

TEST REPORT

of

FCC Part 2 Subpart J, Part 22 Subpart C/H,
Part 24 Subpart E and Part 27 Subpart C

FCC ID: BEJTN1R23NR

Equipment Under Test : Telematics
Model Name : TN1R23NR
Variant Model Name(s) : Refer to the page 4
Applicant : LG Electronics USA
Manufacturer : LG Electronics Inc.
Date of Receipt : 2022.11.04
Date of Test(s) : 2022.11.04 ~ 2023.01.20
Date of Issue : 2023.01.20

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

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Tested by:


Murphy 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 Electronics USA

Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, United States, 07632

Contact Person : Cho, Hee-jae

Phone No. : +1 201 470 2696

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
Model Name		TN1R23NR
Variant Model Name		TN1R23NE
Serial Number		352162110229030
Power Supply		DC 12.5 V
Rated Power	SIM 1	WCDMA II, IV, V: 24 dBm GSM 850: 33 dBm GSM 1 900: 30 dBm
	SIM 2	GSM 850: 33 dBm GSM 1 900: 30 dBm
Frequency Range	SIM 1	WCDMA II: 1 850 MHz ~ 1 910 MHz WCDMA IV: 1 710 MHz ~ 1 755 MHz WCDMA V: 824 MHz ~ 849 MHz GSM 850: 824 MHz ~ 849 MHz GSM 1 900: 1 850 MHz ~ 1 910 MHz
	SIM 2	GSM 850: 824 MHz ~ 849 MHz GSM 1 900: 1 850 MHz ~ 1 910 MHz
Modulation Technique		QPSK, 16QAM, GMSK, 8PSK
Antenna Type	SIM 1	External Antenna
	SIM 2	External Antenna
Antenna Gain*	SIM 1	824 MHz ~ 849 MHz: 3 dB i 1 710 MHz ~ 1 755 MHz: 4.1 dB i 1 850 MHz ~ 1 910 MHz: 3.5 dB i
	SIM 2	824 MHz ~ 849 MHz: 5 dB i 1 850 MHz ~ 1 910 MHz: 5 dB i
H/W Version		Rev.D1
S/W Version		v004.144.010

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMA100B	106887	Oct. 13, 2022	Annual	Oct. 13, 2023
Signal Generator	R&S	SMBV100A	255834	May 25, 2022	Annual	May 25, 2023
Spectrum Analyzer	R&S	FSV30	103210	Dec. 07, 2022	Annual	Dec. 07, 2023
Spectrum Analyzer	Agilent	N9020A	MY53421758	Aug. 26, 2022	Annual	Aug. 26, 2023
Mobile Test Unit	R&S	CMW 500	144034	Feb. 21, 2022	Annual	Feb. 21, 2023
Power Meter	Anritsu	ML2495A	1223004	Nov. 29, 2022	Annual	Nov. 29, 2023
Power Sensor	Anritsu	MA2411B	1207272	May 27, 2022	Annual	May 27, 2023
Temperature Chamber	ESPEC CORP.	SH-662	93000533	Jun. 02, 2022	Annual	Jun. 02, 2023
Low Pass Filter	Mini-Circuits	NLP-1200+	V 8979400903-2	Feb. 10, 2022	Annual	Feb. 10, 2023
High Pass Filter	Wainwright Instrument GmbH	WHKX10-900-1000-18000-40SS	7	Mar. 04, 2022	Annual	Mar. 04, 2023
High Pass Filter	Wainwright Instrument GmbH	WHKX2.2/12.75G-10SS	8	Mar. 04, 2022	Annual	Mar. 04, 2023
High Pass Filter	Wainwright Instrument GmbH	WHKX3.0/18G-6SS	21	Jun. 09, 2022	Annual	Jun. 09, 2023
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	11	Oct. 24, 2022	Annual	Oct. 24, 2023
BRIDGE COUPLER	MARKI MICROWAVE INC	CBR16-0012	1542	May 06, 2022	Annual	May 06, 2023
Directional Coupler	KRYTAR	152613	122660	Jul. 06, 2022	Annual	Jul. 06, 2023
DC Power Supply	Agilent	U8002A	MY49030063	Jan. 25, 2022	Annual	Jan. 25, 2023
Preamplifier	H.P.	8447F	2944A03909	Aug. 04, 2022	Annual	Aug. 04, 2023
Preamplifier	R&S	SCU 18	10117	Jun. 13, 2022	Annual	Jun. 13, 2023
Preamplifier	TESTEK	TK-PA1840H	130016	Jan. 11, 2023	Annual	Jan. 11, 2024
Test Receiver	R&S	ESCI 7	100911	Feb. 23, 2022	Annual	Feb. 23, 2023
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 23, 2021	Biennial	Aug. 23, 2023
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	01126	Feb. 07, 2022	Annual	Feb. 07, 2023
Horn Antenna	R&S	HF906	100326	Feb. 18, 2022	Annual	Feb. 18, 2023
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	9170-540	Nov. 30, 2022	Annual	Nov. 30, 2023
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	RFONE	MWX221-NMSNMS (4 m)	J1023142	Oct. 04, 2022	Semi-Annual	Apr. 04, 2023
Coaxial Cable	Qualwave Inc.	QA500-18-NN-10 (10 m)	22200114	Oct. 04, 2022	Semi-Annual	Apr. 04, 2023
Coaxial Cable	RADIALL	TESTPRO 3	182287	Aug. 18, 2022	Semi-Annual	Feb. 18, 2023
Coaxial Cable	RADIALL	TESTPRO 3	182288	Aug. 18, 2022	Semi-Annual	Feb. 18, 2023
Coaxial Cable	RADIALL	TESTPRO 3	182291	Aug. 18, 2022	Semi-Annual	Feb. 18, 2023

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, 22, 24 and 27		
Section(s)	Test Item	Result
§2.1046 §22.913(a)(5) §24.232(c) §27.50(d)(4)	E.R.P. / E.I.R.P.	Complied
§2.1053 §22.917(a) §24.238(a) §27.53(h)(1)	Radiated Spurious Emissions	Complied
§2.1046	Conducted Output Power	Complied
§2.1049	Occupied Bandwidth	Complied
§22.913(d) §24.232(d) §27.50(d)(5)	Peak-Average Ratio	Complied
§2.1051 §22.917(a) §24.238(a) §27.53(h)(1)	Spurious Emission at Antenna Terminal	Complied
§22.917(a) §24.238(a) §27.53(h)(1)	Band Edge	Complied
§2.1055 §22.355 §24.235 §27.54	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 (dB μ V) + 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 and HSUPA Modulation. All testing was performed using RMC and HSDPA modulations, except spurious radiated emission spurious 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 radiated 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

