not detected								

WCDMA V

Frequency (㎒)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (826.4 ㎒)									
1 651.34	54.35	H	25.82	-36.59	43.58	-97.41	-53.83	-13	40.83
1 650.34	52.71	V	25.81	-36.60	41.92	-97.41	-55.49	-13	42.49
2 479.08	52.54	H	28.32	-33.21	47.65	-97.41	-49.76	-13	36.76
2 476.08	53.13	V	28.30	-33.04	48.39	-97.41	-49.02	-13	36.02
Above 2 500.00	Not detected								
Middle Channel (836.6 ㎒)									
1 671.32	58.23	H	26.18	-36.25	48.16	-97.41	-49.25	-13	36.25
1 671.32	55.93	V	26.18	-36.25	45.86	-97.41	-51.55	-13	38.55
2 505.62	54.31	H	28.42	-34.38	48.35	-97.41	-49.06	-13	36.06
2 506.08	54.55	V	28.42	-34.38	48.59	-97.41	-48.82	-13	35.82
Above 2 600.00	Not detected								
High Channel (846.6 ㎒)									
1 691.82	61.75	H	26.55	-36.24	52.06	-97.41	-45.35	-13	32.35
1 691.78	54.53	V	26.55	-36.24	44.84	-97.41	-52.57	-13	39.57
2 537.60	59.07	H	28.55	-34.01	53.61	-97.41	**-43.80**	-13	30.80
2 537.58	55.36	V	28.55	-34.01	49.90	-97.41	-47.51	-13	34.51
Above 2 600.00	Not detected	–	–	–	–	–	–	–	–

Remark;

1. AF = Antenna Factor, CL = Cable Loss, CF = Conversion Factor.
2. E (dBμV/m) = Measured Level (dBμV) + Antenna Factor (dB/m) + AMP (dB) + Cable Loss (dB).
3. E.I.R.P. (dB m) = E (dBμV/m) + CF (dB).
4. E.R.P. (dB m) = E (dBμV/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

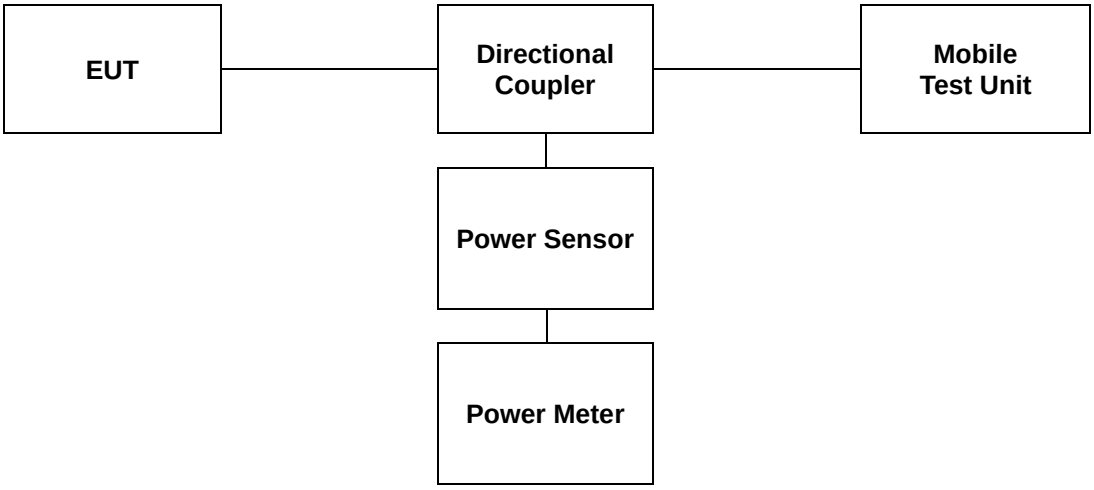
3.1. Limit

CFR 47, Section FCC §2.1046.

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 ± 2 %

GSM 850							
Mode		Conducted Output Power					
		128 (824.2 ㎒)		190 (836.6 ㎒)		251 (848.8 ㎒)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
VOICE		32.22	1.667	32.58	1.811	**32.76**	**1.888**
GPRS	1 Tx slot	32.44	1.754	32.57	1.807	**32.72**	**1.871**
	2 Tx slot	31.39	1.377	31.47	1.403	31.52	1.419
	3 Tx slot	29.41	0.873	29.59	0.910	29.57	0.906
	4 Tx slot	27.13	0.516	27.44	0.555	27.61	0.577
EGPRS	1 Tx slot	26.52	0.449	26.63	0.460	26.81	0.480
	2 Tx slot	24.33	0.271	24.21	0.246	24.51	0.282
	3 Tx slot	23.12	0.205	23.05	0.202	23.38	0.218
	4 Tx slot	22.01	0.159	22.09	0.162	22.38	0.173

WCDMA Ⅴ							
Mode	3GPP 34.121 Subtest	Conducted Output Power					
		4132 (826.4 ㎒)		4183 (836.6 ㎒)		4233 (846.6 ㎒)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Release 99	12.2 Kbps RMC	23.60	0.229	**23.87**	**0.244**	23.56	0.227
HSDPA	Subtest 1	22.61	0.182	**22.84**	**0.191**	22.60	0.182
	Subtest 2	22.61	0.182	22.80	0.191	22.57	0.181
	Subtest 3	22.09	0.162	22.28	0.169	22.04	0.160
	Subtest 4	22.09	0.162	22.29	0.169	21.94	0.156
HSUPA	Subtest 1	22.64	0.182	22.82	0.192	22.61	0.182
	Subtest 2	20.60	0.115	20.80	0.120	20.53	0.113
	Subtest 3	21.61	0.145	21.82	0.152	21.61	0.145
	Subtest 4	20.59	0.115	20.85	0.122	20.59	0.115
	Subtest 5	22.63	0.183	22.83	0.192	22.62	0.183
DC-HSDPA	Subtest 1	22.12	0.163	22.05	0.160	21.93	0.156
	Subtest 2	22.43	0.175	22.46	0.176	22.31	0.170
	Subtest 3	22.34	0.171	22.29	0.169	22.15	0.164
	Subtest 4	22.51	0.178	22.52	0.179	22.33	0.171
HSPA+		22.36	0.172	22.42	0.175	22.29	0.177

