

MEASUREMENT REPORT


(FCC Part : 22/24)




Testing Laboratory
1288

Product..... : EFTPOS
Trade Name..... : CASTLES TECHNOLOGY
Model No..... : VEGA5000M
Applicant..... : CASTLES TECHNOLOGY CO., LTD
Applicant Address..... : 2F, No.205, Sec.3, Beixin Rd., Xindian District,
New Taipei City 23143, Taiwan (R.O.C.)

Report Number	MLT1109P22001
Applicant	CASTLES TECHNOLOGY CO., LTD
Product	EFTPOS
Sample Received Date	2011/9/21

Report Prepared By	Jesse Tien
Signature	
Date Prepared	2011/9/21 ~ 2012/1/18

Report Authorized By	Roger Chen
Signature	
Date Authorized	2012/1/19

Test By

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History of Test Report

Original Report Issue Date: Jan. 19, 2012

No additional attachment

additional attachments were issued as in the following record:

Attachment No.	Issue Date	Description
MLT1109P22001	Jan. 19, 2012	Original report

1. General

1.1 Customer Details

Applicant Name	CASTLES TECHNOLOGY CO., LTD
Applicant Address	2F, No.205, Sec.3, Beixin Rd., Xindian District, New Taipei City 23143, Taiwan (R.O.C.)
Manufacturer Name	CASTLES TECHNOLOGY CO., LTD
Manufacturer Address	2F, No.205, Sec.3, Beixin Rd., Xindian District, New Taipei City 23143, Taiwan (R.O.C.)

1.2 Technical data of EUT

Equipment	EFTPOS
Model No	VEGA5000
FCC ID	WIY-VEGA5000M
Type of Modulation	GMSK
Transmission Power	GSM/GPRS 850: 32.9 dBm GSM/GPRS 1900: 31.0dBm
GPRS connectivity	Class 10 (2D2U, ↓ ↓ ↑ ↑)
Type of Antenna	Dipole Antenna (Antenna P/N : APP8P-700260)
Antenna Gain (dBi)	GSM/GPRS 850: -8.1dBi GSM/GPRS 1900: -2.0dBi
Frequency Range	GSM/GPRS 850: 824.2MHz ~ 848.8MHz GSM/GPRS 1900: 1850.2MHz ~ 1909.8MHz
Power Supply	AC adapter : Powertron Electronics Corp. Model No.: PA1050-090T1A500 Input : AC 100-240V / 1.8A Output : DC 9V, 5.0A Battery : Li Polymer Battery 7.4V, 1050mAh

Note: "D"; "↓" downstream, "U", "↑": upstream

1.3 GSM/GPRS Specification

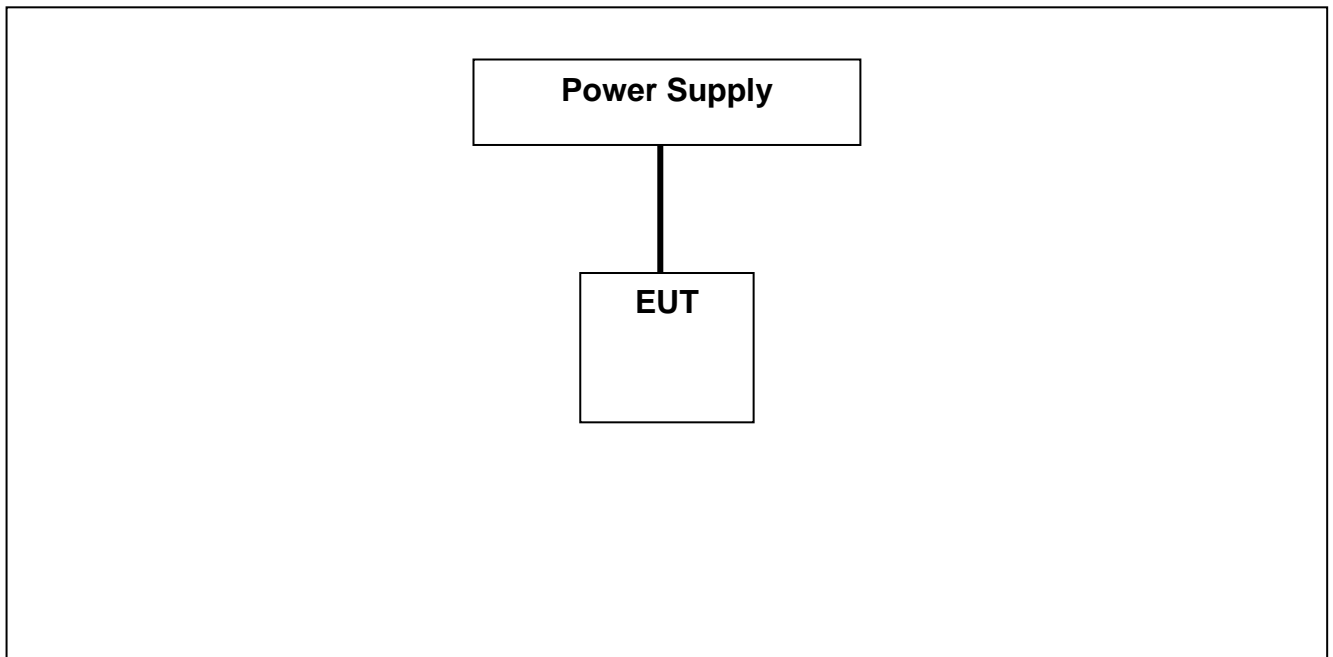
Equipment	GSM/GPRS quad-band module
Module No	GC864-QUAD V2
DC Power Supply	3.3 Volt
DC Current Max.	370 mA

1.4 Standard Test Conditions

Temperature	+15°C ~ +35 Degrees Celsius
Relative Humidity	20% ~ 75%
Supply Voltage	120VAC

1.5 Description of Support Equipment

The EUT itself forms a system. No support equipment is required for its normal operation.



2. Summary of Tests

2.1 Follow the regulations

Standard	Description	Result
2.1046, 22.913	Conducted Power of Transmitter	PASS
22.913, 24.232	Radiated Power of Transmitter	PASS
2.1047	Modulation Characteristics	PASS
2.1051, 22.917, 24.238	Band Edges Compliance	PASS
2.1049	Occupied Bandwidth	PASS
2.1051, 22.917, 24.238	Spurious Emissions at Antenna Terminals	PASS
2.1053, 22.917, 24.238	Radiated Spurious Emissions	PASS
2.1055, 22.355	Frequency Stability	PASS

2.2 Measurement uncertainty

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

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Parameter	Uncertainty
Radio Frequency	$\pm 2.18E-08\%$
Total RF power (conducted)	± 1.32 dB
Spurious emissions (conducted)	± 2.36 dB
All emissions (radiated)	± 4.24 dB
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	± 3.66 %
DC and low frequency voltages	± 0.335 %

Remark : The test results only relate to the submitted test sample specified above.

3. Conducted RF Output Power and Radiated RF Output Power - FCC 22.913(a), 24.232(b)

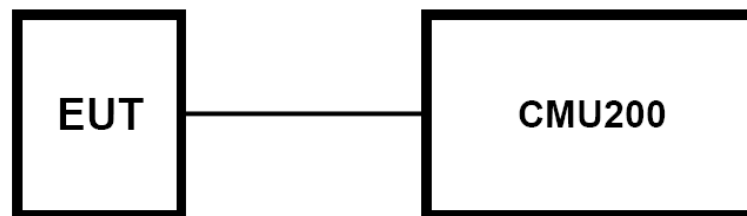
3.1 Test Condition

The conducted RF output power measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyzer. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

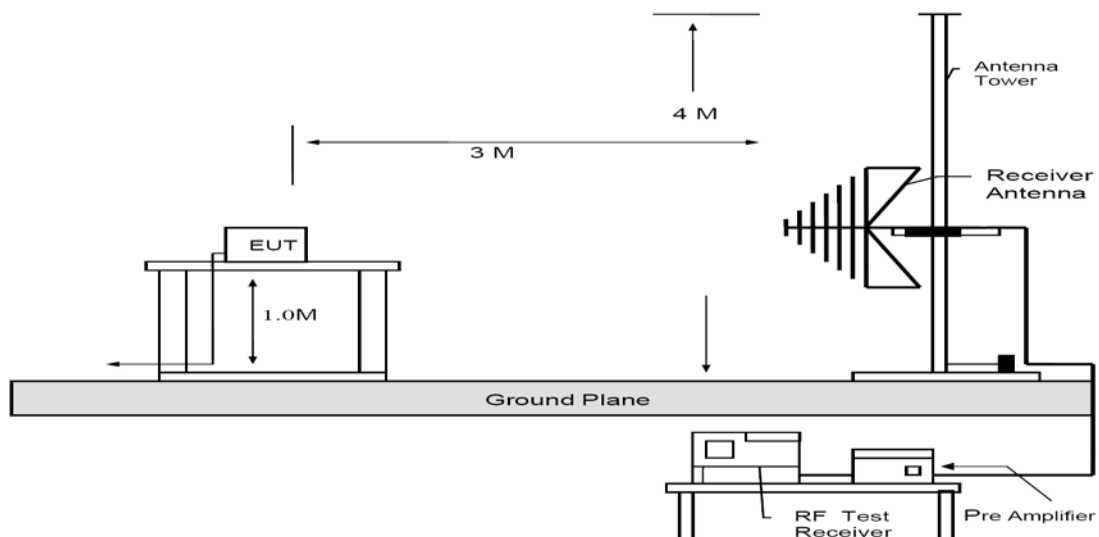
For radiated measurements the EUT was placed on a 1 m high non-conductive stand inside an anechoic chamber. The measuring antenna was placed at 3 m distance and the maximum field strength was measured for the three channels. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

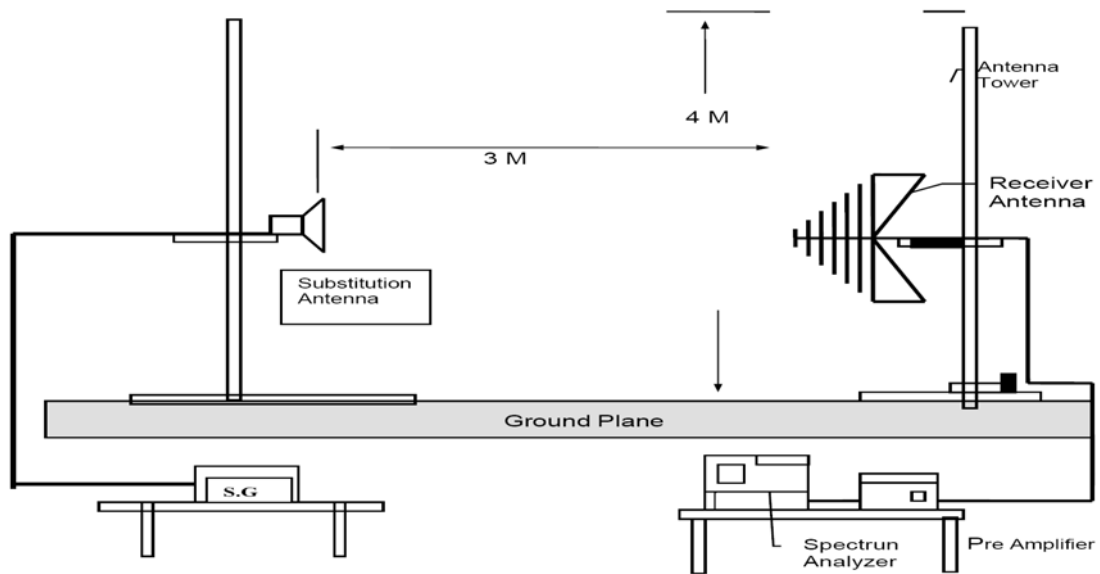
The Effective Radiated Power (E.R.P.) is obtained by using the Substitution Method according to ANSI/TIA/EIA-603-C 2004.

Conducted output power



Radiated output power





3.2 Limits

Compliance with part 22.913, in no any case may the peak power of a transmitter exceed 7 W. And calculate longitude ERP by following formula: $ERP \text{ (dBm)} = 10 \cdot \log (ERP_{in} \text{ mwatts})$; $EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15\text{dB}$.