SIM1

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

Test Items	Band	Test Channel			Modulation		
		Low	Mid	High	VOICE	GPRS	EGPRS
Conducted Output Power	GSM 850	V	V	V	V	V	V
	GSM 1900	V	V	V	V	V	V
Frequency Stability	GSM 850	-	V	-	V	-	-
	GSM 1900	-	V	-	V	-	-
Occupied Bandwidth	GSM 850	-	V	-	V	-	V
	GSM 1900	-	V	-	V	-	V
Peak to Average Ratio	GSM 850	V	V	V	V	-	V
	GSM 1900	V	V	V	V	-	V
Band Edge	GSM 850	V	-	V	V	-	V
	GSM 1900	V	-	V	V	-	V
Spurious Emission at Antenna Terminal and Radiated Spurious Emissions	GSM 850	Worst case					
	GSM 1900	Worst case					

1.10. Measurement Uncertainty

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

Parameter	Uncertainty	
RF Output Power	0.32 dB	
Occupied Bandwidth	3.90 kHz	
Conducted Spurious Emissions	0.61 dB	
Peak to Average Ratio	0.60 dB	
Frequency Stability	5.97 kHz	
Radiated Emission, 9 kHz to 30 MHz	H	3.40 dB
	V	3.40 dB
Radiated Emission, below 1 GHz	H	4.50 dB
	V	5.10 dB
Radiated Emission, above 1 GHz	H	3.70 dB
	V	3.90 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-RTL003735	2023.01.20	Initial

1.12. Emission Designator and Max Power

SIM 1 WCDMA

Band	Modulation	Low Freq. (MHz)	Upper Freq. (MHz)	Conducted Power (dB m)	Ant. Gain (dB i)	E.R.P. / E.I.R.P. Average (dB m)	E.R.P. / E.I.R.P. Average (W)	Emission Designator
WCDMA II	RMC	1 852.4	1 907.6	22.84	3.5	26.34	0.431	4M15F9W
	HSDPA			21.90		25.40	0.347	4M15F9W
WCDMA IV	RMC	1 712.4	1 752.6	22.90	4.1	27.00	0.501	4M15F9W
	HSDPA			21.91		26.01	0.399	4M15F9W
WCDMA V	RMC	826.4	846.6	22.98	3	23.83	0.242	4M17F9W
	HSDPA			22.01		22.86	0.193	4M17F9W

GSM

Band	Modulation	Low Freq. (MHz)	Upper Freq. (MHz)	Conducted Power (dB m)	Duty Cycle (%)	Ant. Gain (dB i)	E.R.P. / E.I.R.P. Average (dB m)	E.R.P. / E.I.R.P. Average (W)	Emission Designator
GSM 850	VOICE	824.2	848.8	32.62	12.5	3	24.44	0.278	243KGXW
	EDGE			26.53			18.35	0.068	249KG7W
GSM 1900	VOICE	1 850.2	1 909.8	29.65	12.5	3.5	24.12	0.258	237KGXW
	EDGE			25.55			20.02	0.100	245KG7W

SIM 2 GSM

Band	Modulation	Low Freq. (MHz)	Upper Freq. (MHz)	Conducted Power (dB m)	Duty Cycle (%)	Ant. Gain (dB i)	E.R.P. / E.I.R.P. Average (dB m)	E.R.P. / E.I.R.P. Average (W)	Emission Designator
GSM 850	VOICE	824.2	848.8	32.62	12.5	5	26.44	0.441	242KGXW
	EDGE			26.54			20.36	0.109	246KG7W
GSM 1900	VOICE	1 850.2	1 909.8	29.69	12.5	5	25.66	0.368	239KGXW
	EDGE			25.56			21.53	0.142	245KG7W

1.13. Information of Variant Model

Model Name		Differences Hardware Part	Description
Basic Model	TN1R23NR	Reference	Fully mounted on hardware.
Variant Model	TN1R23NE	Remove Band 21 related parts	Not support LTE Band 21
		Remove QPM5679AQ, QDM5679AQ	Not support 5G NR n79

- Supported Cellular Band

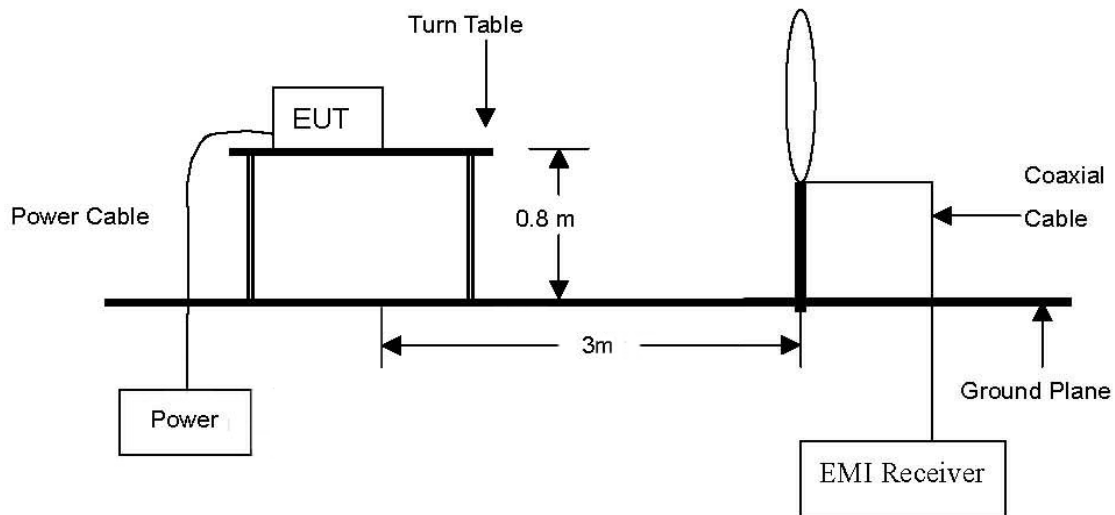
MODEL	Mode	SIM 1	SIM 2
TN1R23NR	GSM	GSM850, PCS1900	GSM850, PCS1900
	WCDMA	B2, B4, B5	N/A
	LTE	B2, B4, B5, B7, B12(B17), B26, B41	B2, B4, B5, B7, B26, B41
	5G Sub6_SA	n41	n41
	5G Sub6_NSA	n41	N/A
TN1R23NE	GSM	N/A	N/A
	WCDMA	B2, B4, B5	N/A
	LTE	B2, B4, B5, B7, B12(B17)	B7
	5G Sub6_SA	N/A	N/A
	5G Sub6_NSA	N/A	N/A

*Operating bands are different by software.