4. Occupied Bandwidth

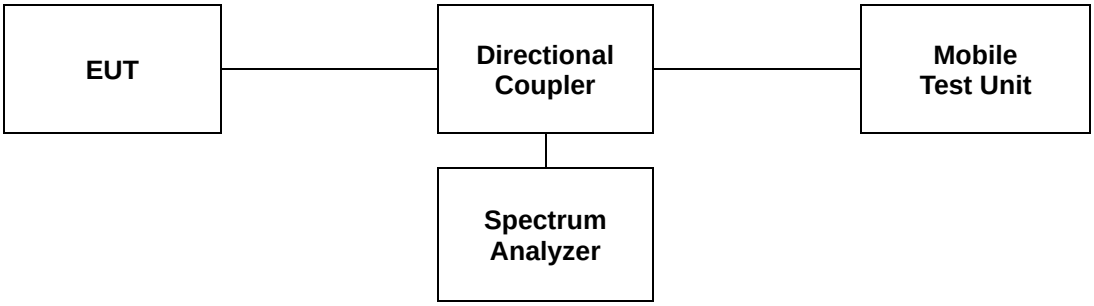
4.1. Limit

CFR 47, Section FCC §2.1049

4.2. Test Procedure

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).



4.3 Test Results

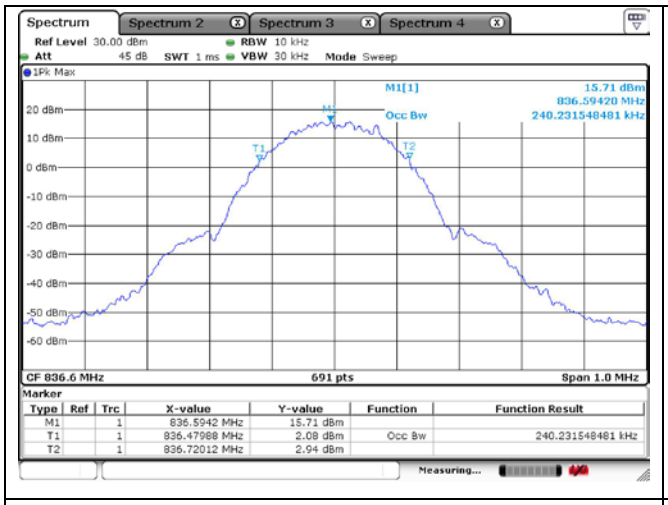
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

Band	Mode	Frequency (㎒)	Occupied Bandwidth (㎒)
GSM 850	VOICE	836.6	0.240
	EDGE		0.242

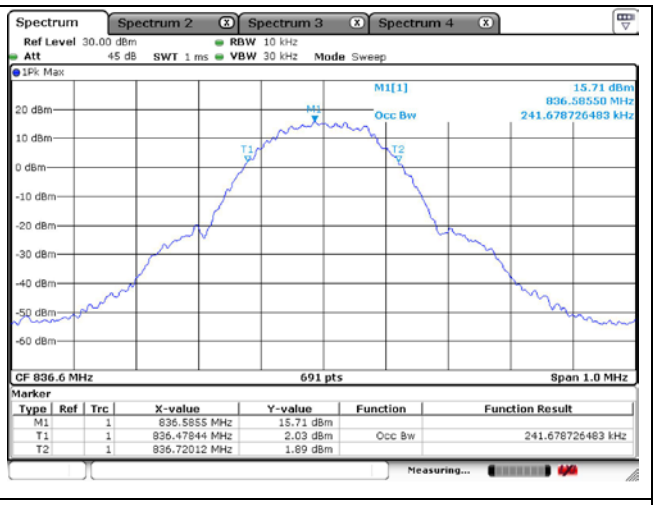
Band	Mode	Frequency (㎒)	Occupied Bandwidth (㎒)
WCDMA Ⅴ	RMC	836.6	4.146
	HSDPA		4.136

- Test plots

GSM

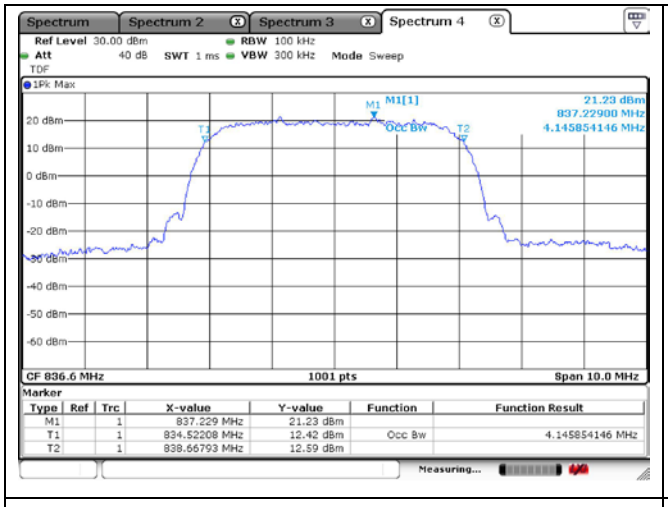


GSM 850 VOICE Middle Channel

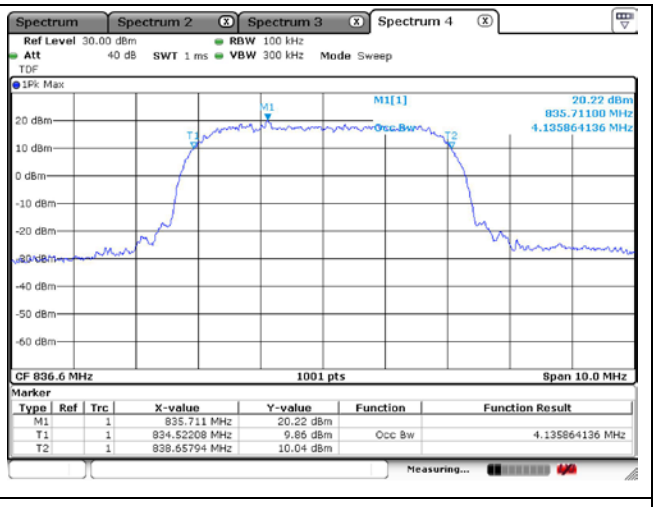


GSM 850 EDGE Middle Channel

WCDMA



WCDMA Ⅴ RMC Middle Channel



WCDMA Ⅴ HSDPA Middle Channel

5. Peak-Average Ratio

5.1. Limit

- §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 dB.

