KTL
Korea Testing Laboratory
222-13, Guro-Dong Guro-Gu Seoul 152-848 Korea Tel.:+82-2-860-1114 Fax.:+82-2-860-1116 http://www.ktl.re.kr

TEST REPORT

Applicant	: AISA Tech Co., ltd.
Address	: 1053-20 Namhyun-dong, Gwanak-gu, Seoul 151-802 Korea
Manufacturer	: AISA Tech Co., ltd.
Address	: 1053-20 Namhyun-dong, Gwanak-gu, Seoul 151-802 Korea
Test Item	: Quad band GSM/GPRS Module
Model / Type	: N701-AT
Standard	: FCC Part 2, Part 22(H), Part 24(E)
Test results	: POSITIVE
Date of application	: May 02, 2006 ~ May 29, 2006
Issued date	: May 29, 2006

Tested by	Reviewed by
Sung-Kyu Cho	Seok-Jin Kim
Engineer	Telecommunication Team Manager

THE TEST RESULTS only responds to the test sample.

KOREA TESTING LABORATORY

TABLE OF CONTENTS

1. GENERAL INFORMATIONS

1.1 Applicant (Client)

Name	AISA Tech Co., ltd.
Address	1053-20 Namhyun-dong, Gwanak-gu, Seoul 151-802 Korea
Contact Person	Mr. Cho, Yong Seok
Telephone No.	+82-(0)2-3474-6744/6745
Facsimile No.	+82-(0)2-3474-6746
E-mail address	yscho@aisatech.com

1.2 Equipment (EUT)

Type of equipment	Quad band GSM/GPRS Module
Model Name	N701-AT
IMEI No	350381-03-003026-6
FCC ID	T5ZN701-AT
Hardware Version	Rev0.0
Software Version	Rev0.10
Emission Designator	250KGXW (GSM)
Manufacturer Name	AISA Tech Co., ltd.
Manufacturer Address	1122-5, Singil-dong, Ansan-si, Gyunggi-do, Korea
Tx Frequency Range	824Mhz ~ 849Mhz (GSM 850) / 1850.2~1909.8Mhz(GSM1900)
Rx Frequency Range	869Mhz ~ 894Mhz (GSM 850) / 1930.2~1989.8Mhz(GSM1900)
Additional Information	Type of modulauion : GSM Frequency : GSM 850/1900 GPRS Class 8/Class B

1.3 Testing Laboratory

Test Method	FCC Part 2, Part 22(H), Part 24(E)
Testing Place	Korea Testing Labortory (KTL) 222-13 Guro-dong, Guro-Gu, Seoul 152-848 Korea
Test Engineer	Sungkyu Cho
Telephone number	+82 2 860 1463
Facsimile number	+82 2 860 1468
E-mail address	skcho@ktl.re.kr
Other Comments	-

3. SUMMARY OF TEST RESULTS

Test case	Test	Result
4.1	Effective Radiated Power Output (GSM850 Mode)	Pass
4.2	Field Strength of Spurious Radiation (GSM850 Mode)	Pass
4.3	Frequency Stability (GSM850 Mode)	Pass
4.4	Conducted Spurious Emissions (GSM850 Mode)	Pass
4.5	Occupied Bandwidth (GSM850 Mode)	Pass
4.6	Conducted Power (GSM850 Mode)	Pass
5.1	Effective Radiated Power Output (GSM1900 Mode)	Pass
5.2	Field Strength of Spurious Radiation (GSM1900 Mode)	Pass
5.3	Frequency Stability (GSM1900 Mode)	Pass
5.4	Conducted Spurious Emissions (GSM1900 Mode)	Pass
5.5	Occupied Bandwidth (GSM1900 Mode)	Pass
5.6	Conducted Power (GSM1900 Mode)	Pass

4. TEST DATA (GSM 850)

4.1 Effective Radiated Power

Measurement procedure

Effective Radiated Power Output and Equivalent Isotropic Radiated Power output Measurements by Substitution Method according to ANSI/TIA/EIA-603- B-2002:
The measurement of Effective Radiated Power was carried out in a KTL absorber-lined Room that was listed up at FCC according to the "Radiated Emissions Testing" procedure specified by ANSI C63.4.
The EUT was placed on a nonconductive turntable 1.5 meter above the ground plane and set up for the max.output power. The ground was covered with absorbing material 1 m thick.
These measurements were done at 3 frequencies, 824.2 MHz, 836.6 MHz, 848.8 MHz. (bottom, middle, and top of operational frequency range)
The measurement was made in same test set up and configuration with 3 orthogonal planes which produced maximum emission level. Receiving antenna was installed at 3-meter distance from the EUT, and was connected to an spectrum analyzer.
The EUT was then replaced by an Log-periodic antenna and polarized in accordance with the EUT's antenna polarization.The Log-periodic antenna was connected to a RF signal generator with a coaxial cable. The signal generator was adjusted to a level that produced the maximum radiated emission level. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and the antenna and further corrected for the gain of the substitution antenna. The signal generator corrected level is the ERP level.

Note. Effective Radiated Power measurement carried by using TC-100G antenna

Limits

Power Control Level	Nominal Peak Output Power
5	38.45 dBm (7 W)

Measurement Results

Frequency (MHz)	Reference Level (dBm)	Polarization (H/V)	Effective Radiated Power (dBm)
824.2	-10.6	H	+ 27.7
836.6	-10.4	H	+ 28.1
848.8	-10.1	H	+ 28.7

4.2 Field Strength of Spurious Radiation

Measurement procedure

Field Strength of Spurious Radiation Measurements by Substitution Method according to ANSI/TIA/EIA-603- B-2002:
The measurement of Effective Radiated Power was carried out in a KTL absorber-lined Room that was listed up at FCC according to the "Radiated Emissions Testing" procedure specified by ANSI C63.4.
The EUT was placed on a nonconductive turntable 1.5 meter above the ground plane and set up for the max.output power. The ground was covered with absorbing material 1 m thick.
These measurements were done at 3 frequencies, 824.2 MHz, 836.6 MHz, 848.8 MHz. (bottom, middle, and top of operational frequency range)
A Log-periodic antenna was substituted in place of the EUT. This Log-periodic antenna was driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or Log-periodic antenna are taken into consideration.

Note. Field Strength of Spurious Radiation measurement carried by using TC-100G antenna

4.2.1 Operating frequency : 824.2 MHz (Bottom channel)

Limits

The Spectrum was investigated from 30 MHz to the 10th Harmonic of the fundamental. A peak detector is used, with RBW=VBW=1MHz. The value that we could measure was only reported.
At least 43 + 10 log (P) dB
Measured Output Power : 27.7 dBm = 0.59 W
Limit : 43 + 10 log (W) = 40.7 dBc

Measurement Results

Frequency (MHz)	Level at Antenna Terminals (dBm)	Substitute Antenna Gain (dBd)	Correct Generator Level (dBm)	dBc	Margin (dB)
1,648.4	-46.1	5.9	-40.2	67.9	27.2
2,472.6	-47.6	7.2	-40.4	68.1	27.4
3,296.8	< -53.2	7.6	< -45.6	< 73.3	< 32.6
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4.2.2 Operating frequency : 836.6 MHz (Middle channel)

Limits

The Spectrum was investigated from 30 MHz to the 10th Harmonic of the fundamental. A peak detector is used, with RBW=VBW=1MHz. The value that we could measure was only reported.
At least 43 + 10 log (P) dB
Measured Output Power : 28.1 dBm = 0.65 W
Limit : 43 + 10 log (W) = 41.1 dBc

Measurement Results

Frequency (MHz)	Level at Antenna Terminals (dBm)	Substitute Antenna Gain (dBd)	Correct Generator Level (dBm)	dBc	Margin (dB)
1,673.2	-46.2	6.0	-40.2	68.3	27.2
2,509.8	-48.9	8.2	-40.7	68.8	27.7
3,350.4	< -52.9	7.6	< -45.3	< 73.4	< 32.3
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4.2.2 Operating frequency : 848.8 MHz (Top channel)

Limits

The Spectrum was investigated from 30 MHz to the 10th Harmonic of the fundamental. A peak detector is used, with RBW=VBW=1MHz. The value that we could measure was only reported.
At least 43 + 10 log (P) dB
Measured Output Power : 28.7 dBm = 0.74 W
Limit : 43 + 10 log (W) = 41.7 dBc

Measurement Results

Frequency (MHz)	Level at Antenna Terminals (dBm)	Substitute Antenna Gain (dBd)	Correct Generator Level (dBm)	dBc	Margin (dB)
1,697.6	-46.4	6.0	-40.4	69.1	27.4
2546.4	-47.6	7.2	-40.4	69.1	27.4
3,395.2	< -52.9	7.6	< -45.3	< 74.0	< 32.3
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4.3 Frequency Stability

Measurement procedure

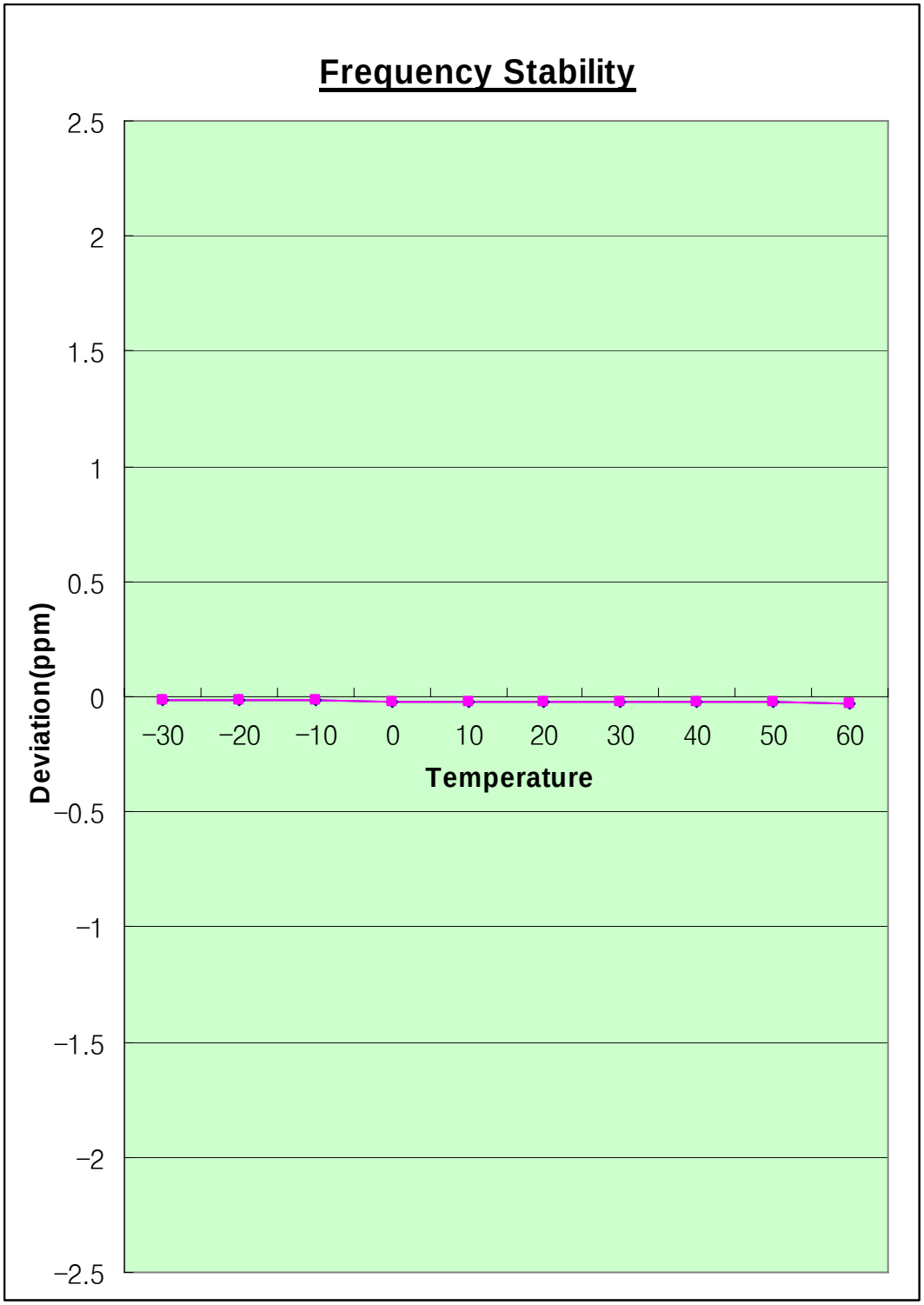
The equipment under test is placed in an environmental chamber. Frequency measurements are made at the extremes of the temperature range -30º C to +60º C and at intervals of 10º C with the primary supply voltage set to the nominal battery operating voltage. A period of time sufficient to stabilize all components of the equipment is allowed at each frequency measurement. The maximum variation of frequency is measured.

