FCC PART 24 TYPE APPROVAL
EMI MEASUREMENT AND TEST REPORT

For

Communication Components Inc.

89 Leuning Street 2nd Floor
South Hackensack, NJ 07606

FCC ID: NT3DAB-DAC-1819-2

January 3, 2003

This Report Concerns:	Equipment Type:
☒ Original Report	GSM Amplifier

Test Engineer:	Benjamin Jing
Report No.:	R0211191
Test Date:	November 18, 2002
Reviewed By:	Jeff Lee
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Communication Components Inc.'s* product, model: *DAB-DAC-1819-2 or the* "EUT" as referred to in this report is a Dual Amplifier Booster/Combiner (CCI Model Number DAB-1819 & DAC-1819).

The EUT measures approximately 8.75"L x 3.5"W x 12.0"H.

The system was fed by NORTEL S8000 BTS Power Supply.

** The test data was only good for test sample. It may have deviation for other product samples.*

1.2 Objective

This type approval report is prepared on behalf of *Communication Components Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and B, and Part 24 Subpart E, of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for RF Power Output, Occupied Bandwidth, Spurious Emissions at Antenna Terminals and Radiated Spurious Emission.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-1992 and TIA/EIA 603A, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed by Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the building at 4420 Rosewood Dr. Bldg 2, Pleasanton, CA 94588.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Data
HP	Spectrum Analyzer	8566B	2610A02165	12/6/03
HP	Spectrum Analyzer	8593B	2919A00242	12/20/03
HP	Amplifier	8349B	2644A02662	12/20/03
HP	Quasi-Peak Adapter	85650A	917059	12/6/03
HP	Amplifier	8447E	1937A01046	12/6/03
A.H. System	Horn Antenna	SAS0200/571	261	12/27/03
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/03
Com-Power	Biconical Antenna	AB-100	14012	11/2/03
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/03
Com-Power	LISN	LI-200	12208	12/20/03
Com-Power	LISN	LI-200	12005	12/20/03
BACL	Data Entry Software	DES1	0001	12/20/03
Rohde & Schwarz	Signal Generator	SMIQ03B	1125.5555.03	7/10/2003
Rohde & Schwarz	I/Q Modulation Generator	AMIQ	1110.2003.02	8/10/2003
HP	Power Meter	E 4418A	N/A	4/29/03

Statement of Traceability: Bay Area Compliance Laboratory Corp. declares that all equipment has been performed calibration using suitable standard traceable to National Institute of Standard and Technology (NIST).

1.7 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Nortel	Base Station	GSM 1900	N/A	AB6OUDS8000

1.8 External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Shielded cable	0.5	Base Station	EUT

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

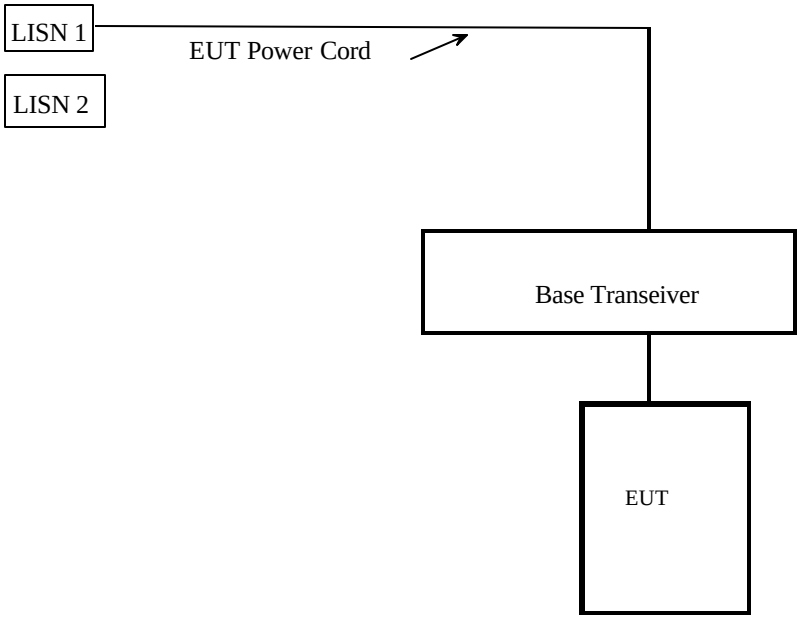
The EUT was configured for testing in a typical fashion (as normally used in a typical application).

The final qualification test was performed with the EUT operating at normal mode.

2.2 Schematics/Block Diagram

Please refer to Exhibit D.

2.3 Test Setup Block Diagram



2.4 Equipment Modifications

No modifications were necessary for the EUT to comply with the applicable standard and limit.

3 - SUMMARY OF TEST RESULTS

FCC RULE	DESCRIPTION OF TEST	Measured	Result
§2.1046 § 24.232	RF power output	45.5dBm	Compliant
§ 2.1047	Modulation Characteristics	N/A	N/A
§ 2.1049 § 24.238(b)	Emission Bandwidth	GSM: 310kHz	Compliant
2.1051 § 24.238(a)	Spurious emissions at antenna terminals	<-13dBm	Compliant
2.1051 § 24.238 (a)	Two-Tone Test (Spurious emissions at antenna terminals)	<-13dBm	Compliant
2.1053 § 24.238 (a)	Radiated Spurious Emissions	Section 8	Compliant
§ 2.1055 § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	N/A	N/A
15.107	AC Line Conducted emission	44.9 dBµV	Compliant

4 - RF POWER OUTPUT

4.1 Applicable Standard

According to FCC §2.1046 and §24.232 (a), in no case may the peak output power of a base station transmitter exceed 100 watt.