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:

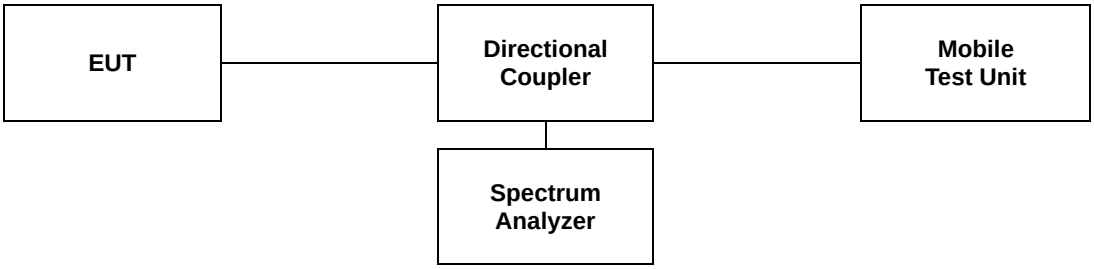
1) For continuous transmissions, set to greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ms.

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

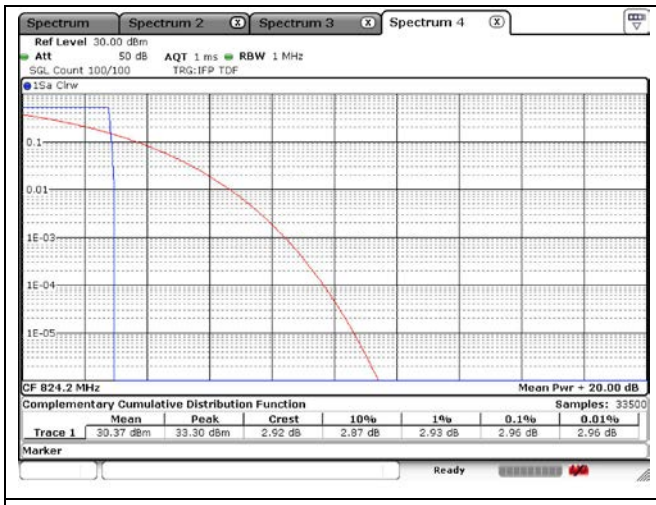
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

Band	Mode	Frequency (㎒)	PAR (㏈)
GSM 850	VOICE	824.2	2.96
		836.6	2.99
		848.8	2.96
	EDGE	824.2	2.93
		836.6	2.96
		848.8	2.96

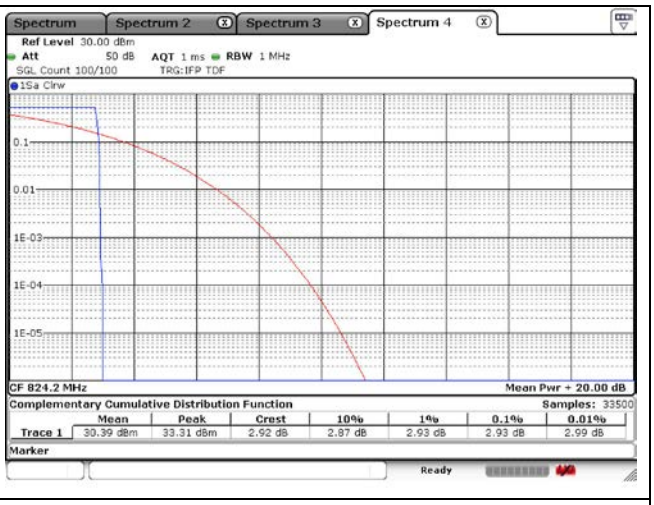
Band	Mode	Frequency (㎒)	PAR (㏈)
WCDMA Ⅴ	RMC	826.4	3.22
		836.6	3.25
		846.6	3.25
	HSDPA	826.4	3.33
		836.6	3.30
		846.6	3.33

