

EMC

TEST REPORT

Report No. : 150700091TWN-001
Model No. : BEC MX-200
Issued Date : Oct 28, 2015

Applicant: Billion Electric Co., Ltd.
Address: 8f., No.192, Sec.2,Zhongxing Road, Xindian Dist., New Taipei City, Taiwan.

Test Method/ Standard: 47 CFR FCC Part 22, 47 CFR FCC Part 24,
47 CFR FCC Part 2, ANSI/TIA-603-D-2010
KDB 971168 D01 Power Meas License Digital Systems
v02r02

Test By: Intertek Testing Services Taiwan Ltd.
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1. Summary of Test Data

Test Requirement	Applicable Rule	Limit	Result
Conducted Output Power	2.1046	Reporting Only	Pass
Effective Radiated Power	22.913(a)(2)	ERP < 7 Watts	Pass
Equivalent isotropic radiated power	24.232(c)	ERP < 2 Watts	Pass
Frequency Stability	2.1055 22.355 24.235 27.54	< 2.5 ppm / Within frequency range	Pass
Occupied Bandwidth	2.1049 22.917(b) 24.238(a) 27.53(h)	Reporting Only	Pass
Peak to average ratio	24.232(d)	< 13 dB	Pass
Band Edge Measurements	2.1049 2.1051 22.917(a) 24.238(a) 27.53(g)	< 43+10log ₁₀ (P[Watts])	Pass
Conducted Spurious Emissions	2.1051 22.917(a) 24.238(a) 27.53(g)	< 43+10log ₁₀ (P[Watts])	Pass
Radiated Spurious Emissions	2.1053 22.917(a) 24.238(a) 27.53(g)	< 43+10log ₁₀ (P[Watts])	Pass

2. General Information

2.1 Identification of the EUT

Product:	MXConnect M2M Advanced Industrial 4G/LTE Router
Model No:	BEC MX-200
FCC ID:	QI3BIL-MX200
Manufacturer:	Billion Electric Co., Ltd.
Address:	8f., No.192, Sec.2, Zhongxing Road, Xindian Dist., New Taipei City, Taiwan.
TX Frequency:	GSM850: 824.2 MHz ~ 848.8 MHz, GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II:: 1852.4 MHz ~ 1907.6 MHz
RX Frequency:	GSM850: 869.2 MHz ~ 893.8 MHz ,GSM1900: 1930.2 MHz ~ 1989.8 MHz z WCDMA Band V: 871.4 MHz ~ 891.6 MHz WCDMA Band II:: 1932.4 MHz ~ 1987.6 MHz
Maximum Output	GSM850: 32.2 dBm,GSM1900: 29.0 dBm WCDMA Band V: 22.83dBm ,WCDMA Band II: 22.47 dBm
Rated Power:	DC 12 V from adapter
Power Cord:	N/A
Sample Received:	Sep. 30, 2015
Sample condition:	Workable
Test Date(s):	Oct. 1, 2015 ~ Oct. 29, 2015
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Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2.2 Emission designator

FCC Rule	System	Type of Modulation	BW	Emission Designator	Frequency Tolerance (ppm)	Maximum ERP (Watts)	Maximum EIRP (Watts)
Part 22	GSM850 GSM+GPRS	GMSK	0.241	241KGXW	0.022	1.079	-
Part 22	GSM850 GSM+EDGE	8PSK	0.245	245KG7W	0.064	0.290	-
Part 22	WCDMA Band V RMC 12.2Kbps	QPSK	4.181	4M18F9W	0.013	0.125	-
Part 24	GSM1900 GSM/GPRS	GMSK	0.242	242KG7W	0.013	-	0.920 W
Part 24	GSM1900 GSM/EDGE	8PSK	0.241	241KG7W	0.011	-	0.374 W
Part 24	WCDMA Band II RMC 12.2Kbps	QPSK	4.194	4M19F9W	0.012	-	0.205 W

2.3 Description of EUT

Product SW/HW version :	M200_GPS / 1.00C
Radio SW/HW version :	05.05.58.00 / 11
Test SW Version :	N/A

2.4 Antenna description

Antenna 1

Antenna model number : AN0727-64DP5BSM

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain : 0.28 dBi max (850 Band), 0.64 dBi max (1900 Band)
Antenna Type : Dipole antenna
Connector Type : SMA

Antenna 2

Antenna model number : AB0727-88Y04BSM

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain : -1.01 dBi max (850 Band), -0.47 dBi max (1900 Band)
Antenna Type : Dipole antenna
Connector Type : SMA

The model number “ AN0727-64DP5BSM” is worst case in ERP/EIRP measurement.

2.5 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Brand	Model no.	Specification
Adapter	EGB	PAW018A12UL	I/P: 100-240V~, 50-60Hz, 0.5A, O/P: 12Vdc, 1.2A

The above EUT information is declared by Billion Electric Corporation and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

2.6 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data cable
Notebook PC	Dell	Vostro 3350	1YWZK1S	LAN Cable 1 meter

2.7 Applied test modes

Conducted	Test items	Band	Test mode	Modulation	Coding Scheme/Subtest	Test Channel
	Max. Output Power	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	128/190/251
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	512/661/810
		WCDMA Band V	12.2kbps RMC	QPSK	-	4132/4182/4233
		WCDMA Band II	12.2kbps RMC	QPSK	-	9262/9400/9538
		HSDPA Band V	RMC + HSDPA	QPSK	1/2/3/4	4132/4182/4233
		HSDPA Band II	RMC + HSDPA	QPSK	1/2/3/4	9262/9400/9538
		HSPA Band V	RMC + HSPA	QPSK	1/2/3/4/5	4132/4182/4233
		HSPA Band II	RMC + HSPA	QPSK	1/2/3/4/5	9262/9400/9538
	Peak-to-Average Ratio	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1/MCS5	190
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1/MCS5	661
		WCDMA Band V	12.2kbps RMC	QPSK	-	4182
		WCDMA Band II	12.2kbps RMC	QPSK	-	9400
		HSDPA Band V	RMC + HSDPA	QPSK	1	4182
		HSDPA Band II	RMC + HSDPA	QPSK	2	9400
		HSPA Band V	RMC + HSPA	QPSK	1	4182
		HSPA Band II	RMC + HSPA	QPSK	2	9400

	26dB and 99% Bandwidth	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1/MCS5	128/190/251
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1/MCS5	512/661/810
		WCDMA Band V	12.2kbps RMC	QPSK	-	4132/4182/4233
		WCDMA Band II	12.2kbps RMC	QPSK	-	9262/9400/9538
	Conducted Band Edge	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1/MCS5	128 / 251
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1/MCS5	512 / 810
		WCDMA Band V	12.2kbps RMC	QPSK	-	4132 / 4233
		WCDMA Band II	12.2kbps RMC	QPSK	-	9262 / 9538
	Conducted Spurious Emission	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	128/192/251
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	512/661/810
		WCDMA Band V	12.2kbps RMC	QPSK	-	4132/4182/4233
		WCDMA Band II	12.2kbps RMC	QPSK	-	9262/9400/9538
	Frequency Stability	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	128 / 251
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	512 / 810
		WCDMA Band V	12.2kbps RMC	QPSK	-	4132 / 4233
		WCDMA Band II	12.2kbps RMC	QPSK	-	9262 / 9538
Radiated	E.I.R.P / E.R.P	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	128/190/251
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	512/661/810

		WCDMA Band V	12.2kbps RMC	QPSK	-	4132/4182/4233
		WCDMA Band II	12.2kbps RMC	QPSK	-	9262/9400/9538
		HSDPA Band V	RMC + HSDPA	QPSK	1	4132/4182/4233
		HSDPA Band II	RMC + HSDPA	QPSK	2	9262/9400/9538
		HSPA Band V	RMC + HSPA	QPSK	1	4132/4182/4233
		HSPA Band II	RMC + HSPA	QPSK	2	9262/9400/9538
	Radiated Spurious Emission	GSM 850	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	128/190/251
		GSM 1900	GPRS/EGPRS	GMSK/8PSK	CS-1,MCS5	512/661/810
		WCDMA Band V	12.2kbps RMC	QPSK	-	4132/4182/4233
		WCDMA Band II	12.2kbps RMC	QPSK	-	9262/9400/9538
		HSDPA Band V	RMC + HSDPA	QPSK	1	4132/4182/4233
		HSDPA Band II	RMC + HSDPA	QPSK	2	9262/9400/9538
		HSPA Band V	RMC + HSPA	QPSK	1	4132/4182/4233
		HSPA Band II	RMC + HSPA	QPSK	2	9262/9400/9538

2.8 Applied test axis

Pre-Scan has been executed at X , Y , Z axis. The worst case is as below.

Radiated test item	Mode	Axis
Radiated Spurious Emission	GSM	X
	WCDMA	X

2.9 Applied standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

FCC 47 CFR Part 2

FCC 47 CFR Part 22

FCC 47 CFR Part 24

FCC 47 CFR Part 27

ANSI/TIA-603-D-2010

FCC KDB 412172 D01 Determining ERP and EIRP v01r01

FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02

3. Output Power Measurement

3.1 Test conditions

Temperature:	24	°C
Relative Humidity:	57	%
Atmospheric Pressure	1008	hPa

3.2 Limit for output power measurement

§22.913(a)(2)

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.

3.3 Test procedure

3.3.1 Conducted power measurement

1. The EUT was established communication with base station simulator and set up to transmit the maximum power.
2. Set the EUT to transmit at low, middle and high channel and record the power level on the base station simulator.
- 3,According to KDB 412172 D01 Power Approach

$ERP/EIRP = P_T + G_T - L_C$, $ERP = EIRP - 2.15$,
where;

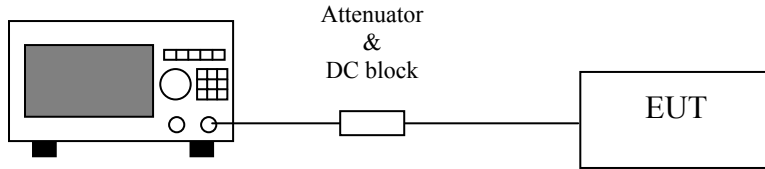
P_T =transmitter output power, in dBW, dBm

G_T = gain of the transmitting antenna, in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna,in dB.

3.4 Test diagram

3.4.1 Conducted test setup



Base station simulator

3.5 Test results

3.5.1 Conducted output power

Mode	Ch.	Freq.	1 time slot		2 time slots	
			Average(dBm)	Peak(dBm)	Average(dBm)	Peak(dBm)
GPRS	128	824.2	32.2	32.4	32.0	32.2
	190	836.6	32.2	32.4	32.0	32.1
	251	848.8	32.1	32.3	31.8	32.0
GPRS	512	1850.2	29.0	32.3	28.7	28.9
	661	1880.0	28.7	29.1	28.5	28.7
	810	1909.8	28.7	28.9	28.7	28.9

Mode	Ch.	Freq.	1 time slot		2 time slots		3 time slots		4 time slots	
			Average (dBm)	Peak (dBm)	Average (dBm)	Peak (dBm)	Average (dBm)	Peak (dBm)	Average (dBm)	Peak (dBm)
EGPRS	128	824.2	26.5	29.5	26.3	29.4	26.2	29.3	26.1	29.2
	190	836.6	26.4	29.5	26.3	29.3	26.2	29.2	26.0	29.1
	251	848.8	26.4	29.4	26.4	29.5	26.2	29.3	26.0	29.0
EGPRS	512	1850.2	25.0	28.1	24.9	28.0	24.8	27.9	24.8	27.9
	661	1880.0	25.1	28.1	25.0	28.0	24.9	28.0	24.9	28.0
	810	1909.8	25.0	28.1	24.9	27.9	24.8	27.9	24.8	27.9

Mode	Ch.	Freq.	Average(dBm)	Peak(dBm)
WCDMA Rel99 Band V	4132	826.4	22.76	25.94
	4182	836.4	22.83	26.17
	4233	846.6	22.67	25.86
WCDMA Rel99 Band II	9262	1850.2	22.47	25.95
	9400	1880.0	22.41	25.81
	9538	1909.8	22.46	25.78

Band	Subtest	Channel	Freq.	Peak power (dBm)	Average Power (dBm)
Band 5 HSDPA 850MHz	1	4132	826.4	25.85	21.47
		4182	836.4	26.01	21.67
		4233	846.6	26.05	21.73
	2	4132	826.4	25.87	20.97
		4182	836.4	25.85	21.18
		4233	846.6	25.67	21.04
	3	4132	826.4	25.76	21.1
		4182	836.4	25.65	21.29
		4232	846.6	26.15	21.26
	4	4132	826.4	26.28	21.16
		4182	836.4	25.67	21.27
		4233	846.6	25.82	21.25

Band	Subtest	Channel	Freq.	Peak power (dBm)	Average Power (dBm)
Band 2 HSDPA 1900MHz	1	9262	1852.4	26.07	21.85
		9400	1880	26.02	21.97
		9538	1907.6	25.81	21.92
	2	9262	1852.4	26.75	21.9
		9400	1880	26.03	21.99
		9538	1907.6	26.6	21.95
	3	9262	1852.4	26.21	21.46
		9400	1880	26.23	21.54
		9538	1907.6	25.93	21.45
	4	9262	1852.4	26.35	21.45
		9400	1880	25.79	21.46
		9538	1907.6	26.57	21.55

Band	Subtest	Channel	Freq.	Peak power (dBm)	Average Power (dBm)
Band 5 HSPA 850MHz	1	4132	826.4	26.86	21.53
		4182	836.4	26.84	21.71
		4233	846.6	26.06	21.66
	2	4132	826.4	25.12	20.42
		4182	836.4	24.78	20.65
		4233	846.6	24.58	20.54
	3	4132	826.4	25.99	21.58
		4182	836.4	26.22	21.77
		4233	846.6	26.08	21.76
	4	4132	826.4	25.73	21.59
		4182	836.4	25.81	21.75
		4233	846.6	25.8	21.74
	5	4132	826.4	26	21.6
		4182	836.4	27.07	21.7
		4233	846.6	26.62	21.73

Band	Subtest	Channel	Freq.	Peak power (dBm)	Average Power (dBm)
Band 2 HSPA 1900MHz	1	9262	1852.4	25.96	21.88
		9400	1880	25.95	22.06
		9538	1907.6	25.7	22.07
	2	9262	1852.4	25.62	21.36
		9400	1880	25.6	21.48
		9538	1907.6	25.56	21.52
	3	9262	1852.4	26.65	21.85
		9400	1880	26.98	21.88
		9538	1907.6	26.25	22.02
	4	9262	1852.4	26.03	21.82
		9400	1880	26.26	21.98
		9538	1907.6	26	21.9
	5	9262	1852.4	26.52	21.9
		9400	1880	26.02	21.95
		9538	1907.6	26.45	21.97

3.5.2 Radiated output power

Average E.R.P. for 850 Band

Mode	Channel	Freq.	Conducted Power (dBm)	Ant Gain (dBi)	ERP (dBm)
GPRS	128	824.2	32.2	0.28	30.33
	190	836.6	32.2	0.28	30.33
	251	848.8	32.1	0.28	30.23
EGPRS	128	824.2	26.5	0.28	24.63
	190	836.6	26.4	0.28	24.53
	251	848.8	26.4	0.28	24.53
WCDMA REL 99	4132	826.4	22.76	0.28	20.89
	4182	836.4	22.83	0.28	20.96
	4233	846.6	22.67	0.28	20.8
HSDPA REL 5	4132	826.4	21.47	0.28	19.6
	4182	836.4	21.67	0.28	19.8
	4233	846.6	21.73	0.28	19.86
HSPA REL 6	4132	826.4	21.58	0.28	19.71
	4182	836.4	21.77	0.28	19.9
	4233	846.6	21.76	0.28	19.89