4.2 Test Procedure

The GSM signals were provided by the Base Transceiver. The EUT output was connected to a calibrated coaxial attenuator (50 Ohm), the other end of which was connected to a power meter. The EUT output was read off the power meter in dBm. The power output at the EUT was determined by adding the value of the attenuator to the power meter reading.

The test was performed at three frequencies (low, middle, and high channels) and on all power levels which can be setup on the EUT.

4.3 Test equipment

HPE4418A Power Meter
NORTEL S8000 GSM Base Transceiver

4.4 Test Results

Modulation Type	Channel	Input Power in dBm	Output Power in dBm	Output Power in W	Limit W
GSM	Low	4.5	45.5	35.48	100
GSM	Mid	4.39	45.39	34.59	100
GSM	High	4.87	44.87	30.69	100

5 - EMISSION BANDWIDTH

5.1 Applicable Standards

According to FCC §2.1049 and §24.238 (b), the emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power.

5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 3 KHz and the spectrum was recorded.

5.3 Test Equipment

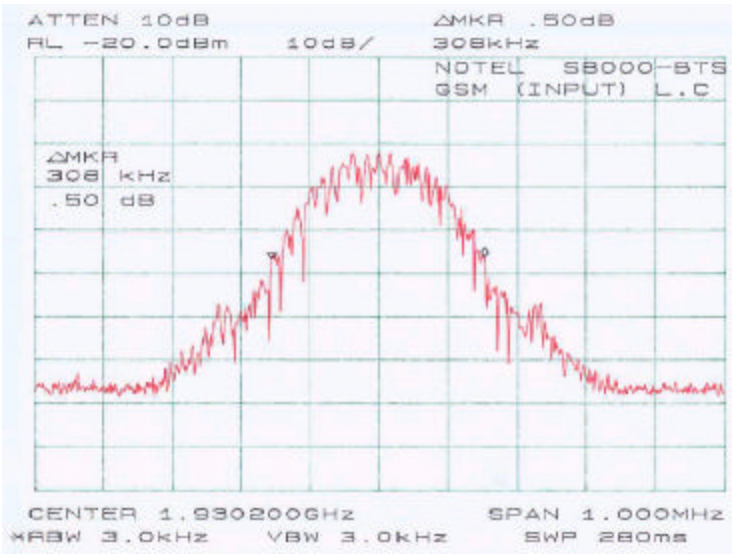
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
NORTEL S8000 GSM Base Transceiver

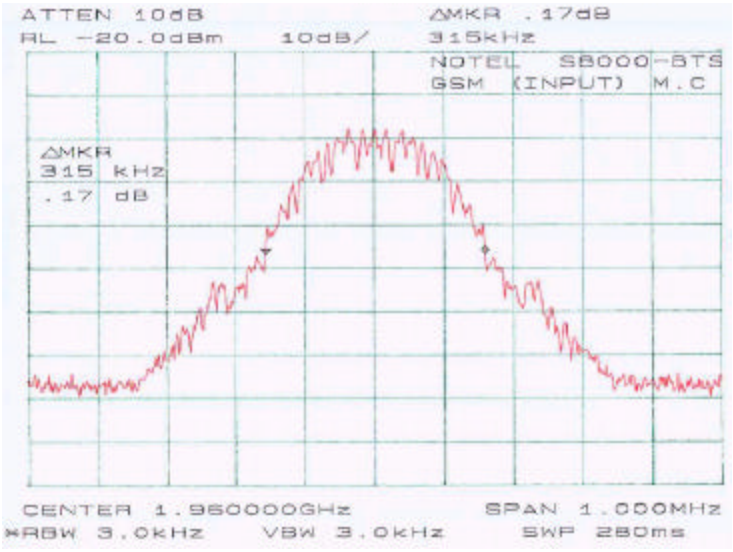
5.4 Plots of Occupied Bandwidth

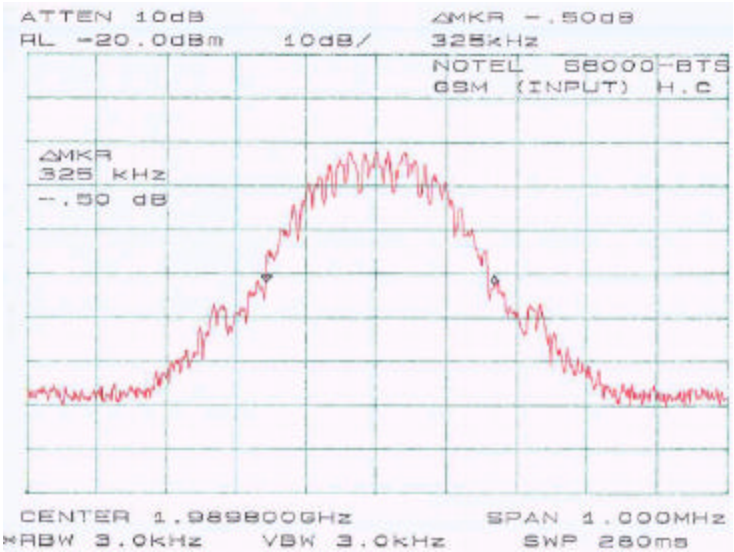
Please refer to plots hereinafter.