- Test plots

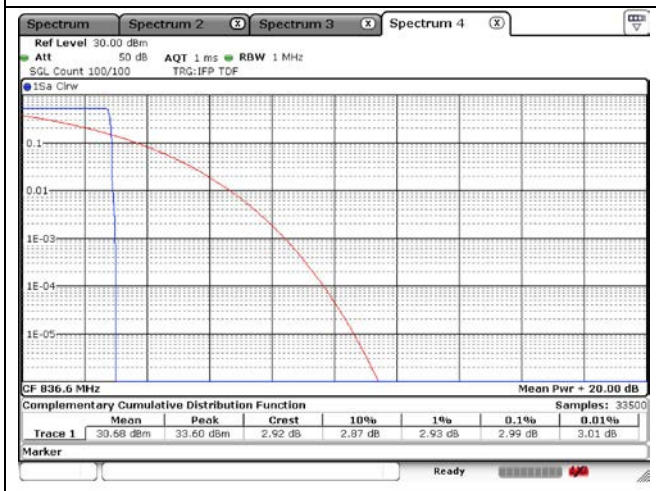
GSM 850



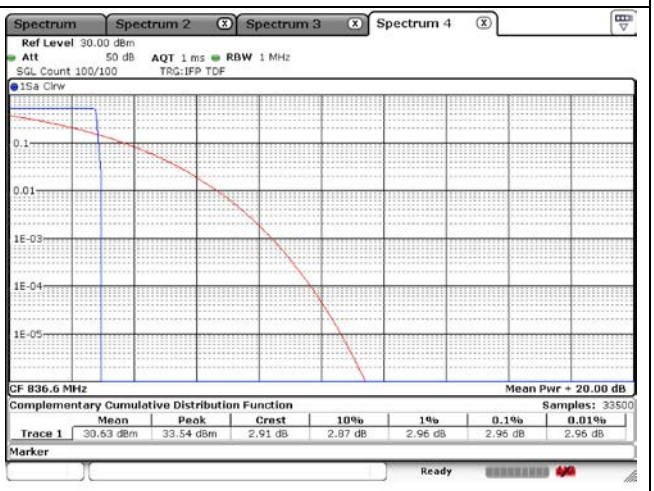
GSM 850 VOICE Low Channel



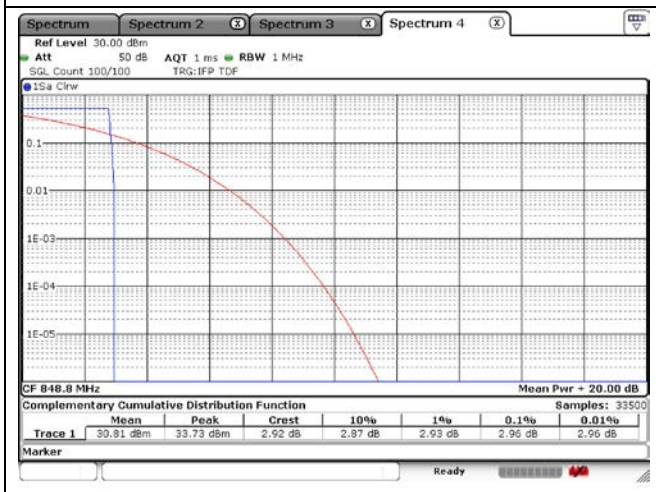
GSM 850 EDGE Low Channel



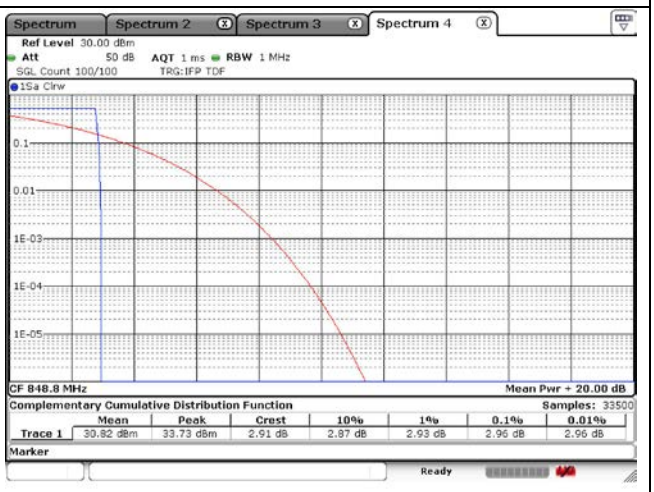
GSM 850 VOICE Middle Channel



GSM 850 EDGE Middle Channel

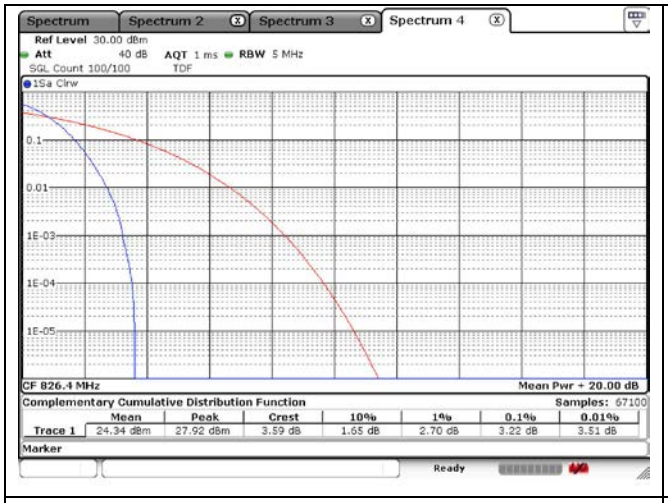


GSM 850 VOICE High Channel

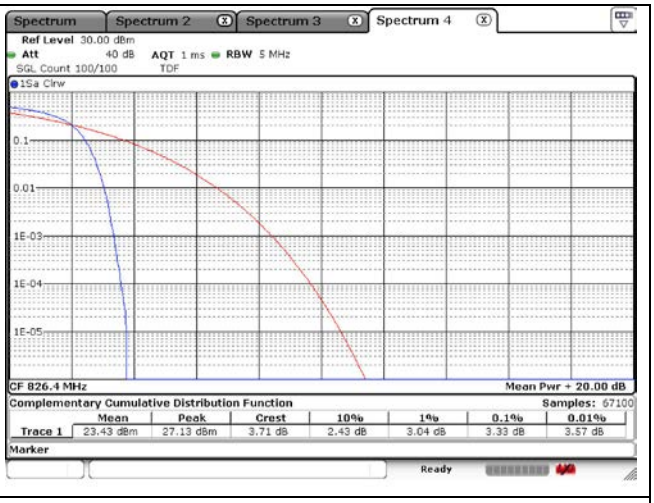


GSM 850 EDGE High Channel

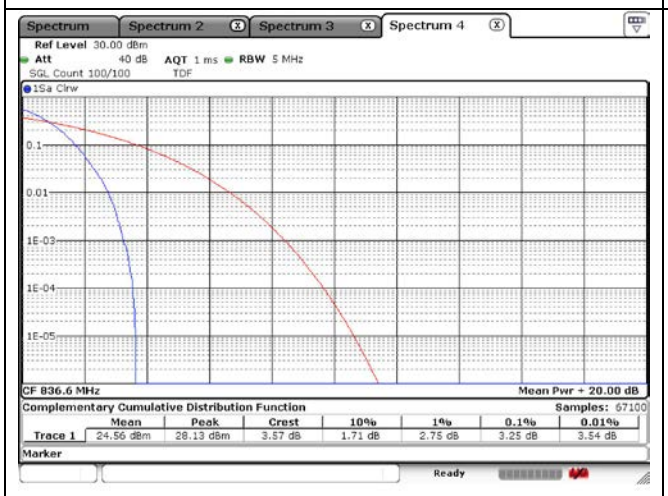
WCDMA Ⅴ



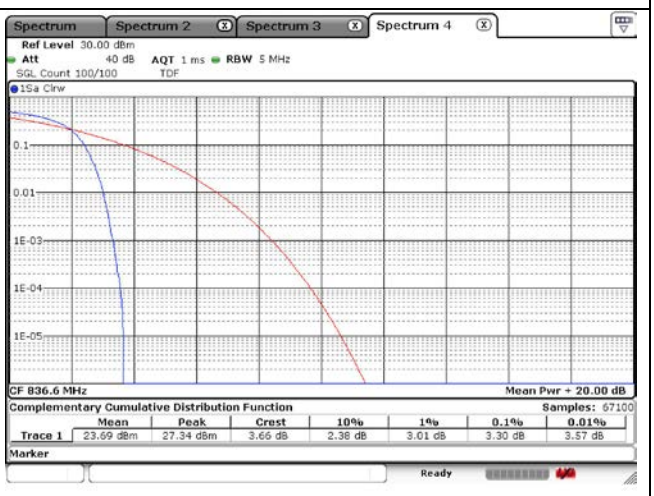
WCDMA Ⅴ RMC Low Channel



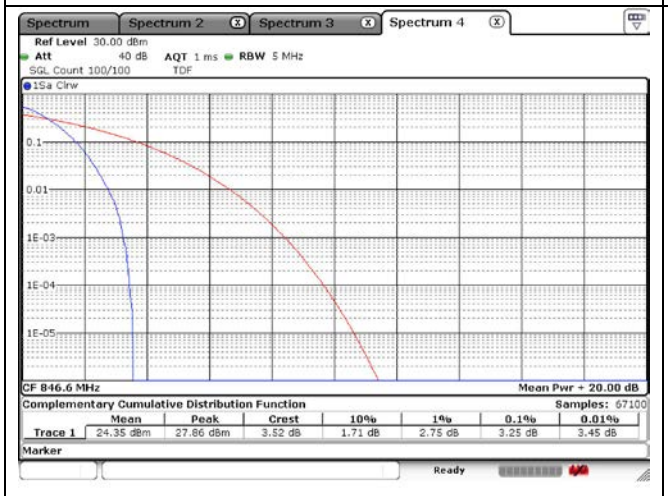
WCDMA Ⅴ HSDPA Low Channel



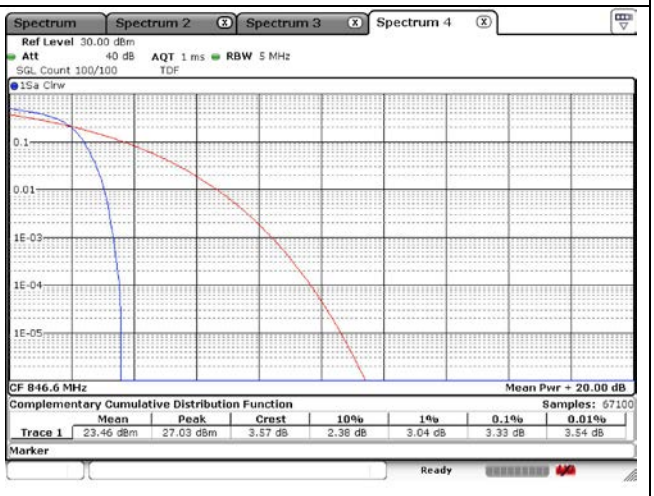
WCDMA Ⅴ RMC Middle Channel