Limits

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 0.00025 (± 2.5ppm) of the center frequency.

Measurement Results

Voltage (%)	Power (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	4.0	+ 20 (Ref)	-17	-0.020
100 %		- 30	-22	-0.026
100 %		- 20	-16	-0.019
100 %		- 10	-15	-0.018
100 %		0	-16	-0.019
100 %		+ 10	-19	-0.023
100 %		+ 20	-18	-0.022
100 %		+ 30	-17	-0.020
100 %		+ 40	-19	-0.023
100 %		+ 50	-23	-0.027
100 %		+ 60	-27	-0.032
85 %	3.4	+ 20	-21	-0.025
115 %	4.6	+ 20	-19	-0.023


Frequency Stability
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
Deviation(ppm)
−30
−20
−10
0
10
20
30
40
50
60
Temperature

4.4 Conducted Spurious Emissions

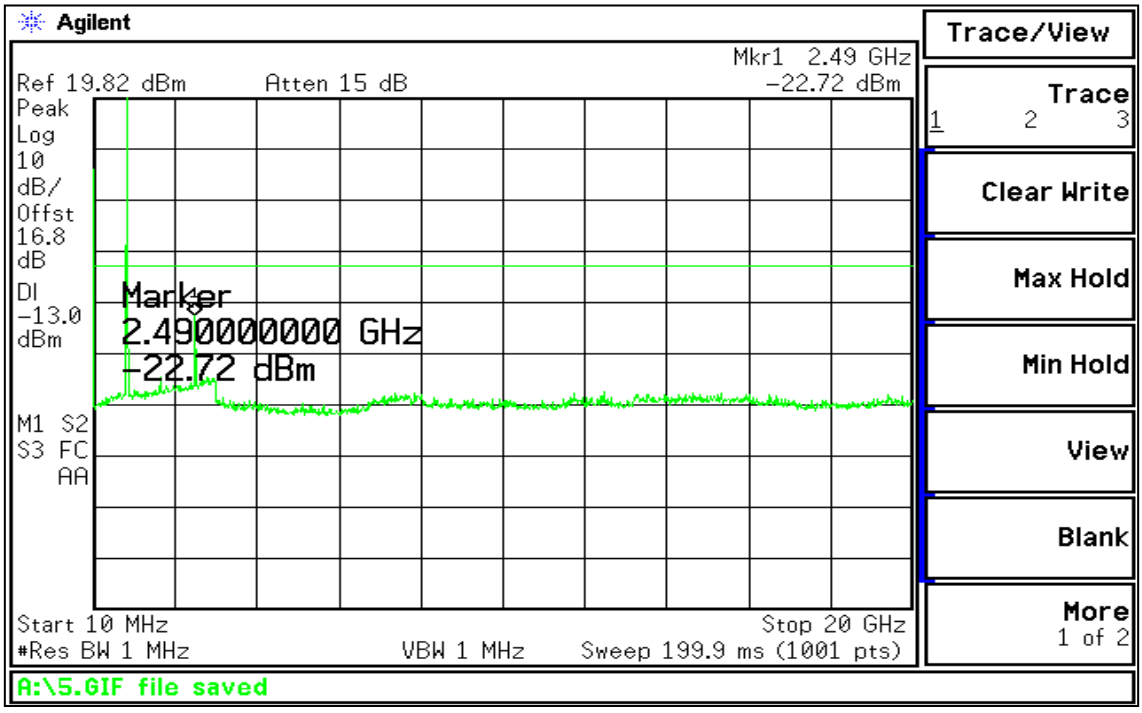
Measurement procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by calibrated spectrum analyzer.
These measurements were done at 3 frequencies, 824.2 MHz, 836.6 MHz, 848.8 MHz. (bottom, middle, and top of operational frequency range)
The Resolution BW of the analyzer is set to 1% of the emission bandwidth to show compliance with the –13dBm limit, in the 1MHz bands immediately outside and adjacent to the edge of the frequency block. For the Out-of-Band measurements a 1MHz RBW was used to scan from 10MHz to 10GHz. A display line was placed at –13dBm to show compliance.

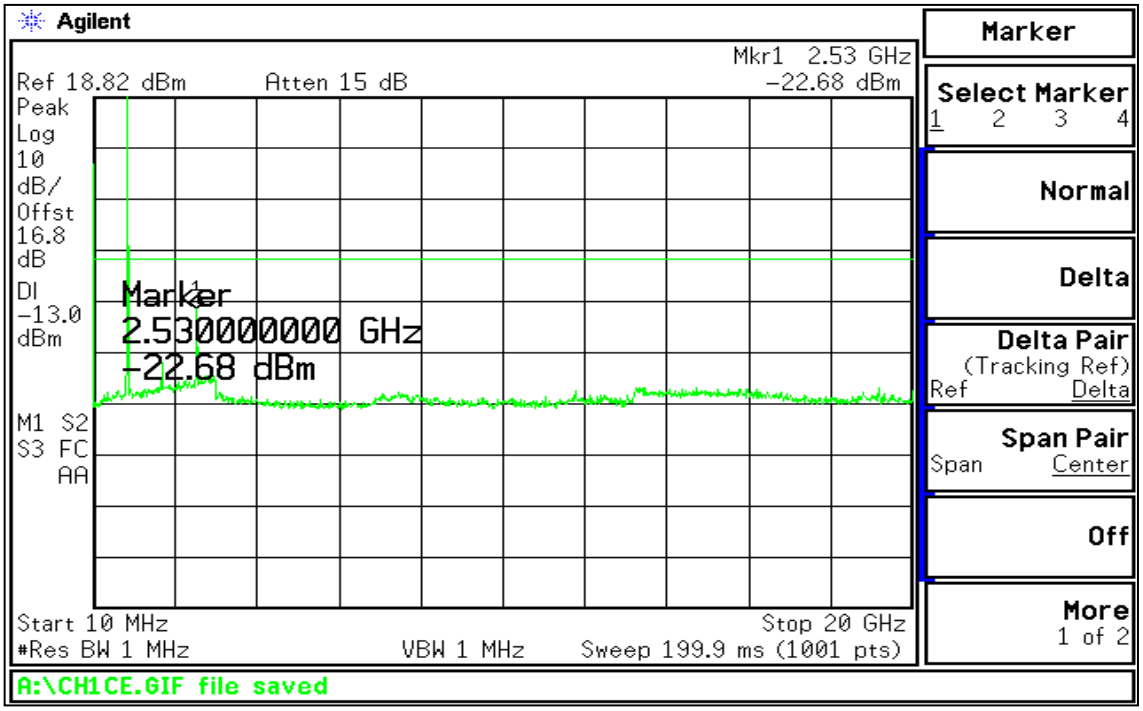
Limits

On any frequency outside frequency band, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

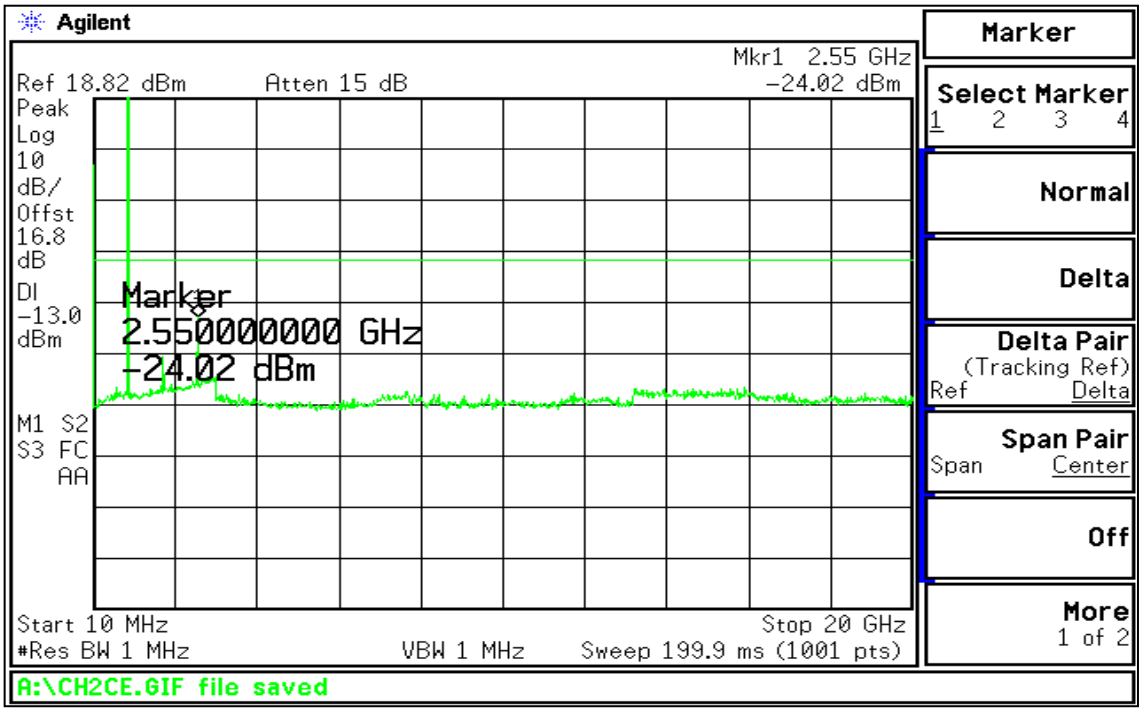
Measurement Results



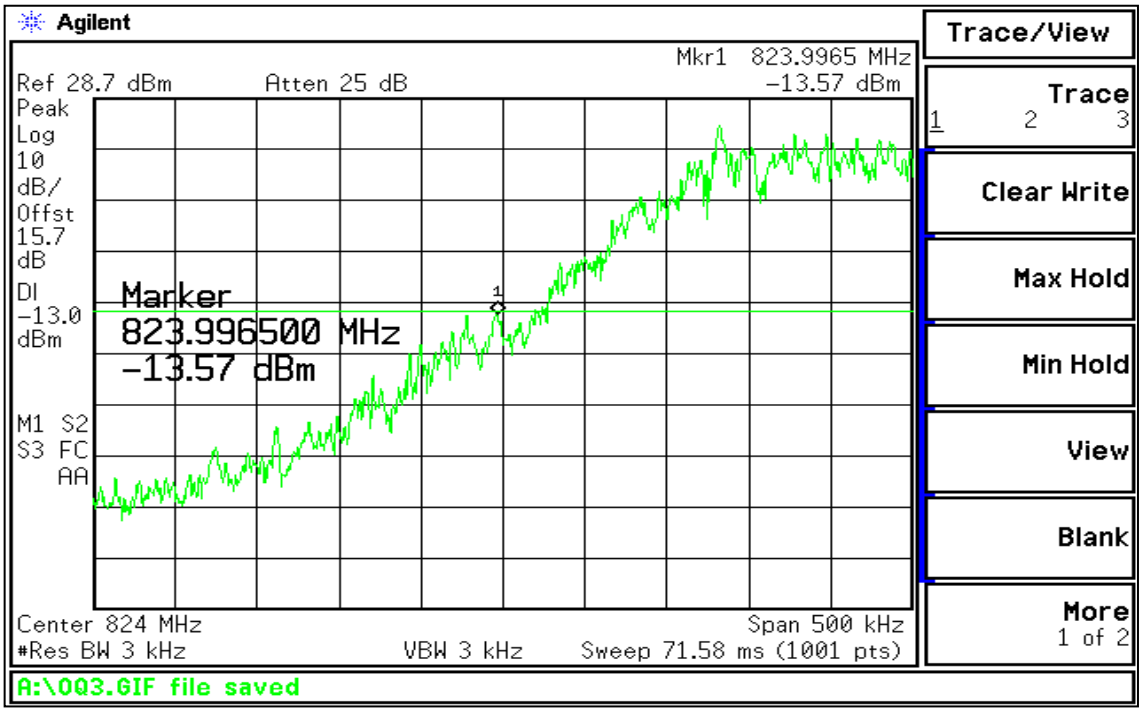
– Operating frequency : 824.2 MHz (Bottom channel) –