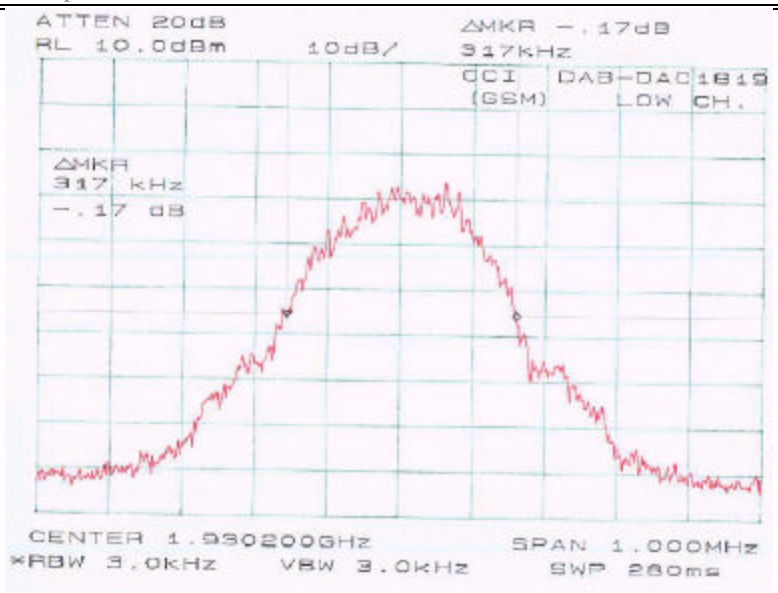
Test Data Summary

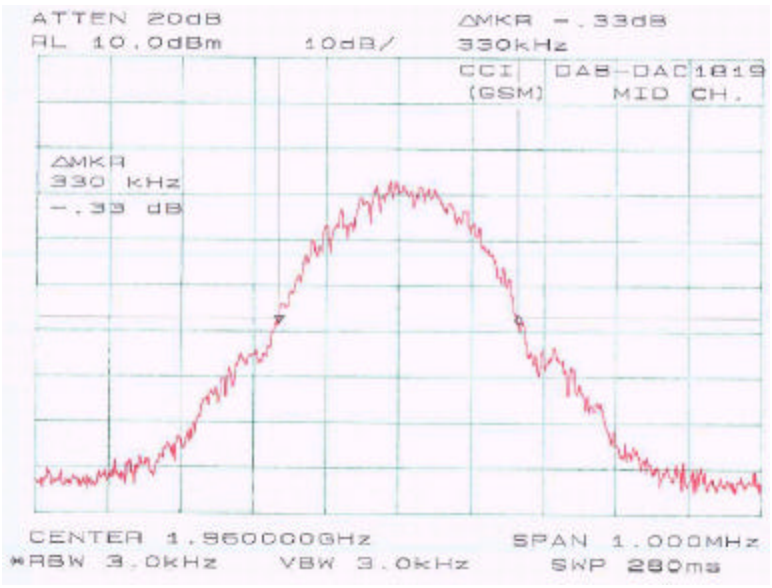
Modulation Type	Channel	Emission Bandwidth
GSM	Low	317 KHz
GSM	Mid	330 KHz
GSM	High	327 KHz