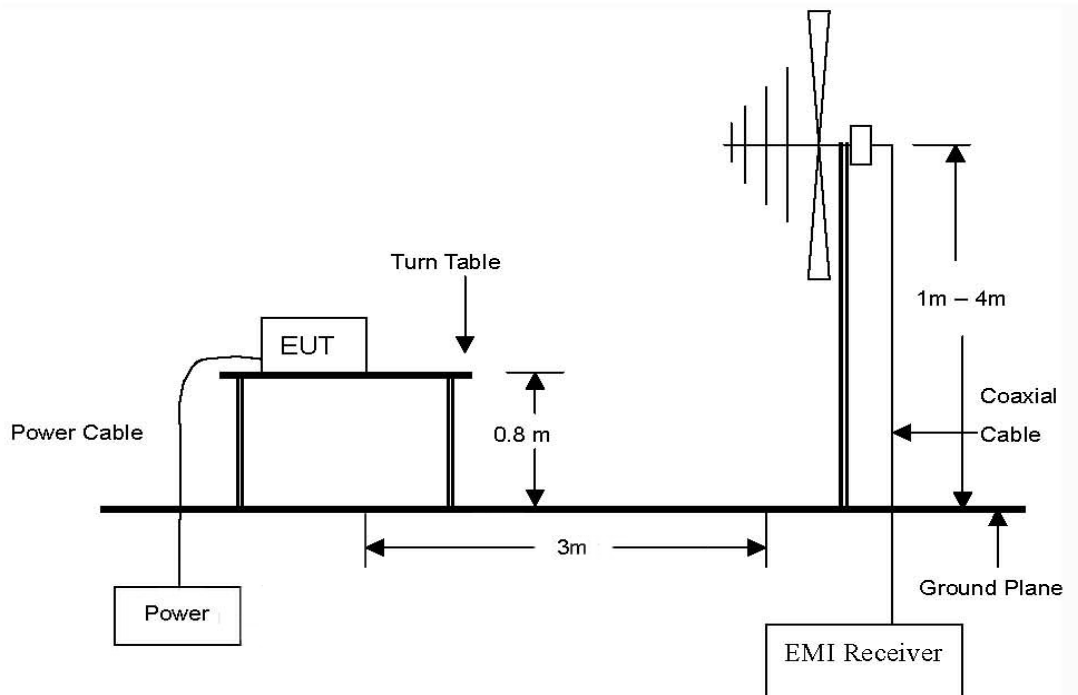
2. E.R.P. / E.I.R.P. & Radiated Spurious Emissions

2.1. Test setup

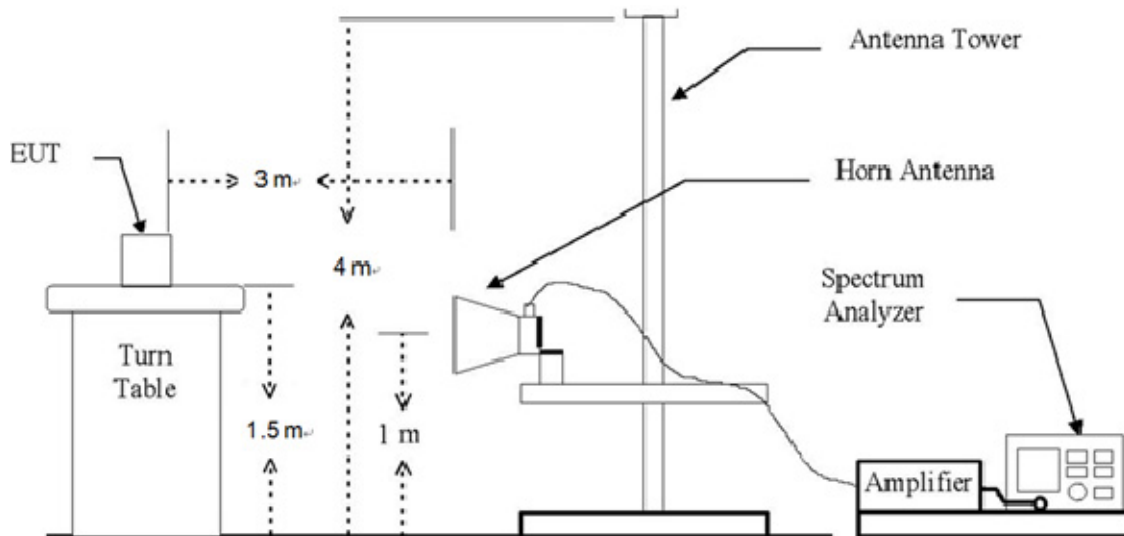
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz.



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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 20 GHz 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.
- §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 MHz band and mobile and portable stations operating in the 1 695-1 710 MHz and 1 755-1 780 MHz bands are limited to 1 watt EIRP.

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 $43 + 10\log(P)$ dB.
- §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 $43 + 10 \log(P)$ dB.
- §27.53(h)(1), for operations in the 1 695-1 710 MHz, 1 710-1 755 MHz, 1 755-1 780 MHz, 1 915-1 920 MHz, 1 995-2 000 MHz, 2 000-2 020 MHz, 2 110-2 155 MHz, 2 155-2 180 MHz, 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 $43 + 10 \log_{10}(P)$ dB.

2.3. Test Procedure: Based on ANSI/TIA 603E: 2016 and ANSI C63.26-2015, 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 $\geq 3 \times$ 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) °C
Relative humidity : 47 % R.H.