WCDMA Ⅴ HSDPA Middle Channel



WCDMA Ⅴ RMC High Channel



WCDMA Ⅴ HSDPA High Channel

6. Spurious Emissions at Antenna Terminal

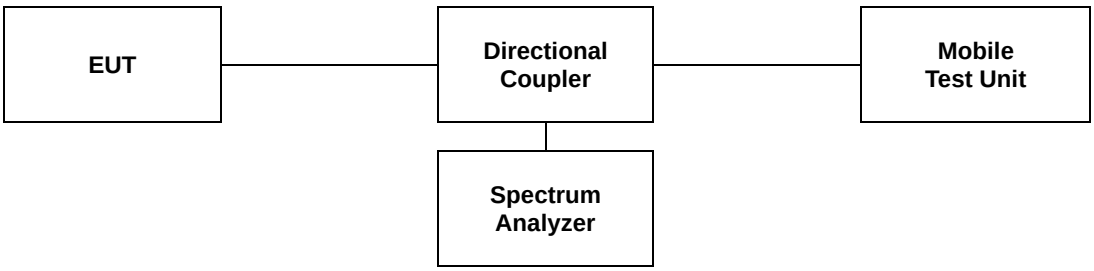
6.1. Limit

- §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) ㏈.

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 = RMS.
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 10 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



Note;

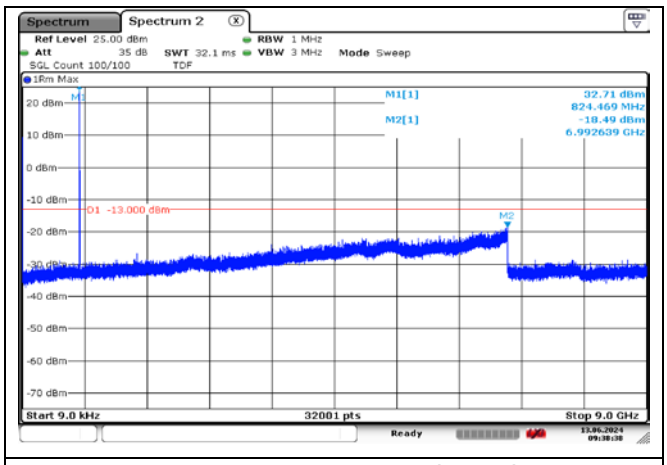
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and frequencies greater than 1 ㎓. However, in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution 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