Operation Band	Mode	Limit (dBm)	Limit (W)
GSM/GPRS 850	ERP	<38.5	<7
GSM/GPRS 1900	EIRP	<33	<2

3.3 Test Equipment List

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum	US39240419	E4407B	2011/2/1	2012/2/1
2.	Agilent	Spectrum	US44300422	E4446A	2011/6/10	2012/6/10
3.	R & S	Universal Radio Communication Tester	111968	CMU200	2011/5/21	2012/5/20
4.	ETS	Horn Antenna	00033655	3115	2011/9/25	2012/9/24
5.	SCHWARZBECK	Horn Antenna	304	BBHA 9120D	2011/9/26	2012/9/25
6.	SCHWARZBECK	Horn Antenna	181	BBHA 9170	2011/9/26	2012/9/25
7.	EMCO	Biconilog Antenna	59739	3142C	2011/8/18	2012/8/17
8.	EMCO	Biconilog Antenna	44568	3142C	2011/8/19	2012/8/18
9.	MLT	Pre Amplifier	20110209	PREAMP6G-01	2011/3/5	2012/3/5
10.	TA	Pre Amplifier	RF01	0.10~19.1GHz 60dBm	2011/8/25	2012/8/25
11.	Herotek	Pre Amplifier	30690	A402-417	2011/9/26	2012/9/25
12.	Agilent	Signal Generator	US43320482	E8257C	2011/1/25	2012/1/25

3.4 Test Results

3.4.1 Conducted RF Output Power

Test Mode : GSM/GPRS 850

Test Mode	Freq(MHz)	Channel	Results (dBm)	Watt
↑	824.2	128	32.7	1.8621
↑	836.6	190	32.8	1.9055
↑	848.8	251	32.9	1.9498
↑ ↑	824.2	128	32.7	1.8621
↑ ↑	836.6	190	32.7	1.8621
↑ ↑	848.8	251	32.7	1.8621

Test Mode : GSM/GPRS 1900

Test Mode	Freq(MHz)	Channel	Results (dBm)	Watt
↑	1850.2	512	30.8	1.2023
↑	1880.0	661	30.9	1.2303
↑	1909.8	810	31.0	1.2589
↑ ↑	1850.2	512	30.9	1.2303
↑ ↑	1880.0	661	30.9	1.2303
↑ ↑	1909.8	810	30.9	1.2303

3.4.2 Radiated RF Output Power

Test Mode : GSM/GPRS 850 (X Axis)

GSM/GPRS 850	Freq (MHz)	Meas. (dBm)	Ant. Pol.	Ant. Gain (dBi)	S.G (dBm)	Cable (dB)	ERP (dBm)	Limit (dBm)	Margin (dBm)
↑	824.2	-0.36	V	5.92	19.35	2.42	20.70	38.5	-17.80
	824.2	-3.20	H	5.92	16.35	2.42	17.70	38.5	-20.80
	836.6	1.63	V	5.95	21.30	2.42	22.68	38.5	-15.82
	836.6	-1.88	H	5.95	17.95	2.42	19.33	38.5	-19.17
	848.8	3.05	V	5.98	22.60	2.43	24.00	38.5	-14.50
	848.8	-1.14	H	5.98	18.80	2.43	20.20	38.5	-18.30
↑ ↑	824.2	-0.41	V	5.92	19.10	2.42	20.45	38.5	-18.05
	824.2	-3.55	H	5.92	16.00	2.42	17.35	38.5	-21.15
	836.6	1.26	V	5.95	20.85	2.42	22.23	38.5	-16.27
	836.6	-1.70	H	5.95	17.80	2.42	19.18	38.5	-19.32
	848.8	3.09	V	5.98	22.30	2.43	23.70	38.5	-14.80
	848.8	-1.67	H	5.98	18.25	2.43	19.65	38.5	-18.85

Test Mode : GSM/GPRS 1900 (X Axis)

GSM/GPRS 1900	Freq (MHz)	Meas. (dBm)	Ant. Pol.	Ant. Gain (dBi)	S.G (dBm)	Cable (dB)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
↑	1850.2	-11.39	V	9.67	15.10	3.61	23.31	33	-9.69
	1850.2	-9.97	H	9.67	17.55	3.61	25.76	33	-7.24
	1880.0	-6.15	V	9.78	21.35	3.63	29.65	33	-3.35
	1880.0	-12.15	H	9.78	16.10	3.63	24.40	33	-8.60
	1909.8	-5.31	V	9.88	20.90	3.64	29.29	33	-3.71
	1909.8	-12.94	H	9.88	14.00	3.64	22.39	33	-10.61
↑ ↑	1850.2	-6.27	V	9.67	19.95	3.61	28.16	33	-4.84
	1850.2	-9.98	H	9.67	17.40	3.61	25.61	33	-7.39
	1880.0	-6.27	V	9.78	21.45	3.63	29.75	33	-3.25
	1880.0	-12.18	H	9.78	16.25	3.63	24.55	33	-8.45
	1909.8	-5.38	V	9.88	20.75	3.64	29.14	33	-3.86
	1909.8	-12.98	H	9.88	14.15	3.64	22.54	33	-10.46

Test Mode : GSM/GPRS 850 (Y Axis)

GSM/GPRS 850	Freq (MHz)	Meas. (dBm)	Ant. Pol.	Ant. Gain (dBi)	S.G (dBm)	Cable (dB)	ERP (dBm)	Limit (dBm)	Margin (dBm)
↑	824.2	6.24	V	5.92	25.95	2.42	27.30	38.5	-11.20
	824.2	-0.30	H	5.92	19.25	2.42	20.60	38.5	-17.90
	836.6	6.85	V	5.95	26.50	2.42	27.88	38.5	-10.62
	836.6	0.30	H	5.95	20.10	2.42	21.48	38.5	-17.02
	848.8	7.28	V	5.98	26.80	2.43	28.20	38.5	-10.30
	848.8	-0.60	H	5.98	19.35	2.43	20.75	38.5	-17.75
↑ ↑	824.2	5.79	V	5.92	25.25	2.42	26.60	38.5	-11.90
	824.2	0.88	H	5.92	20.40	2.42	21.75	38.5	-16.75
	836.6	6.48	V	5.95	26.05	2.42	27.43	38.5	-11.07
	836.6	-0.55	H	5.95	18.95	2.42	20.33	38.5	-18.17
	848.8	7.41	V	5.98	26.60	2.43	28.00	38.5	-10.50
	848.8	-0.47	H	5.98	19.45	2.43	20.85	38.5	-17.65

Test Mode : GSM/GPRS 1900 (Y Axis)

GSM/GPRS 1900	Freq (MHz)	Meas. (dBm)	Ant. Pol.	Ant. Gain (dBi)	S.G (dBm)	Cable (dB)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
↑	1850.2	-4.97	V	9.67	21.50	3.61	29.71	33	-3.29
	1850.2	-5.68	H	9.67	21.85	3.61	30.06	33	-2.94
	1880.0	-6.96	V	9.78	20.55	3.63	28.85	33	-4.15
	1880.0	-6.24	H	9.78	22.00	3.63	30.30	33	-2.70
	1909.8	-5.63	V	9.88	20.55	3.64	28.94	33	-4.06
	1909.8	-7.31	H	9.88	19.60	3.64	27.99	33	-5.01
↑ ↑	1850.2	-5.42	V	9.67	20.80	3.61	29.01	33	-3.99
	1850.2	-5.77	H	9.67	21.60	3.61	29.81	33	-3.19
	1880.0	-6.93	V	9.78	20.80	3.63	29.10	33	-3.90
	1880.0	-6.18	H	9.78	22.25	3.63	30.55	33	-2.45
	1909.8	-5.45	V	9.88	20.65	3.64	29.04	33	-3.96
	1909.8	-7.43	H	9.88	19.70	3.64	28.09	33	-4.91

Test Mode : GSM/GPRS 850 (Z Axis)

GSM/GPRS 850	Freq (MHz)	Meas. (dBm)	Ant. Pol.	Ant. Gain (dBi)	S.G (dBm)	Cable (dB)	ERP (dBm)	Limit (dBm)	Margin (dBm)
↑	824.2	0.68	V	5.92	20.35	2.42	21.70	38.5	-16.80
	824.2	6.98	H	5.92	26.50	2.42	27.85	38.5	-10.65
	836.6	0.85	V	5.95	20.50	2.42	21.88	38.5	-16.62
	836.6	5.39	H	5.95	25.20	2.42	26.58	38.5	-11.92
	848.8	3.72	V	5.98	23.25	2.43	24.65	38.5	-13.85
	848.8	7.67	H	5.98	27.60	2.43	29.00	38.5	-9.50
↑ ↑	824.2	0.88	V	5.92	20.35	2.42	21.70	38.5	-16.80
	824.2	7.66	H	5.92	27.20	2.42	28.55	38.5	-9.95
	836.6	2.36	V	5.95	21.90	2.42	23.28	38.5	-15.22
	836.6	5.53	H	5.95	25.00	2.42	26.38	38.5	-12.12
	848.8	3.63	V	5.98	22.80	2.43	24.20	38.5	-14.30
	848.8	6.61	H	5.98	26.50	2.43	27.90	38.5	-10.60

Test Mode : GSM/GPRS 1900 (Z Axis)

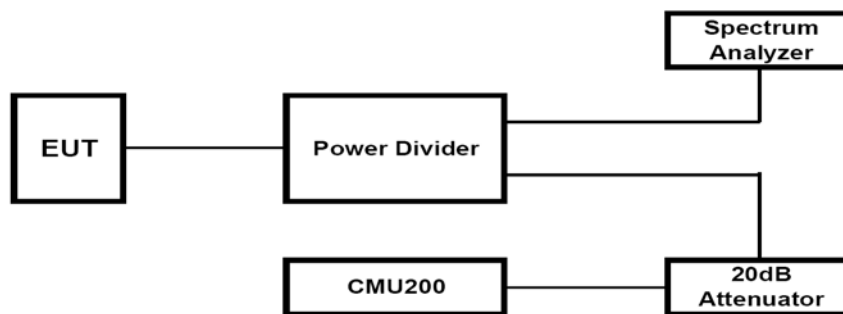
GSM/GPRS 1900	Freq (MHz)	Meas. (dBm)	Ant. Pol.	Ant. Gain (dBi)	S.G (dBm)	Cable (dB)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
↑	1850.2	-12.17	V	9.67	14.30	3.61	22.51	33	-10.49
	1850.2	-12.35	H	9.67	15.15	3.61	23.36	33	-9.64
	1880.0	-12.25	V	9.78	15.25	3.63	23.55	33	-9.45
	1880.0	-12.35	H	9.78	15.90	3.63	24.20	33	-8.80
	1909.8	-12.51	V	9.88	13.70	3.64	22.09	33	-10.91
	1909.8	-13.23	H	9.88	13.70	3.64	22.09	33	-10.91
↑ ↑	1850.2	-13.46	V	9.67	12.75	3.61	20.96	33	-12.04
	1850.2	-12.54	H	9.67	14.80	3.61	23.01	33	-9.99
	1880.0	-13.31	V	9.78	14.40	3.63	22.70	33	-10.30
	1880.0	-12.52	H	9.78	15.90	3.63	24.20	33	-8.80
	1909.8	-12.47	V	9.88	13.65	3.64	22.04	33	-10.96
	1909.8	-13.15	H	9.88	13.95	3.64	22.34	33	-10.66

4. Conducted Band Edge and Radiated Band Edge Compliance - FCC 22.917(a), 24.238(a)

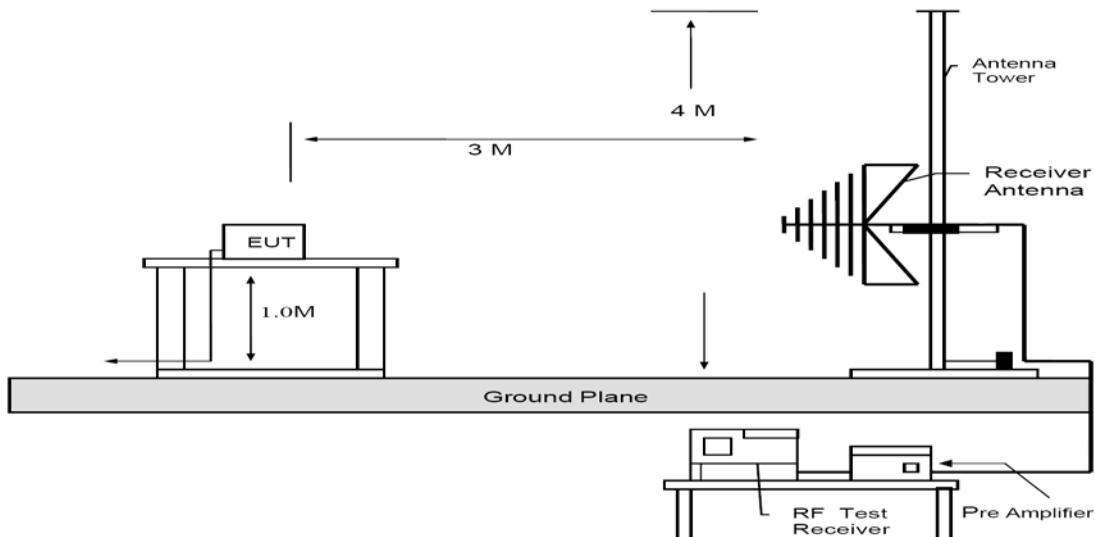
4.1 Test Condition

Ambient Temperature	+25 Degrees Celsius
Relative Humidity	67%

Conduct Band Edge



Radiated Band Edge



4.2 Limits

Operation Band	Frequency Range (MHz)	Limit (dBm)
GSM/GPRS 850	824.2 to 848.8	-13
GSM/GPRS 1900	1850.2 to 1909.8	-13

4.3 Test Equipment List

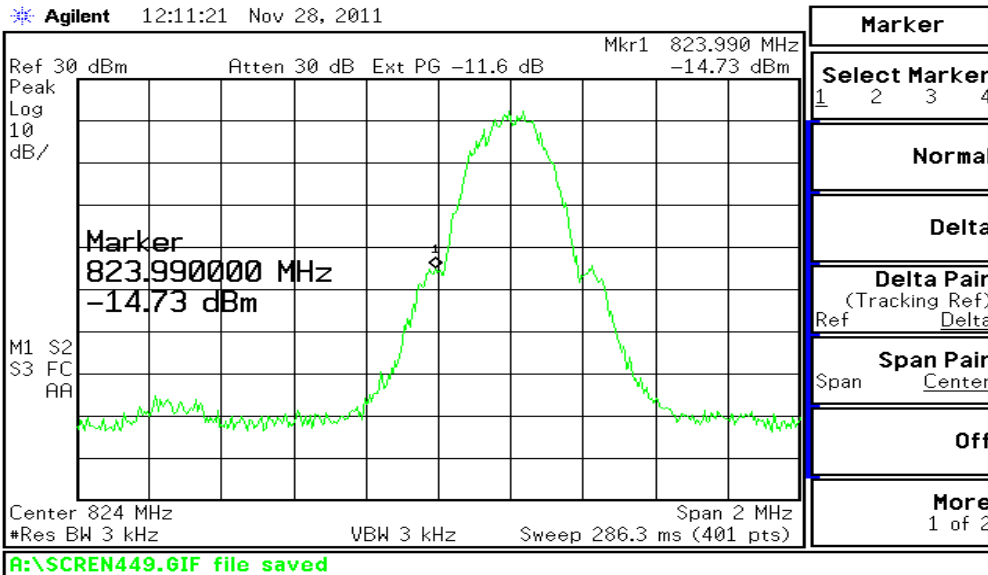
Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum	US39240419	E4407B	2011/2/1	2012/2/1
2.	Agilent	Spectrum	US44300422	E4446A	2011/6/10	2012/6/10
3.	R & S	Universal Radio Communication Tester	111968	CMU200	2011/5/21	2012/5/20
4.	SCHWARZBECK	Horn Antenna	304	BBHA 9120D	2011/9/26	2012/9/25
5.	EMCO	Biconilog Antenna	44568	3142C	2011/8/19	2012/8/18
6.	MLT	Pre Amplifier	20110209	PREAMP6G-01	2011/3/5	2012/3/5