Note: ERP = Conducted Power + Ant Gain(dBi) – 2.15

Average E.I.R.P. for 1900 Band

Mode	Channel	Freq.	Conducted (dBm)	Ant Gain (dBi)	EIRP
GPRS	512	1850.2	29.0	0.64	29.64
	661	1880.0	28.7	0.64	29.34
	810	1909.8	28.7	0.64	29.34
EGPRS	512	1850.2	25.0	0.64	25.64
	661	1880.0	25.1	0.64	25.74
	810	1909.8	25.0	0.64	25.64
WCDMA REL 99	9262	1850.2	22.47	0.64	23.11
	9400	1880	22.41	0.64	23.05
	9538	1909.8	22.46	0.64	23.1
HSDPA REL5	9262	1852.4	21.9	0.64	22.54
	9400	1880	21.99	0.64	22.63
	9538	1907.6	21.95	0.64	22.59
HSPA REL6	9262	1852.4	21.88	0.64	22.52
	9400	1880	22.06	0.64	22.7
	9538	1907.6	22.07	0.64	22.71

Note: EIRP = Conducted Power + Ant Gain(dBi)

4. Frequency Stability

4.1 Test conditions

Temperature:	-30~50	°C
Relative Humidity:	55	%
Atmospheric Pressure	1008	hPa

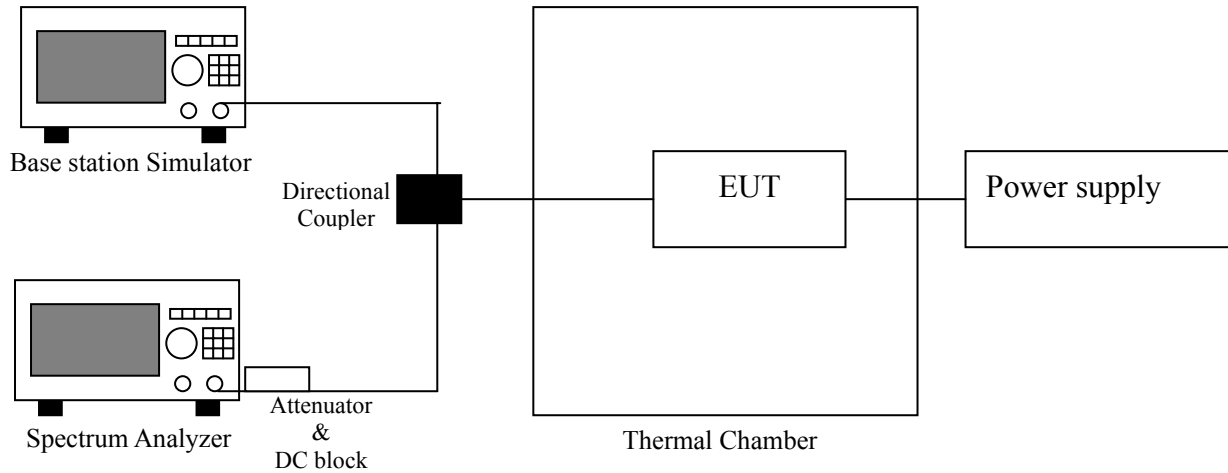
4.2 Limit for frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

4.3 Test procedure

1. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer and Base station Simulator.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency.
5. Repeat step 2 and 3 with the temperature chamber set to the specific temperature. The temperature is decreased by 10 degrees, allowed to stabilize, and then the measurement is repeated. This is repeated until -30°C is reached.
6. The test chamber was allowed to stabilize at +25degree C for minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record

4.4 Test diagram



4.5 Test results

Voltage V.S. Frequency Stability

GPRS 850					
Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F _{Low} @-13dBm MHz	F _{High} @-13dBm MHz		
Temperature	Voltage				
Normal(25°C)	Normal	824.03	849.02		
Extreme(50°C)		824.02	848.98	14	0.017
Extreme(40°C)		824.02	848.98	10	0.012
Extreme(30°C)		824.03	848.98	13	0.016
Extreme(10°C)		824.02	848.97	13	0.015
Extreme(0°C)		824.02	848.97	16	0.019
Extreme(-10°C)		824.02	848.97	18	0.022
Extreme(-20°C)		824.03	848.98	16	0.019
Extreme(-30°C)		824.03	848.98	14	0.017
25°C		+15%	824.02	848.99	11
	-15%	824.03	848.98	14	0.017

EGPRS 850					
Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F _{Low} @-13dBm MHz	F _{High} @-13dBm MHz		
Temperature	Voltage				
Normal(25°C)	Normal	824.04	848.96		
Extreme(50°C)		824.03	848.96	9	0.011
Extreme(40°C)		824.04	848.96	11	0.013
Extreme(30°C)		824.04	848.96	53	0.064
Extreme(10°C)		824.04	848.96	11	0.013
Extreme(0°C)		824.04	848.96	7	0.008
Extreme(-10°C)		824.03	848.96	6	0.007
Extreme(-20°C)		824.04	848.96	9	0.011
Extreme(-30°C)		824.03	848.96	10	0.012
25°C	+15%	824.03	848.95	20	0.024
	-15%	824.04	848.96	6	0.007

GPRS 1900					
Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F _{Low} @-13dBm MHz	F _{High} @-13dBm MHz		
Temperature	Voltage				
Normal(25°C)	Normal	1850.04	1909.97		
Extreme(50°C)		1850.04	1909.97	19	0.010
Extreme(40°C)		1850.03	1909.96	16	0.008
Extreme(30°C)		1850.04	1909.97	16	0.008
Extreme(10°C)		1850.03	1909.97	14	0.008
Extreme(0°C)		1850.03	1909.96	17	0.009
Extreme(-10°C)		1850.03	1909.97	17	0.009
Extreme(-20°C)		1850.04	1909.97	23	0.012
Extreme(-30°C)		1850.03	1909.97	24	0.013
25°C	+15%	1850.04	1909.96	18	0.010
	-15%	1850.02	1909.97	16	0.009

EGPRS 1900					
Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F _{Low} @-13dBm MHz	F _{High} @-13dBm MHz		
Temperature	Voltage				
Normal(25°C)	Normal	1850.04	1909.95		
Extreme(50°C)		1850.05	1909.95	21	0.011
Extreme(40°C)		1850.05	1909.95	15	0.008
Extreme(30°C)		1850.04	1909.95	14	0.008
Extreme(10°C)		1850.04	1909.96	15	0.008
Extreme(0°C)		1850.04	1909.95	13	0.007
Extreme(-10°C)		1850.05	1909.96	16	0.009
Extreme(-20°C)		1850.05	1909.95	14	0.008
Extreme(-30°C)		1850.05	1909.95	16	0.008
25°C	+15%	1850.04	1909.95	16	0.008
	-15%	1850.04	1909.96	15	0.008

WCDMA REL99 Band V					
Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F _{Low} @-13dBm MHz	F _{High} @-13dBm MHz		
Temperature	Voltage				
Normal(25°C)	Normal	824.03	848.94		
Extreme(50°C)		824.04	848.95	6	0.007
Extreme(40°C)		824.06	848.94	6	0.007
Extreme(30°C)		824.04	848.95	5	0.006
Extreme(10°C)		824.05	848.96	7	0.008
Extreme(0°C)		824.04	848.95	7	0.008
Extreme(-10°C)		824.03	848.95	9	0.011
Extreme(-20°C)		824.03	848.95	8	0.009
Extreme(-30°C)		824.05	848.96	8	0.009
25°C	+15%	824.03	848.95	11	0.013
	-15%	824.05	848.94	10	0.012

WCDMA REL99 Band II					
Limit		1850	1907.6	Delta (Hz)	Frequency Stability (ppm)
Condition		F _{Low}	F _{High}		
Temperature	Voltage	@-13dBm MHz	@-13dBm MHz		
Normal(25°C)	Normal	1850.05	1909.95		
Extreme(50°C)		1850.04	1909.94	13	0.007
Extreme(40°C)		1850.06	1909.95	18	0.009
Extreme(30°C)		1850.05	1909.95	20	0.011
Extreme(10°C)		1850.06	1909.94	15	0.008
Extreme(0°C)		1850.03	1909.94	22	0.012
Extreme(-10°C)		1850.03	1909.95	16	0.009
Extreme(-20°C)		1850.07	1909.94	16	0.009
Extreme(-30°C)		1850.06	1909.94	14	0.008
25°C	+15%	1850.04	1909.95	12	0.006
	-15%	1850.04	1909.94	13	0.007

5. Occupied Bandwidth Measurement

5.1 Test conditions

Temperature:	23	°C
Relative Humidity:	57	%
Atmospheric Pressure	1008	hPa

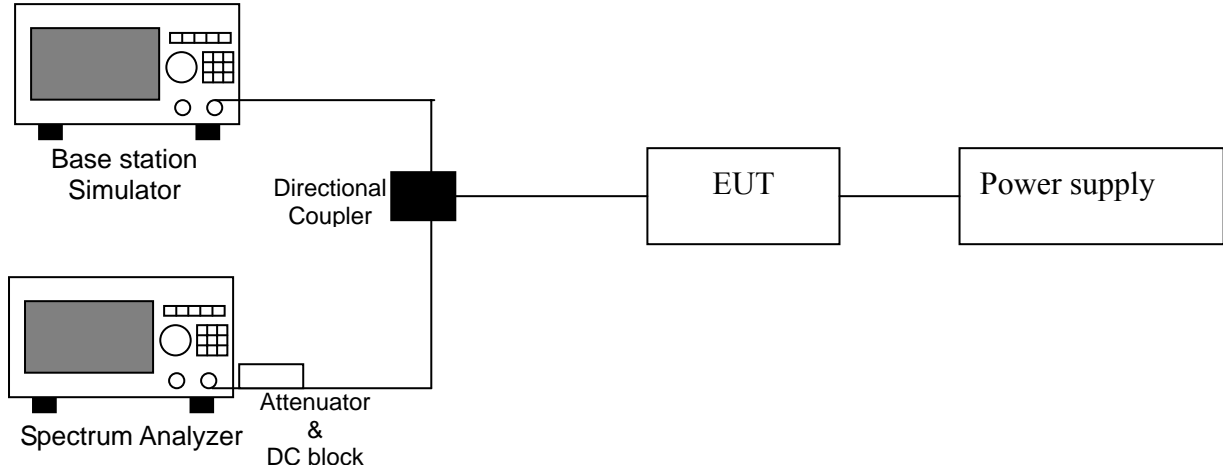
5.2 Limit for minimum occupied bandwidth

The occupied bandwidth (OBW), that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission,

5.4 Test procedure

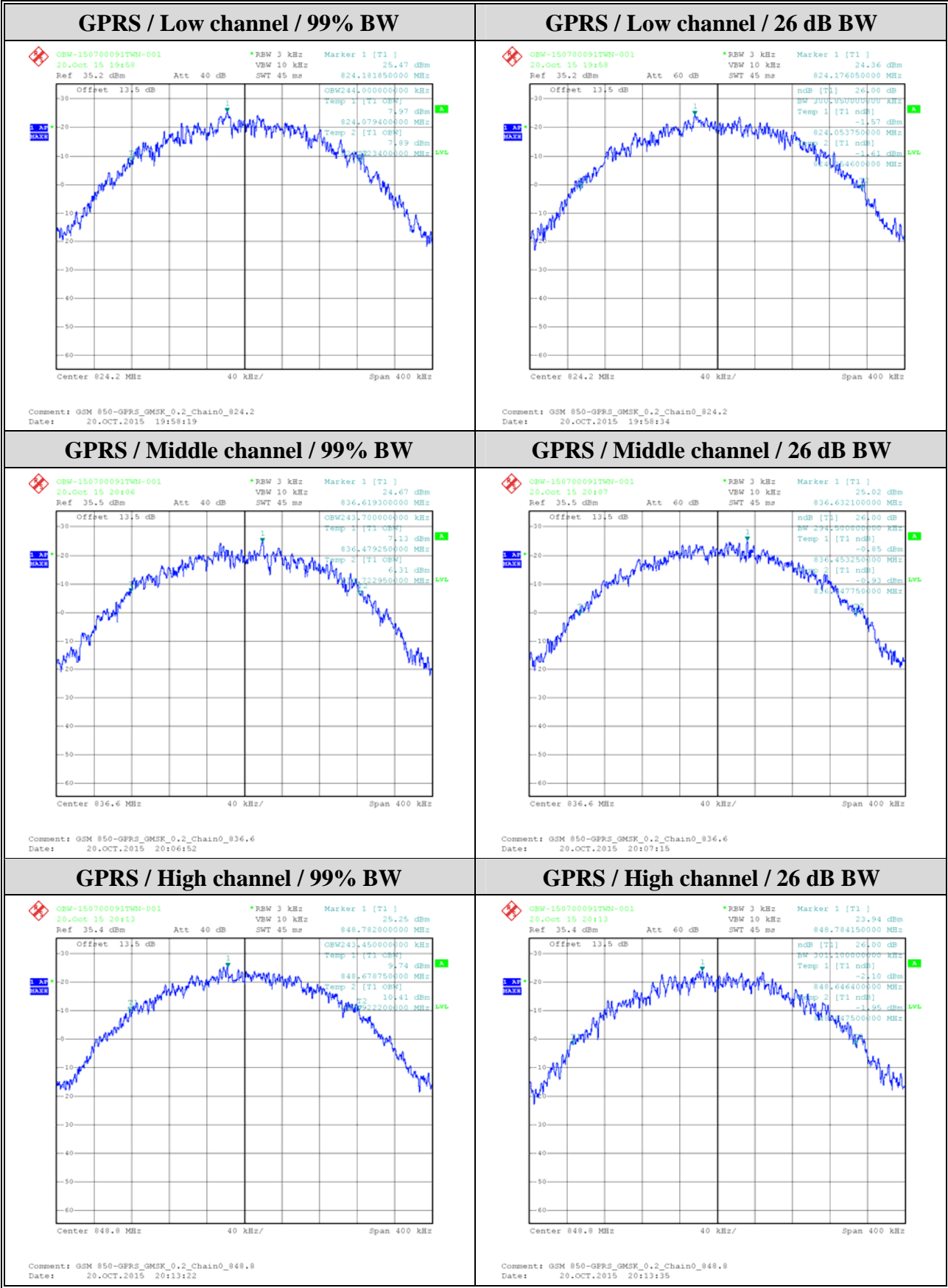
1. The conducted occupied bandwidth test used the directional coupler via EUT RF power connector between Base station Simulator and spectrum analyzer.
2. Use OBW measurement function of Spectrum analyzer to measure 99 % Occupied bandwidth.