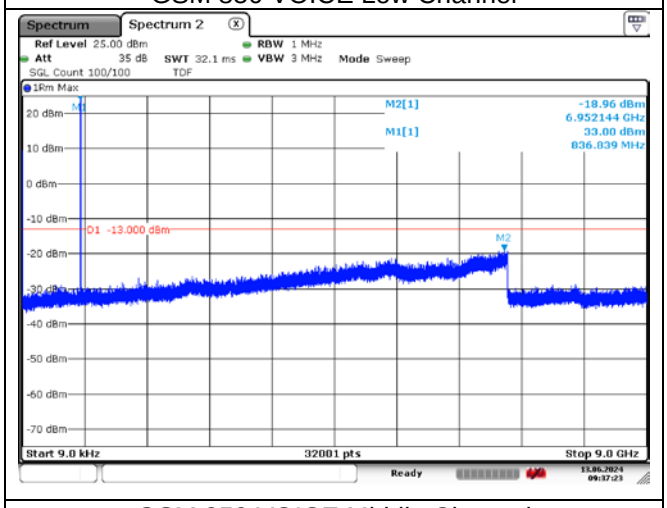
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

- Test plots

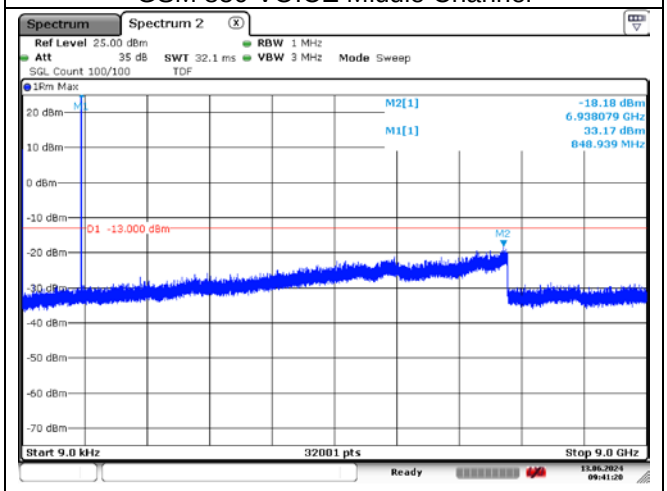
GSM 850



GSM 850 VOICE Low Channel

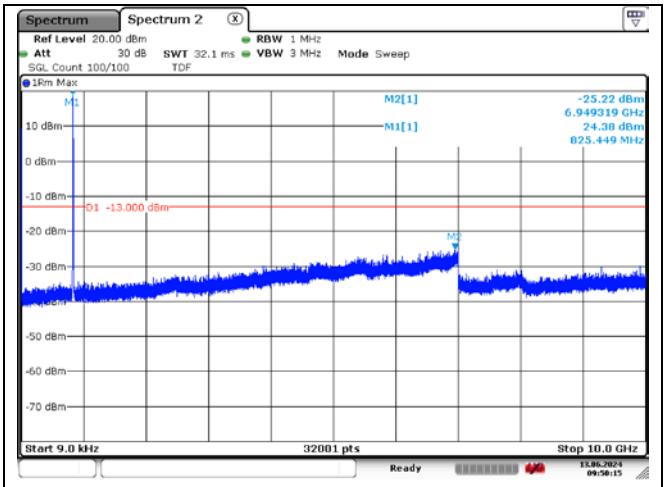


GSM 850 VOICE Middle Channel

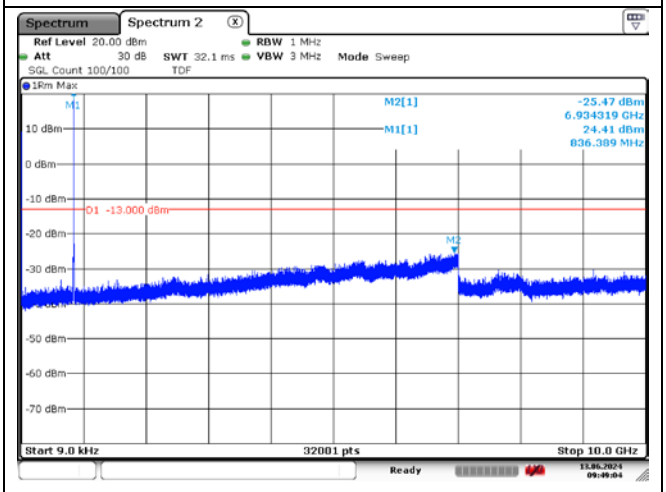


GSM 850 VOICE High Channel

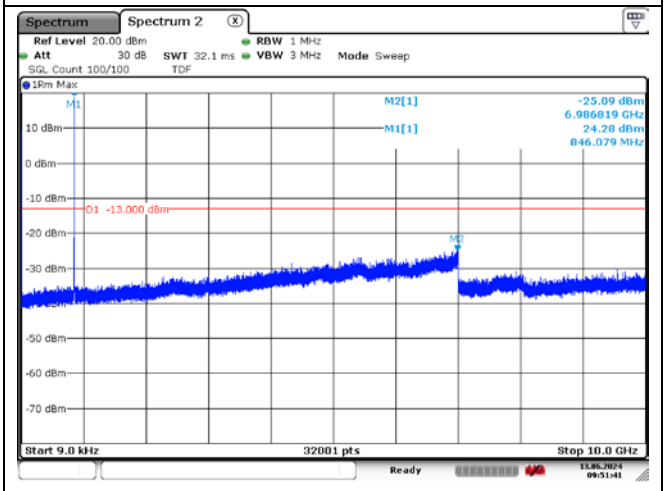
WCDMA Ⅴ



WCDMA Ⅴ RMC Low channel