4.4 Test Results

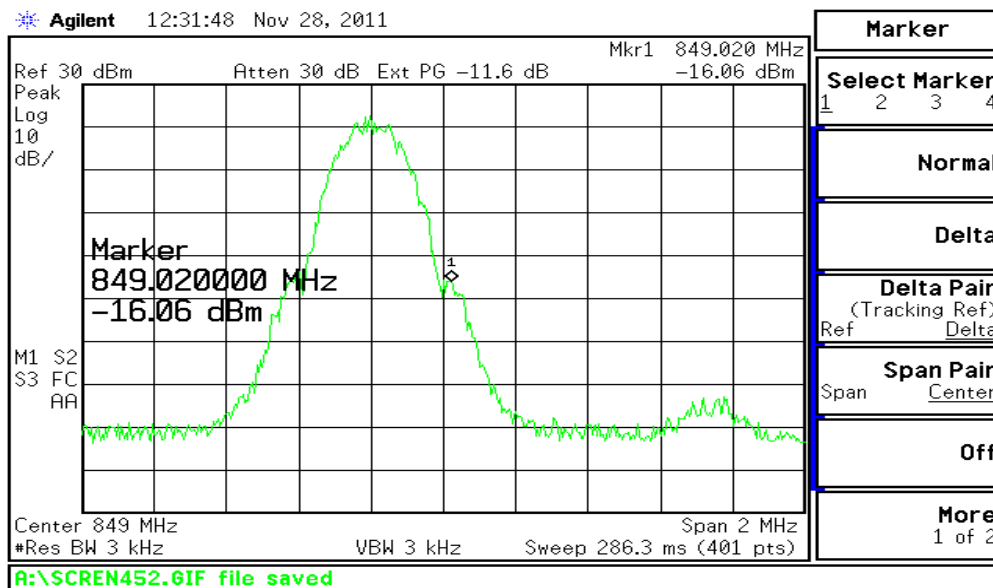
4.4.1 Conducted Mode

GSM/GPRS	Channel		Results	Limit
			(dBm)	(dBm)
850	Low	128	-14.73	-13
	Hi	251	-16.06	-13
1900	Low	512	-18.47	-13
	Hi	810	-18.57	-13

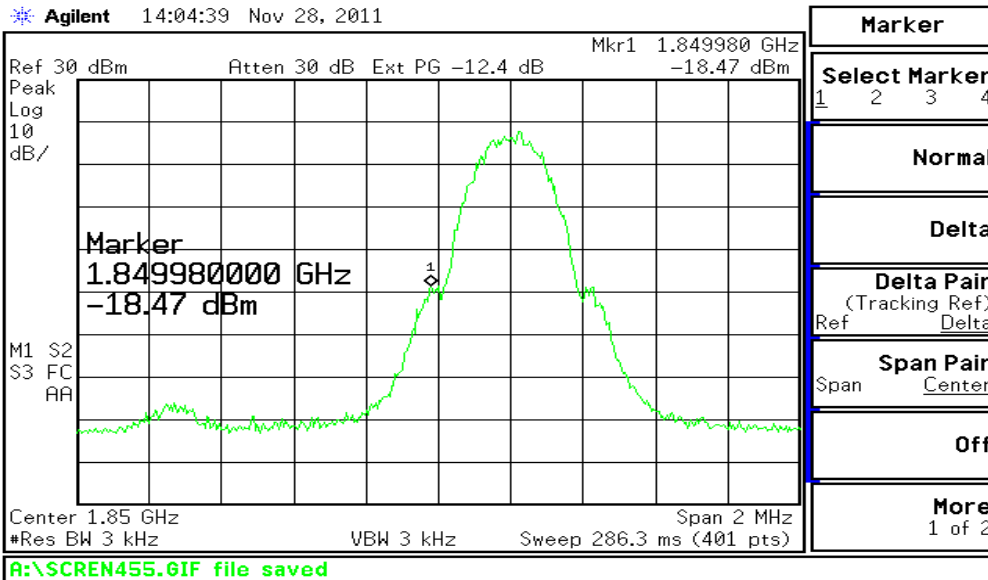
GSM/GPRS 850 Channel 128



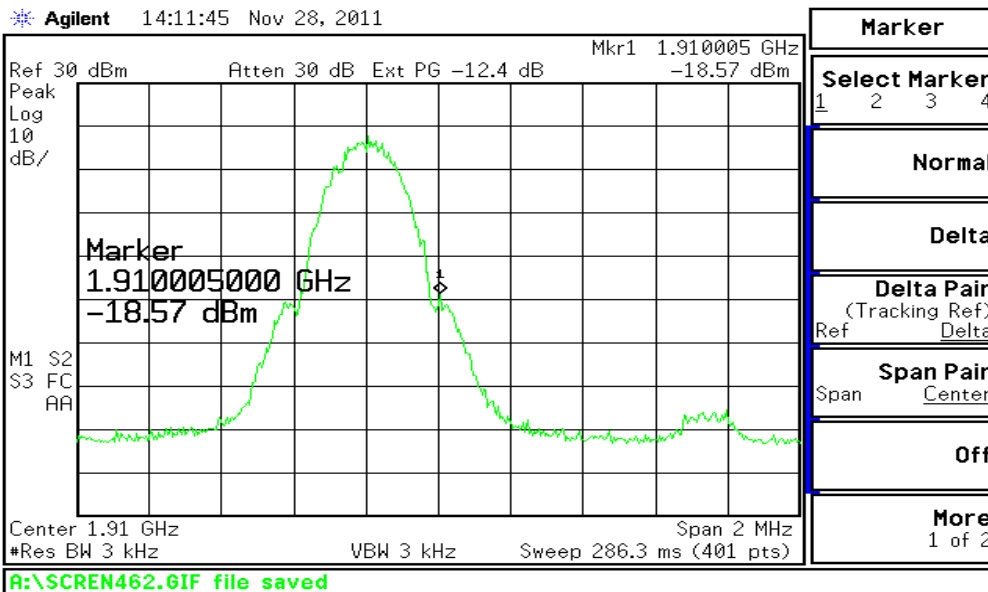
GSM/GPRS 850 Channel 251



GSM/GPRS 1900 Channel 512



GSM/GPRS 1900 Channel 810

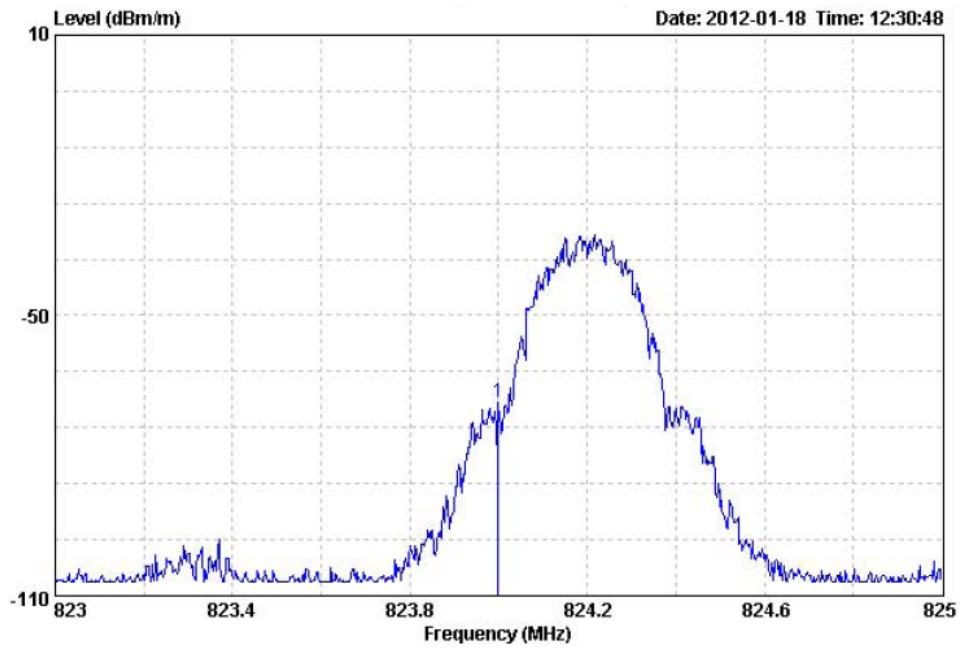


4.4.2 Radiated Mode

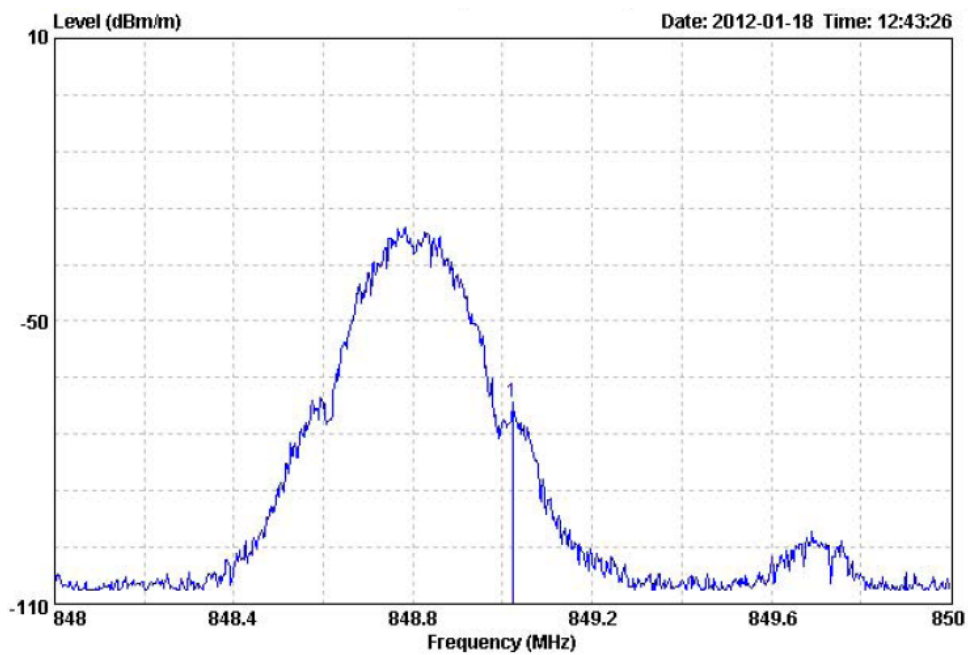
GSM/GPRS	Channel		Frequency (MHz)	Ant. Pol.	Read	Factor	Results	Limit	Marign
					(dBm)	(dB)	(dBm)	(dBm)	(dBm)
850	Low	128	824.00	H	-43.57	-35.98	-79.55	-13	-66.55
			824.00	V	-32.53	-35.98	-68.57	-13	-55.57
	Hi	251	849.02	H	-41.93	-35.64	-77.63	-13	-64.63
			849.02	V	-31.54	-35.64	-67.18	-13	-54.18
1900	Low	512	1849.99	H	-47.38	-7.05	-54.43	-13	-41.43
			1849.98	V	-41.22	-7.05	-48.27	-13	-35.27
	Hi	810	1910.00	H	-55.60	-6.37	-61.97	-13	-48.97
			1910.02	V	-40.46	-6.37	-46.83	-13	-33.83