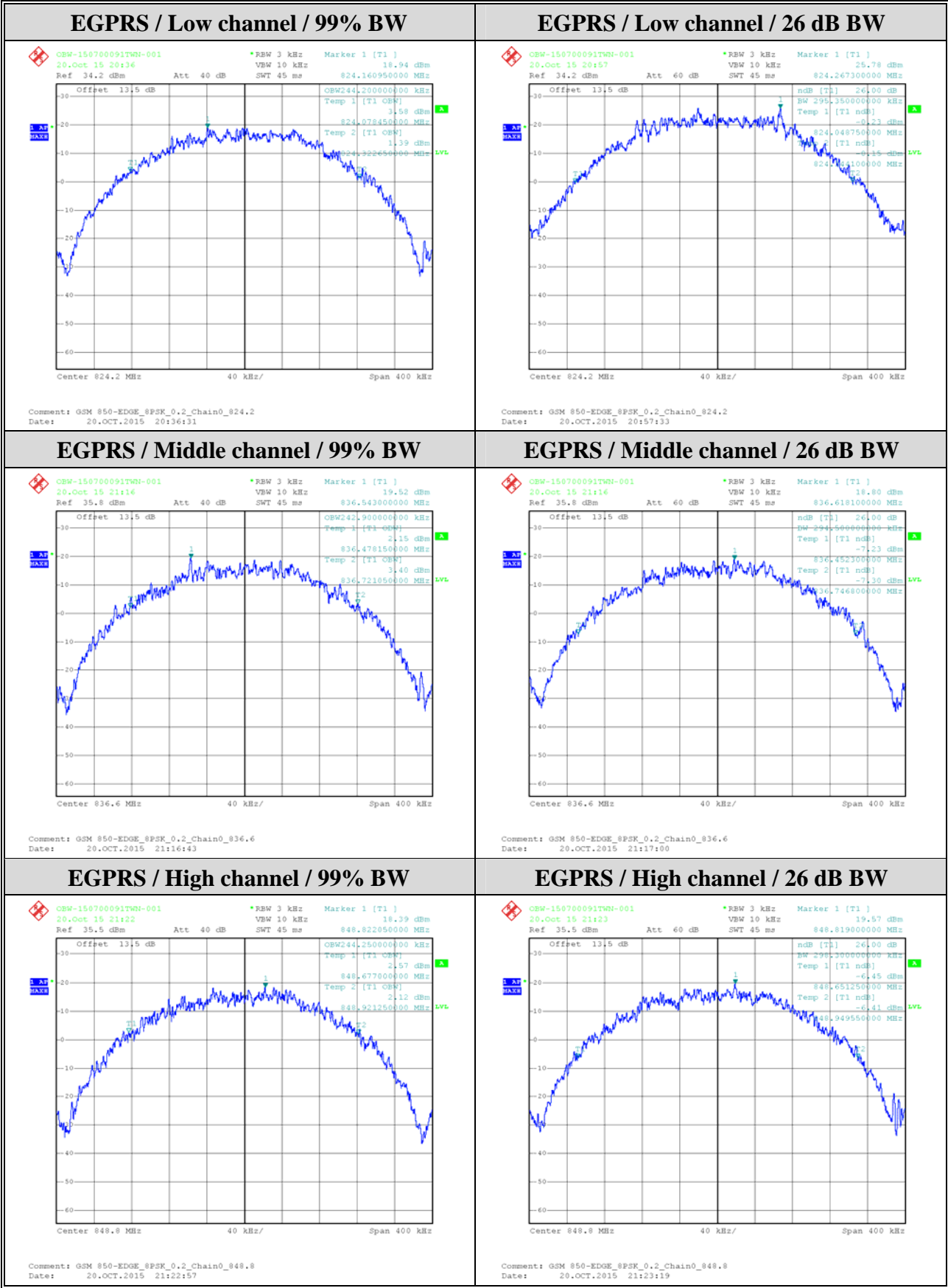
5.5 Test diagram

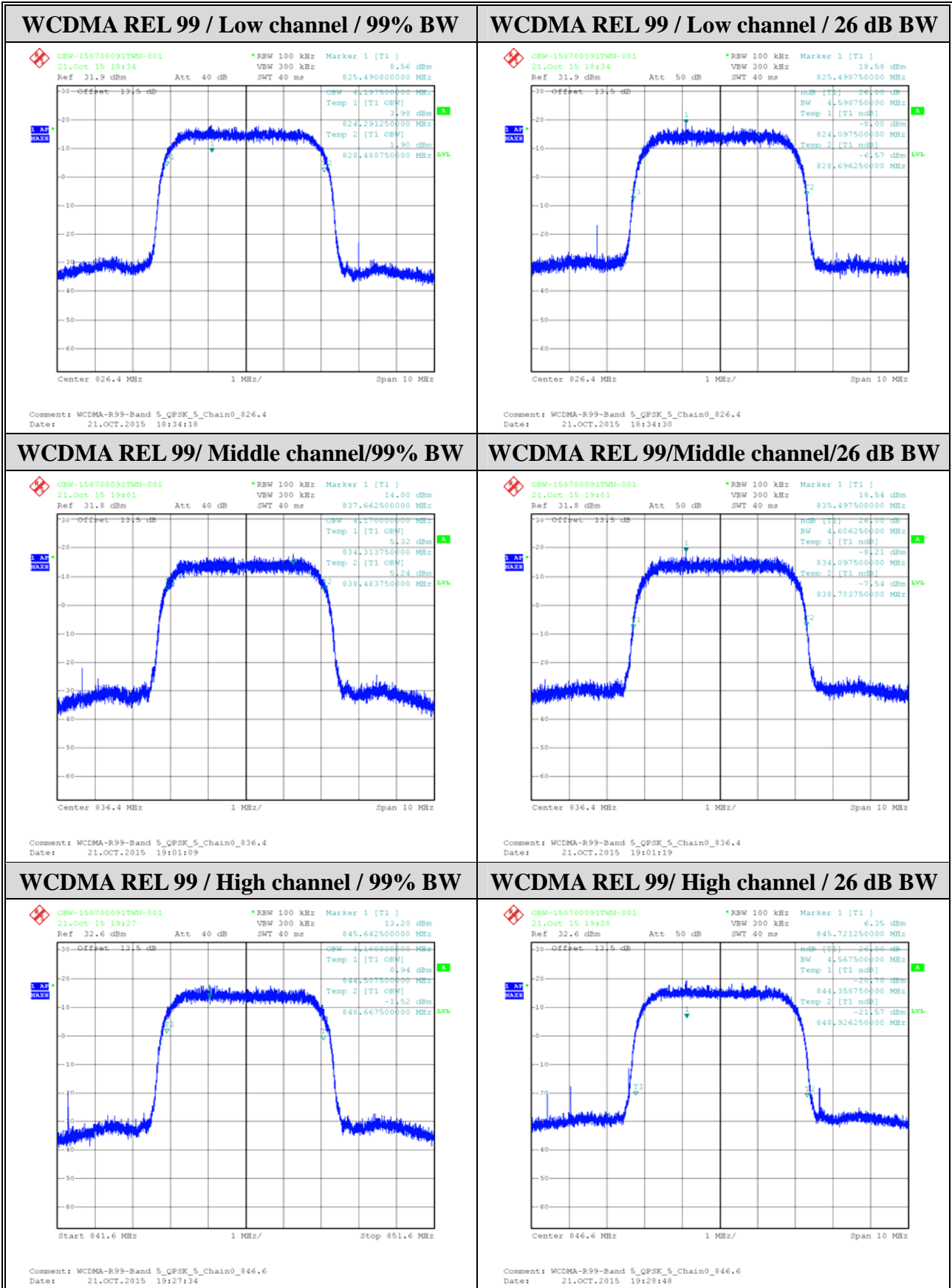


5.6 Test results

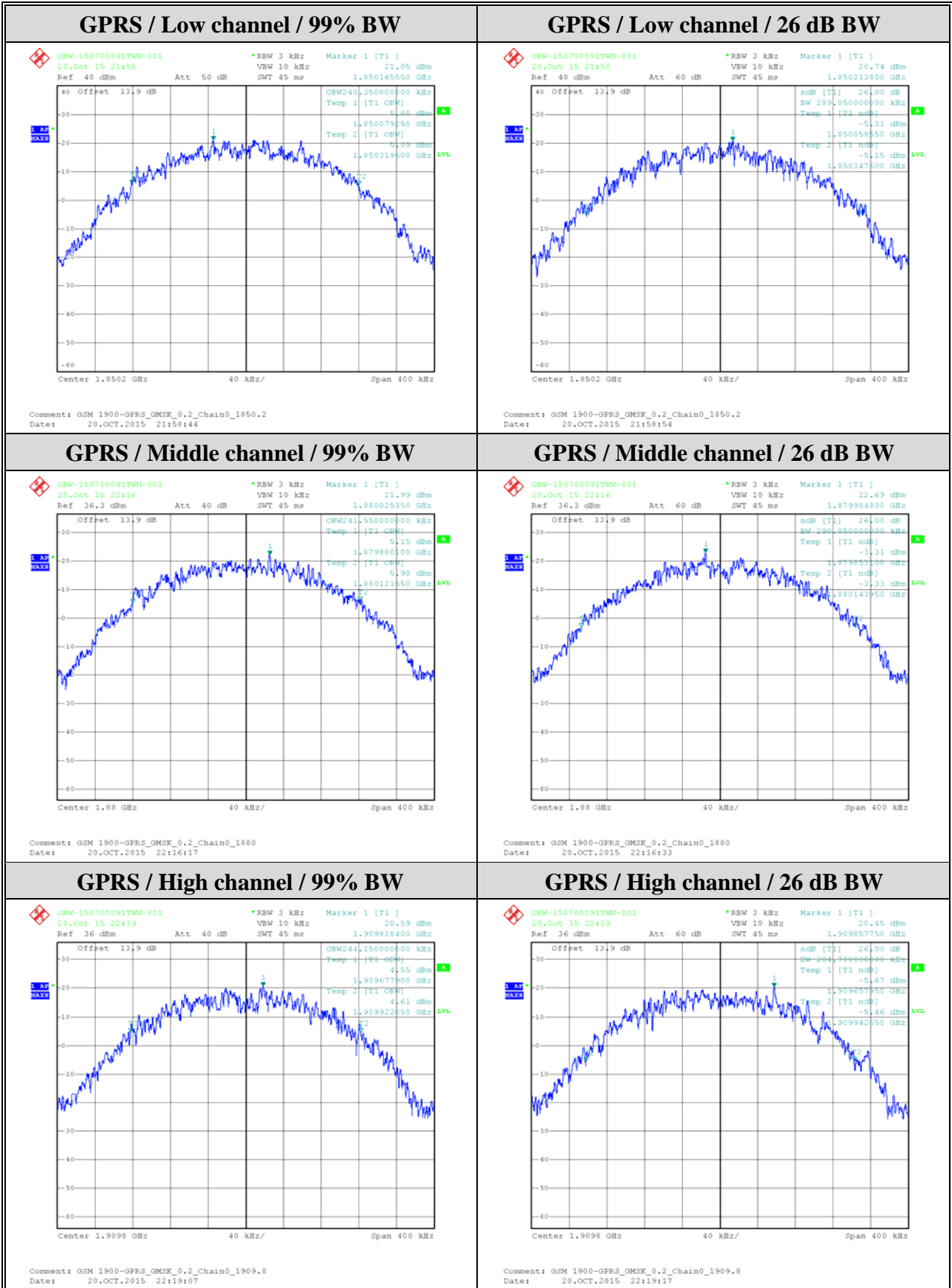
850 Band				
Mode	Channel	Frequency (MHz)	Bandwidth (MHz)	
			99%	26 dB
GPRS	128	824.2	0.241	0.301
	190	836.6	0.207	0.295
	251	848.8	0.236	0.301
EGPRS	128	824.2	0.228	0.295
	190	836.6	0.245	0.295
	251	848.8	0.243	0.298
WCDMA REL 99	4132	826.4	4.159	4.599
	4182	836.4	4.181	4.606
	4233	846.6	4.155	4.611