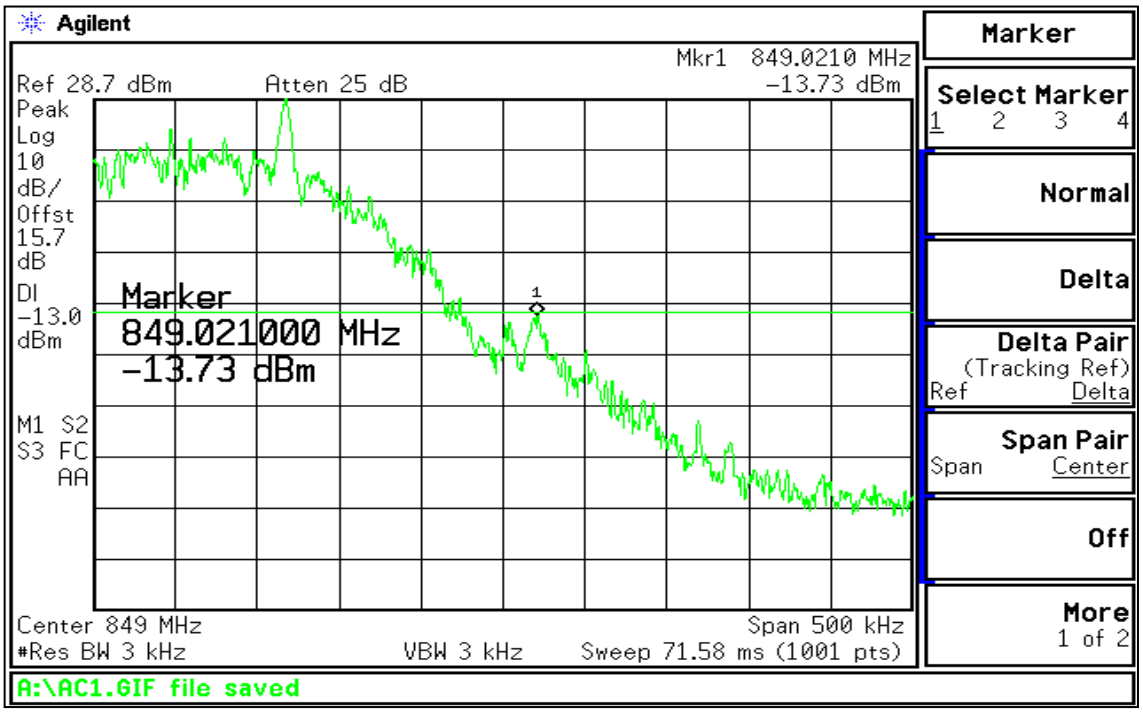
- Operating frequency : 836.6 MHz (Middle channel) -



- Operating frequency : 848.4 MHz (Top channel) -



– Lower Band Edge –



– Higher Band Edge –

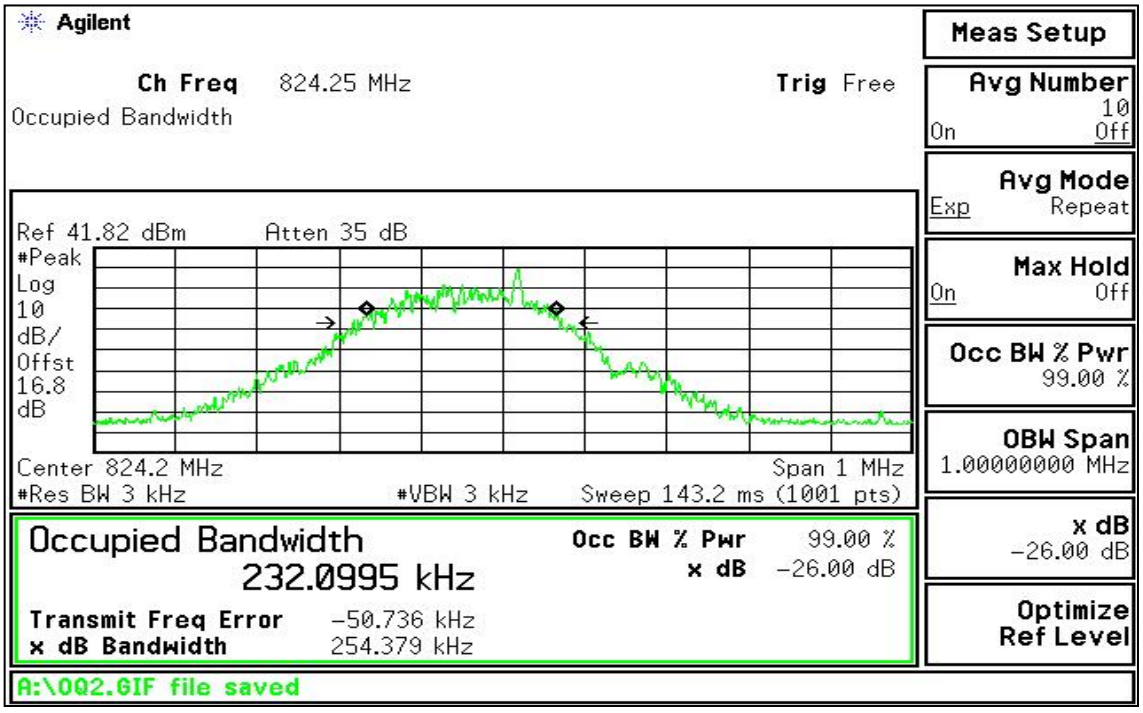
4.5 Occupied Bandwidth

Measurement procedure

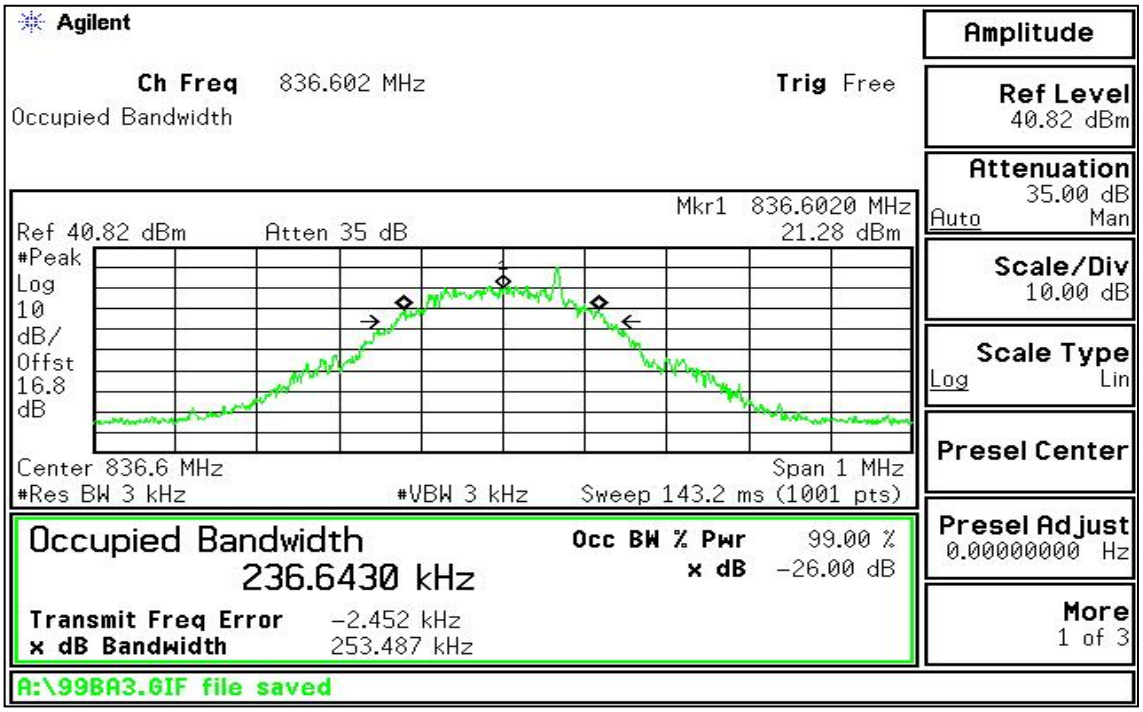
The RF output port of the equipment under test is directly coupled to the input of the Spectrum analyzer through a specialized RF connector. The analyzer is set for Peak Detector and each trace is set for Max Hold. These measurements were done at 3 frequencies, 824.2 MHz, 836.6 MHz, 848.8 MHz. (bottom, middle, and top of operational frequency range)

Measurement Results

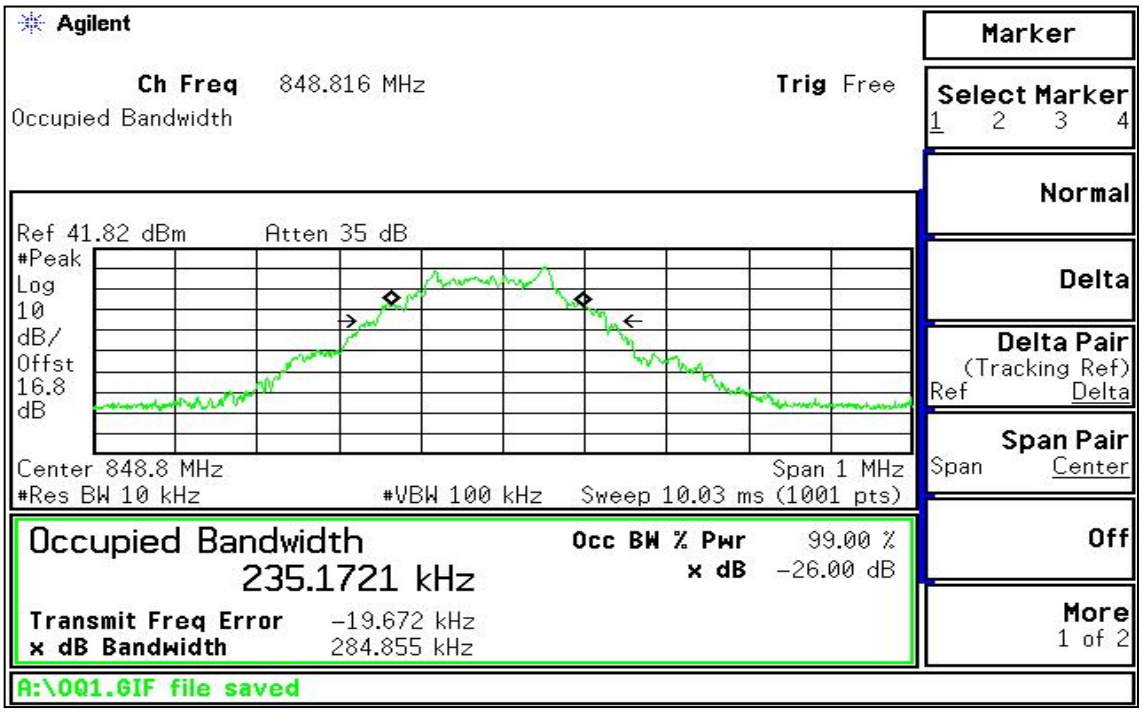
Frequency (MHz)	99 % Occupied Bandwidth
824.2	232.09 KHz
836.6	236.64 KHz
848.8	235.17 KHz