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

SIM 1 WCDMA

Band	Frequency (MHz)	Maximum Conducted Average Power (dB m)	Maximum Conducted Average 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)	Limit
WCDMA II	1 850 ~ 1 910	22.84	0.192	3.5	26.34	0.431			2 W E.I.R.P.
WCDMA IV	1 710 ~ 1 755	22.90	0.195	4.1	27.00	0.501			1 W E.I.R.P.
WCDMA V	824 ~ 849	22.98	0.199	3	25.98	0.396	23.83	0.242	7 W E.R.P.

GSM

Band	Frequency (MHz)	Maximum Conducted Average Power (dB m)	Maximum Conducted Average Power (W)	Duty Cycle (%)	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)	Limit
GSM 850	824 ~ 849	32.62	1.828	12.5	3	26.59	0.456	24.44	0.278	7 W E.I.R.P.
GSM 1900	1 850 ~ 1 910	29.65	0.923	12.5	3.5	24.12	0.258			2 W E.R.P.

SIM 2 GSM

Band	Frequency (MHz)	Maximum Conducted Average Power (dB m)	Maximum Conducted Average Power (W)	Duty Cycle (%)	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)	Limit
GSM 850	824 ~ 849	32.62	1.828	12.5	5	28.59	0.723	26.44	0.441	7 W E.I.R.P.
GSM 1900	1 850 ~ 1 910	29.69	0.931	12.5	5	25.66	0.368			2 W E.R.P.

Remark;

1. E.I.R.P. (dB m) = Maximum Conducted Average Power (dB m) + 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.

2.4.2. Radiated Spurious Emissions

SIM 1

WCDMA II

Frequency (MHz)	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 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (1 880.0 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-
High Channel (1 907.6 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

WCDMA IV

Frequency (MHz)	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 (1 712.4 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (1 732.6 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-
High Channel (1 752.6 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

WCDMA V

Frequency (MHz)	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 MHz)									
1 651.32	63.20	H	25.62	-38.67	50.15	-97.41	-47.26	-13	34.26
1 654.23	66.65	V	25.65	-38.67	53.63	-97.41	-43.78	-13	30.78
2 399.62	58.37	H	28.10	-36.23	50.24	-97.41	-47.17	-13	34.17
2 333.46	49.41	V	27.80	-36.44	40.77	-97.41	-56.64	-13	43.64
2 477.06	63.48	H	28.15	-36.88	54.75	-97.41	-42.66	-13	29.66
2 476.86	65.75	V	28.15	-36.88	57.02	-97.41	-40.39	-13	27.39
Above 2 500.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.6 MHz)									
1 674.14	63.66	H	25.89	-38.66	50.89	-97.41	-46.52	-13	33.52
1 670.33	64.81	V	25.84	-38.66	51.99	-97.41	-45.42	-13	32.42
2 399.79	58.24	H	28.10	-36.23	50.11	-97.41	-47.30	-13	34.30
2 333.02	54.70	V	27.80	-36.44	46.06	-97.41	-51.35	-13	38.35
2 505.70	60.26	H	28.13	-37.13	51.26	-97.41	-46.15	-13	33.15
2 510.68	63.17	V	28.16	-37.06	54.27	-97.41	-43.14	-13	30.14
Above 2 600.00	Not detected	-	-	-	-	-	-	-	-
High Channel (846.6 MHz)									
1 695.56	64.33	H	26.15	-38.76	51.72	-97.41	-45.69	-13	32.69
1 691.65	62.71	V	26.10	-38.74	50.07	-97.41	-47.34	-13	34.34
2 399.90	60.66	H	28.10	-36.23	52.53	-97.41	-44.88	-13	31.88
2 333.33	49.46	V	27.80	-36.44	40.82	-97.41	-56.59	-13	43.59
2 536.32	56.14	H	28.32	-36.70	47.76	-97.41	-49.65	-13	36.65
2 536.80	56.14	V	28.32	-36.69	47.77	-97.41	-49.64	-13	36.64
Above 2 600.00	Not detected	-	-	-	-	-	-	-	-

GSM 850_VOICE

Frequency (MHz)	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 MHz)									
1 648.40	66.20	H	25.60	-38.67	53.13	-97.41	-44.28	-13	31.28
1 648.52	69.47	V	25.60	-38.68	56.39	-97.41	-41.02	-13	28.02
2 472.56	48.68	H	28.15	-36.80	40.03	-97.41	-57.38	-13	44.38
2 472.66	51.48	V	28.15	-36.80	42.83	-97.41	-54.58	-13	41.58
Above 2 500.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.6 MHz)									
1 673.42	66.38	H	25.88	-38.66	53.60	-97.41	-43.81	-13	30.81
1 673.32	70.53	V	25.88	-38.66	57.75	-97.41	<u>-39.66</u>	-13	26.66
2 510.16	48.31	H	28.16	-37.06	39.41	-97.41	-58.00	-13	45.00
2 509.84	49.41	V	28.16	-37.07	40.50	-97.41	-56.91	-13	43.91
Above 2 600.00	Not detected	-	-	-	-	-	-	-	-
High Channel (848.8 MHz)									
1 697.82	66.75	H	26.17	-38.77	54.15	-97.41	-43.26	-13	30.26
1 697.68	68.65	V	26.17	-38.77	56.05	-97.41	-41.36	-13	28.36
2 546.54	49.42	H	28.38	-36.57	41.23	-97.41	-56.18	-13	43.18
2 546.62	52.95	V	28.38	-36.56	44.77	-97.41	-52.64	-13	39.64
Above 2 600.00	Not detected	-	-	-	-	-	-	-	-

GSM 1900_VOICE

Frequency (MHz)	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 MHz)									
3 700.70	45.54	H	32.10	-36.60	41.04	-95.26	-54.22	-13	41.22
3 700.46	52.49	V	32.10	-36.60	47.99	-95.26	<u>-47.27</u>	-13	34.27
Above 3 800.00	Not detected	—	—	—	—	—	—	—	—
Middle Channel (1 880.0 MHz)									
3 759.86	43.23	H	32.16	-36.89	38.50	-95.26	-56.76	-13	43.76
3 760.13	49.60	V	32.16	-36.89	44.87	-95.26	-50.39	-13	37.39
Above 3 800.00	Not detected	—	—	—	—	—	—	—	—
High Channel (1 909.8 MHz)									
3 819.40	46.19	H	32.04	-36.44	41.79	-95.26	-53.47	-13	40.47
3 819.85	47.70	V	32.04	-36.44	43.30	-95.26	-51.96	-13	38.96
Above 3 900.00	Not detected	—	—	—	—	—	—	—	—