WCDMA Ⅴ RMC Middle channel



WCDMA Ⅴ RMC High channel

7. Band Edge

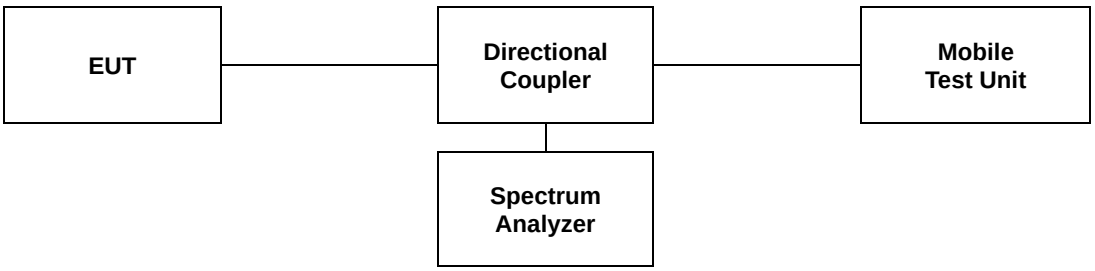
7.1. Limit

- §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) ㏈.

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.

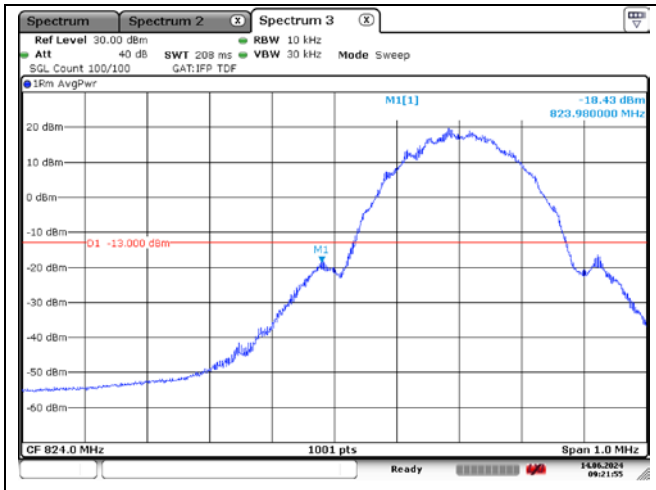


7.3. Test Results

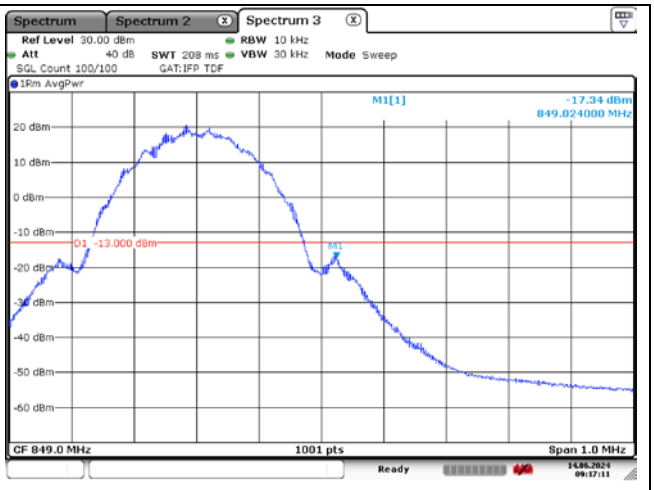
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