- Operating frequency : 824.2 MHz (Bottom channel) -



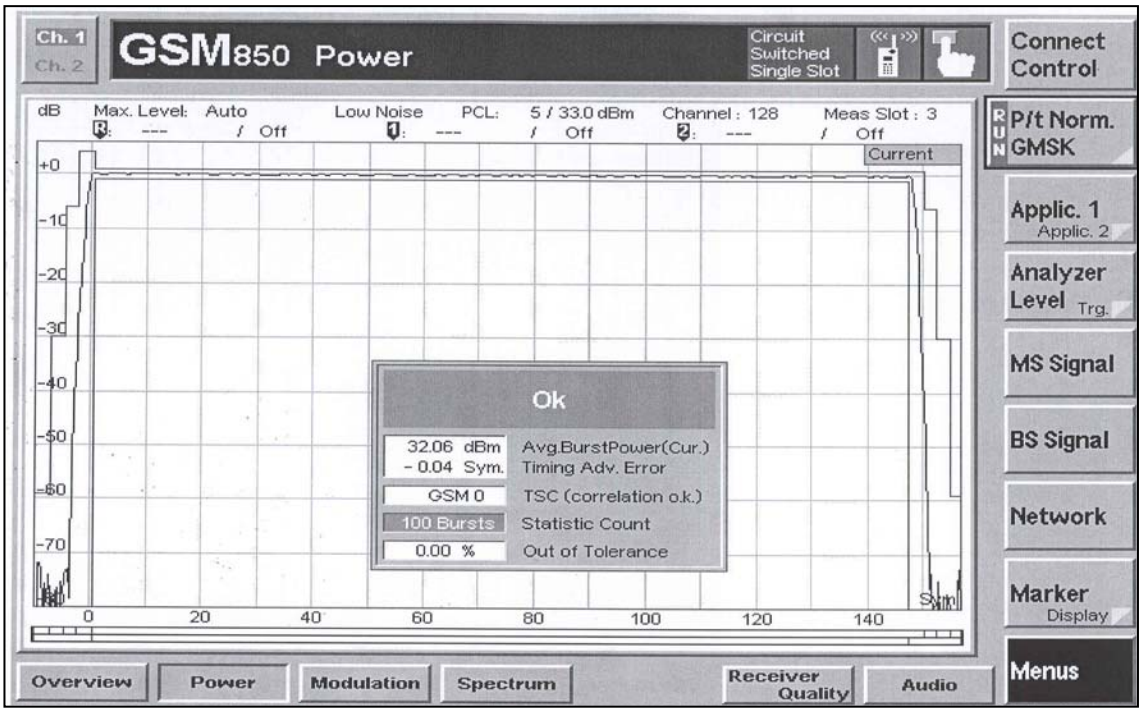
– Operating frequency : 836.6 MHz (Middle channel) –



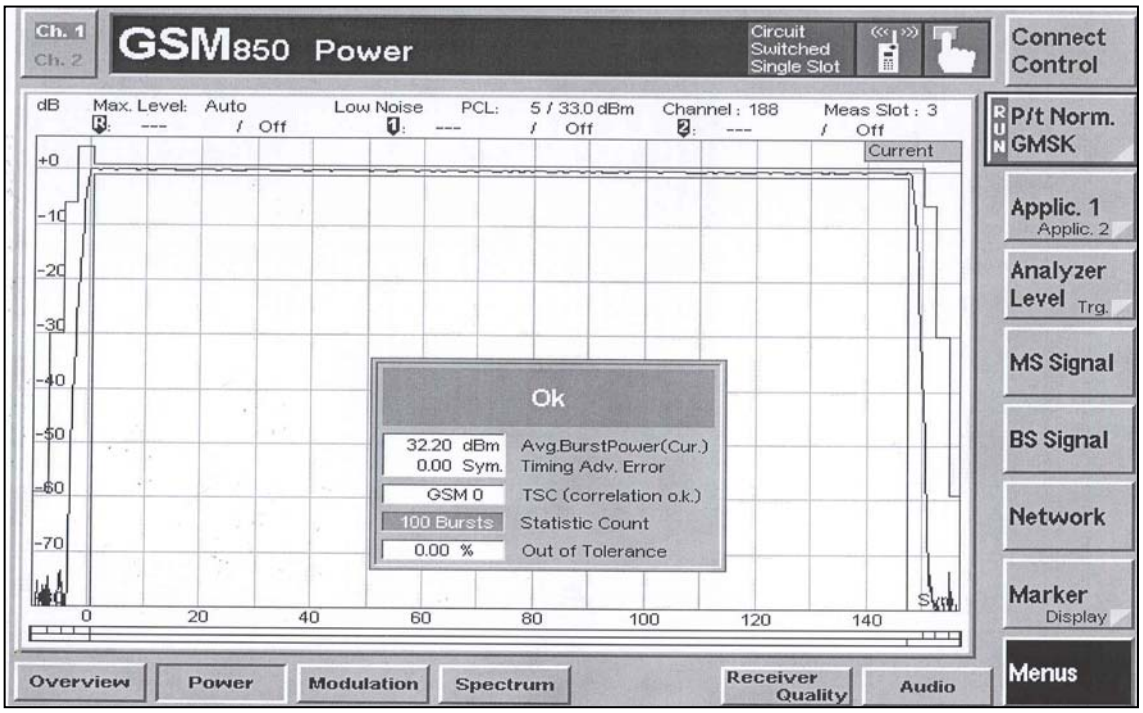
– Operating frequency : 848.4 MHz (Top channel) –

4.6 Conducted Power

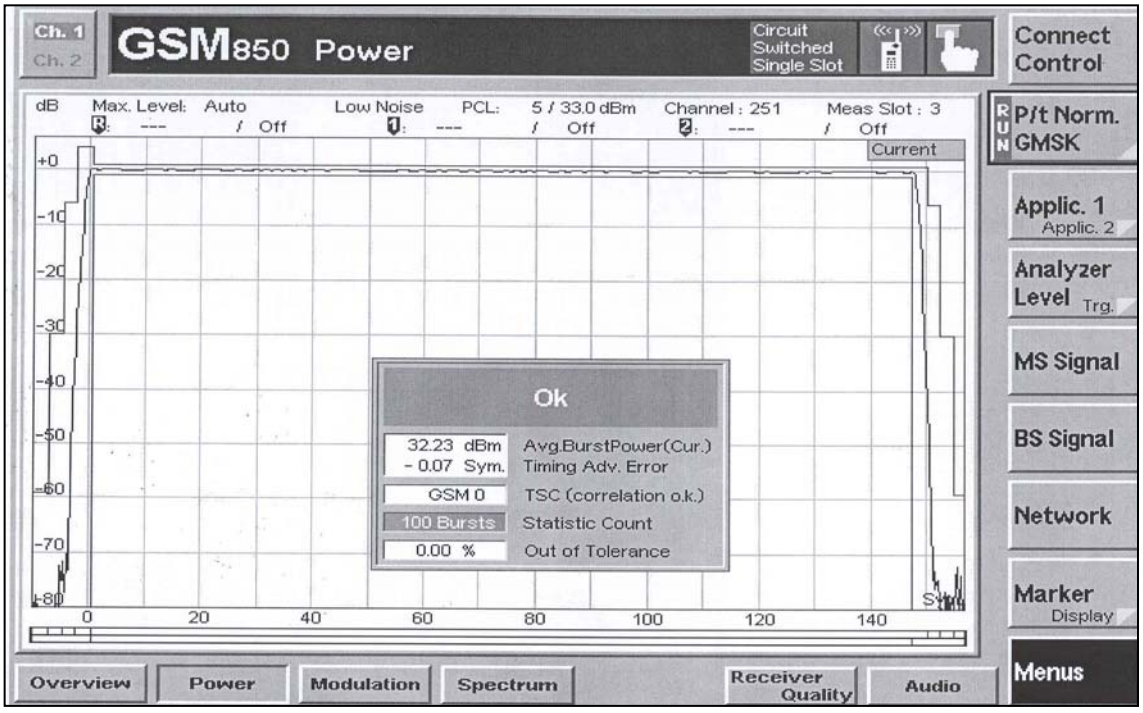
The RF output port of the equipment under test is directly coupled to the input of the CMU-200 through a specialized RF connector. These measurements were done at 3 frequencies, 824.2 MHz, 836.6 MHz, 848.8 MHz. (bottom, middle, and top of operational frequency range) The Power Control Level was set to 5.



- Operating frequency : 848.4 MHz (Top channel) -



– Operating frequency : 836.6 MHz (Middle channel) –



– Operating frequency : 848.4 MHz (Top channel) –

5. TEST DATA (GSM 1900)

5.1 Effective Isotropic Radiated Power

Measurement procedure

Effective Radiated Power Output and Equivalent Isotropic Radiated Power output Measurements by Substitution Method according to ANSI/TIA/EIA-603- B-2002:
The measurement of Effective Isotropic Radiated Power was carried out in a KTL absorber-lined Room that was listed up at FCC according to the "Radiated Emissions Testing" procedure specified by ANSI C63.4.
The EUT was placed on a nonconductive turntable 1.5 meter above the ground plane and set up for the max.output power. The ground was covered with absorbing material 1 m thick.
These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0 MHz, 1909.8 MHz (bottom, middle, and top of operational frequency range)
The measurement was made in same test set up and configuration with 3 orthogonal planes which produced maximum emission level. Receiving antenna was installed at 3-meter distance from the EUT, and was connected to an spectrum analyzer.
The EUT was then replaced by an horn antenna and polarized in accordance with the EUT's antenna polarization.The horn antenna was connected to a RF signal generator with a coaxial cable. The signal generator was adjusted to a level that produced the maximum radiated emission level. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and the antenna and further corrected for the gain of the substitution antenna. The signal generator corrected level is the EIRP level.

Note. Effective Isotropic Radiated Power measurement carried by using TC-100G antenna

Limits

Power Control Level	Nominal Peak Output Power
0	+ 33 dBm (2 W)

Measurement Results

Frequency (MHz)	Reference Level (dBm)	Polarization (H/V)	Peak Output Power (dBm)
1850.2	-16.2	V	29.0
1880.0	-16.0	V	29.3
1909.8	-15.7	V	29.8

5.2 Field Strength of Spuriois Radiation

Measurement procedure

Field Strength of Spurious Radiation Measurements by Substitution Method according to ANSI/TIA/EIA-603- B-2002:
The measurement of Effective Radiated Power was carried out in a KTL absorber-lined Room that was listed up at FCC according to the "Radiated Emissions Testing" procedure specified by ANSI C63.4.
The EUT was placed on a nonconductive turntable 1.5 meter above the ground plane and set up for the max.output power. The ground was covered with absorbing material 1 m thick.
These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0 MHz, 1909.8 MHz. (bottom, middle, and top of operational frequency range)
A Log-periodic and horn antenna was substituted in place of the EUT. This Log-periodic and horn antenna was driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or Log-periodic antenna are taken into consideration.