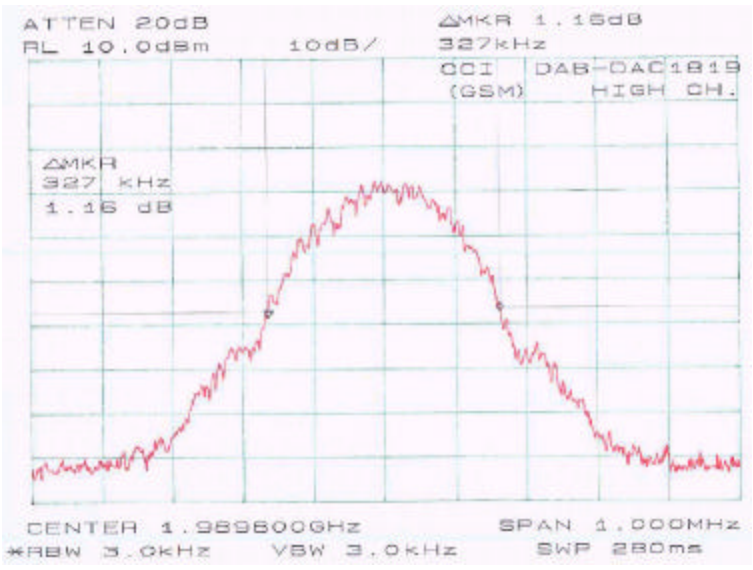

ATTEN 10dB
RL -20.0dBm
10dB/
ΔMKR .50dB
308kHz
NOTEL SB000-BTS
GSM (INPUT) L.C
ΔMKR
308 kHz
.50 dB
CENTER 1.930200GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL -20.0dBm
10dB/
ΔMKR .17dB
315kHz
NOTEL SB000-BTS
GSM (INPUT) M.C
ΔMKR
315 kHz
.17 dB
CENTER 1.960000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL -20.0dBm
10dB/
ΔMKR -.50dB
325kHz
NOTEL SB000-BTS
GSM (INPUT) H.C
ΔMKR
325 kHz
-.50 dB
CENTER 1.989800GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -.17dB
317kHz
CCI (GSM)
DAB-DAC1819
LOW CH.
ΔMKR
317 kHz
-.17 dB
CENTER 1.930200GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -.33dB
330kHz
CCI (GSM)
DAB-DAC1819
MID CH.
ΔMKR
330 kHz
-.33 dB
CENTER 1.960000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR 1.16dB
327kHz
CCI (GSM)
DAB-DAC1819
HIGH CH.
ΔMKR
327 kHz
1.16 dB
CENTER 1.989800GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms

6 - OUT OF BAND EMISSIONS AT ANTENNA TERMINALS

6.1 Applicable Standards

According to FCC §2.1049 and §22.238, on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

6.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1 MHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

6.3 Test Equipment

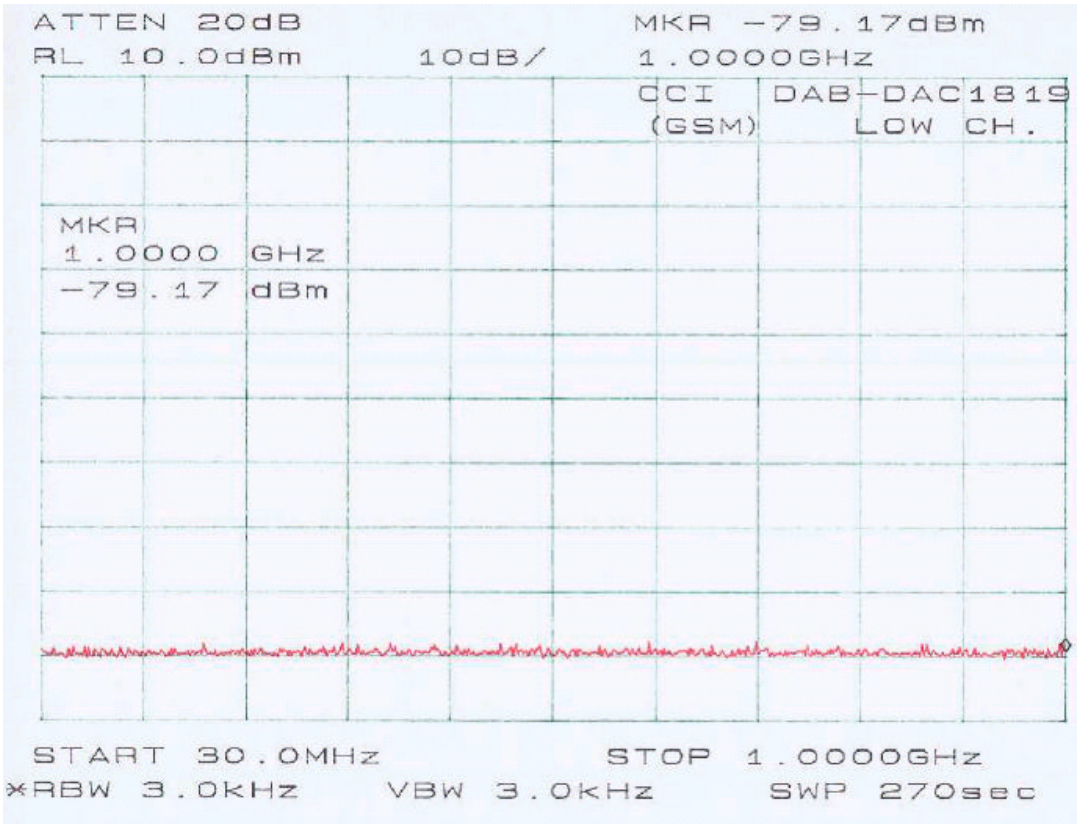
HP 8566B Spectrum Analyzer
HP 7470A Plotter
NORTEL S8000 GSM Base Transceiver