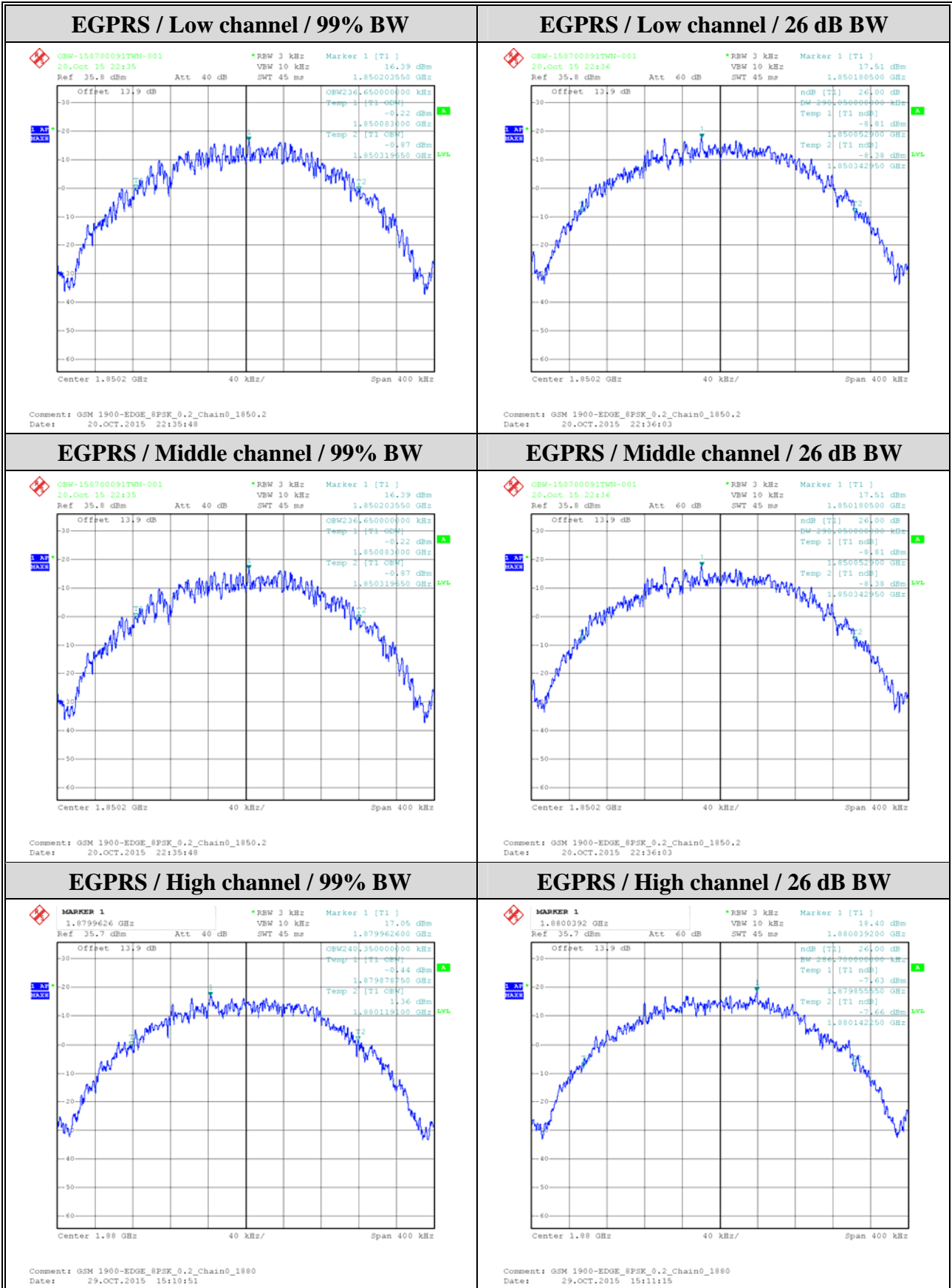


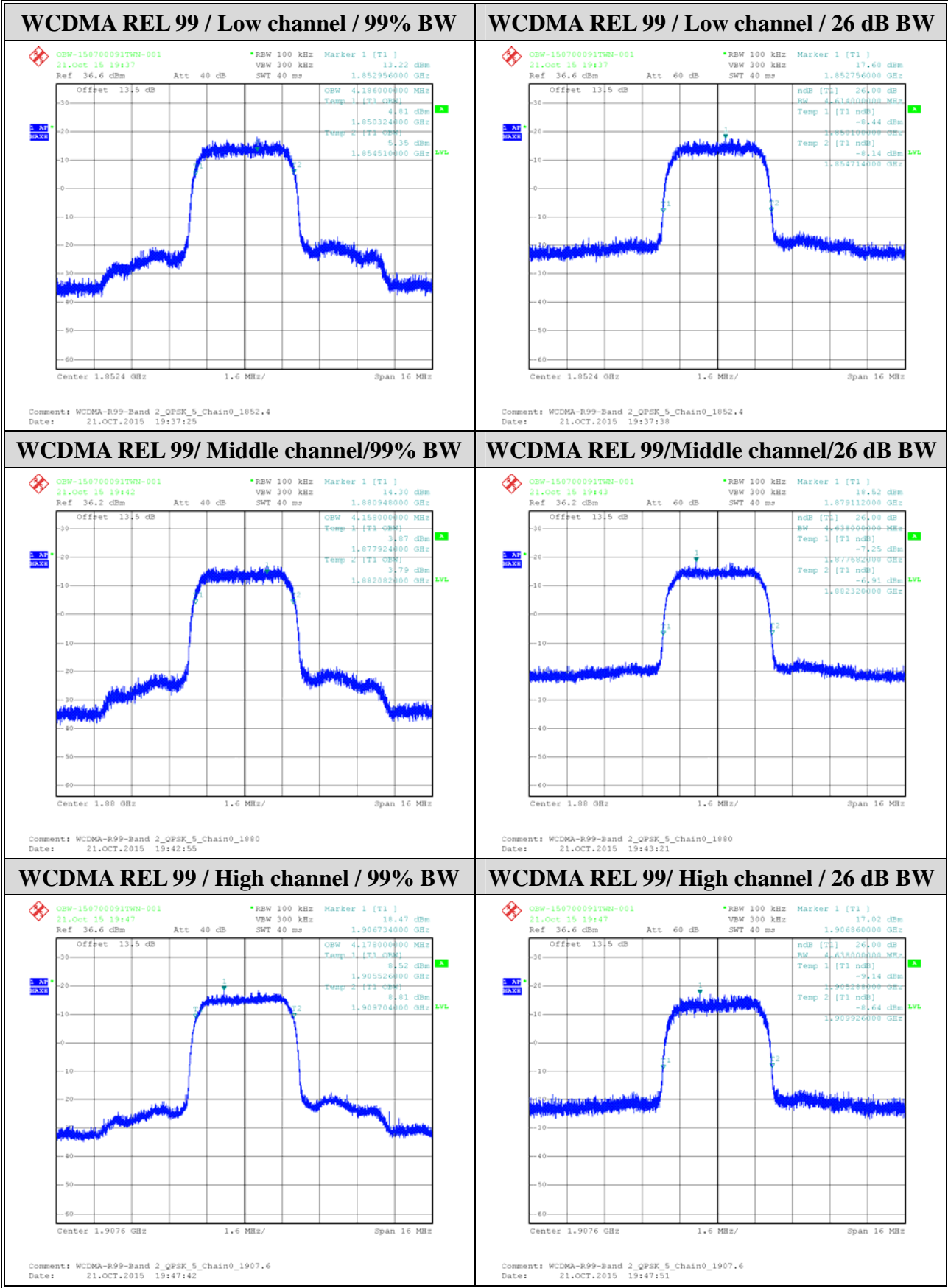




1900 Band				
Mode	Channel	Frequency (MHz)	Bandwidth (MHz)	
			99%	26 dB
GPRS	512	1850.2	0.240	0.289
	661	1880	0.242	0.291
	810	1909.8	0.242	0.285
EGPRS	512	1850.2	0.227	0.290
	661	1880	0.240	0.290
	810	1909.8	0.241	0.296
WCDMA REL 99	9262	1852.4	4.178	4.614
	9400	1880.0	4.178	4.638
	9538	1907.6	4.194	4.638







6. Peak Excursion to Average Ratio

6.1 Test conditions

Temperature:	22	°C
Relative Humidity:	58	%
Atmospheric Pressure	1008	hPa

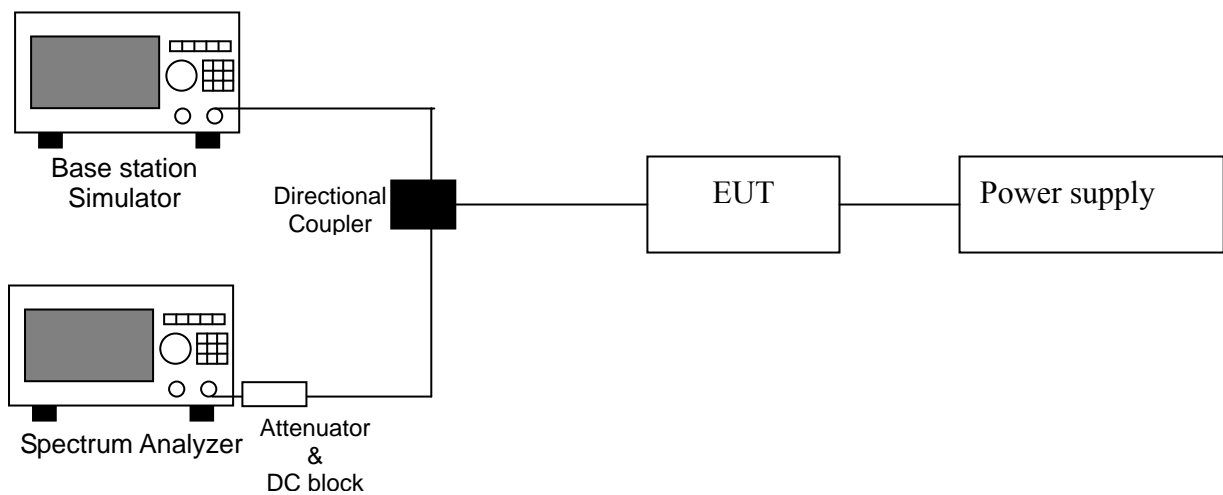
6.2 Limit for peak excursion to average ratio

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

6.3 Test procedure

1. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAR level associated with a probability of 0.1%.

6.4 Test diagram

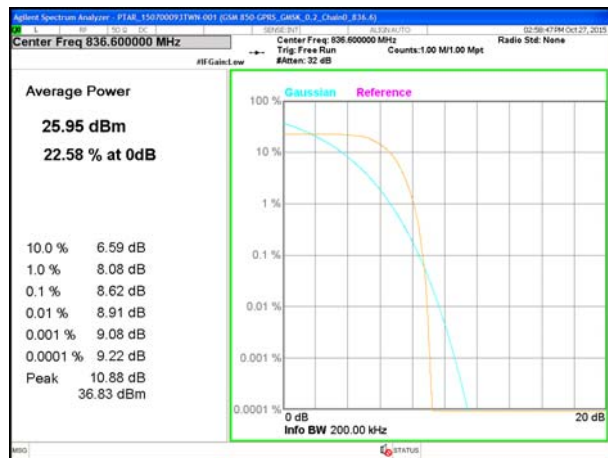


6.5 Test results

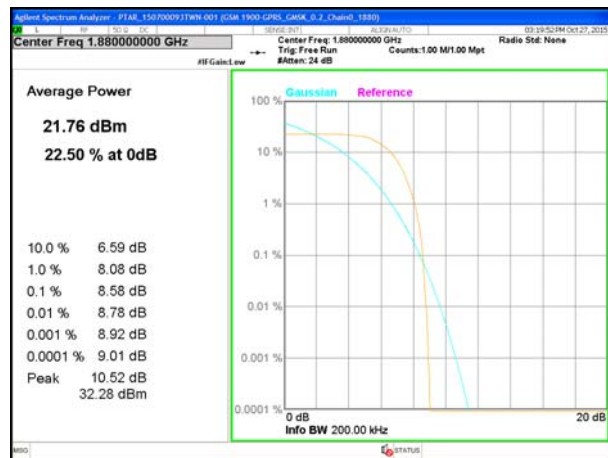
850 Band			
Mode	Channel	Frequency (MHz)	PAR(dB)
GPRS	190	836.6	8.62
EGPRS	190	836.6	9.12
WCDMA REL 99	4182	836.4	3.12
HSDPA REL5	4182	836.4	3.24
HSPA REL6	4182	836.4	3.25

1900 Band			
Mode	Channel	Frequency (MHz)	PAR(dB)
GPRS	661	1880	8.58
EGPRS	661	1880	8.87
WCDMA REL 99	9400	1880	3.17
HSDPA REL 5	9400	1880	3.91
HSPA REL6	9400	1880	4.25

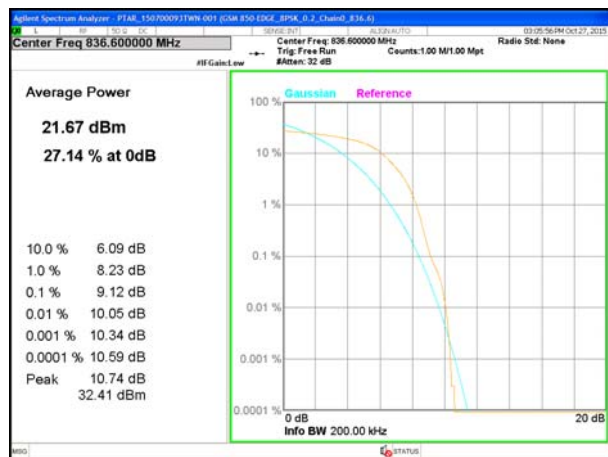
GPRS / Middle channel / 850 Band



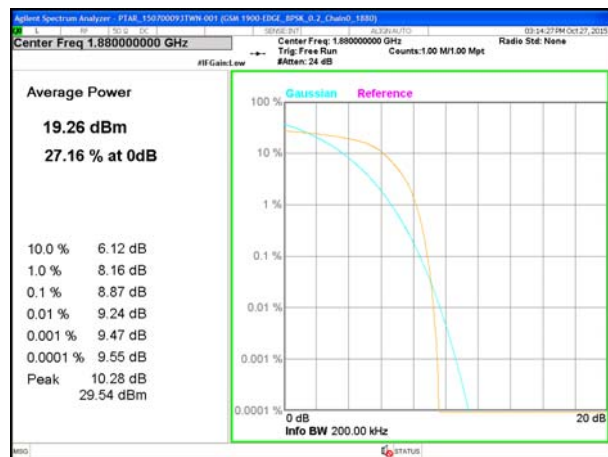
GPRS / Middle channel / 1900 Band



EGPRS / Middle channel / 850 Band



EGPRS / Middle channel / 1900 Band

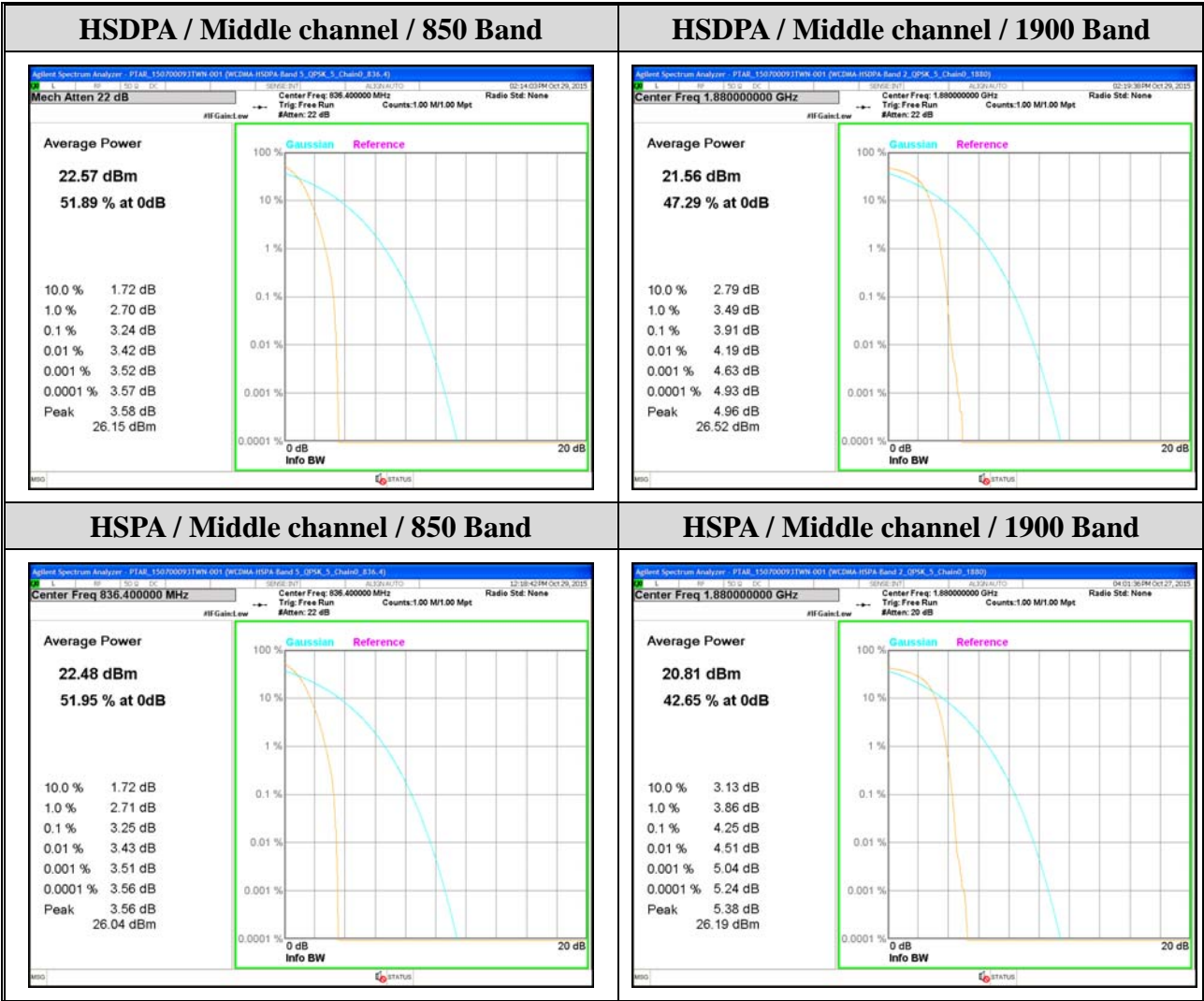


WCDMA / Middle channel / 850 Band



WCDMA / Middle channel / 1900 Band





7. Emission on the Band Edge

7.1 Test conditions

Temperature:	23	°C
Relative Humidity:	57	%
Atmospheric Pressure	1008	hPa

7.2 Limit for emission on the band edge

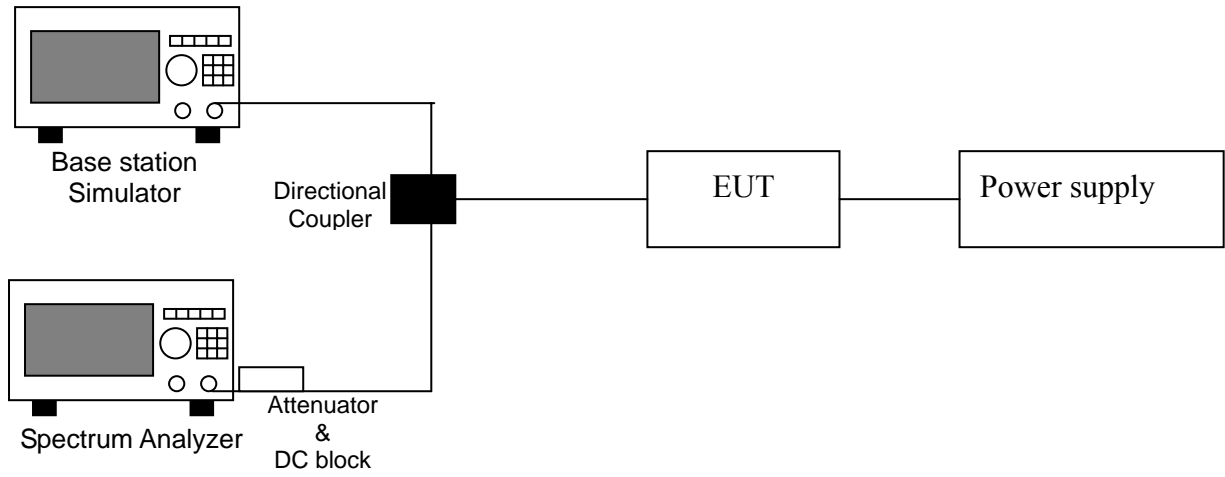
§22.917(a) & §24.238(a)

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.