Test Mode : Vertical

GSM/GPRS 850 Channel 128

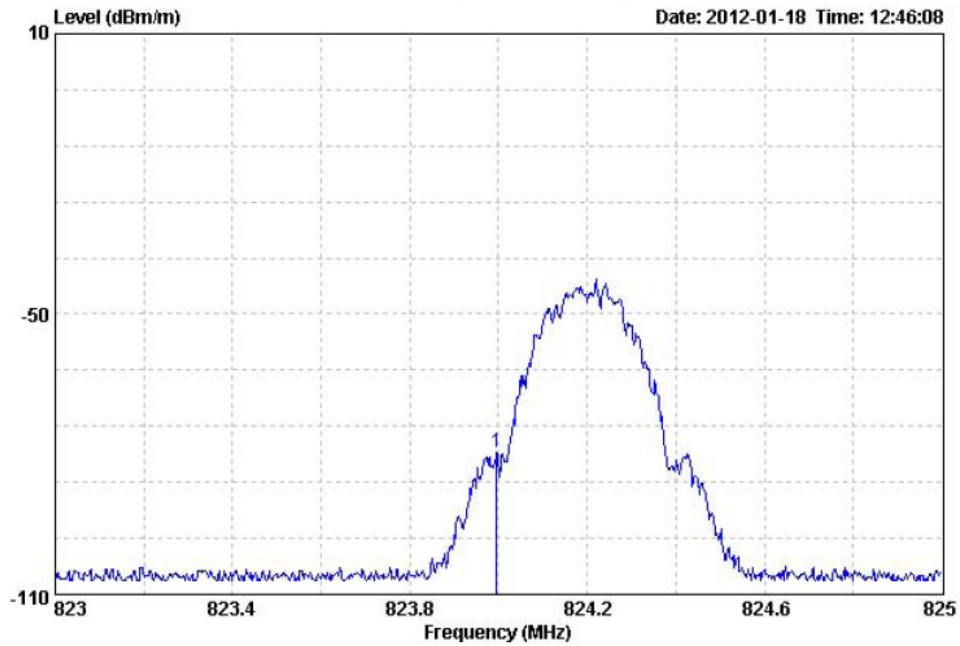


GSM/GPRS 850 Channel 251

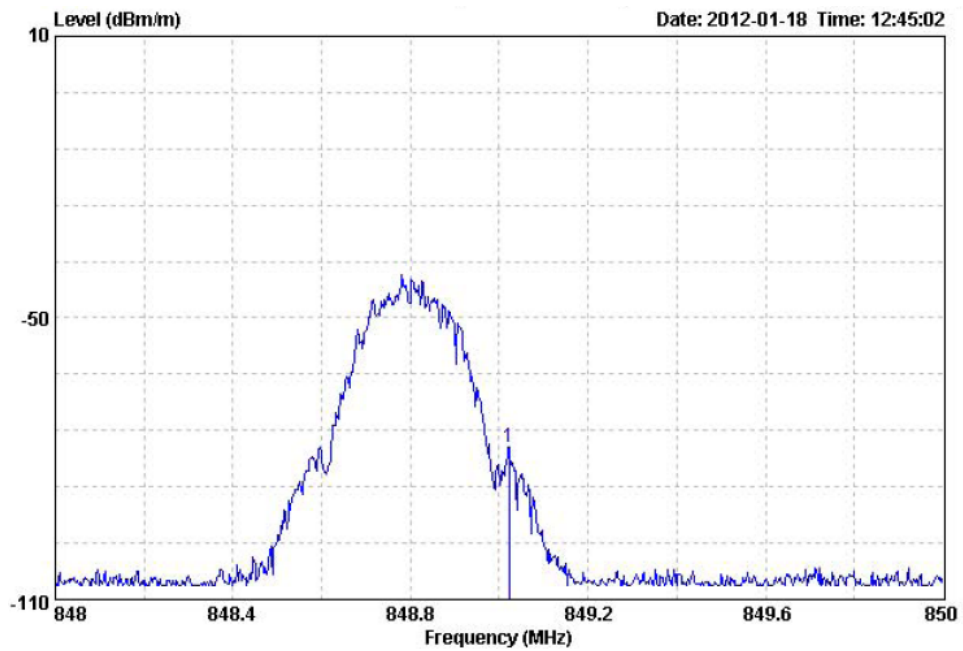


Test Mode : Horizontal

GSM/GPRS 850 Channel 128

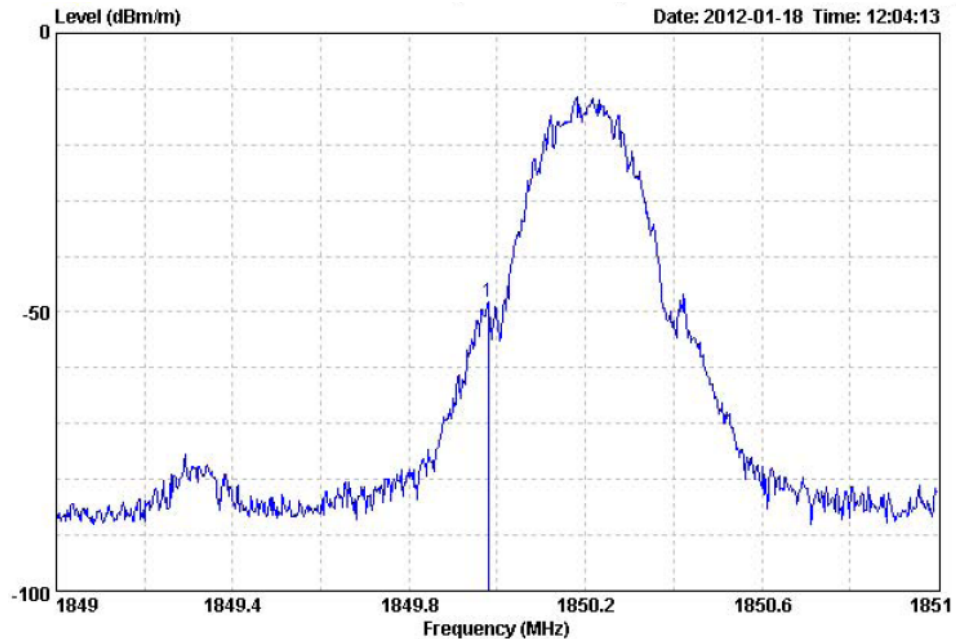


GSM/GPRS 850 Channel 251

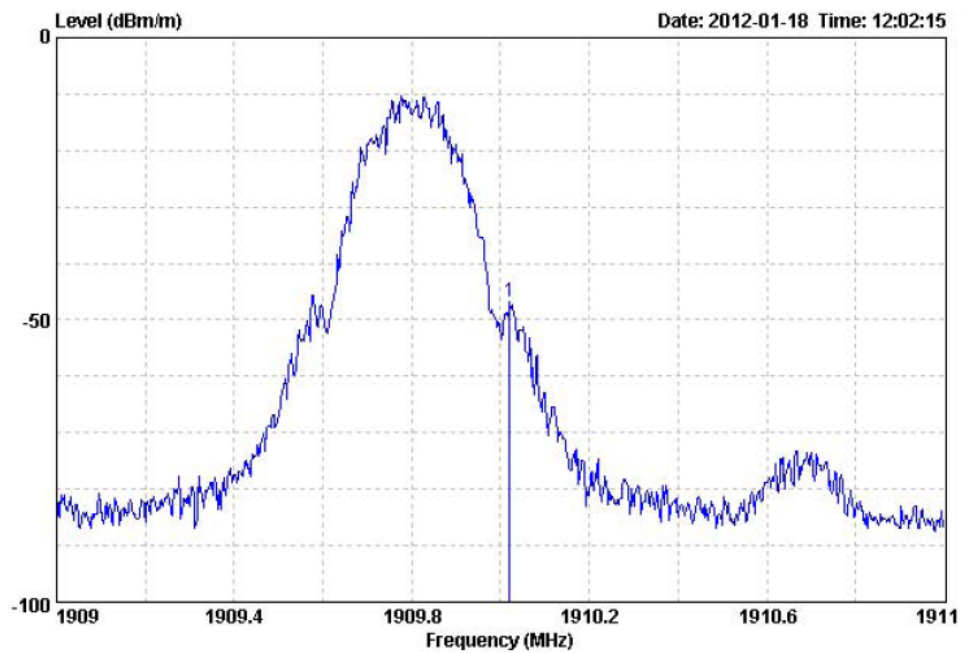


Test Mode : Vertical

GSM/GPRS 1900 Channel 512

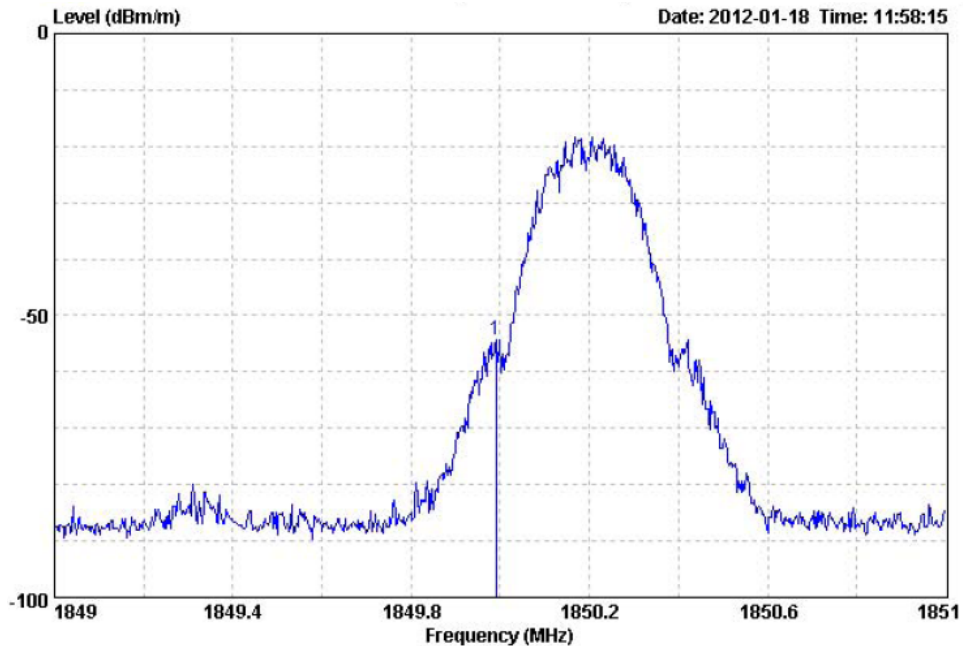


GSM/GPRS 1900 Channel 810

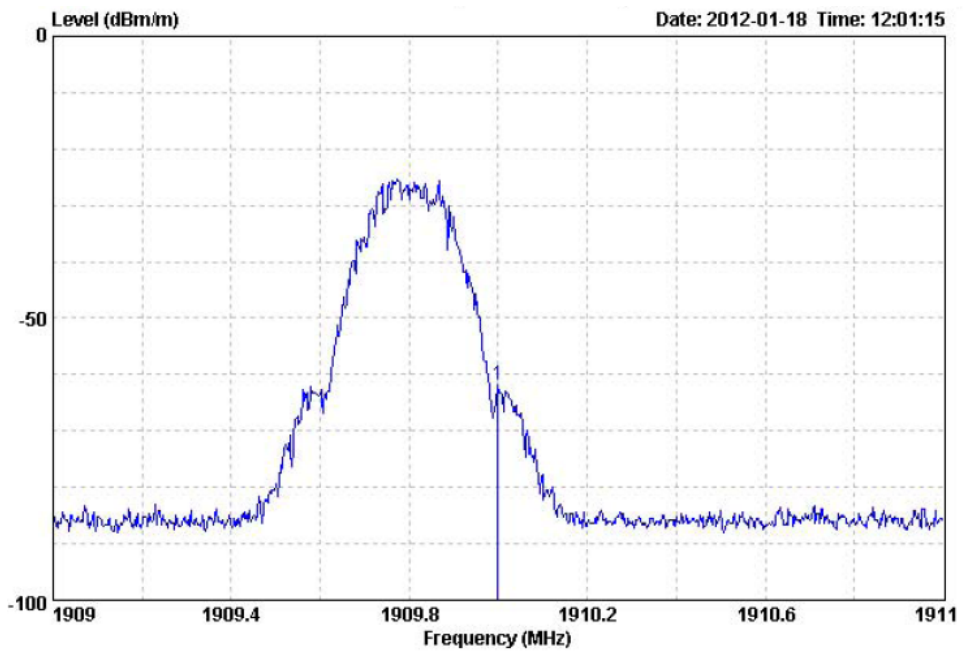


Test Mode : Horizontal

GSM/GPRS 1900 Channel 512



GSM/GPRS 1900 Channel 810

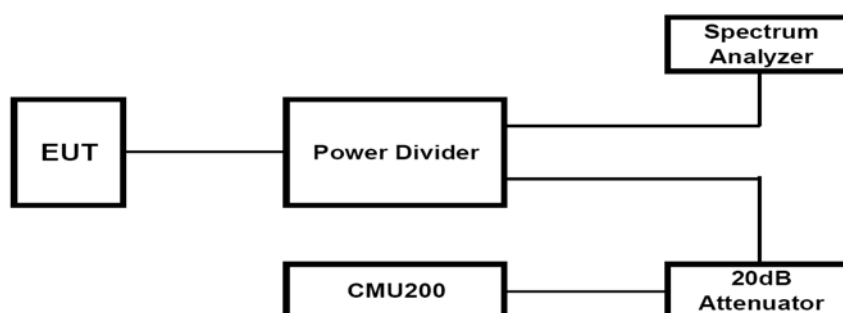


5. Occupied Bandwidth - FCC 2.1049

5.1 Test Condition

The EUT was connected to the wireless communication test set R&S CMU200 the Spectrum Analyzer E4407B via the divider. The band class is set as US Cellular. The EUT was controlled to transmit Maximum power. Measure and record the Occupied Bandwidth of the EUT by the Spectrum Analyzer E4407B.

Refer to 47CFR part 2.1049 section (g) & (h). (g) Transmitter in which the modulating base band comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition. (h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudorandom generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user.



5.2 Limits

No specific occupied bandwidth requirement in part 22 subpart H, but the occupied bandwidth was defined in part 2.1049: 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 shall be measured.