SIM2

GSM 850_VOICE

Frequency (MHz)	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 MHz)									
1 124.76	50.76	H	24.85	-40.17	35.44	-97.41	-61.97	-13	48.97
1 124.96	53.42	V	24.85	-40.17	38.10	-97.41	-59.31	-13	46.31
2 472.81	50.63	H	28.15	-36.80	41.98	-97.41	-55.43	-13	42.43
2 472.67	51.72	V	28.15	-36.80	43.07	-97.41	-54.34	-13	41.34
Above 2 500.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.6 MHz)									
1 124.92	50.29	H	24.85	-40.17	34.97	-97.41	-62.44	-13	49.44
1 124.82	53.51	V	24.85	-40.17	38.19	-97.41	-59.22	-13	46.22
2 509.91	54.44	H	28.16	-37.07	45.53	-97.41	-51.88	-13	38.88
2 509.92	58.08	V	28.16	-37.07	49.17	-97.41	-48.24	-13	35.24
Above 2 600.00	Not detected	-	-	-	-	-	-	-	-
High Channel (848.8 MHz)									
1 125.06	50.61	H	24.85	-40.17	35.29	-97.41	-62.12	-13	49.12
1 125.04	53.46	V	24.85	-40.17	38.14	-97.41	-59.27	-13	46.27
2 546.38	53.95	H	28.38	-36.57	45.76	-97.41	-51.65	-13	38.65
2 546.33	54.77	V	28.38	-36.57	46.58	-97.41	-50.83	-13	37.83
Above 2 600.00	Not detected	-	-	-	-	-	-	-	-

GSM 1900_VOICE

Frequency (MHz)	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 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (1 880.0 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-
High Channel (1 909.8 MHz)									
Below 1 000.00	Not detected	-	-	-	-	-	-	-	-
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

Remark;

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

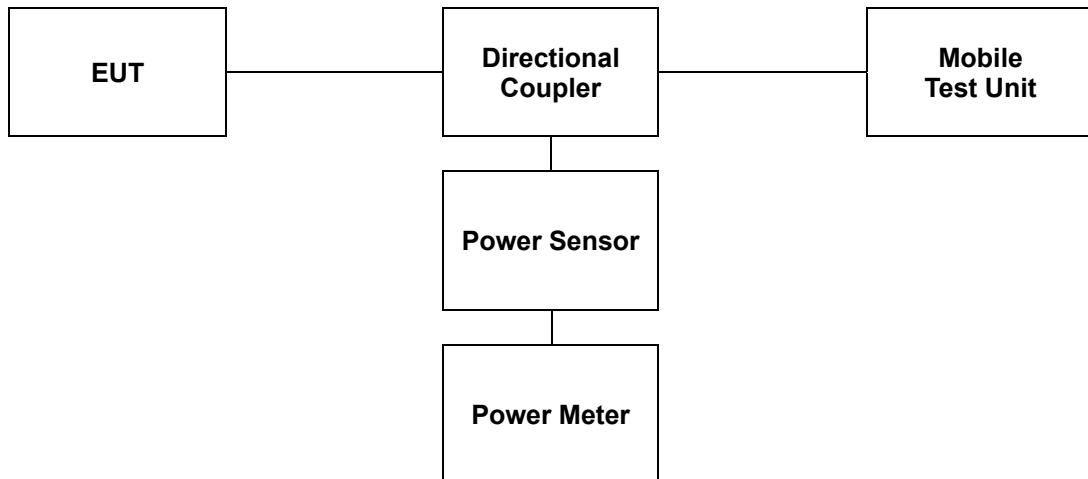
3.1. Limit

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) °C
 Relative humidity : 47 % R.H.

SIM 1

WCDMA II							
Mode	3GPP 34.121 Subtest	Conducted Output Power					
		9262 (1 852.4 MHz)		9400 (1 880.0 MHz)		9538 (1 907.6 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Release 99	12.2 Kbps RMC	22.74	0.188	22.83	0.192	22.84	0.192
HSDPA	Subtest 1	21.80	0.151	21.70	0.148	21.90	0.155
	Subtest 2	21.84	0.153	21.75	0.150	21.79	0.151
	Subtest 3	21.84	0.153	21.72	0.149	21.75	0.150
	Subtest 4	21.71	0.148	21.88	0.154	21.81	0.152
HSUPA	Subtest 1	21.77	0.150	21.72	0.149	21.77	0.150
	Subtest 2	19.79	0.095	19.71	0.094	19.80	0.095
	Subtest 3	20.71	0.118	20.84	0.121	20.82	0.121
	Subtest 4	19.79	0.095	19.79	0.095	19.71	0.094
	Subtest 5	21.89	0.155	21.84	0.153	21.76	0.150
DC-HSDPA	Subtest 1	21.86	0.153	21.85	0.153	21.89	0.155
	Subtest 2	21.89	0.155	21.74	0.149	21.85	0.153
	Subtest 3	21.76	0.150	21.88	0.154	21.76	0.150
	Subtest 4	21.84	0.153	21.78	0.151	21.84	0.153
HSPA+		19.88	0.097	19.89	0.097	19.83	0.096

WCDMA IV							
Mode	3GPP 34.121 Subtest	Conducted Output Power					
		1312 (1 712.4 MHz)		1413 (1 732.6 MHz)		1513 (1 752.6 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Release 99	12.2 Kbps RMC	<u>22.90</u>	<u>0.195</u>	22.87	0.194	22.74	0.188
HSDPA	Subtest 1	<u>21.91</u>	<u>0.155</u>	21.79	0.151	21.77	0.150
	Subtest 2	21.73	0.149	21.73	0.149	21.82	0.152
	Subtest 3	21.80	0.151	21.85	0.153	21.89	0.155
	Subtest 4	21.77	0.150	21.70	0.148	21.90	0.155
HSUPA	Subtest 1	21.86	0.153	21.70	0.148	21.90	0.155
	Subtest 2	19.86	0.097	19.90	0.098	19.80	0.095
	Subtest 3	20.87	0.122	20.86	0.122	20.89	0.123
	Subtest 4	19.89	0.097	19.86	0.097	19.82	0.096
	Subtest 5	21.83	0.152	21.90	0.155	21.82	0.152
DC-HSDPA	Subtest 1	21.89	0.155	21.81	0.152	21.76	0.150
	Subtest 2	21.76	0.150	21.89	0.155	21.90	0.155
	Subtest 3	21.72	0.149	21.75	0.150	21.72	0.149
	Subtest 4	21.85	0.153	21.70	0.148	21.90	0.155
HSPA+		19.82	0.096	19.90	0.098	19.81	0.096