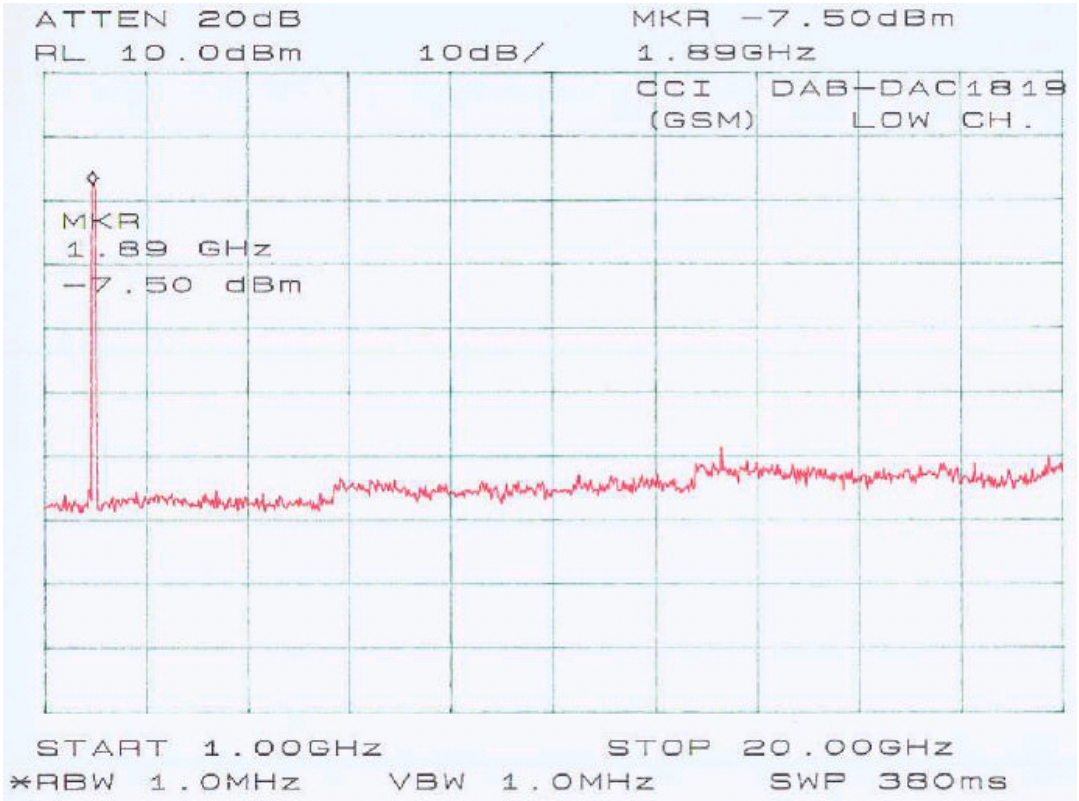
6.4 Test Results

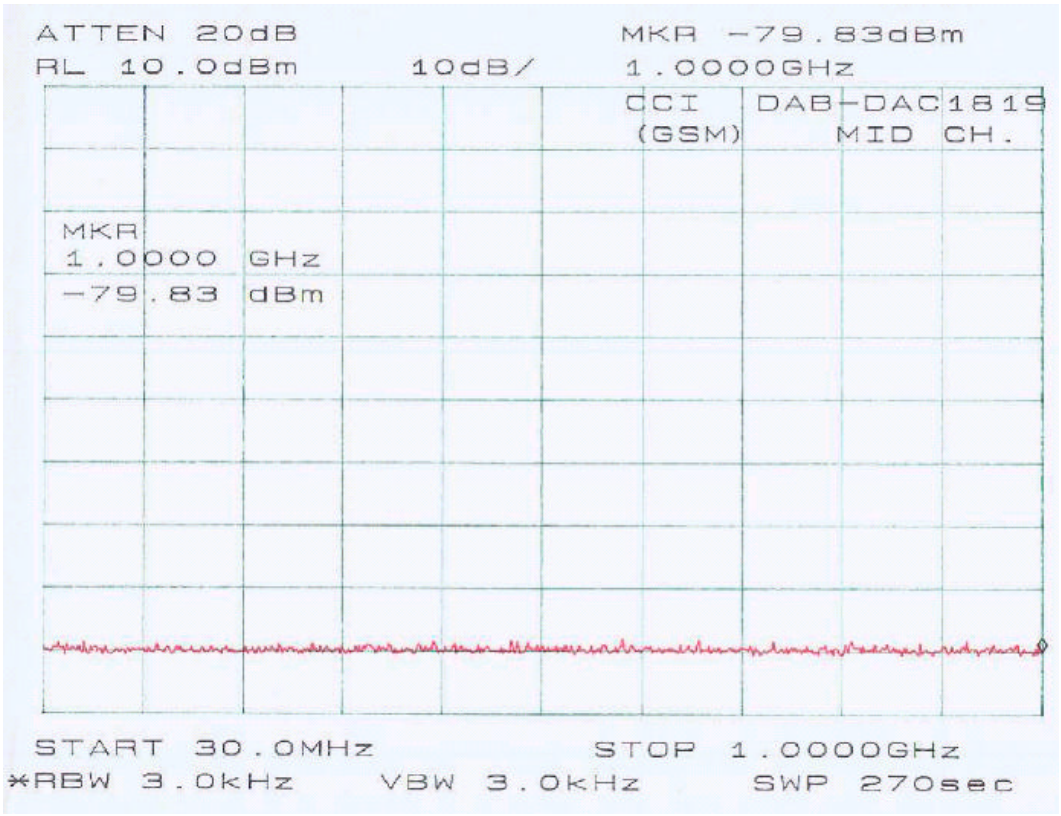
Modulation Type	Channel	Measured
GSM	Low	< -13dBm
GSM	Mid	< -13dBm
GSM	High	< -13dBm