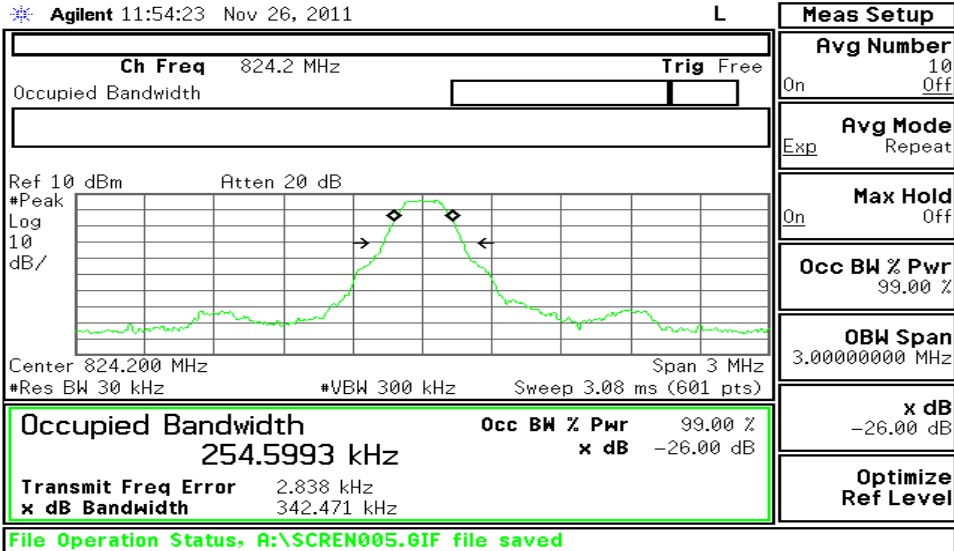
5.3 Test Equipment List

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum	US39240419	E4407B	2011/2/1	2012/2/1
2.	R & S	Universal Radio Communication Tester	111968	CMU200	2011/5/21	2012/5/20

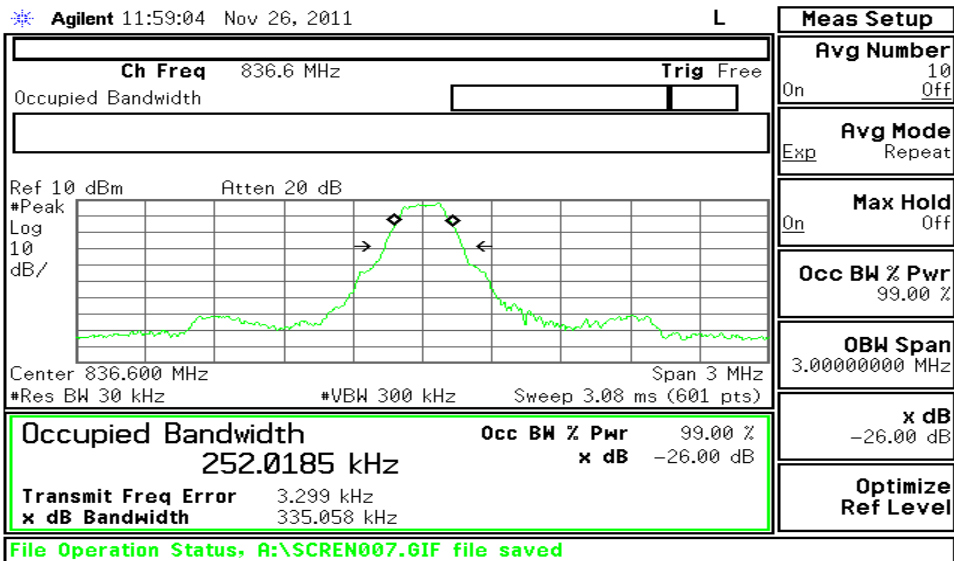
5.4 Test Results

GSM/GPRS	Frequency (MHz)	Channel	Occupied Bandwidth (kHz)
850	824.2	128	254.5993
	836.6	190	252.0185
	848.8	251	253.6281
1900	1850.2	512	255.8712
	1880.0	661	256.5458
	1909.8	810	251.3032

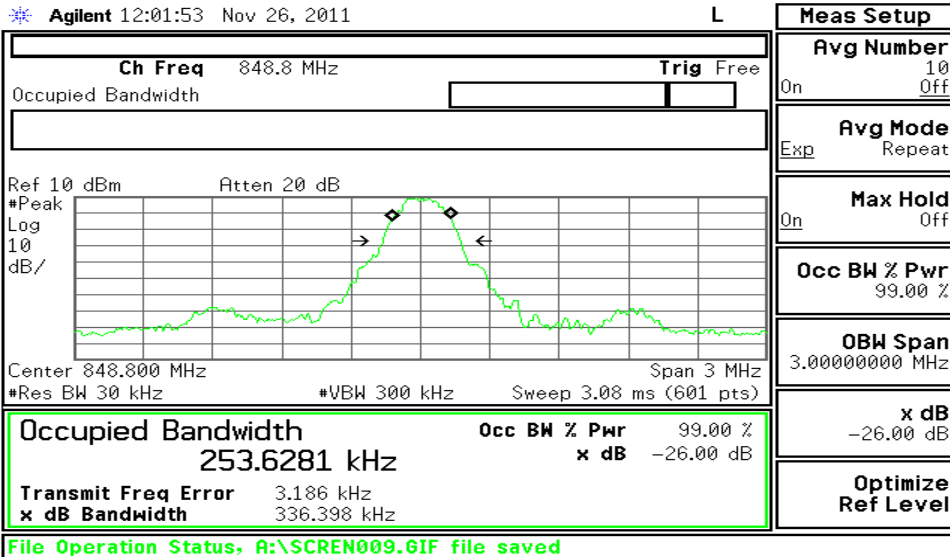
GSM/GPRS 850 CH 128



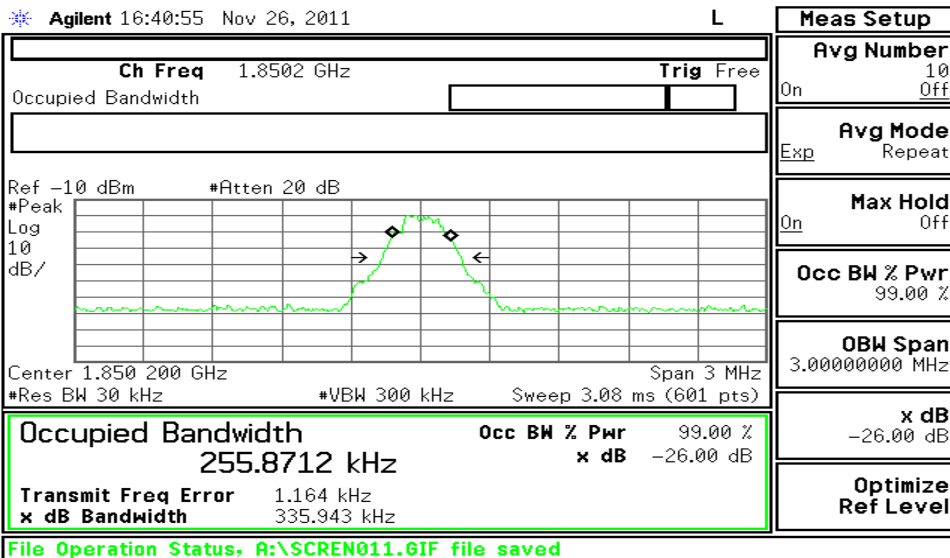
GSM/GPRS 850 CH 190



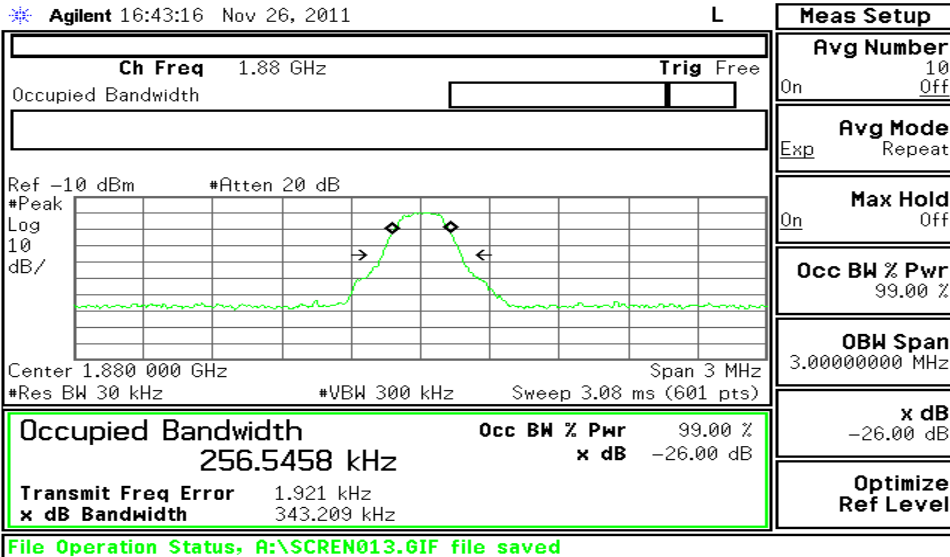
GSM/GPRS 850 CH 251



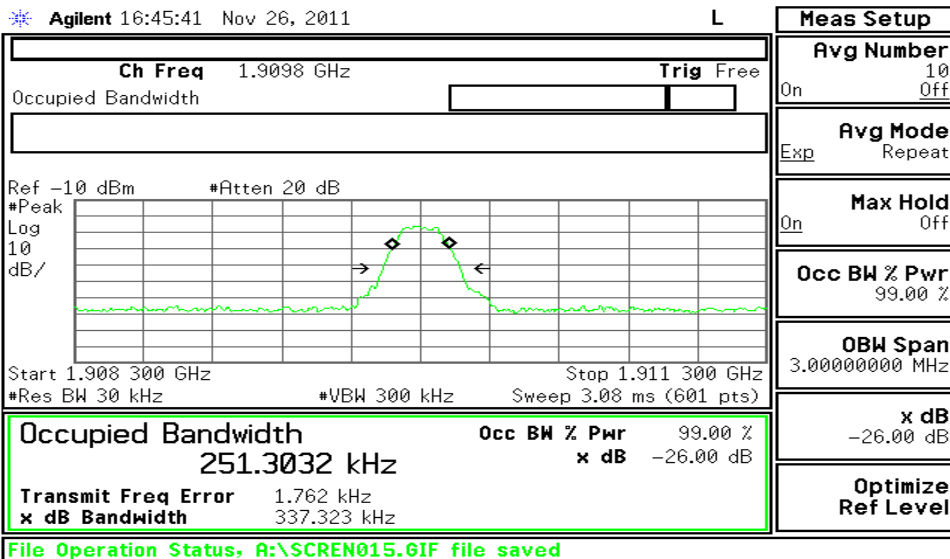
GSM/GPRS 1900 CH 512



GSM/GPRS 1900 CH 661



GSM/GPRS 1900 CH 810



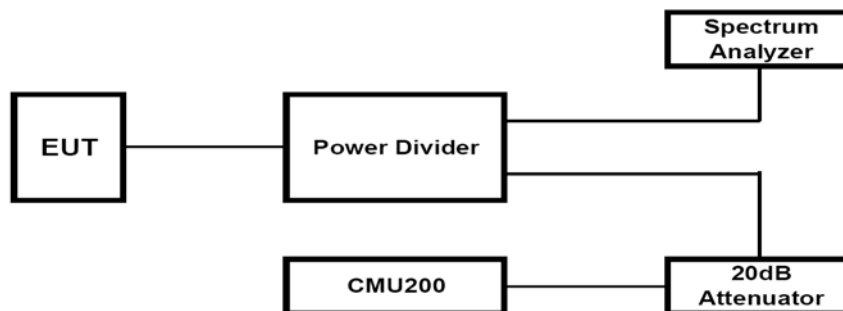
6. Radiated Spurious Emission at antenna terminals - FCC 22.917 , 2.1051 , 24.238(a)

6.1 Test Condition

The EUT RF output connector was connected to an spectrum analyzer using an 50 ohm attenuator and the resolution bandwidth of the spectrum analyzer was set to 1MHz. The spectrum was investigated from 30 MHz to 20 GHz.

The reading of the spectrum analyzer is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyzer.

Ambient Temperature	+24 Degrees Celsius
Relative Humidity	69%



6.2 Limits for Spurious Emissions

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts. At P_o transmitting power, the specified minimum attenuation becomes $43+10\log (P_o)$, and the level in dBm relative P_o becomes: $P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = - 13 \text{ dBm}$

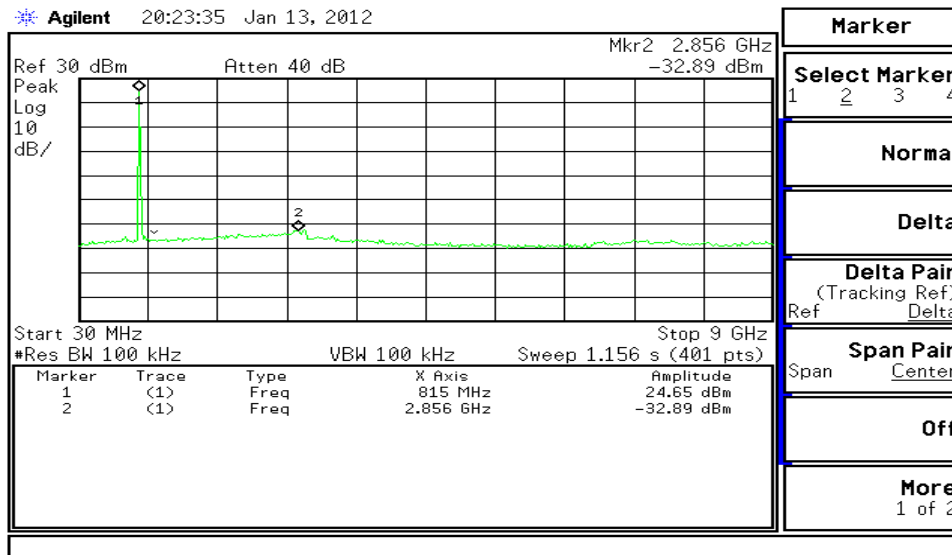
6.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum	US39240419	E4407B	2011/2/1	2012/2/1
2.	R & S	Universal Radio Communication Tester	111968	CMU200	2011/5/21	2012/5/20

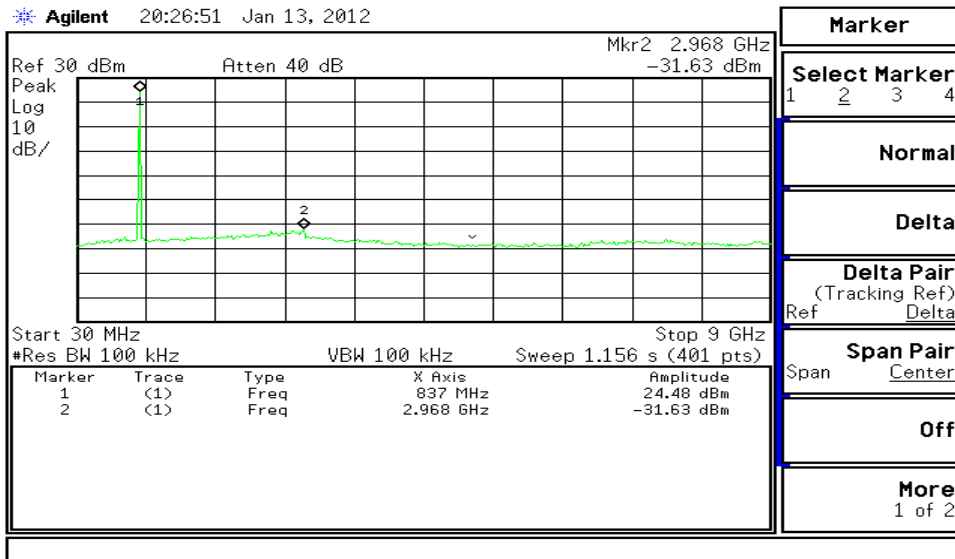
6.4 Test Results

Test Mode Channel		Frequency (MHz)	Result (dBm)	Limits (dBm)	Margin (dB)
850	128	2856.0	-32.89	-13	-19.89
	190	2968.0	-31.63	-13	-18.63
	251	2968.0	-32.50	-13	-19.50
1900	512	1246.0	-34.79	-13	-21.79
		2990.0	-36.06	-13	-23.06
		12665.0	-36.65	-13	-23.65
	661	1114.0	-35.08	-13	-22.08
		2990.0	-34.80	-13	-21.80
		16850.0	-35.73	-13	-22.73
	810	862.0	-35.23	-13	-22.23
		2990.0	-35.19	-13	-22.19
		14015.0	-36.18	-13	-23.18