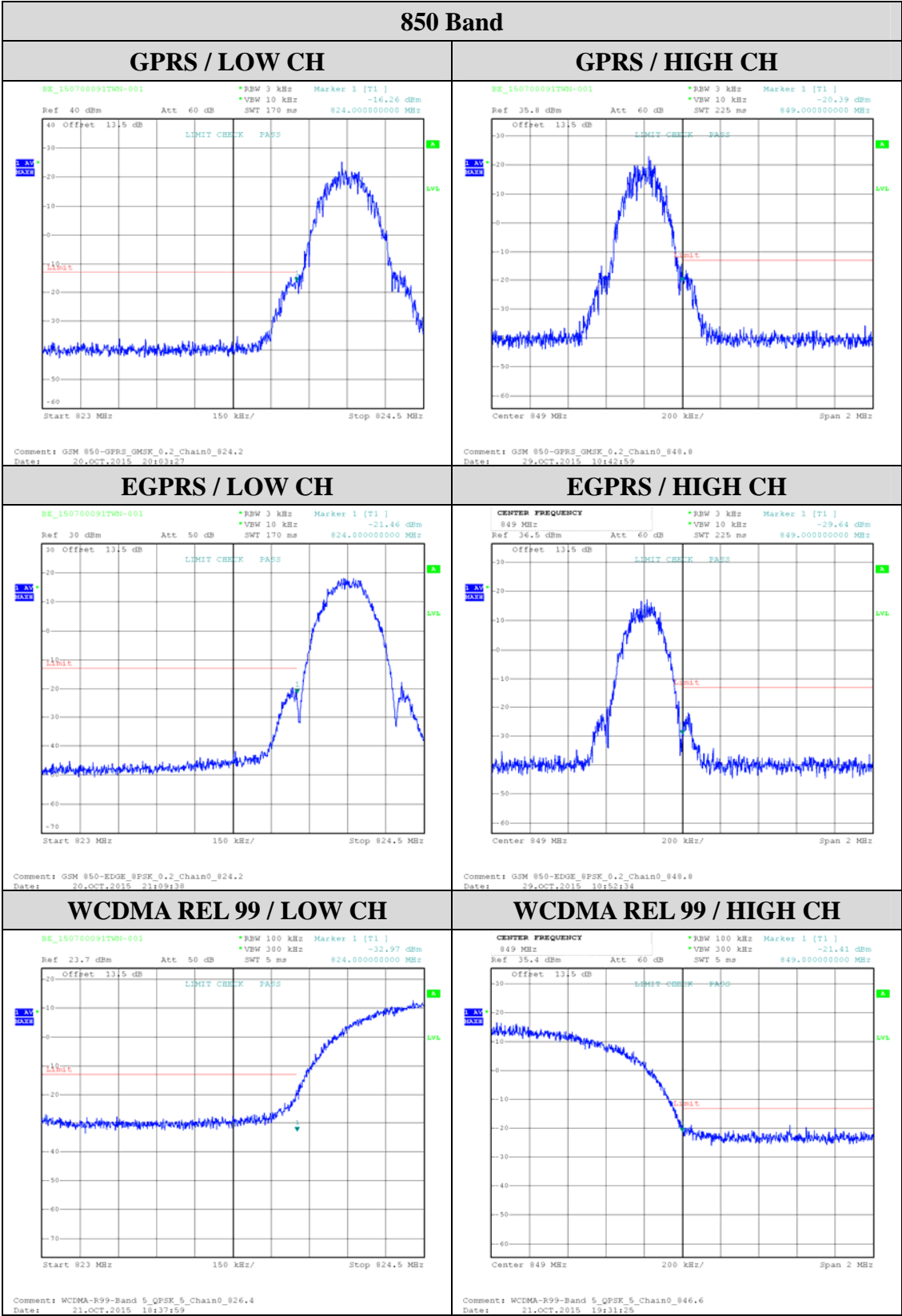
7.3 Test procedure

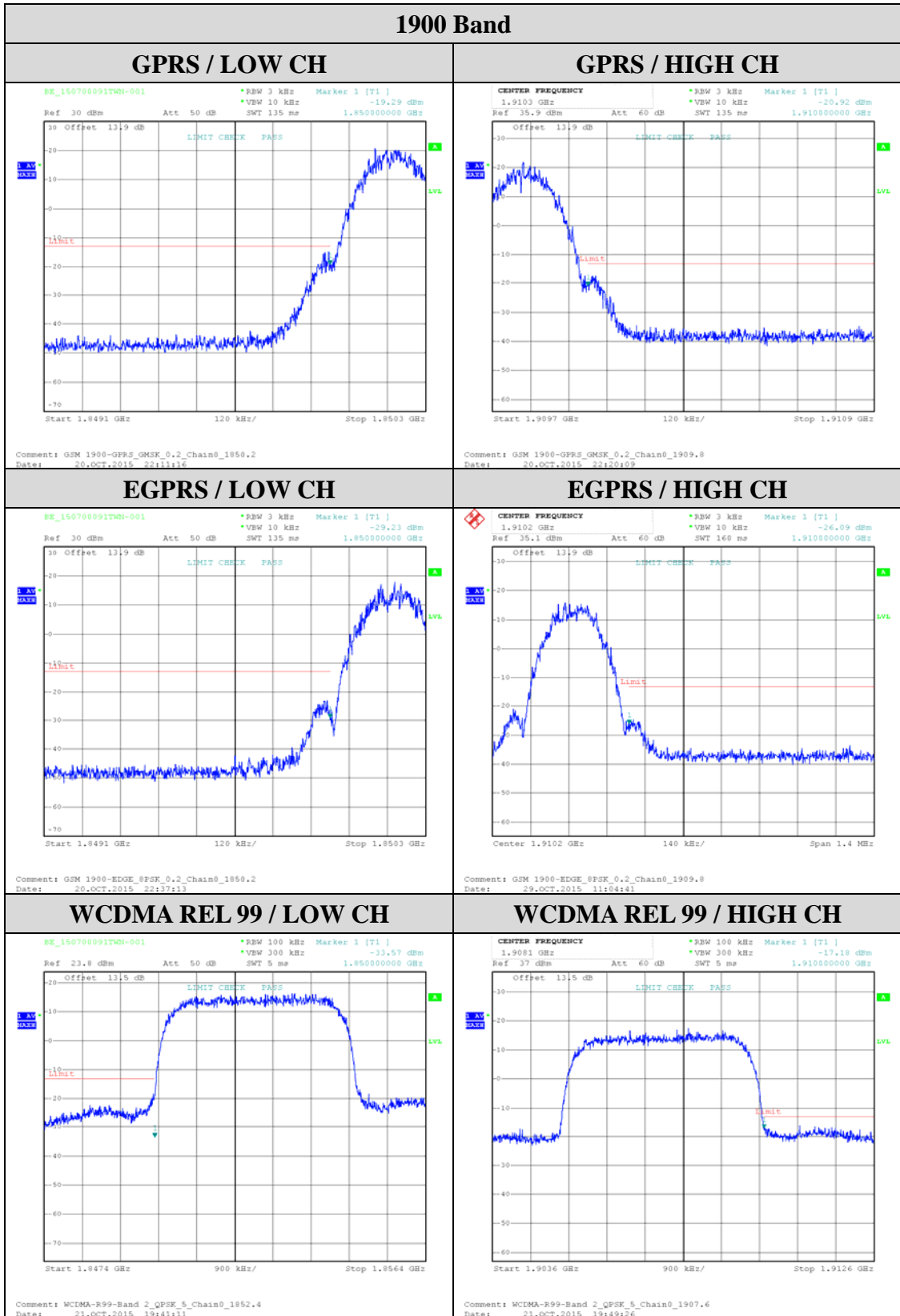
1. The EUT was set up for the maximum peak power with LTE link data modulation.
The power was measured with Spectrum Analyzer. All measurements were done at 2 channels (lowest and highest operating channel for each band.).
2. The band edge measurement used the directional coupler via EUT RF power connector between Base station Simulator and spectrum analyzer.
3. Set the spectrum analyzer span to include the block edge frequency.
4. Set a marker to point the corresponding band edge frequency in each band.
5. Record the max trace plot into the test report.

7.4 Test diagram



7.4 Test results





8. Conducted Spurious Emissions

8.1 Test conditions

Temperature:	23	°C
Relative Humidity:	57	%
Atmospheric Pressure	1008	hPa

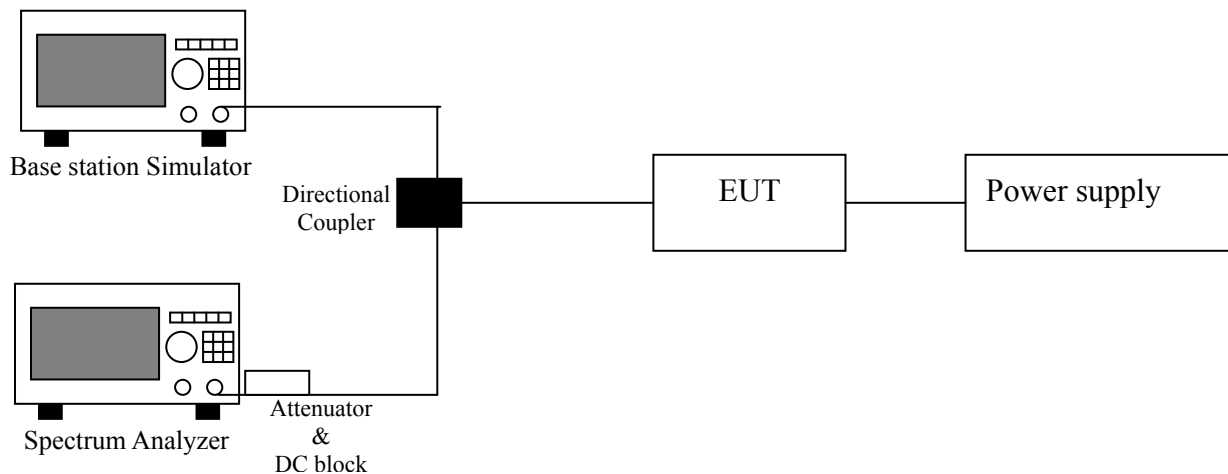
8.2 Limit for conducted spurious emissions