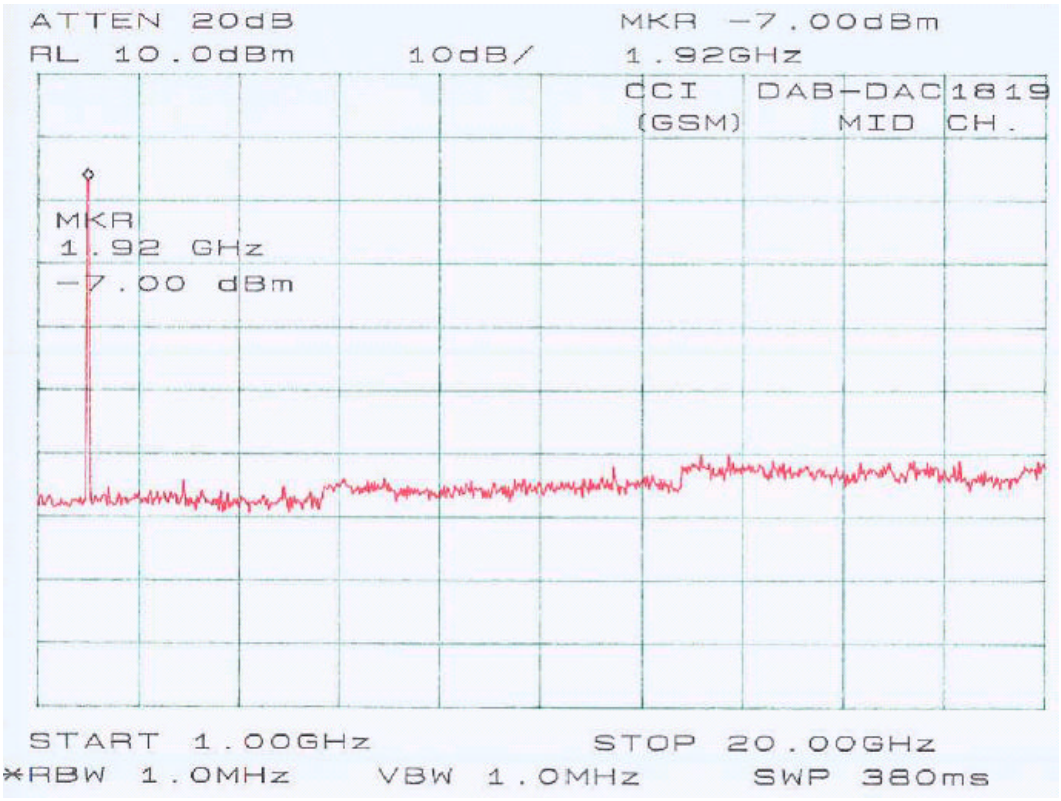
6.5 Plots of Out-of-Band Emissions at Antenna Terminal

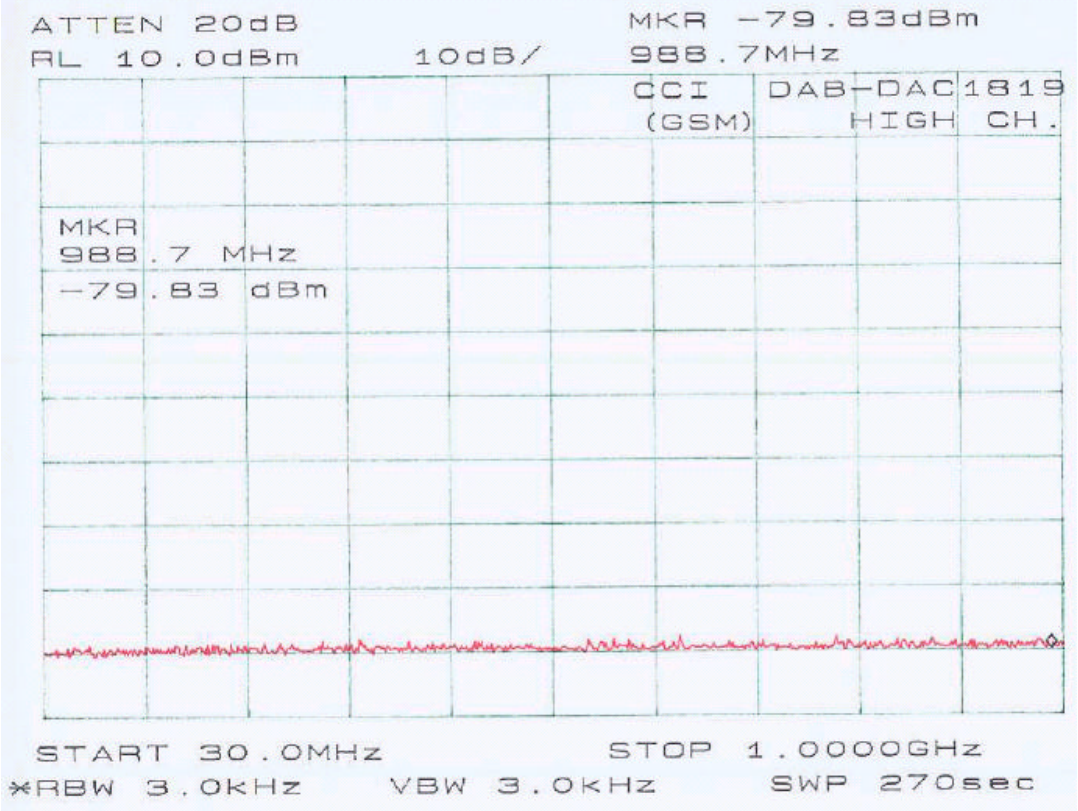
Please refer to plots hereinafter.