WCDMA V							
Mode	3GPP 34.121 Subtest	Conducted Output Power					
		4132 (826.4 MHz)		4183 (836.6 MHz)		4233 (846.6 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Release 99	12.2 Kbps RMC	<u>22.98</u>	<u>0.199</u>	22.90	0.195	22.97	0.198
HSDPA	Subtest 1	<u>22.01</u>	<u>0.159</u>	21.98	0.158	21.96	0.157
	Subtest 2	22.00	0.158	22.00	0.158	21.95	0.157
	Subtest 3	21.90	0.155	21.92	0.156	21.98	0.158
	Subtest 4	22.00	0.158	21.98	0.158	21.94	0.156
HSUPA	Subtest 1	22.00	0.158	21.94	0.156	21.94	0.156
	Subtest 2	19.94	0.099	20.01	0.100	19.96	0.099
	Subtest 3	21.01	0.126	20.94	0.124	20.93	0.124
	Subtest 4	20.00	0.100	19.91	0.098	19.91	0.098
	Subtest 5	21.90	0.155	21.92	0.156	21.90	0.155
DC-HSDPA	Subtest 1	21.99	0.158	21.99	0.158	21.97	0.157
	Subtest 2	22.00	0.158	21.90	0.155	21.94	0.156
	Subtest 3	21.91	0.155	22.00	0.158	21.92	0.156
	Subtest 4	21.90	0.155	22.00	0.158	21.95	0.157
HSPA+		19.91	0.098	20.00	0.100	19.94	0.099

GSM 850							
Mode		Conducted Output Power					
		128 (824.2 MHz)		190 (836.6 MHz)		251 (848.8 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
VOICE		32.42	1.746	<u>32.62</u>	<u>1.828</u>	32.42	1.746
GPRS	1 Tx slot	32.50	1.778	32.54	1.795	32.44	1.754
	2 Tx slot	32.54	1.795	32.60	1.820	32.49	1.774
EGPRS	1 Tx slot	<u>26.53</u>	<u>0.450</u>	26.50	0.447	26.45	0.442
	2 Tx slot	26.49	0.446	26.52	0.449	26.43	0.440

GSM 1900							
Mode		Conducted Output Power					
		512 (1 850.2 MHz)		661 (1 880.0 MHz)		810 (1 909.8 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
VOICE		29.49	0.889	<u>29.65</u>	<u>0.923</u>	29.52	0.895
GPRS	1 Tx slot	29.43	0.877	29.49	0.889	29.53	0.897
	2 Tx slot	29.54	0.899	29.60	0.912	29.48	0.887
EGPRS	1 Tx slot	25.47	0.352	<u>25.55</u>	<u>0.359</u>	25.49	0.354
	2 Tx slot	25.54	0.358	25.43	0.349	25.50	0.355

SIM 2

GSM 850							
Mode		Conducted Output Power					
		128 (824.2 MHz)		190 (836.6 MHz)		251 (848.8 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
VOICE		32.40	1.738	<u>32.62</u>	<u>1.828</u>	32.59	1.816
GPRS	1 Tx slot	32.47	1.766	32.53	1.791	32.51	1.782
	2 Tx slot	32.47	1.766	32.57	1.807	32.59	1.816
EGPRS	1 Tx slot	26.48	0.445	<u>26.54</u>	<u>0.451</u>	26.45	0.442
	2 Tx slot	26.49	0.446	26.50	0.447	26.46	0.443

GSM 1900							
Mode		Conducted Output Power					
		512 (1 850.2 MHz)		661 (1 880.0 MHz)		810 (1 909.8 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
VOICE		29.47	0.885	<u>29.69</u>	<u>0.931</u>	29.45	0.881
GPRS	1 Tx slot	29.54	0.899	29.57	0.906	29.57	0.906
	2 Tx slot	29.55	0.902	29.59	0.910	29.50	0.891
EGPRS	1 Tx slot	<u>25.56</u>	<u>0.360</u>	25.43	0.349	25.43	0.349
	2 Tx slot	25.55	0.359	25.42	0.348	25.49	0.354

4. Occupied Bandwidth

4.1. Limit

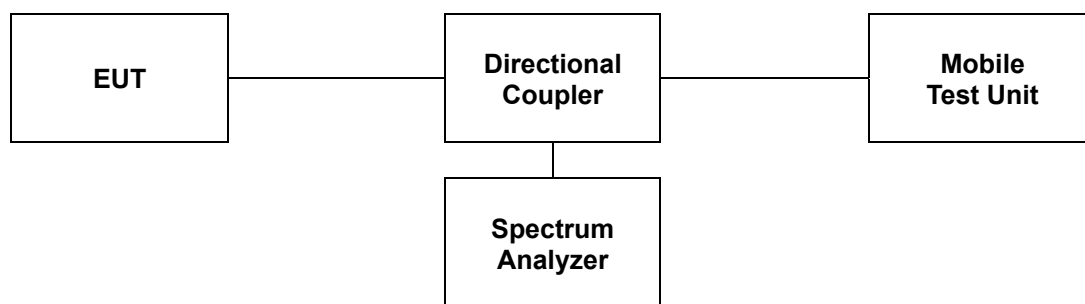
CFR 47, Section FCC §2.1049.

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 $1.5 \times \text{OBW}$ 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 $\geq 3 \times \text{RBW}$.
- 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 between 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).

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) °C
 Relative humidity : 47 % R.H.