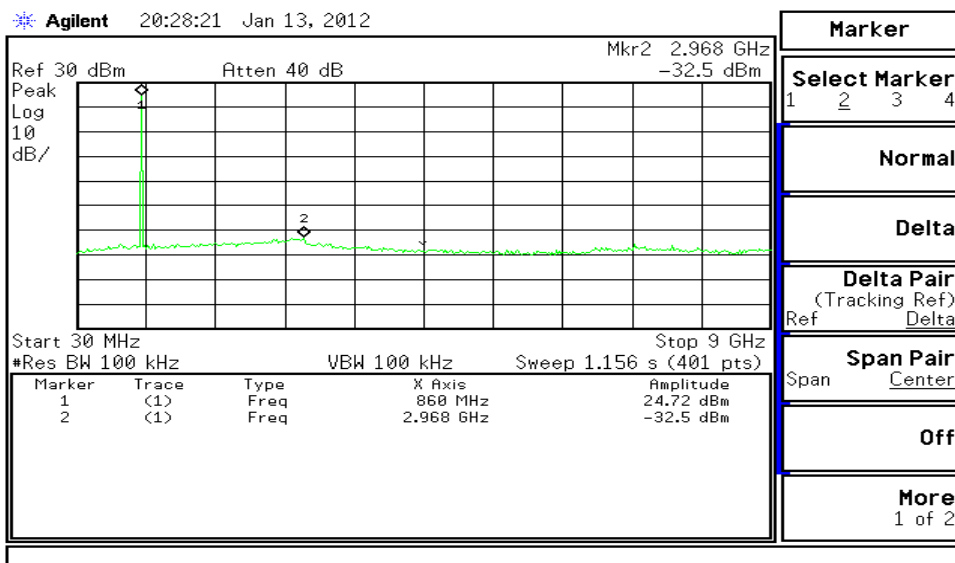
GSM/GPRS 850 CH 128



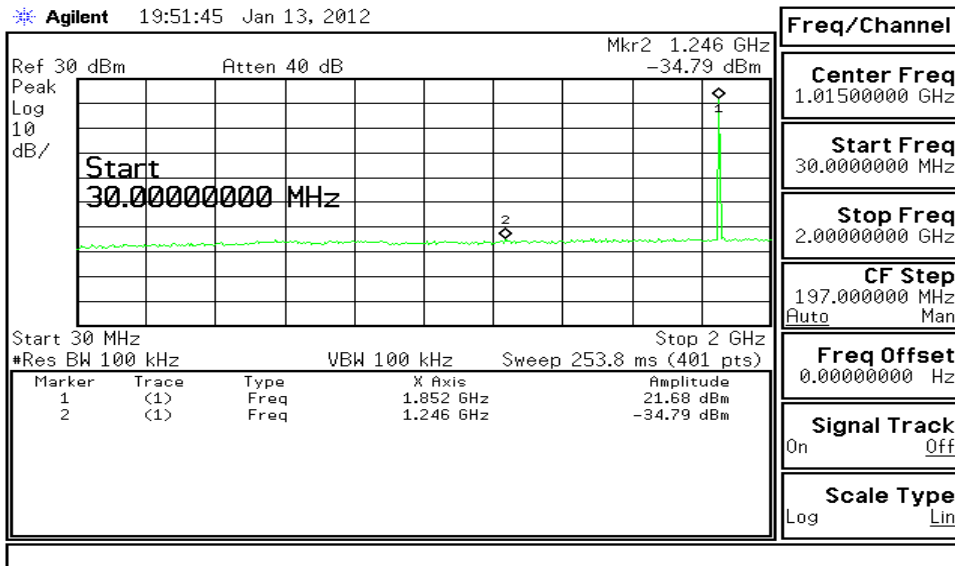
GSM/GPRS 850 CH 190



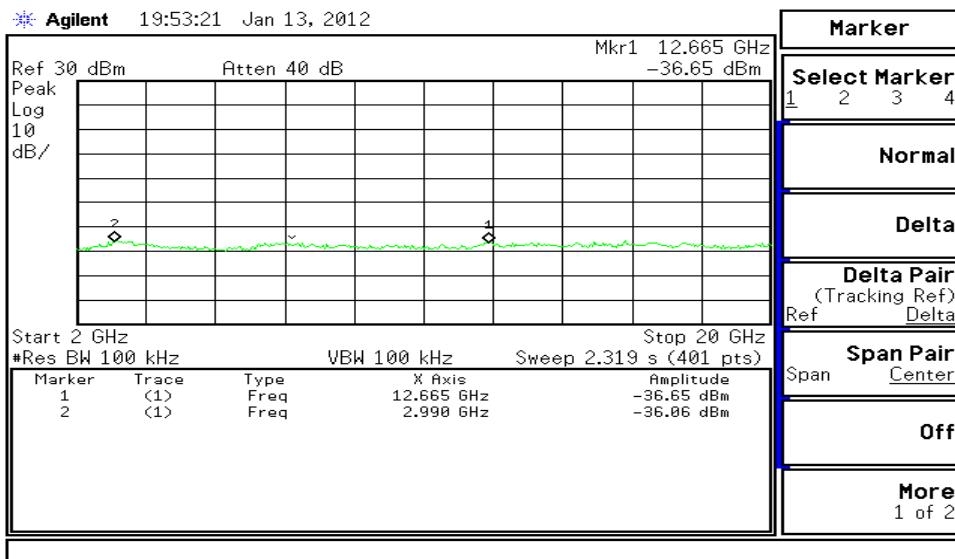
GSM/GPRS 850 CH 251



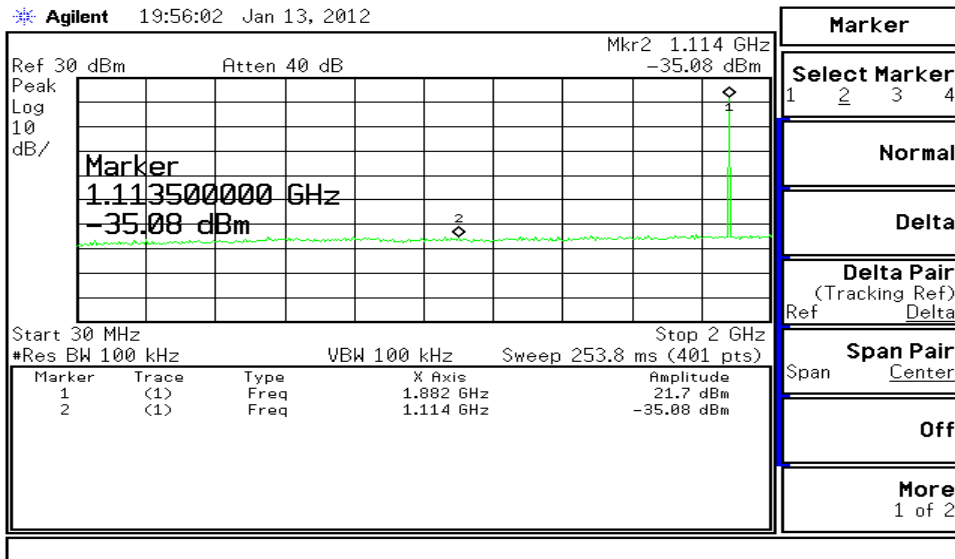
GSM/GPRS 1900 CH 512



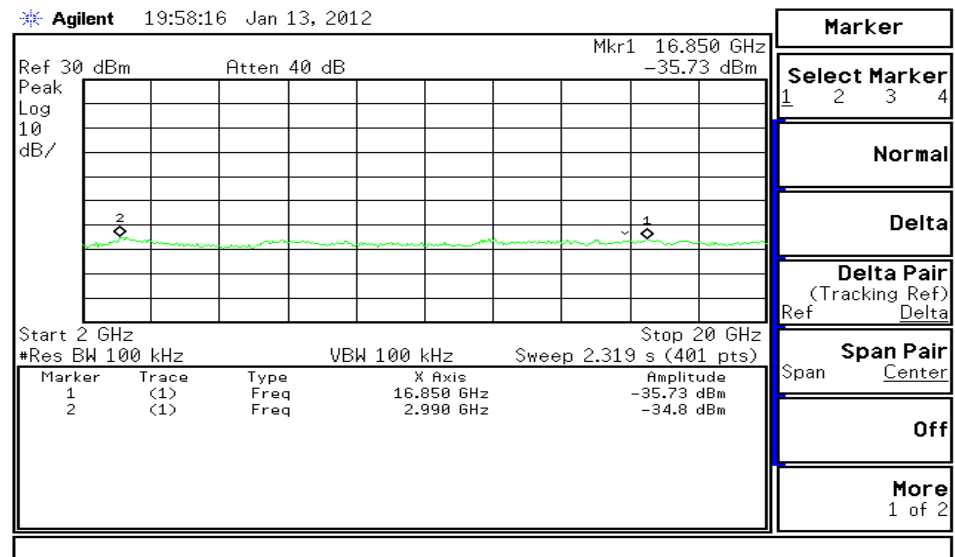
GSM/GPRS 1900 CH 512



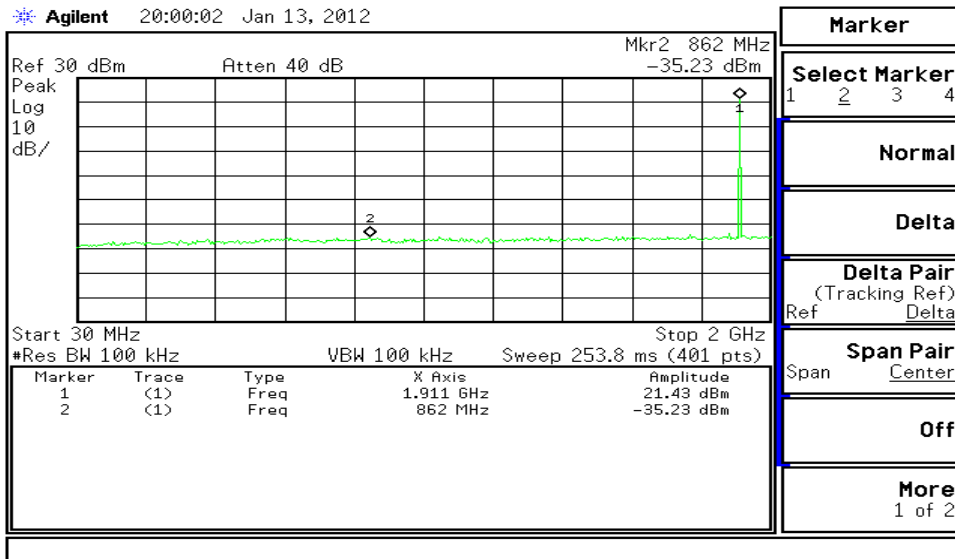
GSM/GPRS 1900 CH 661



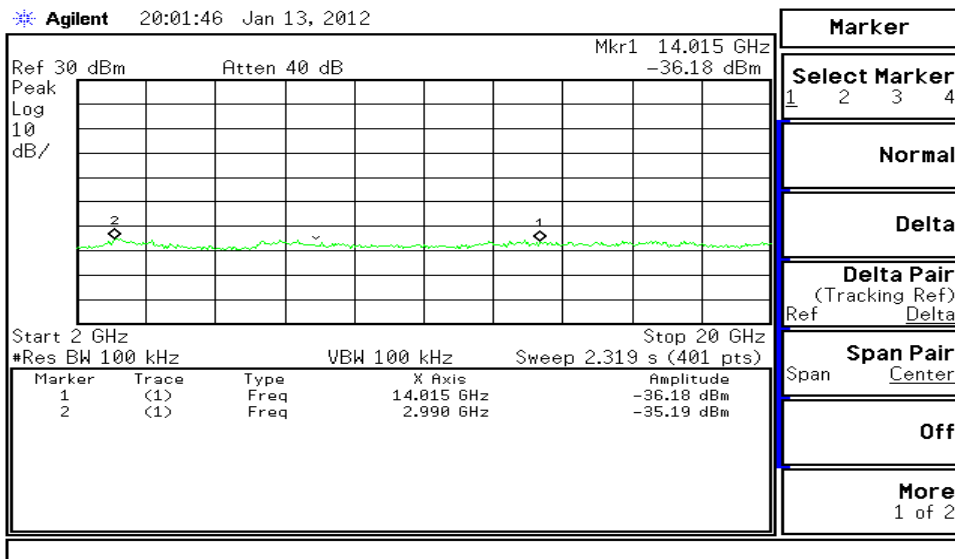
GSM/GPRS 1900 CH 661



GSM/GPRS 1900 CH 810



GSM/GPRS 1900 CH 810



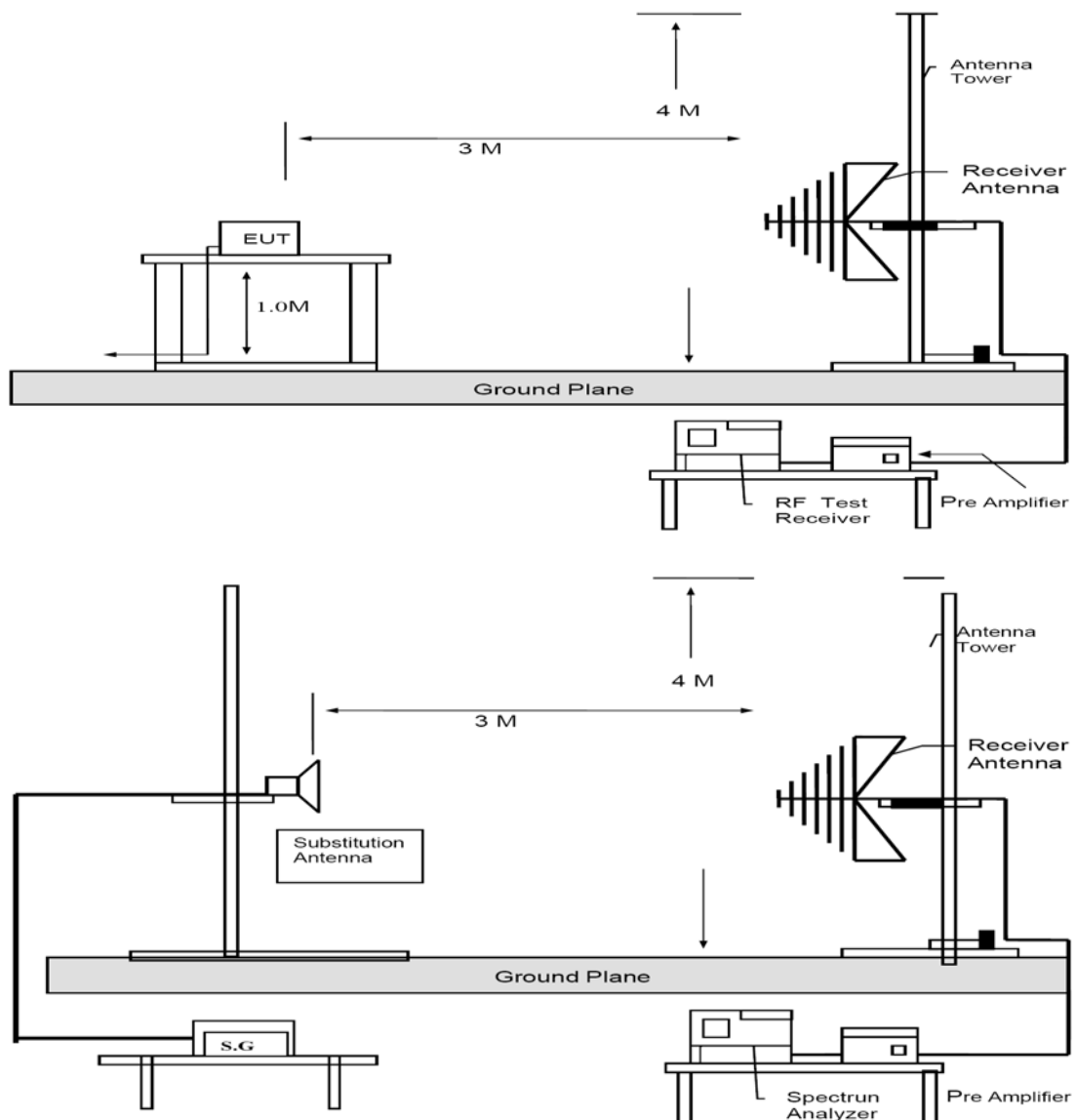
7. Radiated Spurious Emission - FCC 22.917 , 2.1053 , 24.238(a)

7.1 Test Condition

The EUT RF output connector was connected to an spectrum analyzer using an 50 ohm attenuator and the resolution bandwidth of the spectrum analyzer was set to 1MHz. The spectrum was investigated from 30 MHz to 20 GHz.

The reading of the spectrum analyzer is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyzer.

Ambient Temperature	+24 Degrees Celsius
Relative Humidity	69%



7.2 Limits for Spurious Emissions

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts. At P_o transmitting power, the specified minimum attenuation becomes $43+10\log (P_o)$, and the level in dBm relative P_o becomes: $P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = - 13 \text{ dBm}$

7.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum	US44300422	E4446A	2011/6/10	2012/6/10
2.	R & S	Universal Radio Communication Tester	111968	CMU200	2011/5/21	2012/5/20
3.	ETS	Horn Antenna	00033655	3115	2011/9/25	2012/9/24
4.	SCHWARZBECK	Horn Antenna	304	BBHA 9120D	2011/9/26	2012/9/25
5.	SCHWARZBECK	Horn Antenna	181	BBHA 9170	2011/9/26	2012/9/25
6.	EMCO	Biconilog Antenna	59739	3142C	2011/8/18	2012/8/17
7.	EMCO	Biconilog Antenna	44568	3142C	2011/8/19	2012/8/18
8.	MLT	Pre Amplifier	TA010-190-30	RF03	2011/8/25	2012/8/25
9.	TA	Pre Amplifier	RF01	0.10~19.1GHz 60dBm	2011/8/25	2012/8/25
10.	Herotek	Pre Amplifier	30690	A402-417	2011/9/26	2012/9/25
11.	Agilent	Signal Generator	US43320482	E8257C	2011/1/25	2012/1/25

7.4 Test Results

7.4.1 GSM/GPRS 850 (↑)

Radiated Emissions (GSM/GPRS 850 CH128)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
3124	-54.39	-21.90	5.07	V	11.10	-15.87	-13	-2.87
4762	-57.34	-20.60	6.06	V	12.40	-14.26	-13	-1.26
2350	-55.45	-23.60	3.77	H	10.40	-16.97	-13	-3.97
3817	-55.04	-21.30	5.03	H	12.20	-14.13	-13	-1.13

Radiated Emissions (GSM/GPRS 850 CH190)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
1675	-52.79	-28.60	3.35	V	8.40	-23.55	-13	-10.55
4834	-56.83	-21.05	6.23	V	12.40	-14.88	-13	-1.88
3070	-54.27	-21.90	5.05	H	10.80	-16.15	-13	-3.15
4780	-57.39	-21.25	6.10	H	12.40	-14.95	-13	-1.95

Radiated Emissions (GSM/GPRS 850 CH251)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
1684	-51.09	-22.15	3.35	V	8.50	-17.00	-13	-4.00
3205	-53.86	-20.70	5.05	V	11.30	-14.45	-13	-1.45
3079	-54.86	-21.10	5.05	H	10.80	-15.35	-13	-2.35
4744	-57.33	-20.80	6.05	H	12.40	-14.45	-13	-1.45

7.4.2 GSM/GPRS 850 (↑ ↑)

Radiated Emissions (GSM/GPRS 850 CH128)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
3232	-54.49	-21.85	4.88	V	11.30	-15.43	-13	-2.43
4726	-58.22	-20.95	5.97	V	12.40	-14.52	-13	-1.52
3115	-54.46	-22.00	5.07	H	11.00	-16.07	-13	-3.07
4699	-57.84	-21.35	5.85	H	12.40	-14.80	-13	-1.80

Radiated Emissions (GSM/GPRS 850 CH190)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
1675	-53.24	-27.80	3.35	V	8.50	-22.65	-13	-9.65
4699	-57.24	-20.75	5.89	V	12.40	-14.24	-13	-1.24
3070	-54.35	-22.00	5.05	H	10.80	-16.25	-13	-3.25
5635	-57.78	-20.70	6.93	H	12.80	-14.83	-13	-1.83