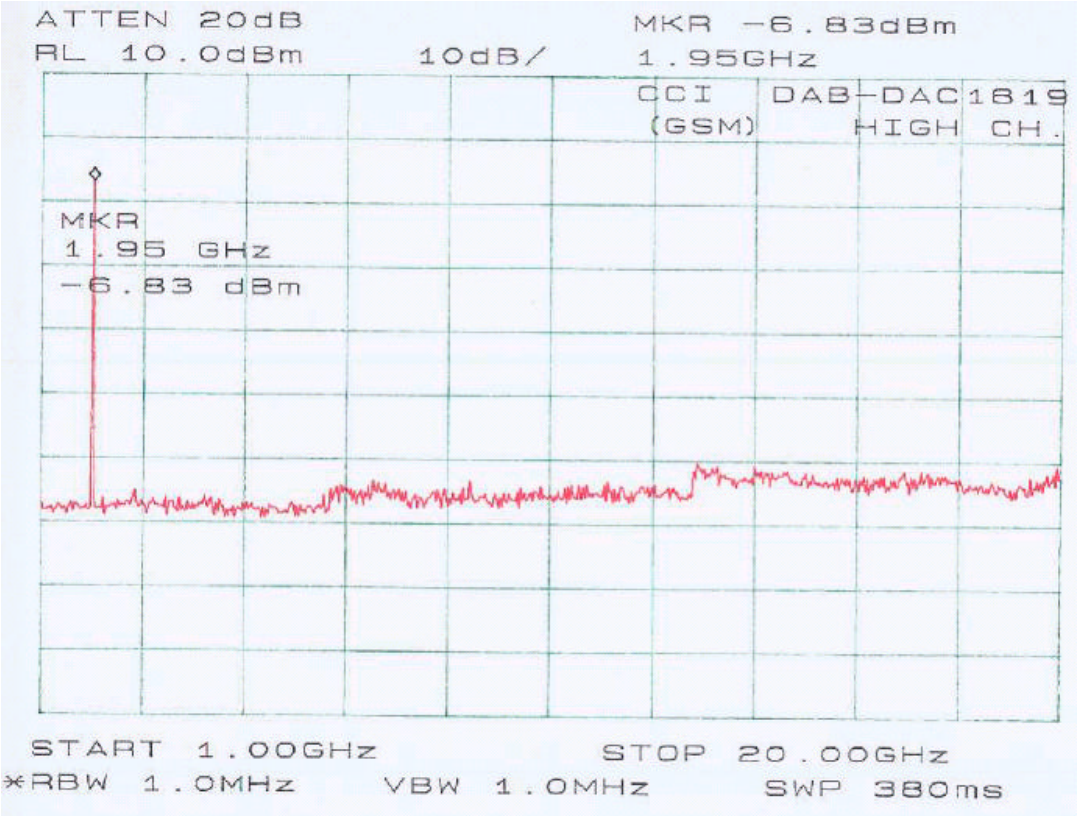

ATTEN 20dB
RL 10.0dBm
10dB/
MKR -79.17dBm
1.0000GHz
CCI (GSM)
DAB-DAC1819 LOW CH.
MKR
1.0000 GHz
-79.17 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 270sec


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -7.50dBm
1.89GHz
CCI (GSM)
DAB-DAC1819 LOW CH.
MKR
1.89 GHz
-7.50 dBm
START 1.00GHz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 380ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -79.83dBm
1.0000GHz
CCI (GSM)
DAB-DAC1819 MID CH.
MKR
1.0000 GHz
-79.83 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 270sec


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -7.00dBm
1.92GHz
CCI (GSM)
DAB-DAC1819 MID CH.
MKR
1.92 GHz
-7.00 dBm
START 1.00GHz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 380ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -79.83dBm
988.7MHz
CCI (GSM)
DAB-DAC1819 HIGH CH.
MKR
988.7 MHz
-79.83 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 270sec


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -6.83dBm
1.95GHz
CCI (GSM)
DAB-DAC1819 HIGH CH.
MKR
1.95 GHz
-6.83 dBm
START 1.00GHz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 380ms

7 – BAND EDGE TEST

7.1 Applicable Standards

According to FCC §2.1049 and §24.238, when measuring the emission limits, carrier frequency shall be adjusted as close to the frequency block edges, both upper and lower.