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13 dBm

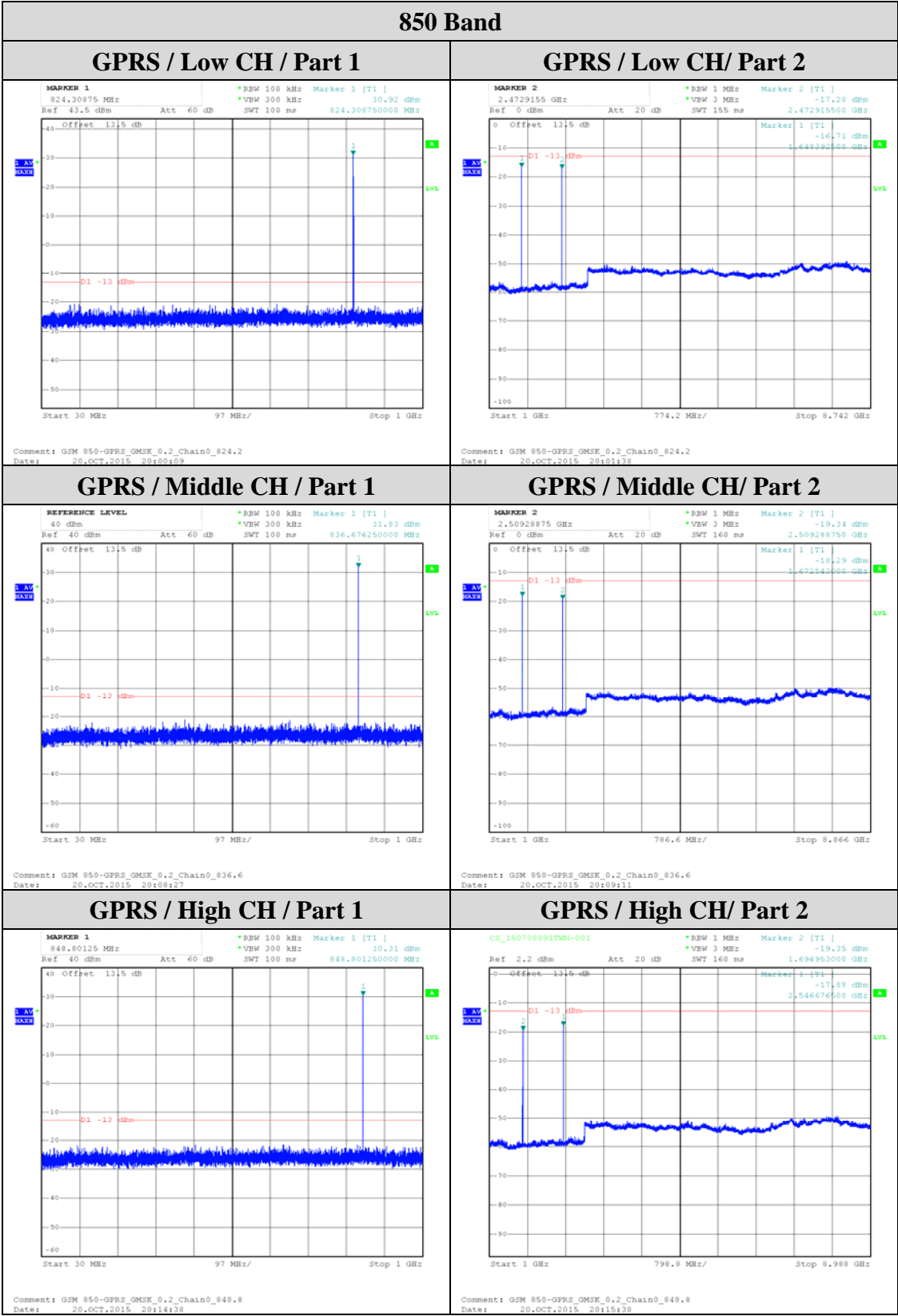
8.3 Test procedure

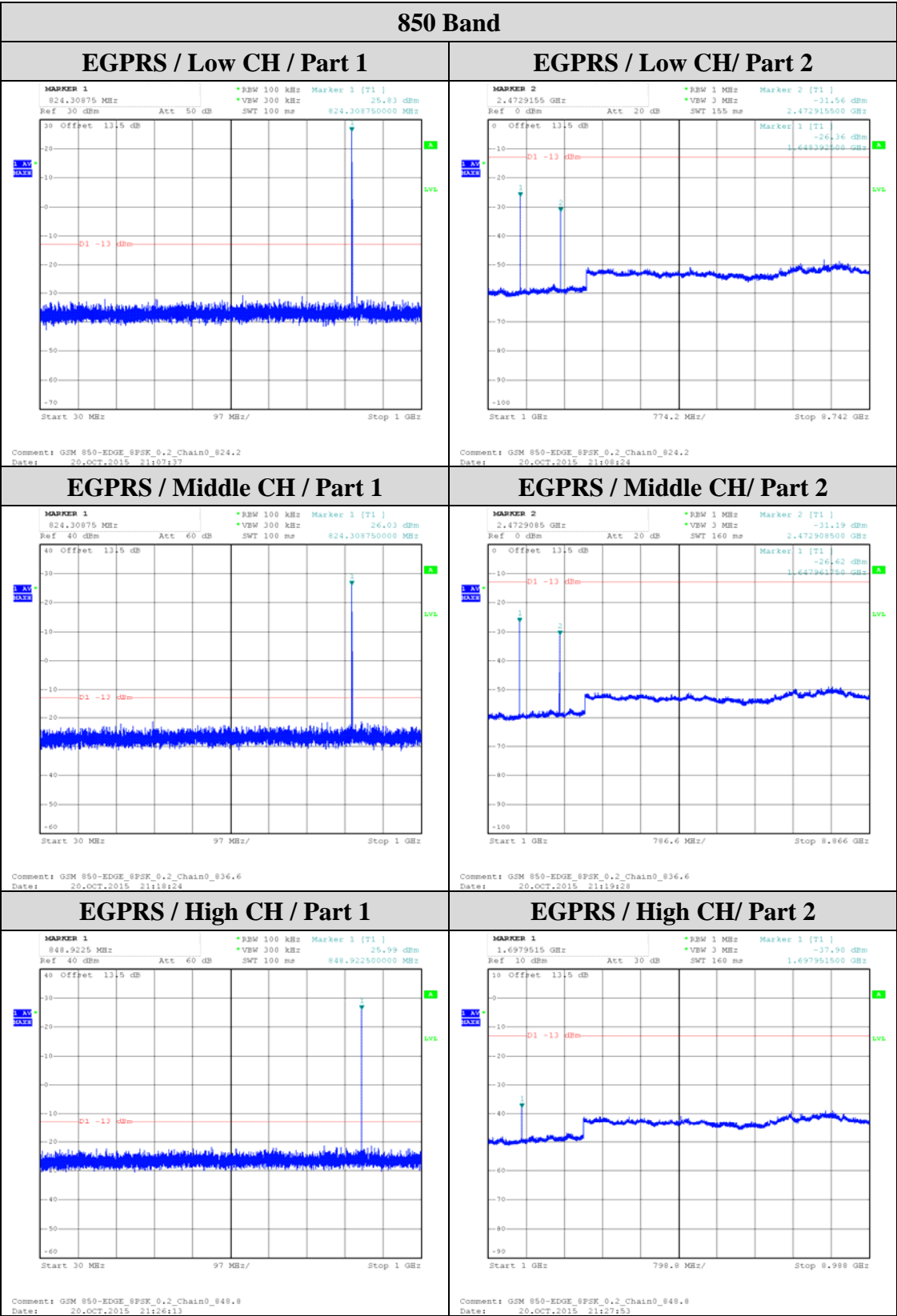
1. The EUT connected to the Base station simulator. All measurements were done at low, middle and high operational frequency range.
2. Measuring frequency range is from 30 MHz to 8GHz for LTE Band 13 and from 30MHz to 18GHz for LTE Band 4. 10dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz are used for conducted emission measurement.