Radiated Emissions (GSM/GPRS 850 CH251)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
1702	-52.39	-26.20	3.39	V	9.10	-20.49	-13	-7.49
7129	-56.46	-19.50	7.01	V	11.30	-15.21	-13	-2.21
3205	-54.53	-22.40	4.96	H	11.30	-16.06	-13	-3.06
9352	-57.42	-16.80	9.28	H	11.50	-14.58	-13	-1.58

7.4.3 GSM/GPRS 1900 (↑)

Radiated Emissions (GSM/GPRS 1900 CH512)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
9012	-33.48	-40.15	7.99	V	11.50	-36.64	-13	-23.64
10512	-25.87	-26.65	9.30	V	10.90	-25.05	-13	-12.05
11232	-32.40	-35.65	8.94	V	10.90	-33.69	-13	-20.69
7392	-32.24	-40.70	7.97	H	11.10	-37.57	-13	-24.57
10512	-22.92	-23.45	9.30	H	10.90	-21.85	-13	-8.85
13560	-33.36	-32.65	10.90	H	12.20	-31.35	-13	-18.35

Radiated Emissions (GSM/GPRS 1900 CH661)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
7512	-33.02	-41.40	8.42	V	11.00	-38.82	-13	-25.82
10512	-20.27	-21.05	9.30	V	10.90	-19.45	-13	-6.45
14100	-33.75	-29.20	11.62	V	11.40	-29.42	-13	-16.42
7512	-30.57	-37.50	8.42	H	11.00	-34.92	-13	-21.92
9060	-33.53	-39.35	8.15	H	11.50	-36.00	-13	-23.00
10512	-23.46	-23.85	9.30	H	10.90	-22.25	-13	-9.25

Radiated Emissions (GSM/GPRS 1900 CH810)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
9372	-34.24	-38.20	8.94	V	11.50	-35.64	-13	-22.64
10512	-23.00	-23.50	9.30	V	10.90	-21.90	-13	-8.90
11400	-33.66	-36.35	9.49	V	11.10	-34.74	-13	-21.74
7512	-30.65	-37.40	8.42	H	11.00	-34.82	-13	-21.82
9060	-24.71	-30.95	8.15	H	11.50	-27.60	-13	-14.60
10512	-32.93	-33.65	9.30	H	10.90	-32.05	-13	-19.05

7.4.4 GSM/GPRS 1900 (↑ ↑)

Radiated Emissions (GSM/GPRS 1900 CH512)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
9156	-33.90	-38.40	8.34	V	11.50	-35.24	-13	-22.24
10512	-20.76	-21.30	9.30	V	10.90	-19.70	-13	-6.70
12012	-31.13	-36.15	9.45	V	12.80	-32.80	-13	-19.80
7392	-30.44	-38.55	7.97	H	11.10	-35.42	-13	-22.42
9120	-33.62	-40.35	8.41	H	11.50	-37.26	-13	-24.26
10512	-19.70	-20.05	9.30	H	10.90	-18.45	-13	-5.45

Radiated Emissions (GSM/GPRS 1900 CH661)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
8316	-33.86	-40.30	9.06	V	11.20	-38.16	-13	-25.16
9696	-34.23	-38.70	8.86	V	11.50	-36.06	-13	-23.06
10512	-23.09	-23.75	9.30	V	10.90	-22.15	-13	-9.15
7512	-30.57	-37.50	8.42	H	11.00	-34.92	-13	-21.92
9060	-33.53	-39.35	8.15	H	11.50	-36.00	-13	-23.00
10512	-23.46	-23.85	9.30	H	10.90	-22.25	-13	-9.25

Radiated Emissions (GSM/GPRS 1900 CH810)								
Freq. (MHz)	Mease. (dBm)	S.G (dB)	Cable (dB)	Ant. Pol.	Ant Gain (dBi)	Result (dBm)	Limits (dBm)	Margin (dB)
9156	-33.94	-38.50	8.34	V	11.50	-35.34	-13	-22.34
10512	-22.67	-23.45	9.30	V	10.90	-21.85	-13	-8.85
13992	-32.59	-33.55	10.85	V	11.40	-33.00	-13	-20.00
7632	-33.17	-39.95	8.59	H	11.00	-37.54	-13	-24.54
10512	-23.58	-23.95	9.30	H	10.90	-22.35	-13	-9.35
12036	-33.36	-36.95	9.59	H	12.90	-33.64	-13	-20.64

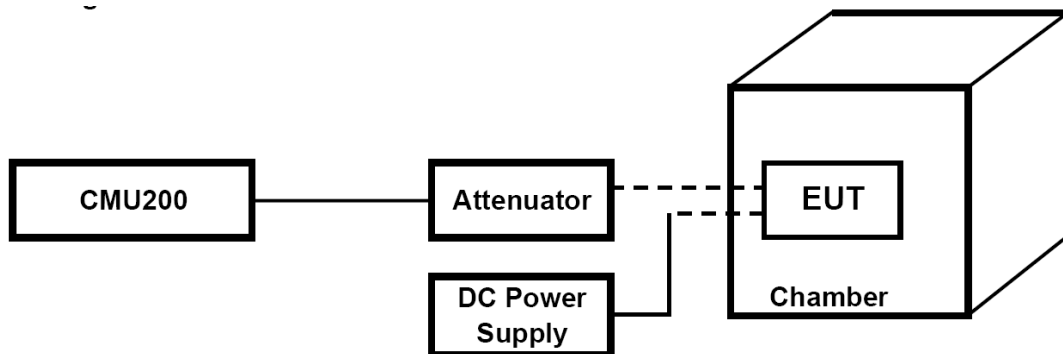
- Notes :**
1. Margin = Amplitude - Limits
 2. Distance of Measurement : 3 Meter
 3. Height of table for EUT placed: 0.8 Meter.
 4. Result = SG – Cable loss + Ant Gain
(Auto calculate in spectrum analyzer)

8. Frequency Stability Temperature Variation - FCC 2.1055 and 22.355 and Voltage Variation - FCC 2.1055(d)

8.1 Test Condition

The frequency tolerance measurements over temperature variations were made over the temperature range of -30°C to $+50^{\circ}\text{C}$. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from -30°C up to $+50^{\circ}\text{C}$.

The frequency tolerance measurements over voltage variations were made at room temperature and at the V_{max} and V_{min} supply voltages as declared by the applicant.