Note. Field Strength of Spurious Radiation measurement carried by using TC-100G antenna

5.2.1 Operating frequency : 1850.2 MHz (Bottom channel)

Limits

The Spectrum was investigated from 30 MHz to the 10th Harmonic of the fundamental. A peak detector is used, with RBW=VBW=1MHz. The value that we could measure was only reported.
At least 43 + 10 log (P) dB
Measured Output Power : 29.0 dBm = 0.79 W
Limit : 43 + 10 log (W) = 42.0 dBc

Measurement Results

Frequency (MHz)	Level at Antenna Terminals (dBm)	Substitute Antenna Gain (dB)	Correct Generator Level (dBm)	dBc	Margin (dB)
3,700.4	< -45.7	9.7	< -36.0	< 65.0	< 23.0
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5.2.2 Operating frequency : 1880.0 MHz (Middle channel)

Limits

The Spectrum was investigated from 30 MHz to the 10th Harmonic of the fundamental. A peak detector is used, with RBW=VBW=1MHz. The value that we could measure was only reported.
At least 43 + 10 log (P) dB
Measured Output Power : 26.80 dBm = 0.48 W
Limit : 43 + 10 log (W) = 39.8 dBc

Measurement Results

Frequency (MHz)	Level at Antenna Terminals (dBm)	Substitute Antenna Gain (dB)	Correct Generator Level (dBm)	dBc	Margin (dB)
3,760.0	< -45.8	9.7	< -36.1	< 62.9	< 23.1
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5.2.3 Operating frequency : 1909.8 MHz (Top channel)

The Spectrum was investigated from 30 MHz to the 10th Harmonic of the fundamental. A peak detector is used, with RBW=VBW=1MHz. The value that we could measure was only reported.
At least 43 + 10 log (P) dB
Measured Output Power : 27.3 dBm = 0.54 W
Limit : 43 + 10 log (W) = 40.3 dBc

Measurement Results

Frequency (MHz)	Level at Antenna Terminals (dBm)	Substitute Antenna Gain (dB)	Correct Generator Level (dBm)	dBc	Margin (dB)
3,819.6	< -46.1	9.7	< -36.4	< 63.7	< 23.4
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5.3 Frequency Stability

Measurement procedure

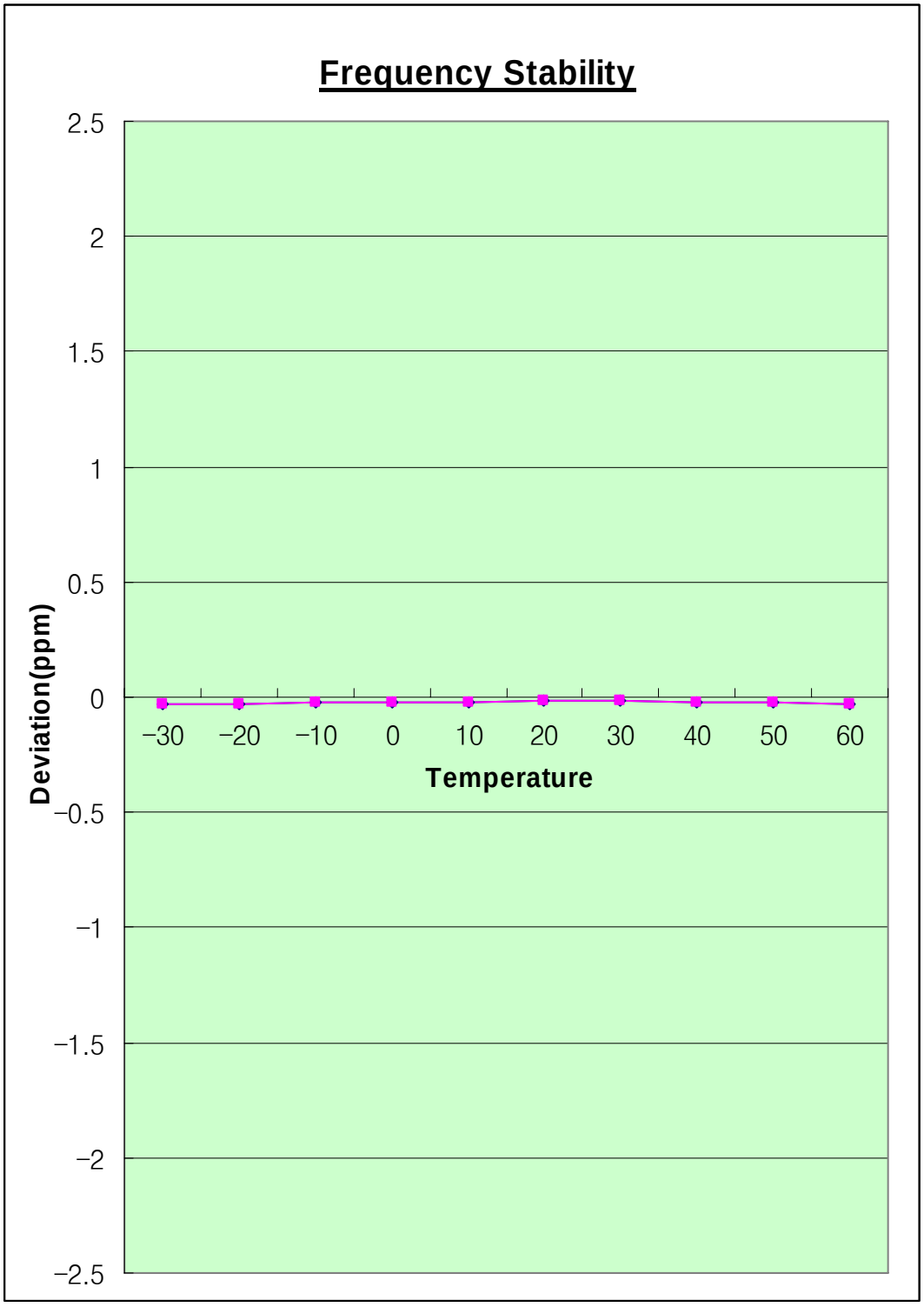
The equipment under test is placed in an environmental chamber. Frequency measurements are made at the extremes of the temperature range -30º C to +60º C and at intervals of 10º C with the primary supply voltage set to the nominal battery operating voltage. A period of time sufficient to stabilize all components of the equipment is allowed at each frequency measurement. The maximum variation of frequency is measured.

Limits

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 0.00025 (± 2.5ppm) of the center frequency.

Measurement Results

Voltage (%)	Power (VDC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	4.0	+ 20 (Ref)	-24	-0.013
100 %		- 30	-58	-0.031
100 %		- 20	-56	-0.030
100 %		- 10	-45	-0.024
100 %		0	-47	-0.025
100 %		+ 10	-38	-0.020
100 %		+ 20	-34	-0.018
100 %		+ 30	-34	-0.018
100 %		+ 40	-41	-0.022
100 %		+ 50	-48	-0.026
100 %		+ 60	-51	-0.027
85 %	3.4	+ 20	-37	-0.020
115 %	4.6	+ 20	-38	-0.020


Frequency Stability
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
Deviation(ppm)
−30
−20
−10
0
10
20
30
40
50
60
Temperature

5.4 Conducted Spurious Emissions

Measurement procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by calibrated spectrum analyzer.

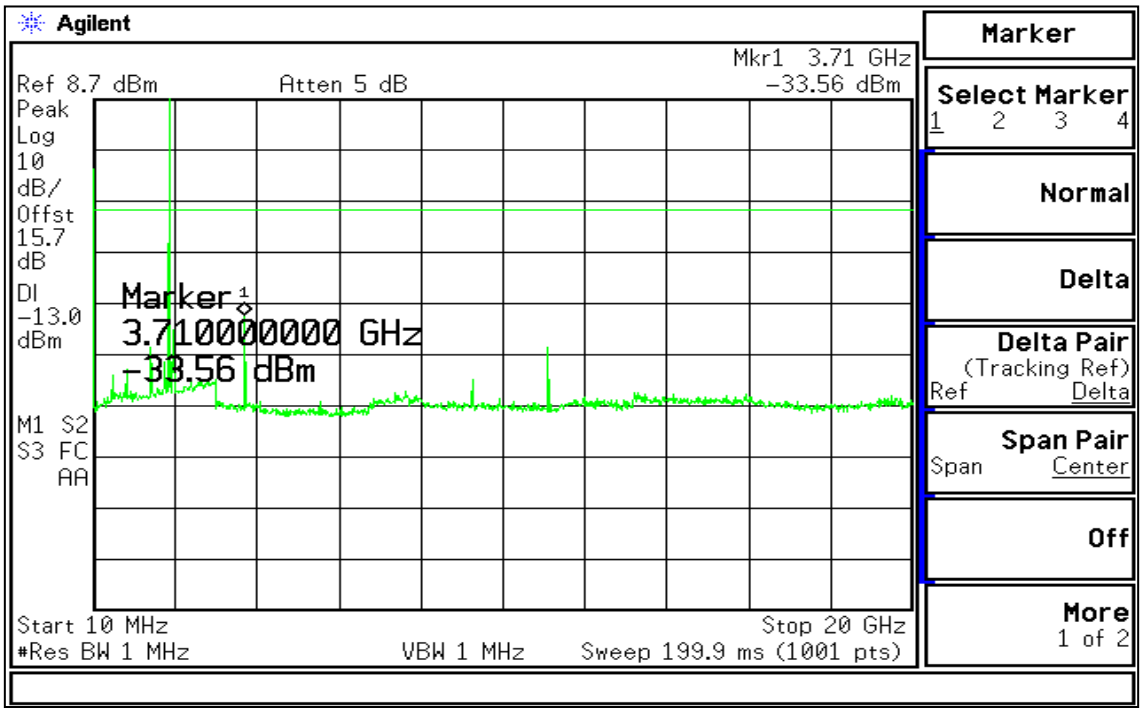
These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0 MHz, 1909.8 MHz. (bottom, middle, and top of operational frequency range)

The Resolution BW of the analyzer is set to 1% of the emission bandwidth to show compliance with the –13dBm limit, in the 1MHz bands immediately outside and adjacent to the edge of the frequency block. For the Out-of-Band measurements a 1MHz RBW was used to scan from 10 MHz to 20 GHz. A display line was placed at –13dBm to show compliance.

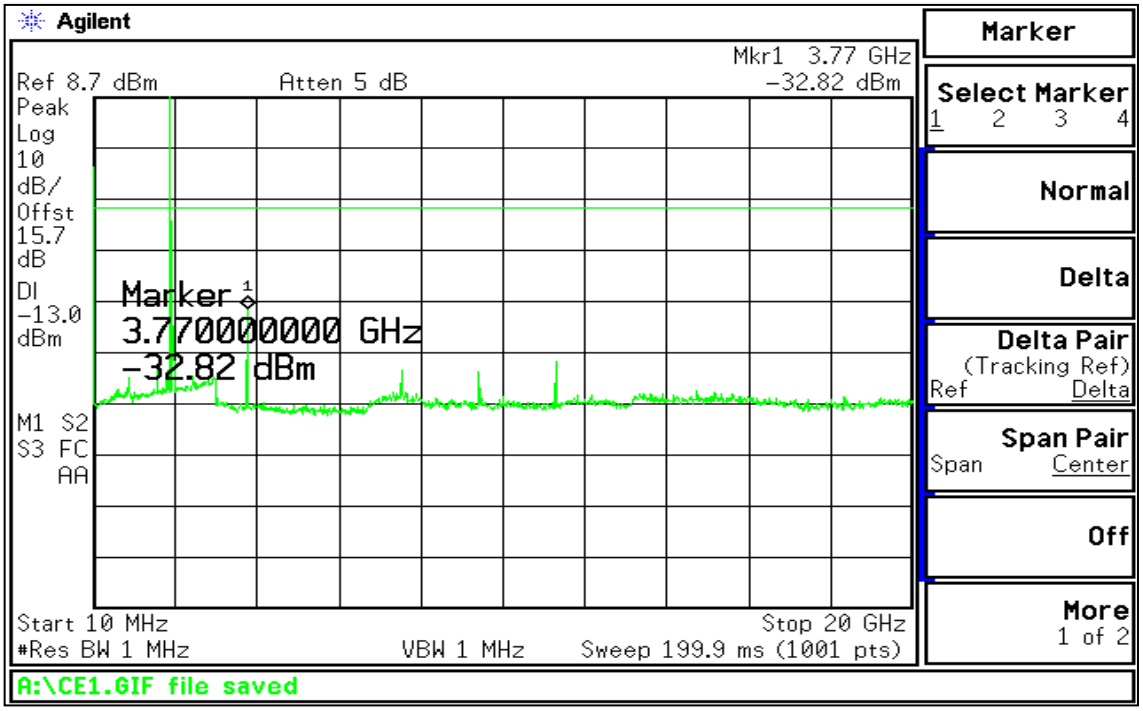
Limits

On any frequency outside frequency band, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