SIM1

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
WCDMA II	RMC	1 880.0	4.153
	HSDPA		4.153
WCDMA IV	RMC	1 732.6	4.153
	HSDPA		4.153
WCDMA V	RMC	836.6	4.168
	HSDPA		4.168

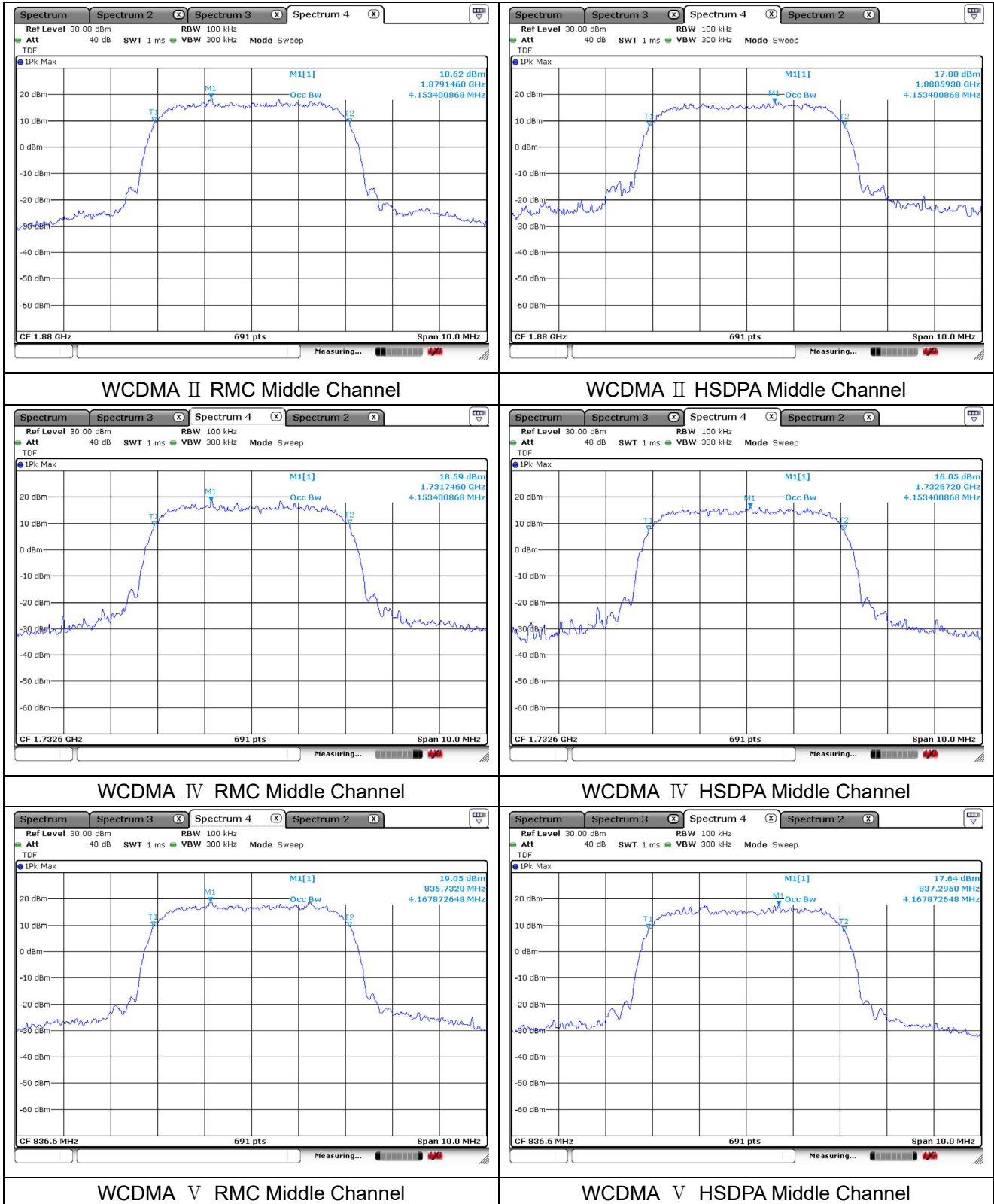
Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
GSM 850	VOICE	836.6	0.243
	EDGE		0.249
GSM 1900	VOICE	1 880.0	0.237
	EDGE		0.245

SIM2

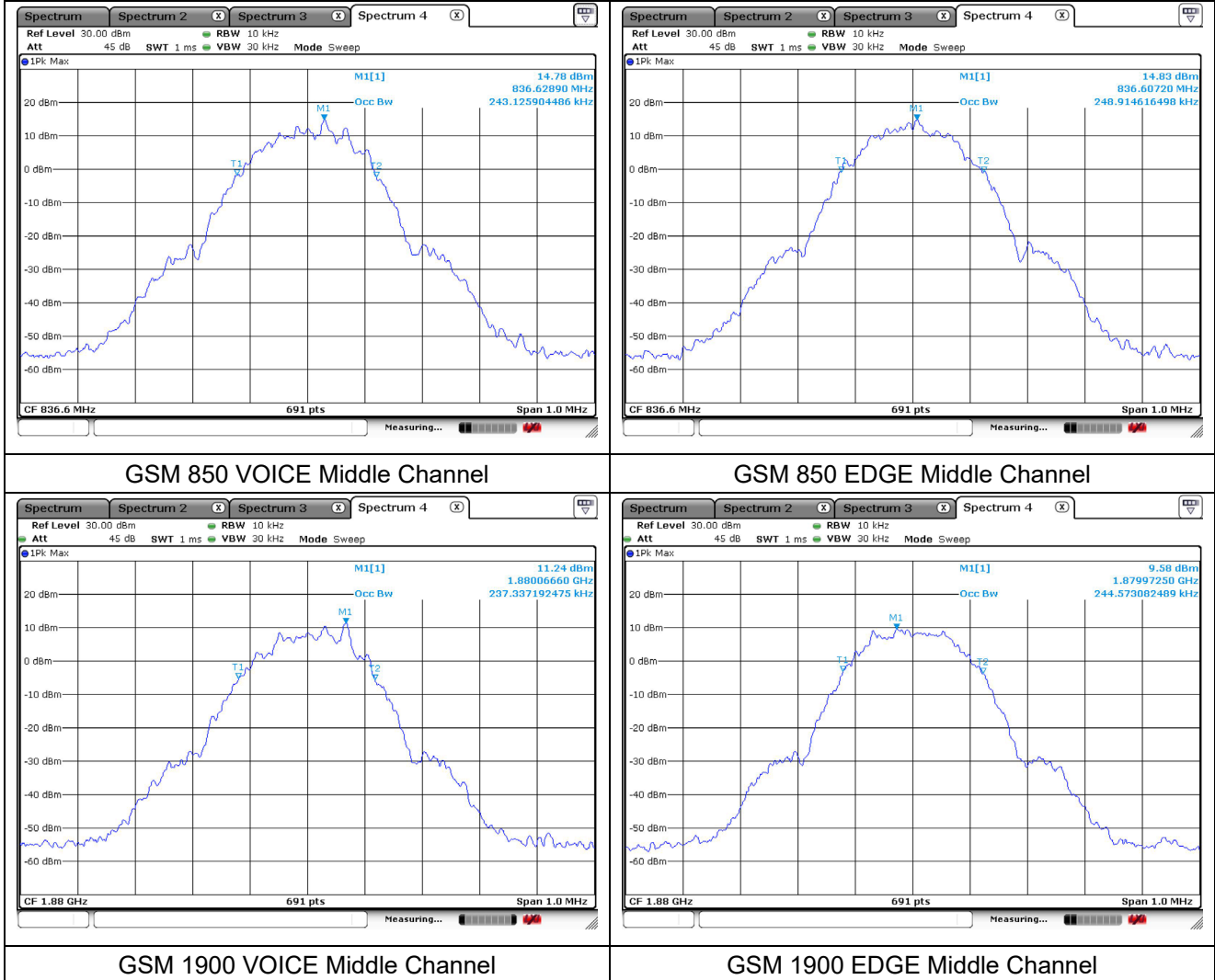
Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
GSM 850	VOICE	836.6	0.242
	EDGE		0.246
GSM 1900	VOICE	1 880.0	0.239
	EDGE		0.245