8.2 Limits

Limits for frequency stability temperature and voltage variation measurements

Frequency Deviation	Limit (ppm)
	± 2.5

8.3 Test Equipment List

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	R & S	Universal Radio Communication Tester	111968	CMU200	2011/5/21	2012/5/20
2.	HP	Power Supply	6643A	US36400362	N/A	N/A
3.	GF	Temp Chamber	GF 94272-1	GTH-064S	2011/7/26	2012/7/25

8.4 Test Results

8.4.1 Frequency Stability Temperature Variation

GSM/GPRS 850
Channel 190 / 836.6 MHz (↑)

Temperature (°C)	Deviation (Hz)	Deviation (ppm)
50	8	0.0096
40	13	0.0155
30	10	0.0120
20	14	0.0167
10	10	0.0120
0	9	0.0108
-10	14	0.0167
-20	10	0.0120
-30	10	0.0120

GSM/GPRS 850
Channel 190 / 836.6 MHz (↑ ↑)

Temperature (°C)	Deviation (Hz)	Deviation (ppm)
50	17	0.0203
40	14	0.0167
30	13	0.0155
20	15	0.0179
10	15	0.0179
0	16	0.0191
-10	12	0.0143
-20	18	0.0215
-30	22	0.0263

GSM/GPRS 1900
Channel 661 / 1880 MHz (↑)

Temperature (°C)	Deviation (Hz)	Deviation (ppm)
50	42	0.0223
40	36	0.0191
30	43	0.0229
20	46	0.0245
10	44	0.0234
0	50	0.0266
-10	56	0.0298
-20	50	0.0266
-30	51	0.0271

GSM/GPRS 1900
Channel 661 / 1880 MHz (↑ ↑)

Temperature (°C)	Deviation (Hz)	Deviation (ppm)
50	56	0.0298
40	58	0.0309
30	52	0.0277
20	52	0.0277
10	51	0.0271
0	57	0.0303
-10	59	0.0314
-20	58	0.0309
-30	68	0.0362

8.4.2 Frequency Stability Voltage Variation

GSM/GPRS 850
Channel 190 / 836.6 MHz (↑)

Voltage (DC V)	Deviation (Hz)	Deviation (ppm)
8.1	10	0.0120
7.4	14	0.0167
6.7	9	0.0108

GSM/GPRS 850
Channel 190 / 836.6 MHz (↑ ↑)

Voltage (DC V)	Deviation (Hz)	Deviation (ppm)
8.1	18	0.0215
7.4	15	0.0179
6.7	18	0.0096

GSM/GPRS 1900
Channel 661 / 1880 MHz (↑)

Voltage (DC V)	Deviation (Hz)	Deviation (ppm)
8.1	44	0.0234
7.4	46	0.0245
6.7	47	0.0250

GSM/GPRS 1900
Channel 661 / 1880 MHz (↑ ↑)

Voltage (DC V)	Deviation (Hz)	Deviation (ppm)
8.1	53	0.0282
7.4	52	0.0277
6.7	56	0.0298

9. Conducted Emissions Requirements - EMI Test

9.1 General & Setup

The power line conducted emission measurements were performed in a shielded enclosure. The EUT was assembled on a wooden table which is 80 centimeters high, was placed 40 centimeters from the back wall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and EMCO Model 3825/2 Line Impedance Stabilization Networks (LISN). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPR quasi-peak detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 9.5.

9.2 Test Equipment List

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum	US40240137	E7403A	2011/2/11	2012/2/11
2.	EMCO	LISN	2658	3825/2	2011/3/5	2012/3/5
3.	TESEQ	ISN	24801	ISN T8	2011/4/7	2012/4/7

9.3 Test condition

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

9.4 Conducted Emissions Limits

FCC Part 15.107

Frequency range (MHz)	Limits (dBuV)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.0	56	46
5.0 to 30	60	50

9.5 Measurement Data Of Conducted Emissions

The following table shows a summary of the highest emissions of power line conducted emissions to the HOT and NEUTRAL conductor of the EUT power.

Conducted Emissions								
Conductor	Frequency (MHz)	Read(dBuV)		Factor	Limits (dBuV)		Amplitude (dBuV)	
		QP	AV		QP	AV	QP	AV
L1	0.1668	43.80	--	1.05	65.12	55.12	44.85	--
	0.3339	39.09	--	1.15	59.35	49.35	40.24	--
	0.5671	46.25	43.85	1.22	56.00	46.00	47.47	45.07
	0.9184	38.57	--	1.25	56.00	46.00	39.82	--
	3.6420	36.83	--	2.00	56.00	46.00	38.83	--
	4.5740	37.00	--	2.05	56.00	46.00	39.05	--
	5.4760	37.85	--	2.03	60.00	50.00	39.88	--
L2	0.3339	38.84	--	1.09	59.35	49.35	39.93	--
	0.5641	46.38	44.63	1.13	56.00	46.00	47.51	45.76
	0.8438	36.07	--	1.21	56.00	46.00	37.28	--
	1.8390	35.83	--	1.46	56.00	46.00	37.29	--
	3.6420	37.55	--	1.90	56.00	46.00	39.45	--
	4.5740	37.56	--	2.01	56.00	46.00	39.57	--
	7.4460	35.59	--	1.95	60.00	50.00	37.54	--

Notes : 1.L1: One end & Ground L2: The other end & Ground

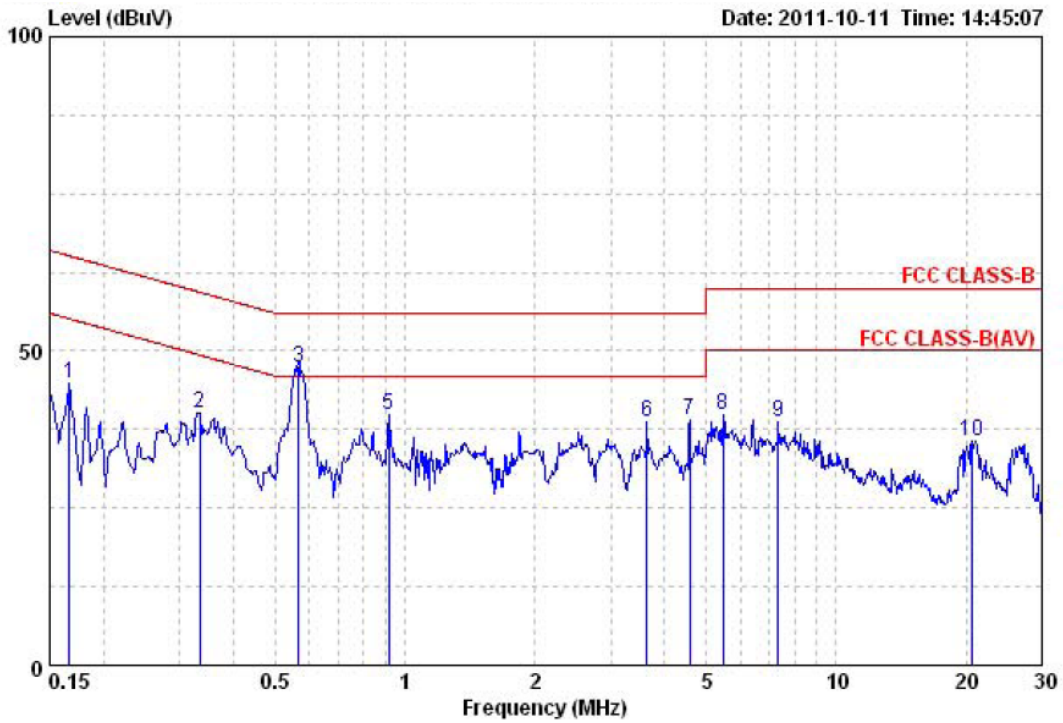
2.Height of table on which the EUT was placed : 0.8 m.

3.The Quasi-Peak Value have already met the Average Value Limit showed on above limits.

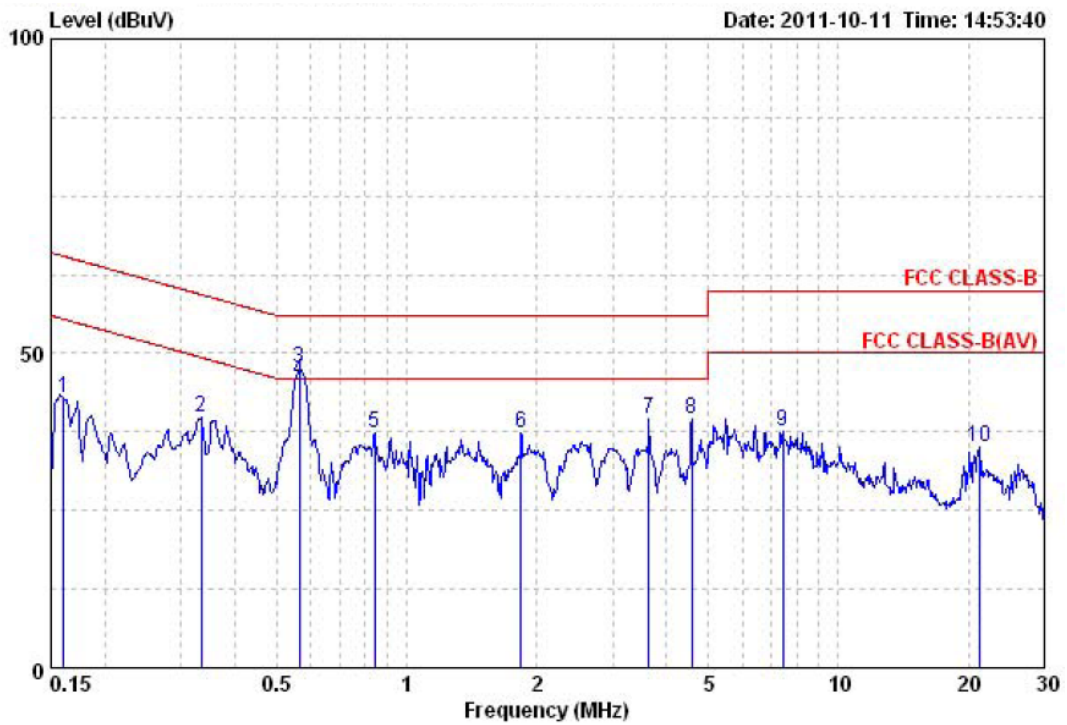
4The above test results are obtained under the normal condition.

5. Amplitude = Read + Factor

Test Port : L1



Test Port : L2



10 Radiated Emissions Requirements - EMI Test

10.1 General Configuration

Prior to open-field testing, the EUT was placed in a shielded enclosure and scanned at a close distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration which produced the highest emissions was noted so it could be reproduced later during the open-field tests. This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT. The radiated emissions test is made at a 10 meters open site from 30MHz to 1GHz. The radiated emissions test is made at a 3 meters open site from 1GHz to 6GHz. The EUT system was placed on a nonconductive turntable which is 0.8 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 30 MHz to 6GHz using an Hewlett Packard E7403A Spectrum Analyzer, EMCO Biconilog Antenna (Model 3142C) for 30MHz -1GHz , SCHWARZBECK Home Antenna (Model BBHA 9120D) for 1GHz-6GHz At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization. Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post-detector video filters were used in the test. The spectrum analyzer's 6 dB bandwidth was set to 120 KHz, and the analyzer was operated in the quasi-peak detection mode. The highest emission amplitudes relative to the appropriate limit were measured and recorded in paragraph 10.5.

Shown in § 15.35 (b) Above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, there also is a limit on the peak level of the radio frequency emissions. Limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device,

10.2 Test Equipment List

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	HP	Spectrum	73412A00110	8591EM	2011/3/25	2012/3/25
2.	MLT	Pre Amplifier	20110301	PREAMP6G-02	2011/3/5	2012/3/5
3.	EMCO	Biconilog Antenna	00059739	3142C	2011/8/18	2012/8/17

10.3 Test condition

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

10.4 Radiated Emissions Limits

FCC Part 15.109

Frequency range (MHz)	Limits (dBuV)	
	Distance (Meter)	Limits (dBuV/m)
30 to 88	3	40
88 to 216	3	43.5
216 to 960	3	46
Above 960	3	54

10.5 Measurement Data Of Radiated Emissions

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Radiated Emissions (VERTICAL)							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
124.00	64.98	-31.99	100	303	32.99	43.5	-10.51
132.00	66.90	-31.94	100	232	34.96	43.5	-8.54
140.00	66.21	-31.52	100	270	34.69	43.5	-8.81
150.00	69.57	-30.07	100	227	39.50	43.5	-4.00
172.00	61.66	-28.78	100	102	32.88	43.5	-10.62
192.00	67.55	-28.47	100	150	39.08	43.5	-4.42
240.00	63.98	-26.46	100	400	37.52	46	-8.48
336.00	64.32	-23.32	100	303	41.00	46	-5.00
815.90	46.20	-10.13	400	182	36.07	46	-9.93

Radiated Emissions (HORIZONTAL)							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
124.00	63.73	-31.79	400	237	31.94	43.5	-11.56
128.10	66.37	-31.85	400	214	34.52	43.5	-8.98
131.79	65.20	-31.84	400	256	33.36	43.5	-10.14
150.00	65.21	-29.99	400	249	35.22	43.5	-8.28
192.00	64.39	-28.51	400	400	35.88	43.5	-7.62
335.98	59.68	-23.68	251	188	36.00	46	-10.00
480.00	53.33	-18.80	100	249	34.53	46	-11.47
719.97	46.28	-12.61	100	205	33.67	46	-12.33
815.98	47.77	-10.55	100	267	37.22	46	-8.78

- Notes :
1. Margin = Amplitude - Limits
 2. Distance of Measurement : 10 Meter
 3. Height of table for EUT placed: 0.8 Meter.
 4. Amplitude = Reading Amplitude + Factor .

Appendix I - Brand / Trade Name & Model No. Multiple Listee

Trade Name	Model No.
N/A	N/A