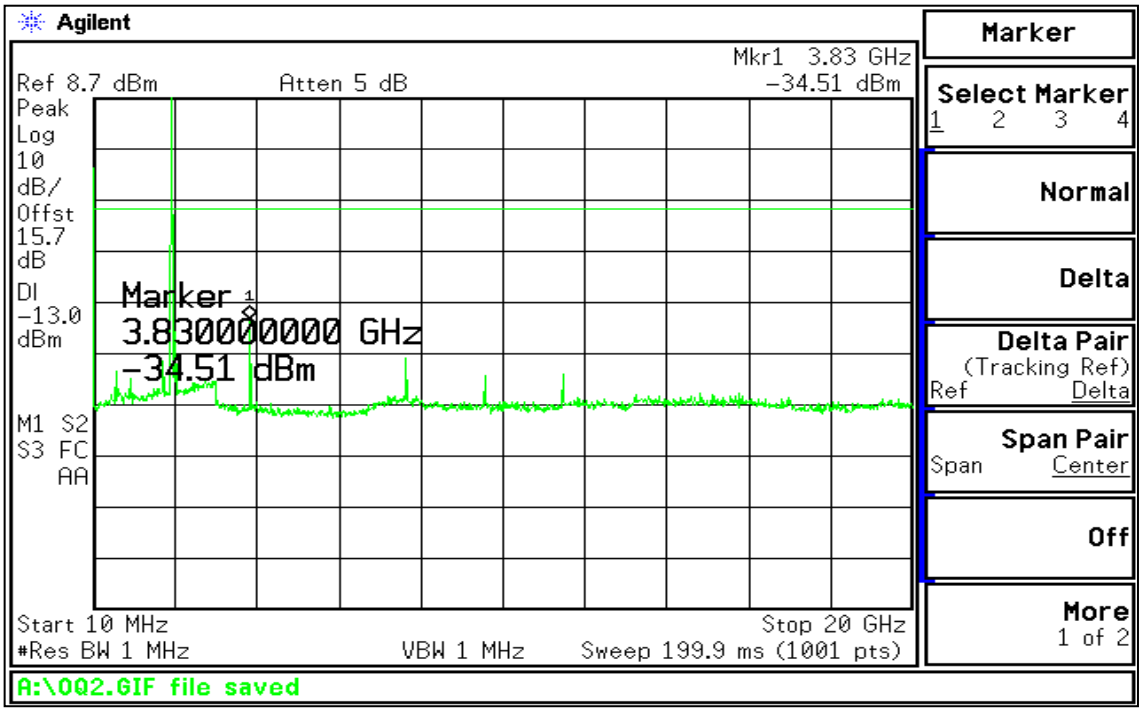
Measurement Results



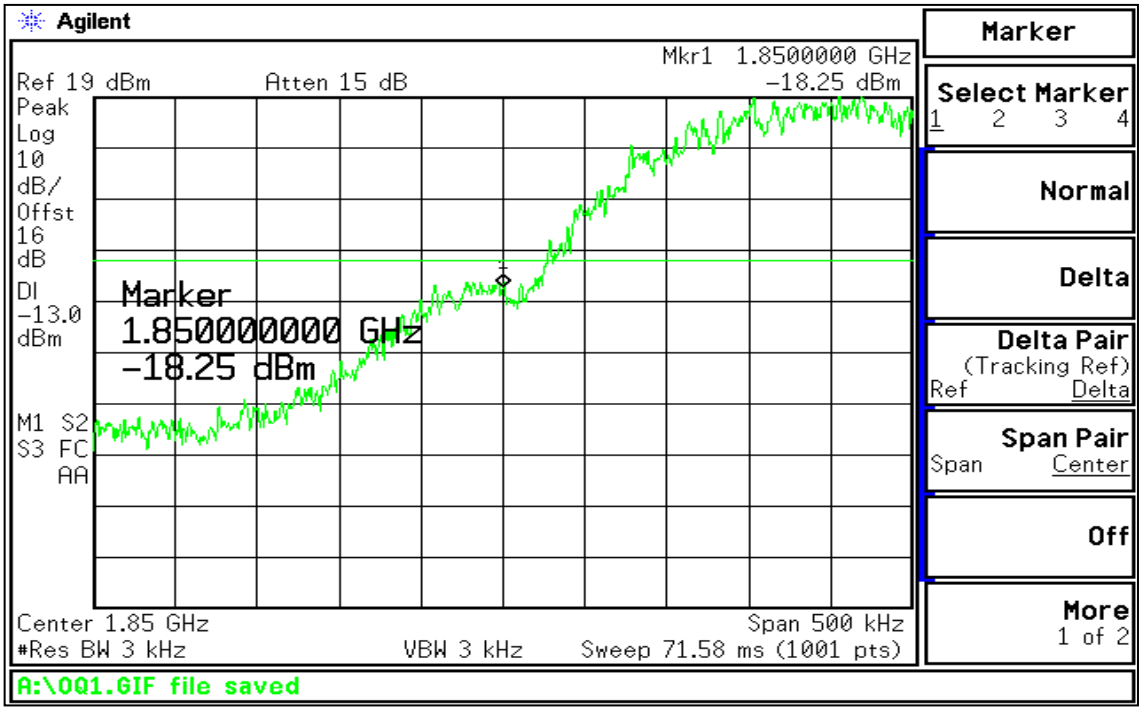
– Operating frequency : 1850.2 MHz (Bottom channel) –



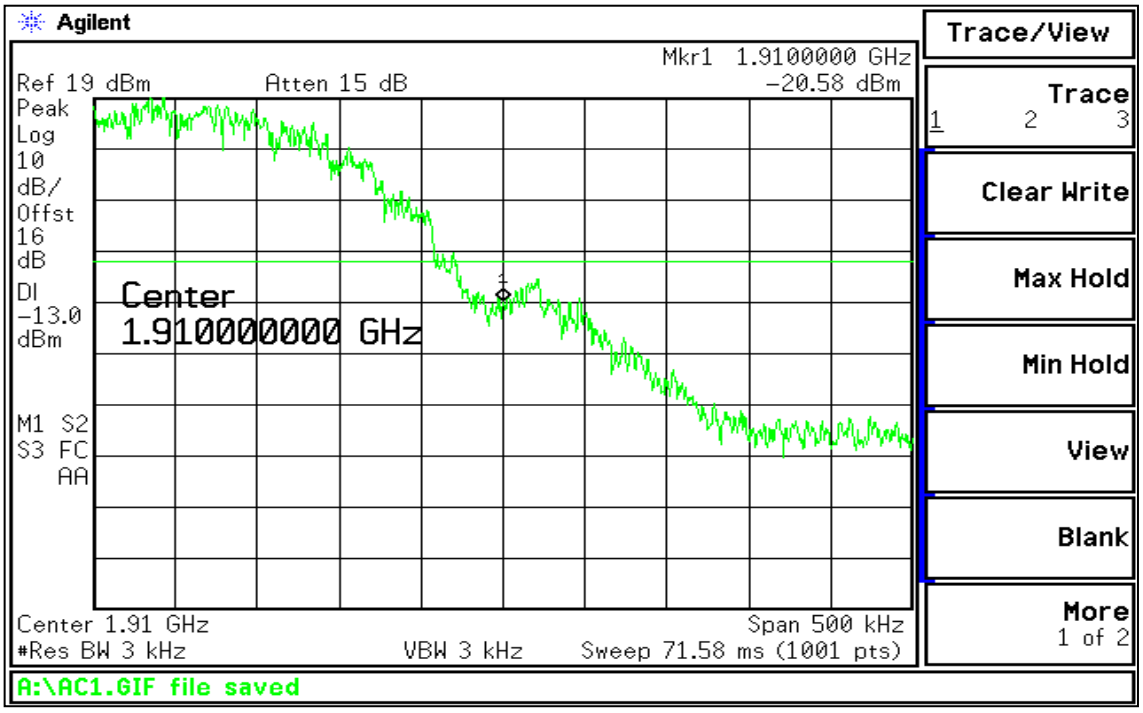
- Operating frequency : 1880.0 MHz (Middle channel) -