- Test plots

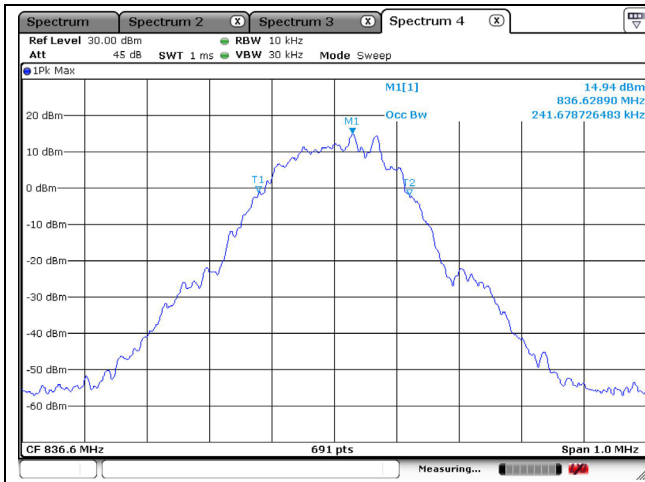
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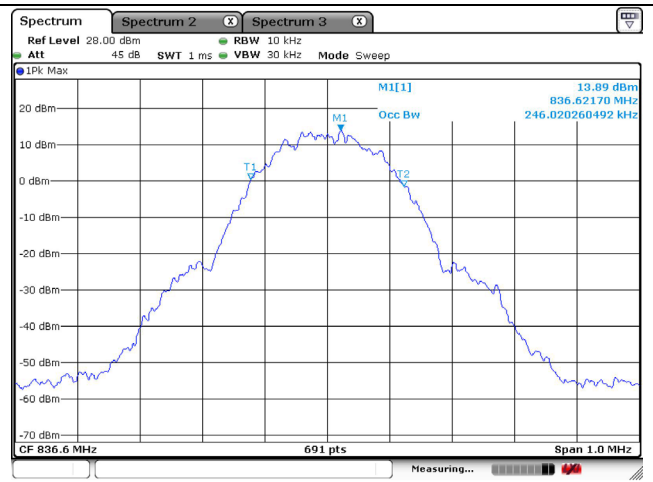
GSM



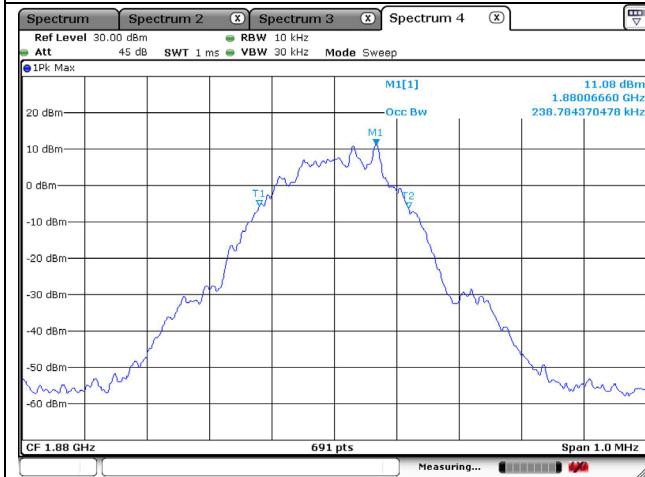
**SIM 2
GSM**



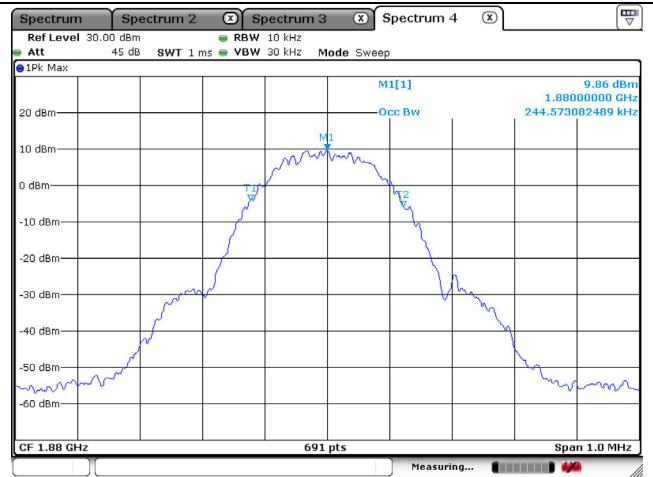
GSM 850 VOICE Middle Channel



GSM 850 EDGE Middle Channel



GSM 1900 VOICE Middle Channel



GSM 1900 EDGE Middle Channel