- Test plots

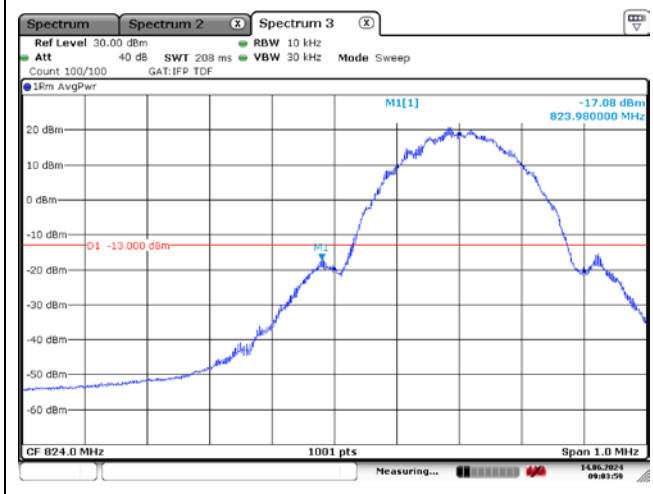
GSM 850



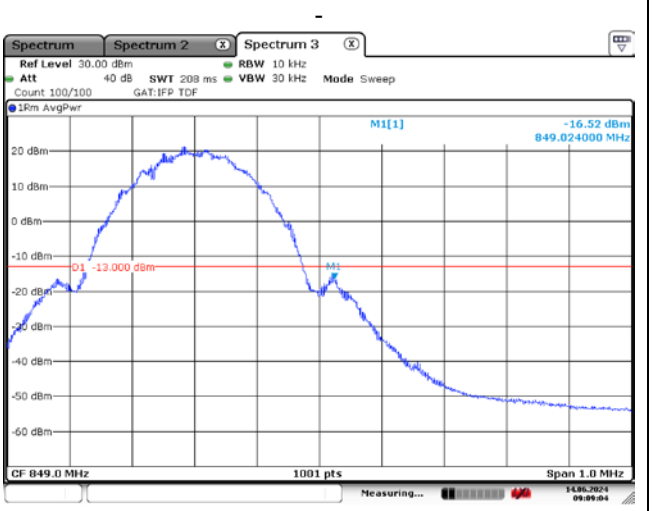
GSM 850 VOICE Low Channel



GSM 850 VOICE High Channel

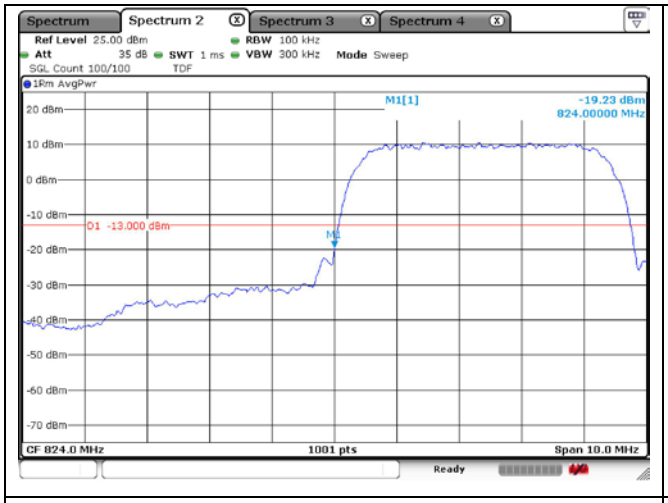


GSM 850 EDGE Low Channel

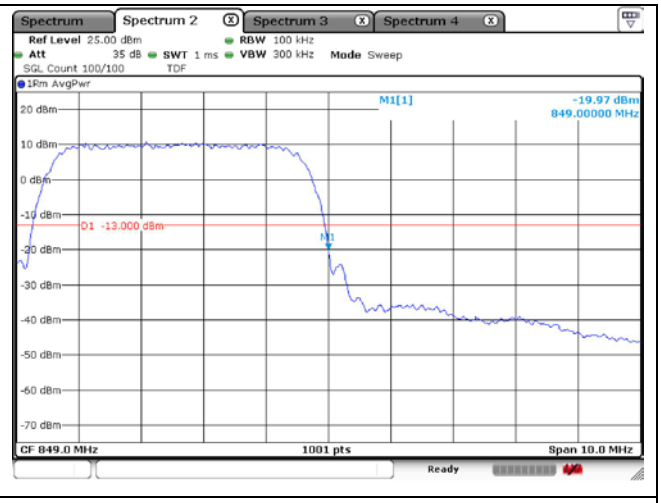


GSM 850 EDGE High Channel

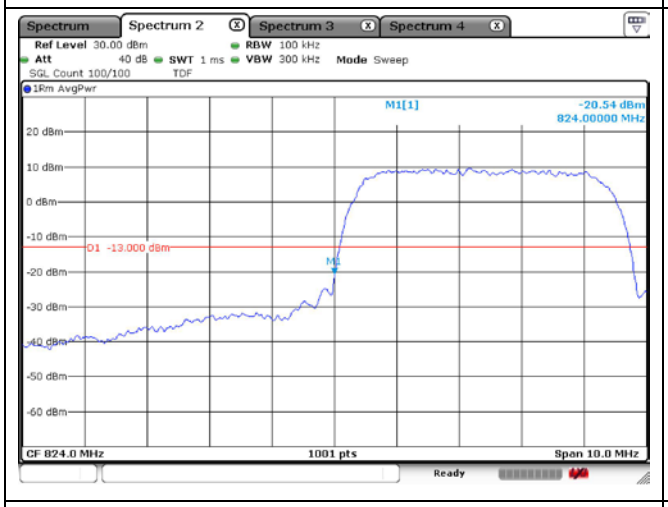
WCDMA Ⅴ



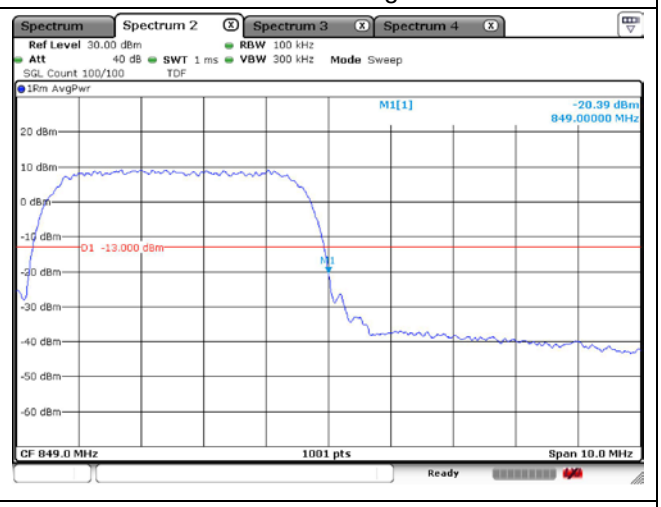
WCDMA Ⅴ RMC Low Channel



WCDMA Ⅴ RMC High Channel



WCDMA Ⅴ HSDPA Low Channel



WCDMA Ⅴ HSDPA High Channel

8. Frequency Stability

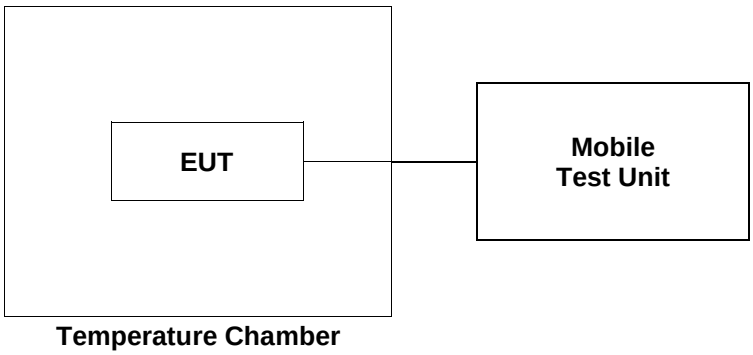
8.1. Limit

- § 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.

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.



8.3. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

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	4.00	8.53	0.005 90
40		1.19	-0.002 87
30		13.02	0.011 27
20(Ref.)		3.59	-
10		10.19	0.007 89
0		7.59	0.004 78
-10		5.59	0.002 39
-20		6.07	0.002 96
-30		2.81	-0.000 93
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	3.40 (85%)	5.87	0.002 73
	4.60 (115%)	7.49	0.004 66

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	4.00	-3.35	-0.002 61
40		1.18	0.002 81
30		-3.02	-0.002 21
20(Ref.)		-1.17	-
10		5.49	0.007 96
0		3.52	0.005 61
-10		4.48	0.006 75
-20		2.97	0.004 95
-30		3.35	0.005 40
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	3.40 (85%)	3.68	0.005 80
	4.60 (115%)	4.02	0.006 20

- End of the Test Report -