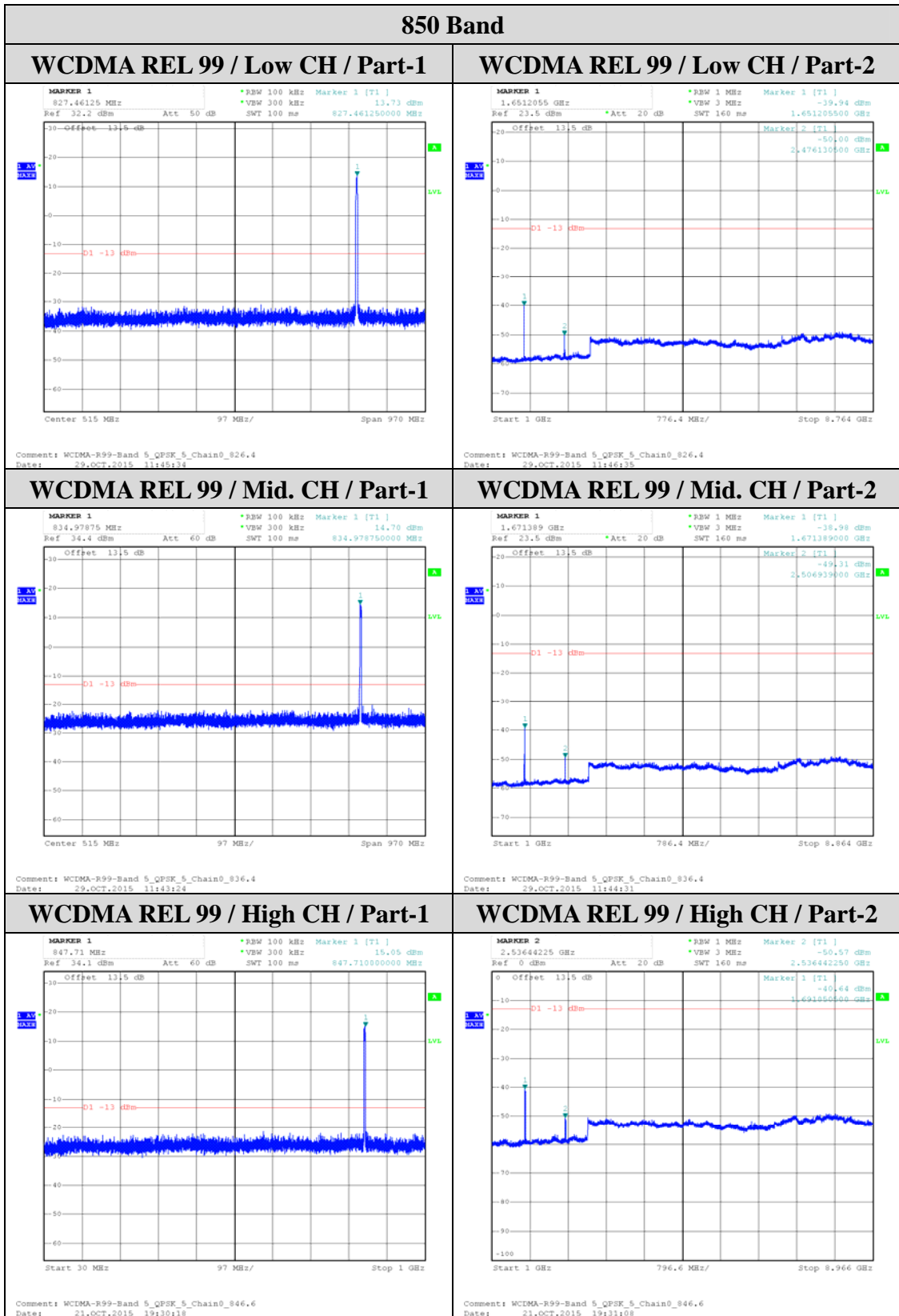
8.4 Test diagram

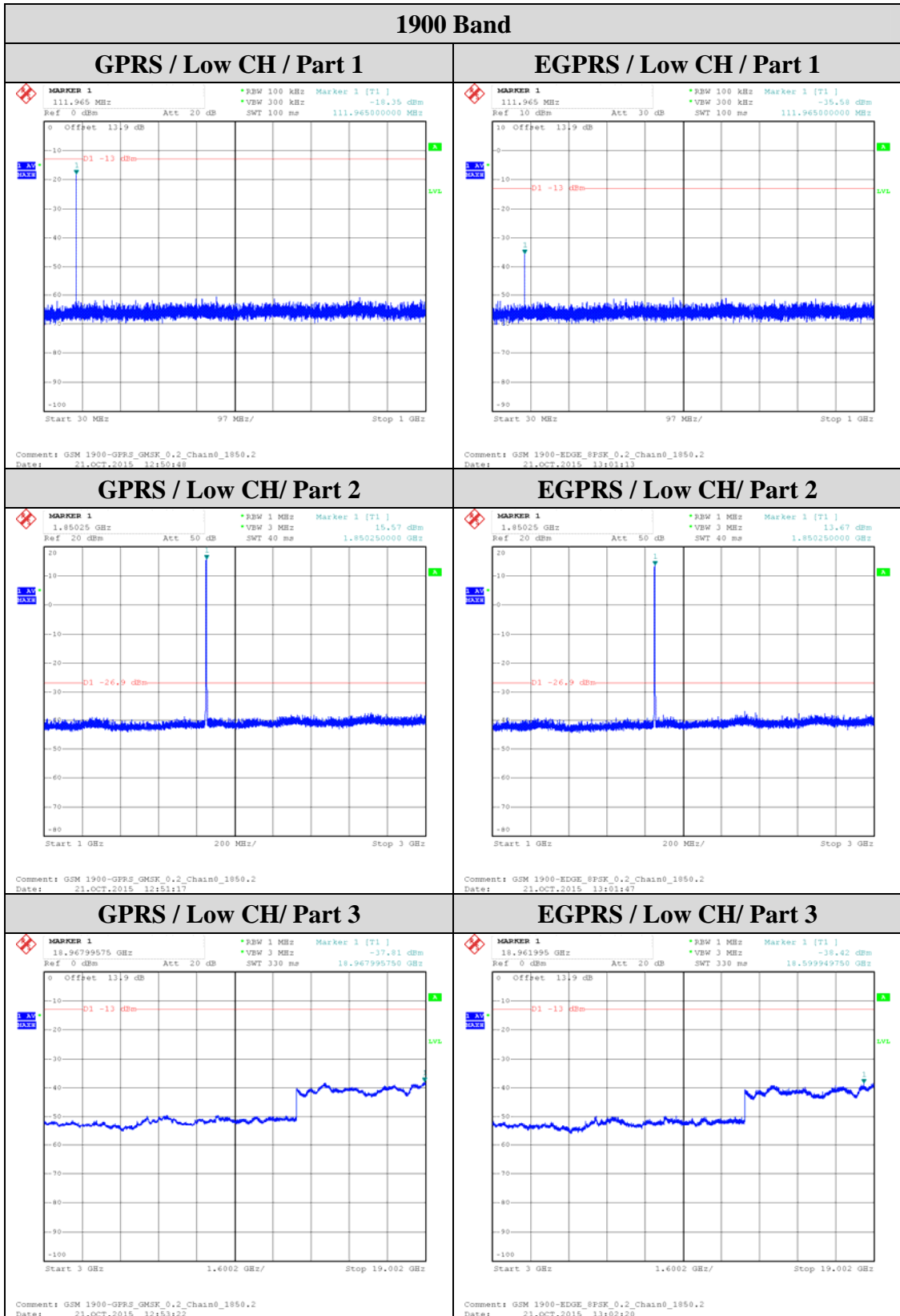


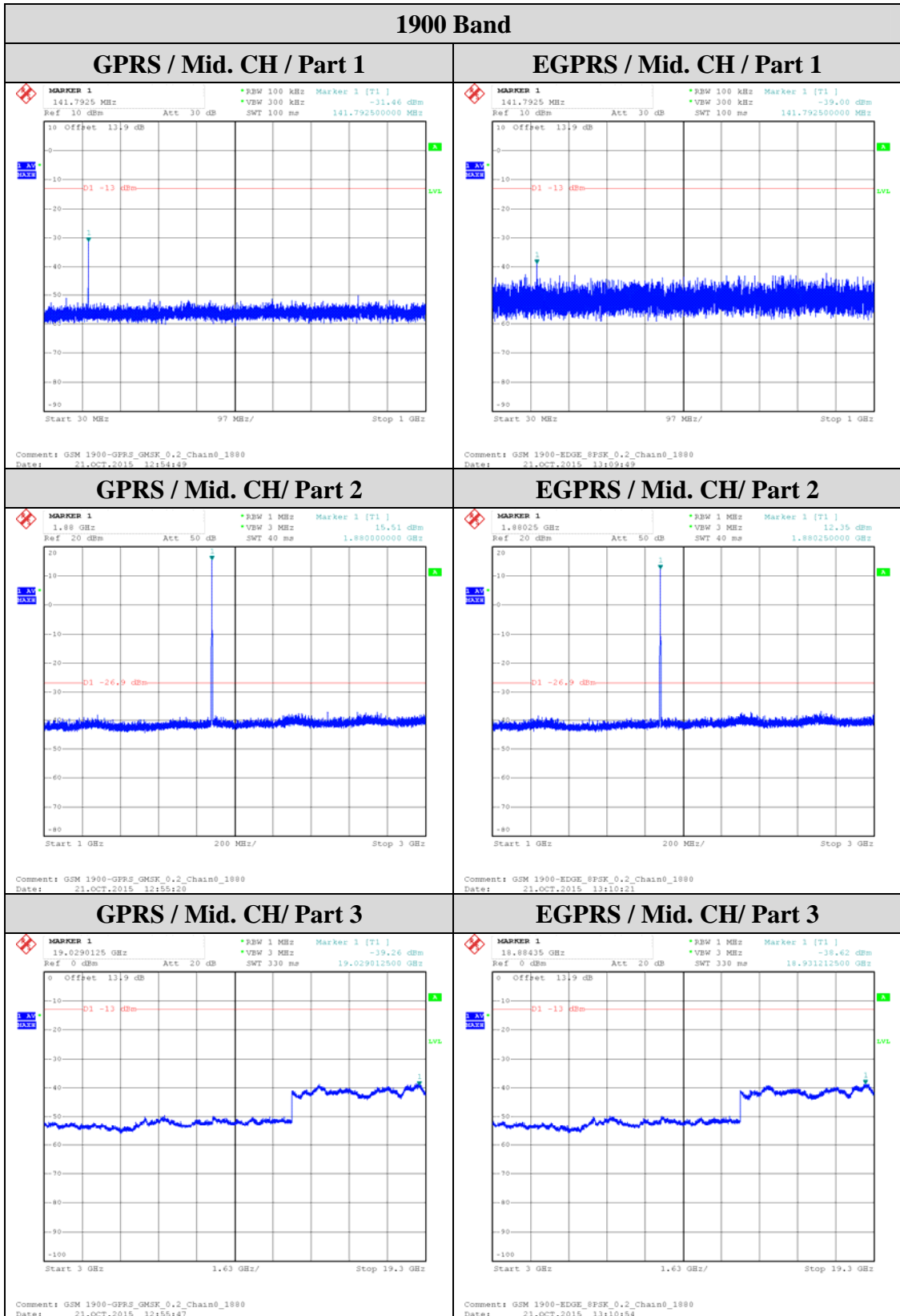
8.5 Test results

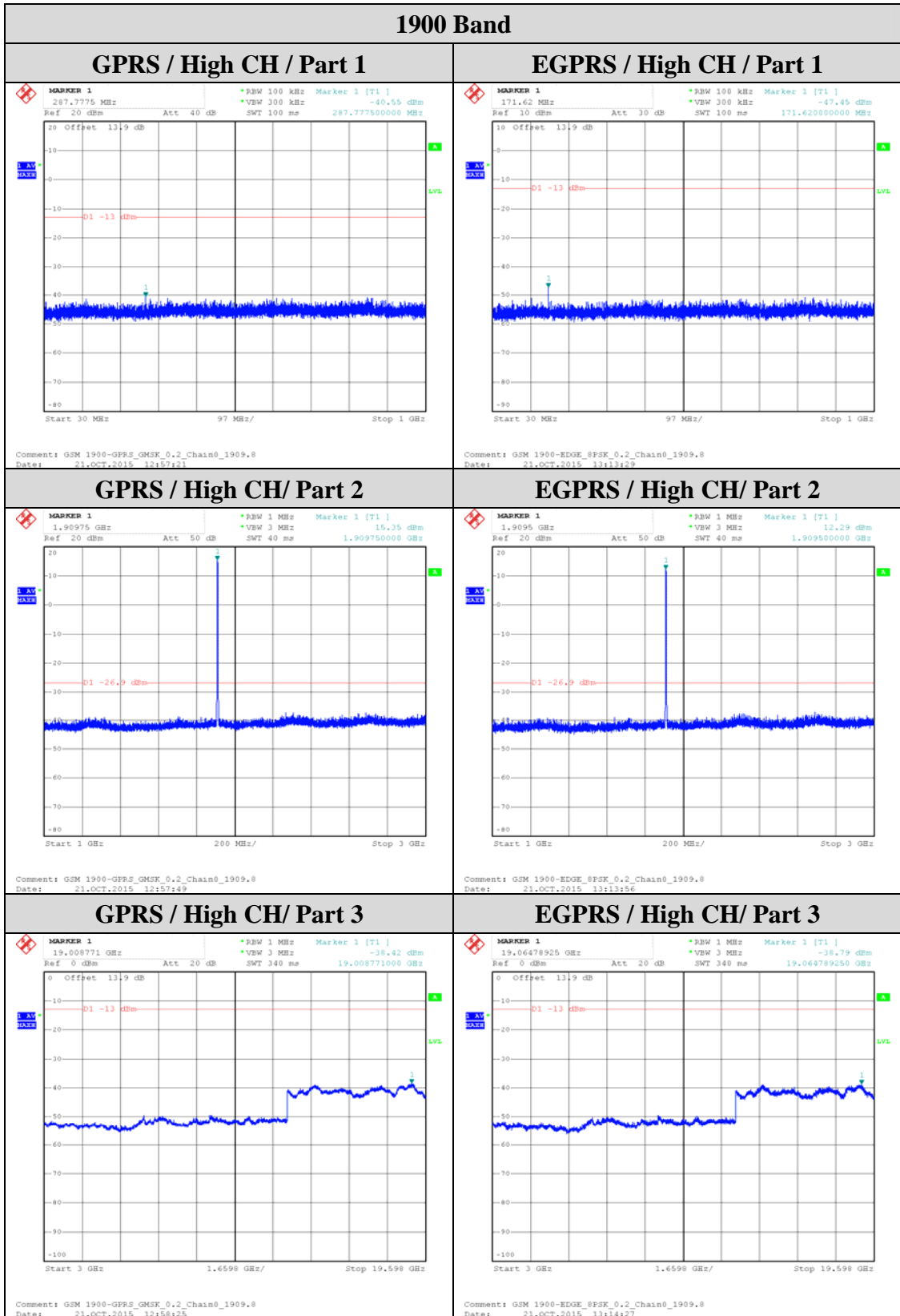


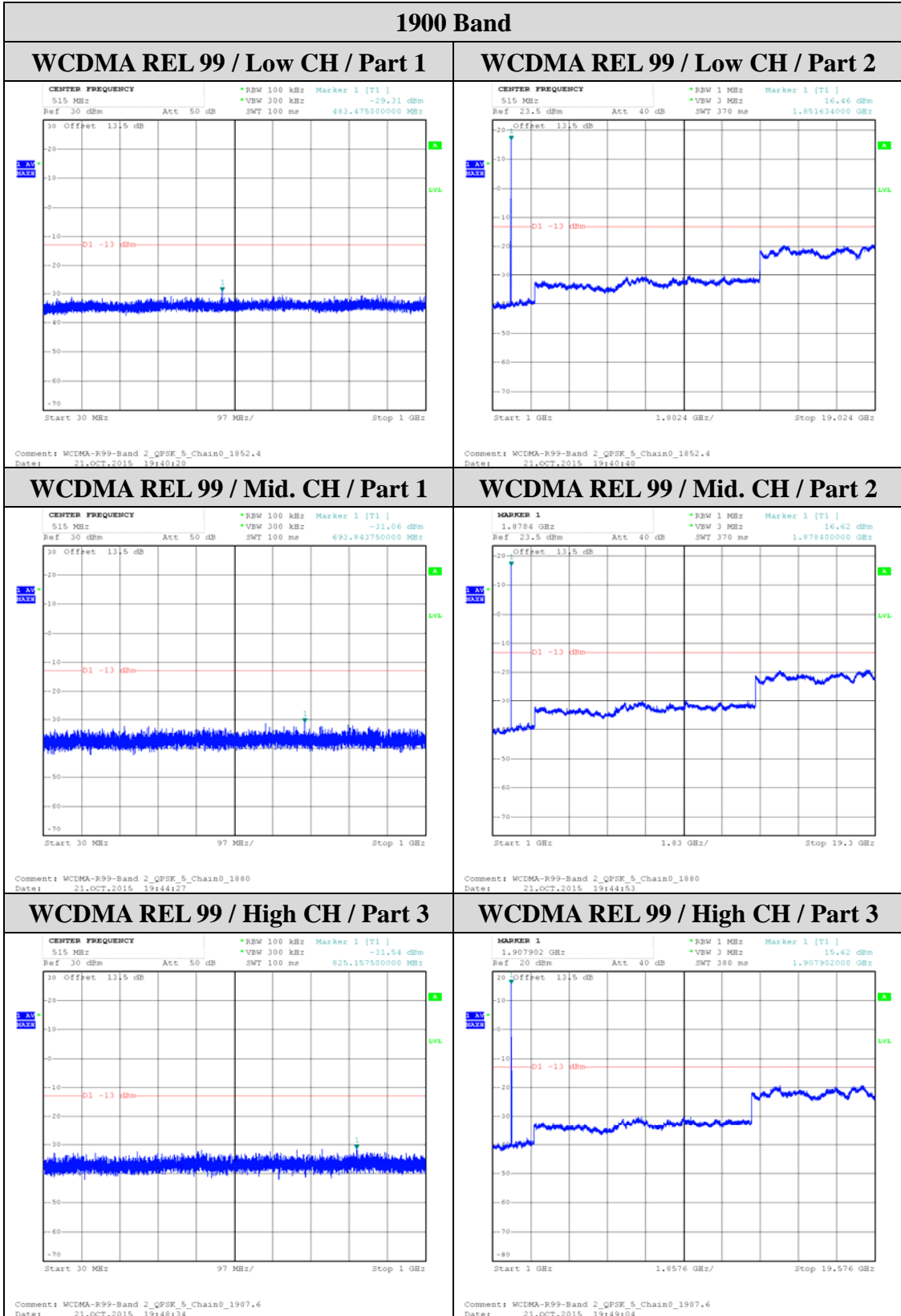












9. Radiated Emission Measurement

9.1 Test conditions

Temperature:	25	°C
Relative Humidity:	57	%
Atmospheric Pressure	1008	hPa

9.2 Limit for radiated emission measurement

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13 dBm

9.3 Test procedure

1. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.

2. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the turn table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value“ of step a. Record the power level of S.G

3. EIRP = Output power level of S.G –TX cable loss + Antenna gain of substitution horn.
4. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.P.R power - 2.15dBi.

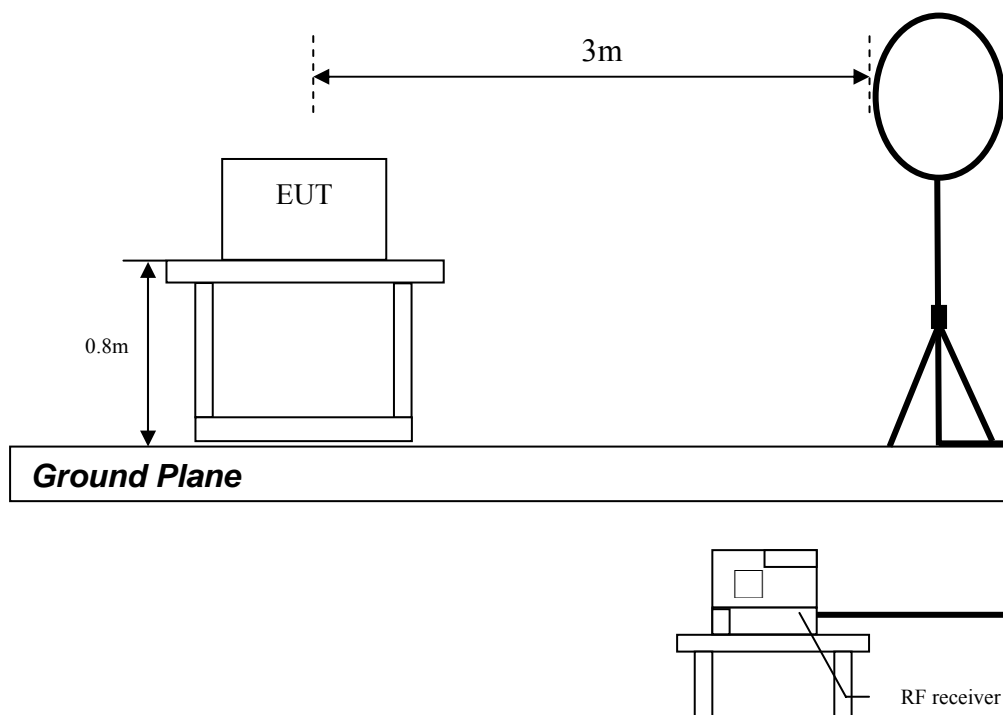
NOTE: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

9.4 Test diagram

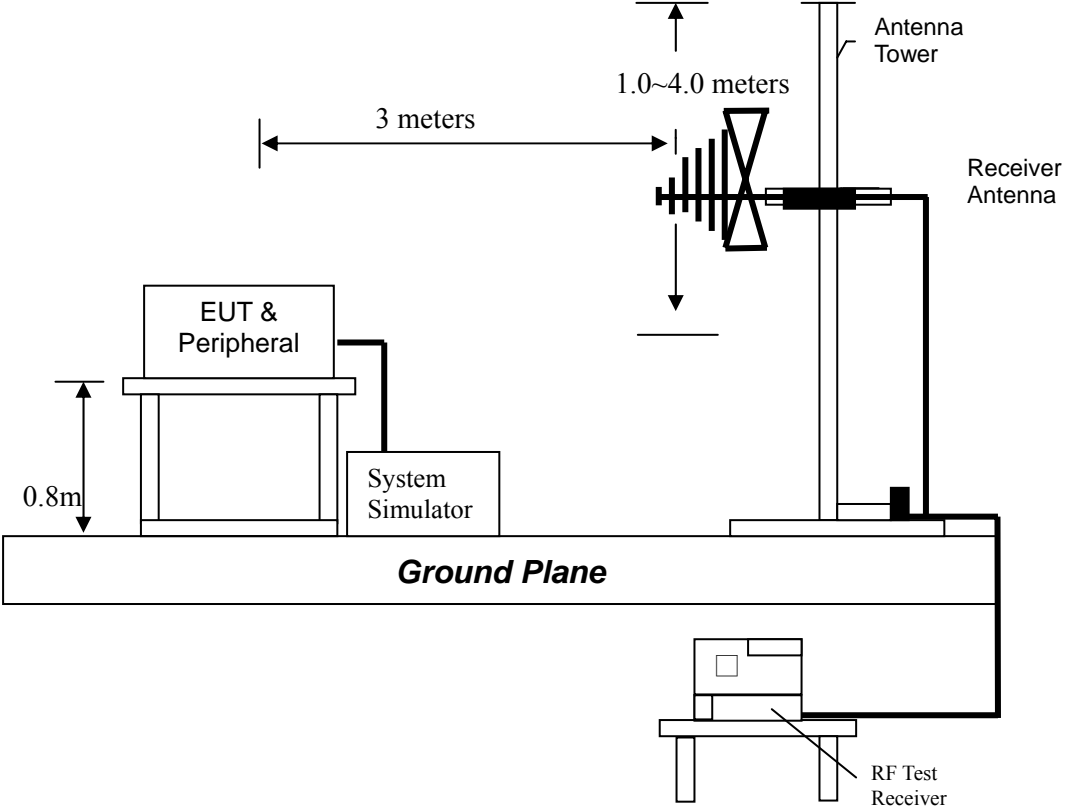
The EUT is investigated for X, Y and Z axis. The worst case was determined to be at X axis after the investigations. The final test data was executed under this configuration.

9.5 Test configuration

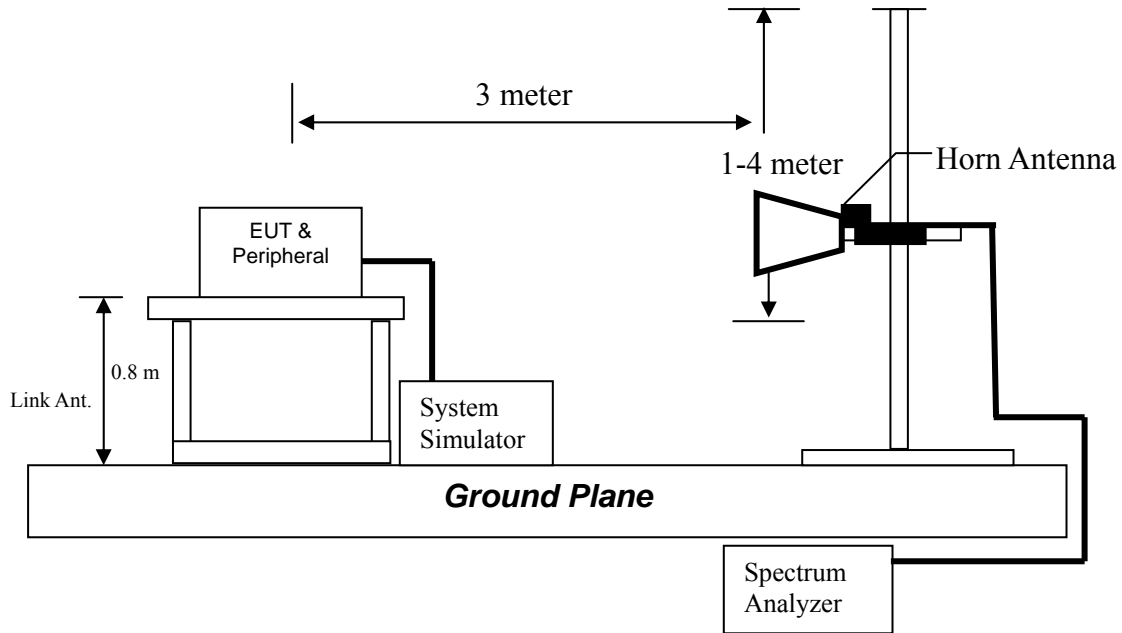
9.5.1 Radiated emission from 9 kHz to 30MHz using Loop Antenna



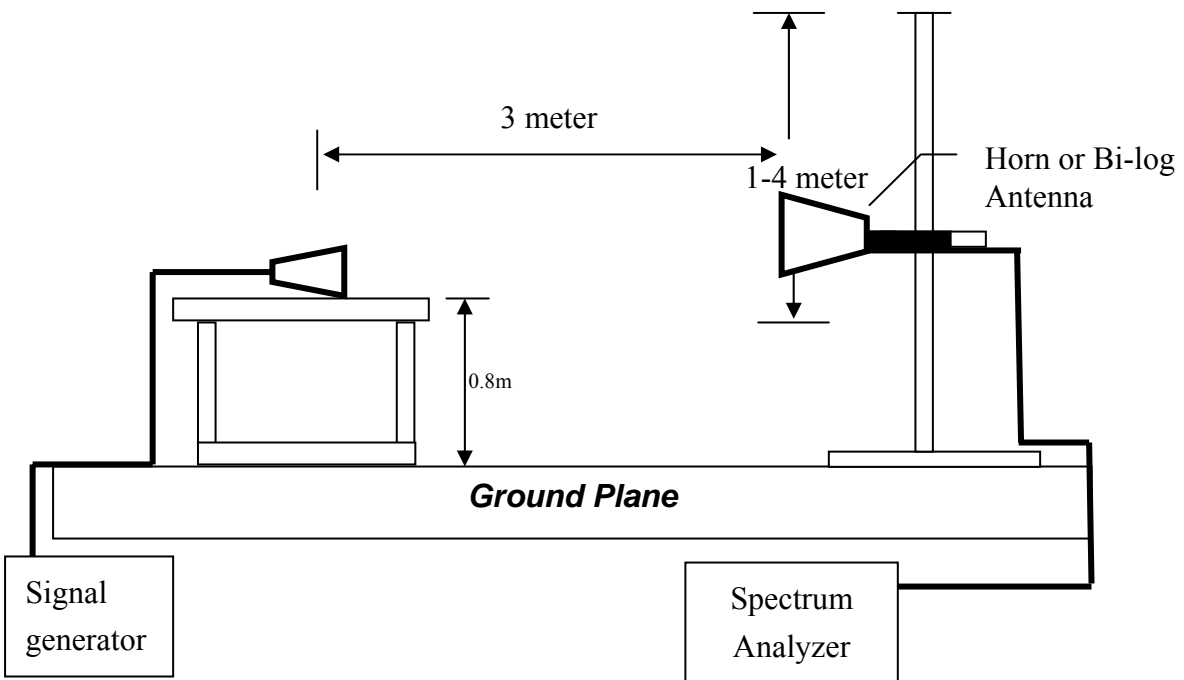
9.5.2 Radiated emission below 1GHz using Bilog Antenna