- Operating frequency : 1909.8 MHz (Top channel) -



– Lower Band Edge –



– Higher Band Edge –

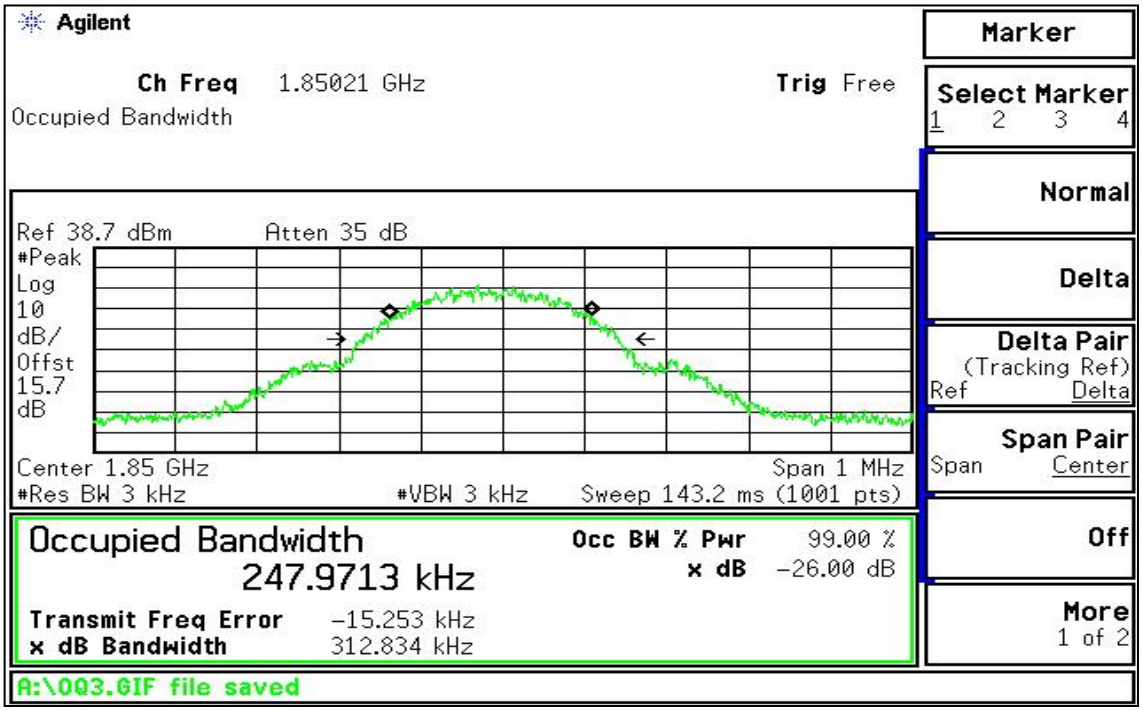
5.5 Occupied Bandwidth

Measurement procedure

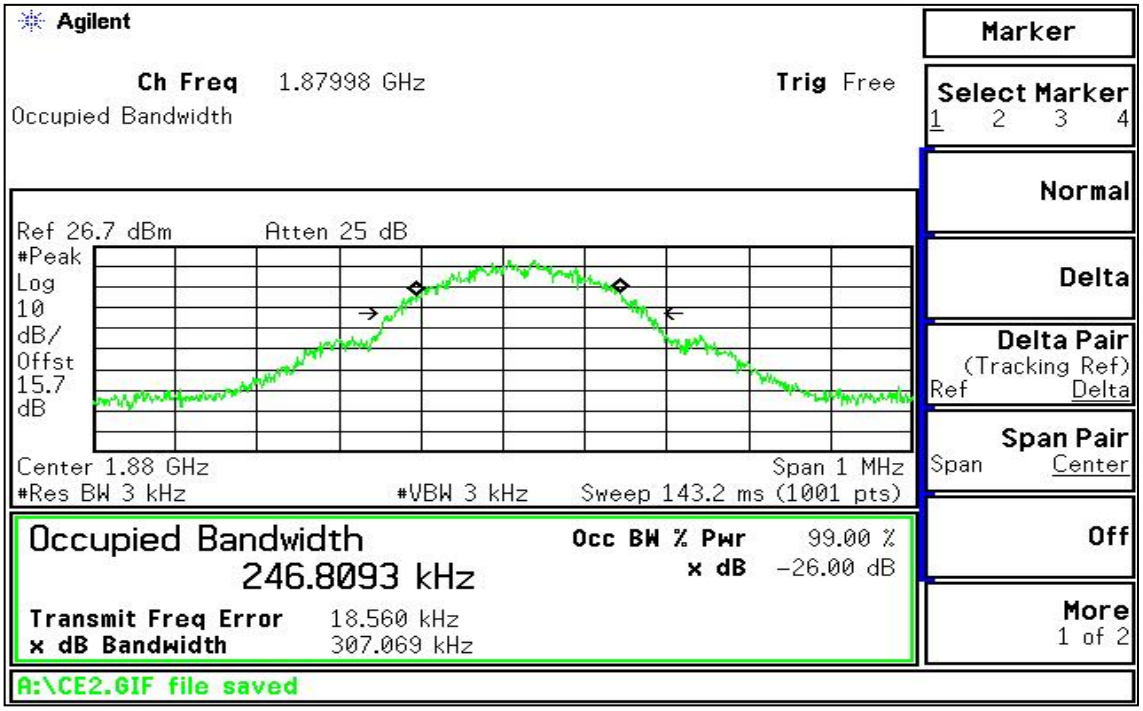
The RF output port of the equipment under test is directly coupled to the input of the Spectrum analyzer through a specialized RF connector. The analyzer is set for Peak Detector and each trace is set for Max Hold. These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0 MHz, 1909.8 MHz. (bottom, middle, and top of operational frequency range)

Measurement Results

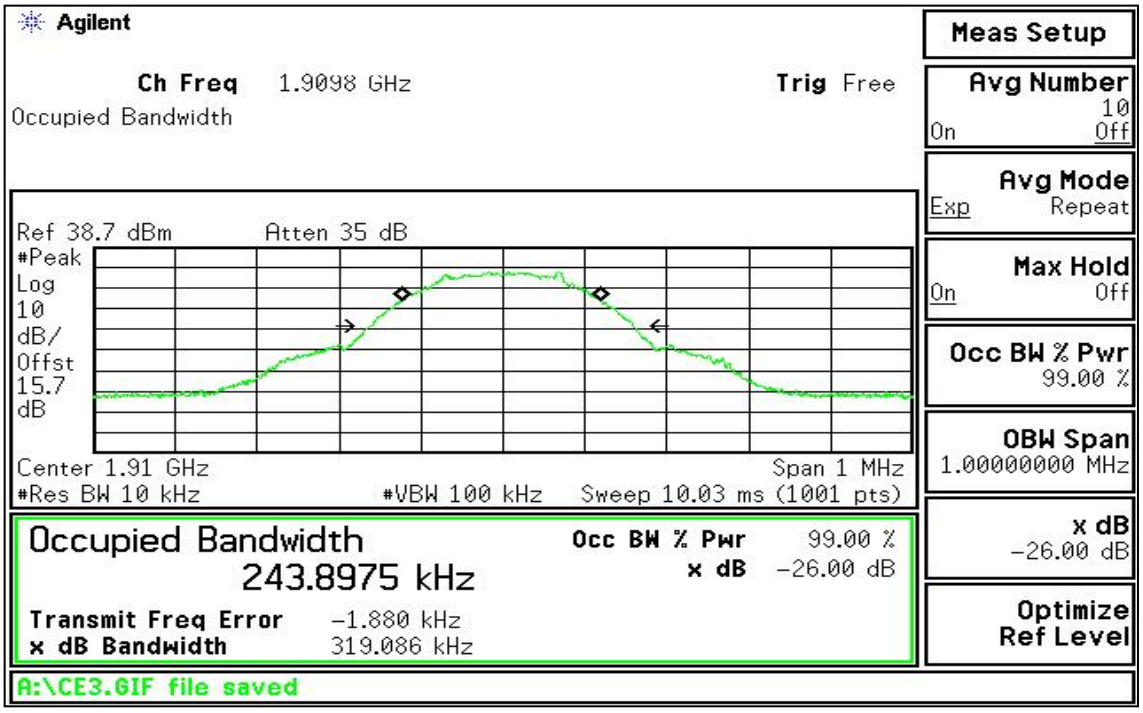
Frequency (MHz)	99 % Occupied Bandwidth
1850.2	247.97 KHz
1880.0	246.81 KHz
1909.8	243.90 KHz



- Operating frequency : 1850.2 MHz (Bottom channel) -



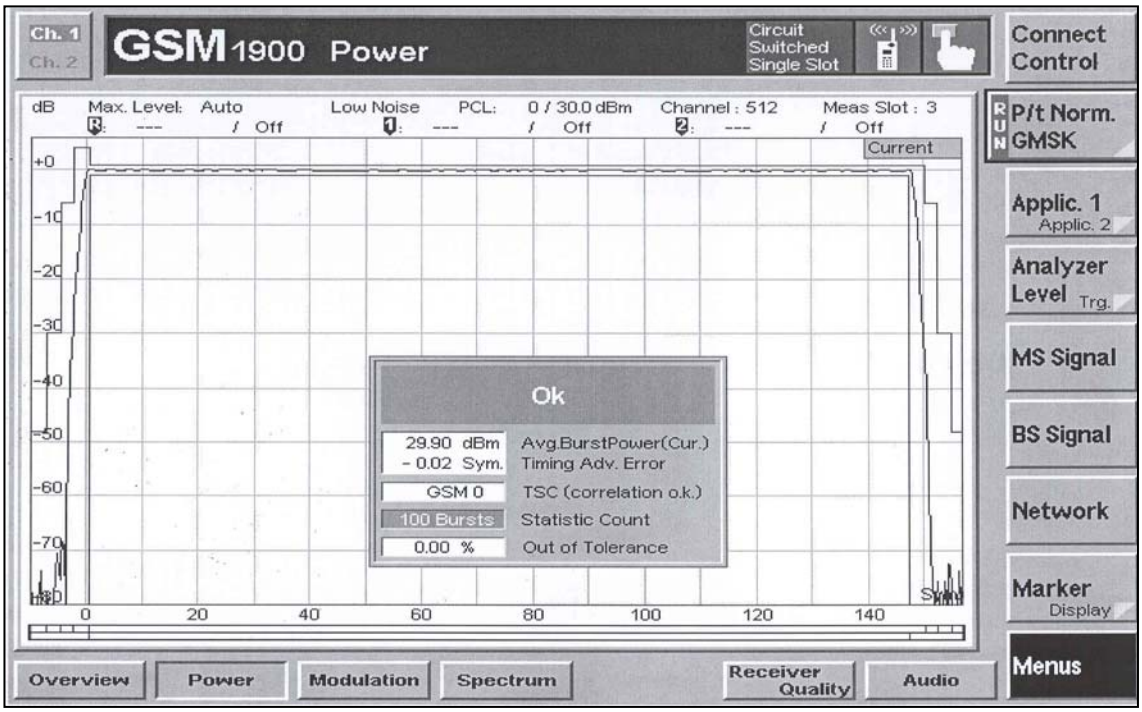
- Operating frequency : 1880.0 MHz (Middle channel) -



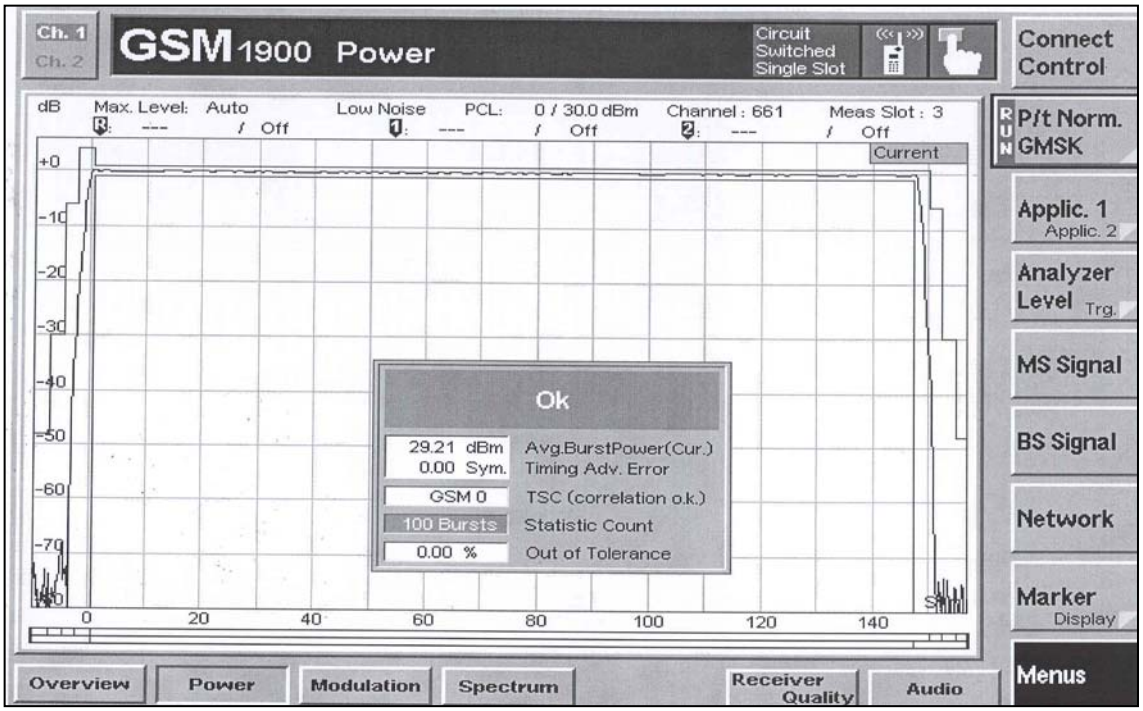
- Operating frequency : 1909.8 MHz (Top channel) -

5.6 Conducted Power

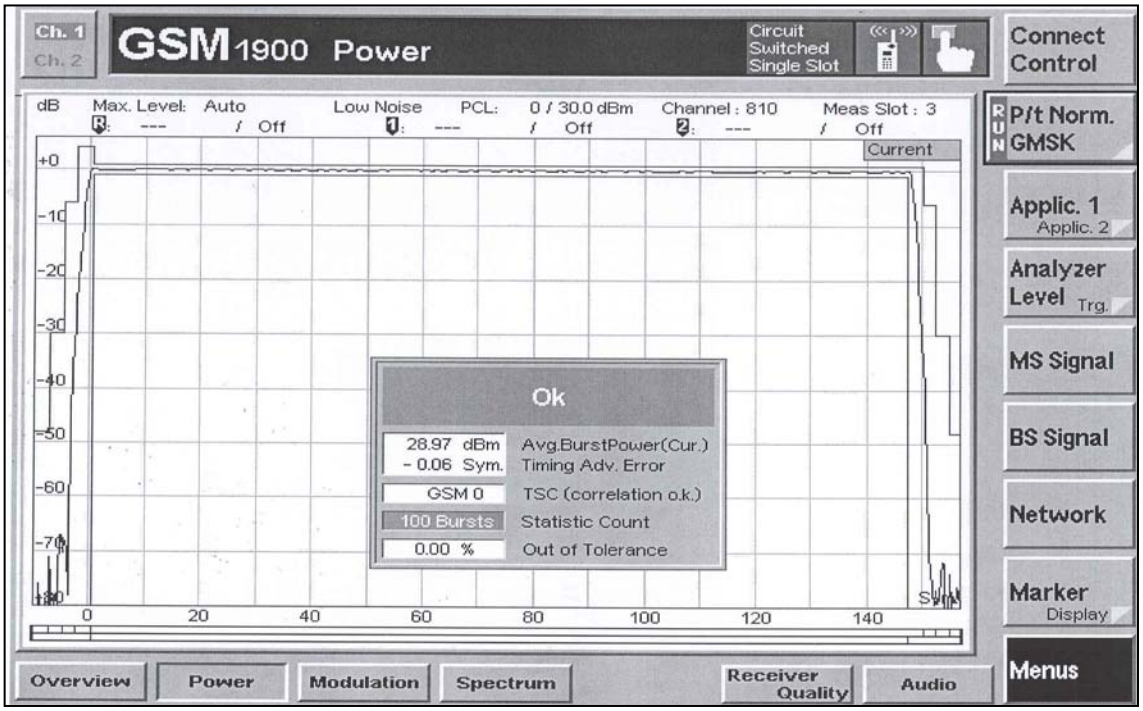
The RF output port of the equipment under test is directly coupled to the input of the CMU-200 through a specialized RF connector. These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0 MHz, 1909.8 MHz. (bottom, middle, and top of operational frequency range) The Power Control Level was set to 0.