9.5.3 Radiated emission above 1GHz using Horn Antenna



9.5.4 Radiated emission with Substitution Antenna



9.5 Test results

Average E.I.R.P. for 850 Band

Mode	Ch.	Vertical		Horizontal		Ant Gain	Cable Loss	Result		Margin		Limit
		Freq.	S.G. Value	Freq.	S.G. Value			Ver	Hor	Ver	Hor	
		(MHz)	(dBm)	(MHz)	(dBm)			(dBi)	(dB)			
GPRS	Low	1648.4	-61.96	1648.4	-51.93	8.72	2.56	-55.80	-45.77	-42.80	-32.77	-13
		2472.6	-60.01	2472.6	-54.08	9.76	3.20	-53.46	-47.53	-40.46	-34.53	-13
		3296.8	-54.01	3296.8	-61.59	9.72	3.60	-47.90	-55.48	-34.90	-42.48	-13
	Mid.	1673.2	-61.27	1673.2	-48.99	8.74	2.57	-55.10	-42.82	-42.10	-29.82	-13
		2509.8	-57.05	2509.8	-55.07	9.80	3.22	-50.48	-48.50	-37.48	-35.50	-13
		3346.4	-54.03	3346.4	-61.82	9.74	3.62	-47.91	-55.70	-34.91	-42.70	-13
	High	1697.6	-61.12	1697.6	-48.41	8.76	2.58	-54.94	-42.23	-41.94	-29.23	-13
		2546.4	-54.89	2546.4	-52.95	9.78	3.25	-48.36	-46.42	-35.36	-33.42	-13
		3395.2	-56.88	3395.2	-62.67	9.76	3.64	-50.76	-56.55	-37.76	-43.55	-13
EGPRS	Low	1648.4	-71.34	1648.4	-65.02	8.72	2.56	-65.18	-58.86	-52.18	-45.86	-13
		2472.6	-61.04	2472.6	-59.92	9.76	3.20	-54.49	-53.37	-41.49	-40.37	-13
	Mid.	1673.2	-72.95	1673.2	-64.73	8.74	2.57	-66.78	-58.56	-53.78	-45.56	-13
		2509.8	-59.97	2509.8	-57.59	9.80	3.22	-53.40	-51.02	-40.40	-38.02	-13
	High	1697.6	-71.02	1697.6	-60.07	8.76	2.58	-64.84	-53.89	-51.84	-40.89	-13
		2546.4	-59.37	2546.4	-57.18	9.78	3.25	-52.84	-50.65	-39.84	-37.65	-13
WCDMA REL 99	Low	1652.8	-59.93	1652.8	-45.06	8.72	2.57	-53.77	-38.90	-40.77	-25.90	-13
		2479.2	-55.87	2479.2	-53.64	9.77	3.21	-49.31	-47.08	-36.31	-34.08	-13
		3305.6	-48.85	3305.6	-58.89	9.72	3.61	-42.74	-52.78	-29.74	-39.78	-13
		4132	-47.89	4132	-63.04	10.02	3.91	-41.78	-56.93	-28.78	-43.93	-13
	Mid.	1673.2	-57.72	1673.2	-41.74	8.74	2.57	-51.55	-35.57	-38.55	-22.57	-13
		2509.8	-51.73	2509.8	-48.27	9.80	3.22	-45.16	-41.70	-32.16	-28.70	-13
		3346.4	-46.83	3346.4	-59.8	9.74	3.62	-40.71	-53.68	-27.71	-40.68	-13
		4183	-41.26	4183	-61.63	10.14	3.93	-35.05	-55.42	-22.05	-42.42	-13
	High	1693.2	-58.71	1693.2	-40.57	8.75	2.58	-52.53	-34.39	-39.53	-21.39	-13
		2539.8	-49.59	2539.8	-46.52	9.78	3.25	-43.05	-39.98	-30.05	-26.98	-13
		3386.4	-45.77	3386.4	-62.43	9.75	3.64	-39.65	-56.31	-26.65	-43.31	-13
		4233	-36.89	4233	-61.49	10.26	3.94	-30.57	-55.17	-17.57	-42.17	-13

Mode	Ch.	Vertical		Horizontal		Ant	Cable	Result		Margin		Limit
		Freq.	S.G. Value	Freq.	S.G. Value	Gain	Loss	Ver	Ver	Ver	Hor	
		(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dB)					
HSDPA REL 5	Low	1652.8	-61.53	1652.8	-47.01	8.72	2.57	-55.37	-40.85	-42.37	-27.85	-13
		2479.2	-55.87	2479.2	-53.15	9.77	3.21	-49.31	-46.59	-36.31	-33.59	-13
		3305.6	-52.03	3305.6	-61.77	9.72	3.61	-45.92	-55.66	-32.92	-42.66	-13
		4132	-48.53	4132	-65.37	10.02	3.91	-42.42	-59.26	-29.42	-46.26	-13
	Mid.	1672.8	-60.91	1672.8	-43.06	8.74	2.57	-54.74	-36.89	-41.74	-23.89	-13
		2509.2	-51.89	2509.2	-49.65	9.80	3.22	-45.32	-43.08	-32.32	-30.08	-13
		3345.6	-50.44	3345.6	-61.17	9.74	3.62	-44.32	-55.05	-31.32	-42.05	-13
		4182	-42.76	4182	-63.65	10.14	3.92	-36.55	-57.44	-23.55	-44.44	-13
	High	1693.2	-59.14	1693.2	-43.52	8.75	2.58	-52.96	-37.34	-39.96	-24.34	-13
		2539.8	-50.41	2539.8	-46.43	9.78	3.25	-43.87	-39.89	-30.87	-26.89	-13
		3386.4	-51.87	3386.4	-63.15	9.75	3.64	-45.75	-57.03	-32.75	-44.03	-13
		4233	-38.07	4233	-62.55	10.26	3.94	-31.75	-56.23	-18.75	-43.23	-13
HSPA REL 99	Low	1652.8	-60.49	1652.8	-46.18	8.72	2.57	-54.33	-40.02	-41.33	-27.02	-13
		2479.2	-56.53	2479.2	-52.06	9.77	3.21	-49.97	-45.50	-36.97	-32.50	-13
		3305.6	-51.16	3305.6	-61.69	9.72	3.61	-45.05	-55.58	-32.05	-42.58	-13
		4132	-46.77	4132	-64.37	10.02	3.91	-40.66	-58.26	-27.66	-45.26	-13
	Mid.	1672.8	-60.11	1672.8	-42.15	8.74	2.57	-53.94	-35.98	-40.94	-22.98	-13
		2509.2	-49.09	2509.2	-47.88	9.80	3.22	-42.52	-41.31	-29.52	-28.31	-13
		3345.6	-48.57	3345.6	-60.85	9.74	3.62	-42.45	-54.73	-29.45	-41.73	-13
		4182	-40.53	4182	-62.13	10.14	3.92	-34.32	-55.92	-21.32	-42.92	-13
	High	1693.2	-58.67	1693.2	-42.55	8.75	2.58	-52.49	-36.37	-39.49	-23.37	-13
		2539.8	-48.01	2539.8	-44.68	9.78	3.25	-41.47	-38.14	-28.47	-25.14	-13
		3386.4	-50.19	3386.4	-61.83	9.75	3.64	-44.07	-55.71	-31.07	-42.71	-13

Average E.I.R.P. for 1900 Band

Mode	Ch.	Vertical		Horizontal		Ant	Cable	Result		Margin		Limit
		Freq.	S.G. Value	Freq.	S.G. Value	Gain	Loss	Ver	Hor	Ver	Hor	
		(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dB)					
GPRS	Low	3700.4	-61.96	3700.4	-51.93	9.76	3.75	-55.95	-45.92	-42.95	-32.92	-13
		5550.6	-60.01	5550.6	-54.08	11.04	4.42	-53.39	-47.46	-40.39	-34.46	-13
		7400.8	-54.01	7400.8	-61.59	11.40	5.09	-47.70	-55.28	-34.70	-42.28	-13
	Mid.	3760	-61.27	3760	-48.99	9.75	3.77	-55.29	-43.01	-42.29	-30.01	-13
		5640	-57.05	5640	-55.07	11.11	4.45	-50.39	-48.41	-37.39	-35.41	-13
		7520	-54.03	7520	-61.82	11.30	5.13	-47.86	-55.65	-34.86	-42.65	-13
	High	3819.6	-61.12	3819.6	-48.41	9.74	3.79	-55.18	-42.47	-42.18	-29.47	-13
		5729.4	-54.89	5729.4	-52.95	11.18	4.48	-48.19	-46.25	-35.19	-33.25	-13
		7639.2	-56.88	7639.2	-62.67	11.33	5.18	-50.73	-56.52	-37.73	-43.52	-13
EGPRS	Low	3700.4	-71.34	3700.4	-65.02	9.76	3.75	-65.33	-59.01	-52.33	-46.01	-13
		5550.6	-61.04	5550.6	-59.92	11.04	4.42	-54.42	-53.30	-41.42	-40.30	-13
	Mid.	3760	-72.95	3760	-64.73	9.75	3.77	-66.97	-58.75	-53.97	-45.75	-13
		5640	-59.97	5640	-57.59	11.11	4.45	-53.31	-50.93	-40.31	-37.93	-13
	High	3819.6	-71.02	3819.6	-60.07	9.74	3.79	-65.08	-54.13	-52.08	-41.13	-13
WCDMA REL 99	Low	3704.8	-59.93	3704.8	-45.06	9.76	3.75	-53.92	-39.05	-40.92	-26.05	-13
		5557.2	-55.87	5557.2	-53.64	11.05	4.42	-49.25	-47.02	-36.25	-34.02	-13
		7409.6	-48.85	7409.6	-58.89	11.39	5.09	-42.55	-52.59	-29.55	-39.59	-13
		9262	-47.89	9262	-63.04	11.71	5.76	-41.94	-57.09	-28.94	-44.09	-13
	Mid.	3760	-57.72	3760	-41.74	9.75	3.77	-51.74	-35.76	-38.74	-22.76	-13
		5640	-51.73	5640	-48.27	11.11	4.45	-45.07	-41.61	-32.07	-28.61	-13
		7520	-46.83	7520	-59.8	11.30	5.13	-40.66	-53.63	-27.66	-40.63	-13
		9400	-41.26	9400	-61.63	11.88	5.81	-35.19	-55.56	-22.19	-42.56	-13
	High	3815.2	-58.71	3815.2	-40.57	9.74	3.79	-52.77	-34.63	-39.77	-21.63	-13
		5722.8	-49.59	5722.8	-46.52	11.18	4.48	-42.89	-39.82	-29.89	-26.82	-13
		7630.4	-45.77	7630.4	-62.43	11.33	5.17	-39.62	-56.28	-26.62	-43.28	-13
		9538	-36.89	9538	-61.49	12.02	5.86	-30.74	-55.34	-17.74	-42.34	-13

Mode	Ch.	Vertical		Horizontal		Ant	Cable	Result		Margin		Limit
		Freq.	S.G. Value	Freq.	S.G. Value	Ver	Hor	Ver	Hor	Ver	Hor	
		(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dB)					
HSDPA REL 5	Low	3704.8	-35.87	3704.8	-52.55	9.76	3.75	-29.86	-46.54	-16.86	-33.54	-13
		5557.2	-57.65	5557.2	-59.38	11.05	4.42	-51.03	-52.76	-38.03	-39.76	-13
	Mid.	3760	-37.52	3760	-51.08	9.75	3.77	-31.54	-45.10	-18.54	-32.10	-13
		5640	-58.36	5640	-61.44	11.11	4.45	-51.70	-54.78	-38.70	-41.78	-13
	High	3815.2	-38.37	3815.2	-48.94	9.74	3.79	-32.43	-43.00	-19.43	-30.00	-13
		5722.8	-57.79	5722.8	-62.36	11.18	4.48	-51.09	-55.66	-38.09	-42.66	-13
HSPA REL 99	Low	3704.8	-36.37	3704.8	-54.13	9.76	3.75	-30.36	-48.12	-17.36	-35.12	-13
		5557.2	-58.26	5557.2	-58.94	11.05	4.42	-51.64	-52.32	-38.64	-39.32	-13
	Mid.	3760	-36.63	3760	-51.58	9.75	3.77	-30.65	-45.60	-17.65	-32.60	-13
		5640	-57.74	5640	-61.56	11.11	4.45	-51.08	-54.90	-38.08	-41.90	-13
	High	3815.2	-39.16	3815.2	-49.88	9.74	3.79	-33.22	-43.94	-20.22	-30.94	-13
		5722.8	-56.84	5722.8	-62.41	11.18	4.48	-50.14	-55.71	-37.14	-42.71	-13

Appendix A: Test equipments list

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESR-7	101232	2014/12/01	2015/11/30
Spectrum Analyzer	Rohde & Schwarz	FSP30	100137	2015/08/18	2016/08/16
Signal Generator	Rohde & Schwarz	SMR27	100036	2014/11/3	2015/11/2
Horn Antenna (1-18G)	EMCO	3115	9906-5822	2014/6/5	2017/6/3
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2013/08/08	2016/08/06
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-067	2015/04/30	2016/04/28
Pre-Amplifier(1-26. 5G)	EMC Co.	EMC12635SE	980205	2015/10/07	2016/10/05
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2015/02/24	2016/02/23
966-2(A) Cable	SUHNER	SMA / EX 100	N/A	2015/05/06	2016/05/04
966-2(B) Cable	JUNFLON	SMA / J12J100880-00	AUG-26-08-002	2015/05/09	2016/05/07
RF Cable	SUHNER	SUCOFLEX 102	CB0006	2015/05/06	2016/05/04
RF Cable	Mini-Circuits	CBL-4FT-SMS M+	CB0001	2015/05/06	2016/05/04
RF Cable	Mini-Circuits	CBL-4FT-SMS M+	CB0002	2015/05/06	2016/05/04
Simulator	Rohde & Schwarz	CMW 500	124781	2015/09/27	2016/09/25
Spectrum Analyzer	Agilent	N9030A	MY51380492	2015/09/21	2016/09/19
Brand		Software		Version	
ADT		Radiated test system		7.5.14	

Appendix B: Measurement Uncertainty

Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty		
Radiated Emission	Below 1 GHz	Vertical	3.90 dB
		Horizontal	3.86 dB
	1G~18GHz	Vertical	4.19 dB
		Horizontal	4.30 dB
	18GHz~40GHz	Vertical	2.92 dB
		Horizontal	2.90 dB
Conducted Output power	0.86 dB		
Conducted Spurious Emission	0.84 dB		

This uncertainty represents an expanded uncertainty expressed at approximately the 95 %