- Operating frequency : 848.4 MHz (Top channel) -



- Operating frequency : 836.6 MHz (Middle channel) -



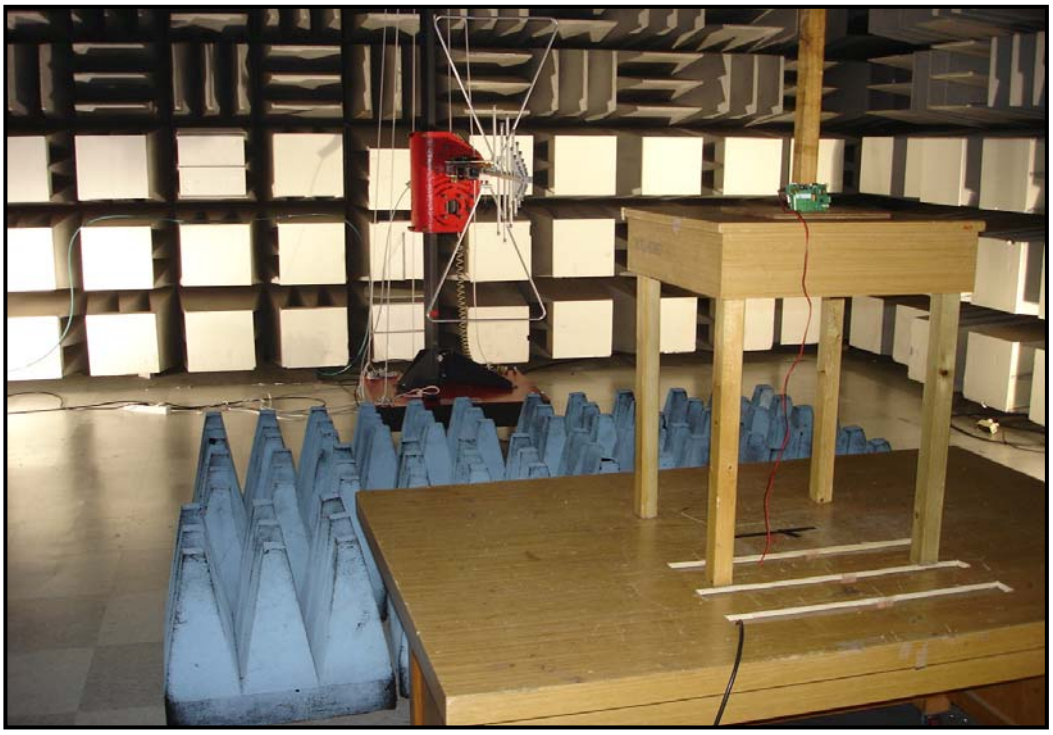
- Operating frequency : 848.4 MHz (Top channel) -

6. TEST EQUIPMENTS

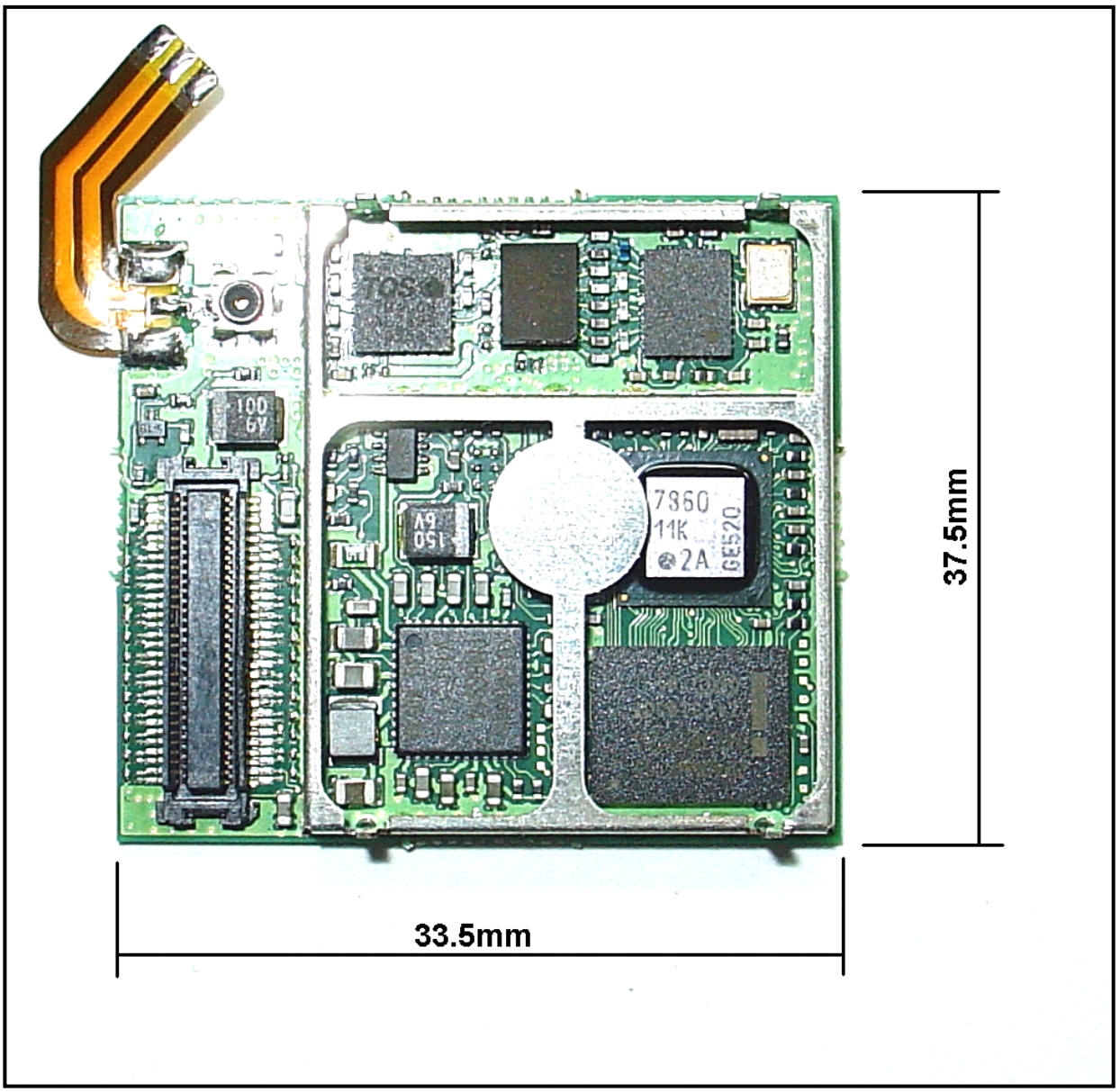
No.	Equipment	Manufacturer	Model	S/N
1	Spectrum Analyzer	Agilent	E4407B	US41443316
2	Universal Radio Communication tester	R&S	CMU200	110019
3	DC Power Supply	Agilent	E3645A	MY40000851
4	Coaxial Attenuator	TenuLine	8340-200	1087
5	Coaxial Attenuator	TenuLine	8080	7676
6	Power Divider	HP	11636A	6047
7	Power Spliter	HP	11667A	21063
8	RF Attenuator	Lucas Weinschel	1433-3	KR785
9	RF Attenuator	Lucas Weinschel	F1426	AZ3615
10	Signal Generator	HP	8648C	3629U00868
11	Pre-Amplifier	HP	8347A	2834A00543
12	Pre-Amplifier	HP	8449B	3008A00302
13	Biconical Antenna	R&S	BBA9106	1062+1063
14	Tuned Dipole Antenna	Schwarzbeck	VHA 9103	--
15	Tuned Dipole Antenna	The Electro-Mechanics comapny	3121C-D134	9011-639
16	Biconi-Log Antenna	ETS-Lindgren	3142B	00023784
17	Double Ridge Wave Guide	ETS-Lindgren	3115	6913
18	Double Ridge Wave Guide	ETS-Lindgren	3116	2664
19	Log-Periodic Antenna	ETS-Lindgren	3146	5051

No.	Equipment	Manufacturer	Model	S/N
20	Temp/Humidity Chamber	Korea Power Machine	HI-5050	HI200420
21	High Pass Filter	Wainwright	WHK1.2/15G-10SS	8
22	High Pass Filter	Wainwright	WHK2.0/18G-10SS	13

Appendix 1. Photograph of the test configuration

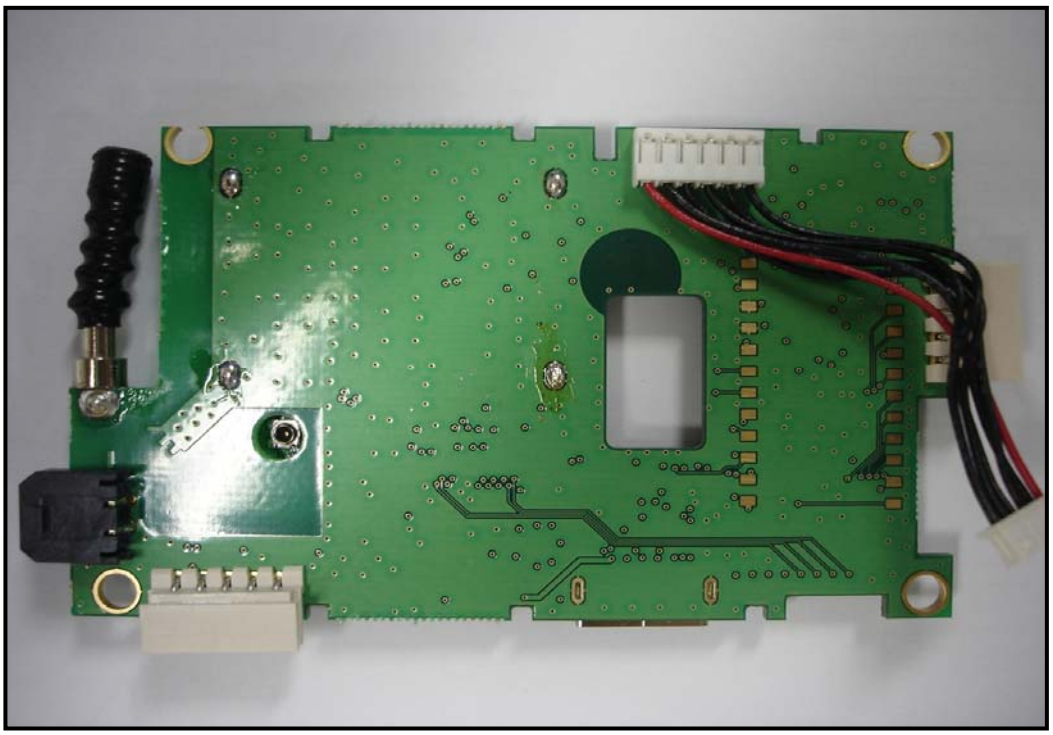


Appendix 2. Photograph of the Equipment



< Quad band GSM/GPRS Module >

Front View (Quad band GSM/GPRS Module with emulation board)



Rear View (Quad band GSM/GPRS Module with emulation board)