7.2 Test Procedure

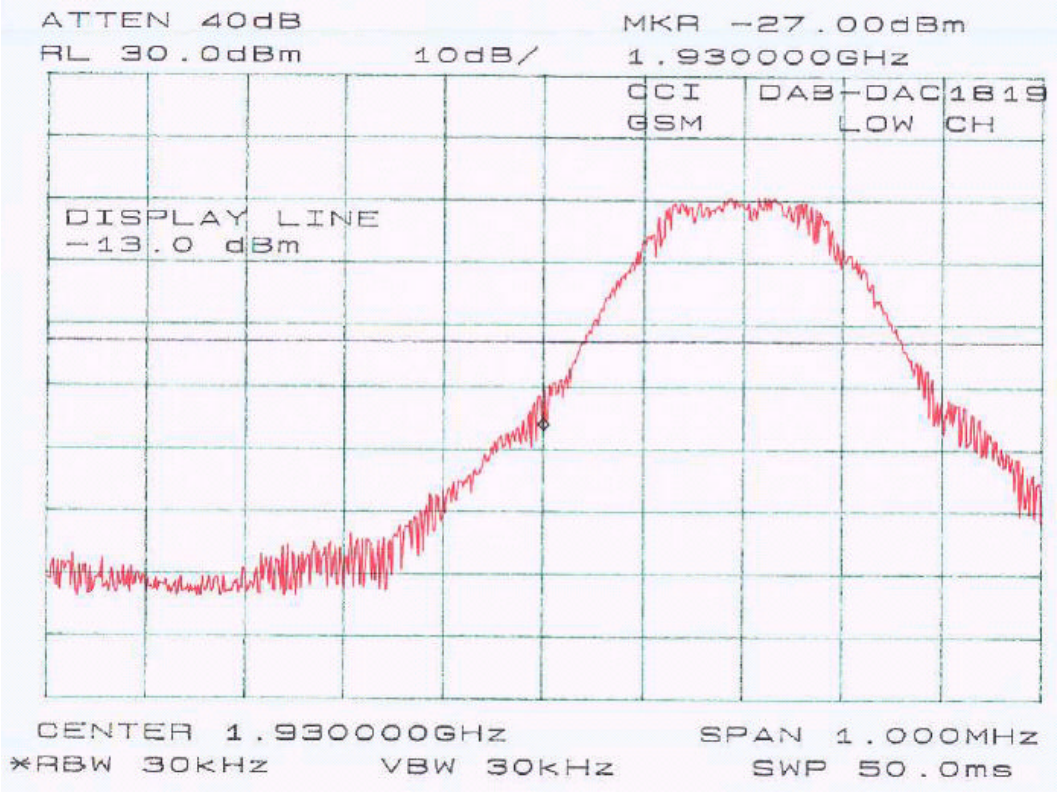
The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. Adjust the carrier frequency as close to the frequency block edges both upper and lower. Sufficient scans were taken to show any out of band-edge emission.

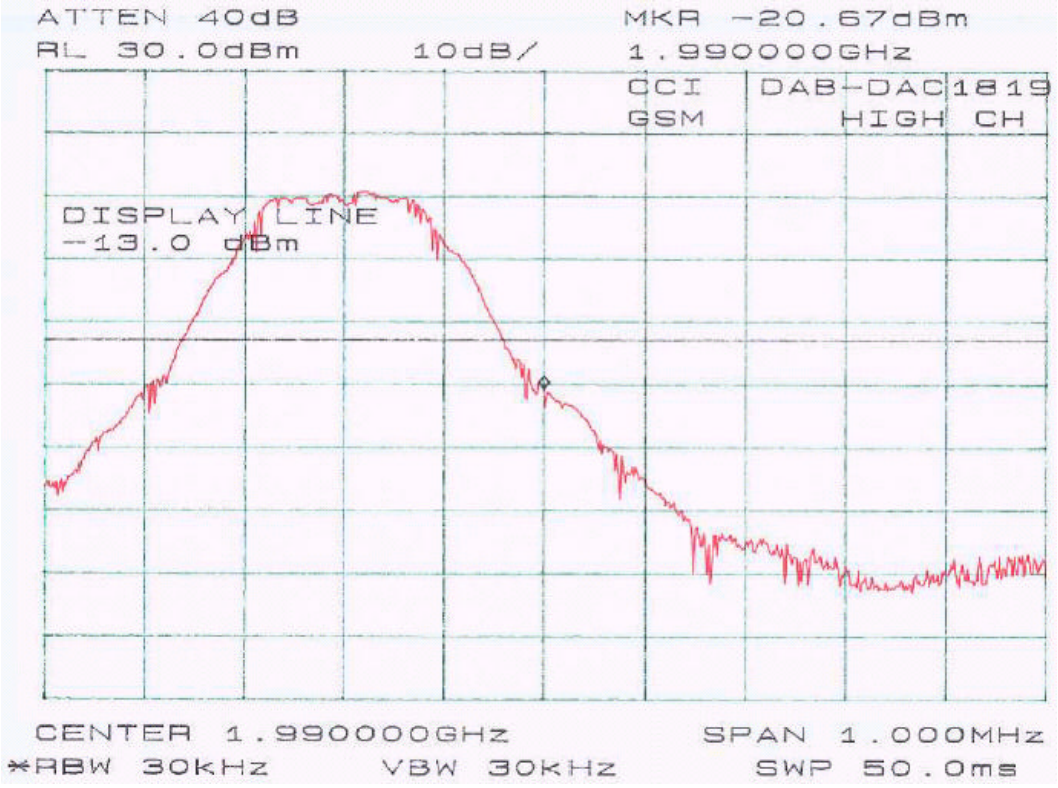
7.3 Test Equipment

Agilent 8565EC Spectrum Analyzer
HP 7470A Plotter
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Rohde & Schwarz SMIQ03B Signal Generator
Rohde & Schwarz AMIQ I/Q Modulation Generator
Hewlett Packard 8449 Amplifier
A.H. Systems, Inc SAS-200/571 Horn Antenna

7.4 Plots of Out-of-Band-Edge Emissions at Antenna Terminal

Please refer to plots hereinafter.


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -27.00dBm
1.930000GHz
CCI DAB-DAC1819
GSM LOW CH
DISPLAY LINE
-13.0 dBm
CENTER 1.930000GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -20.67dBm
1.990000GHz
CCI DAB-DAC1819
GSM HIGH CH
DISPLAY LINE
-13.0 dBm
CENTER 1.990000GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms

8 - TWO-TONE TEST

8.1 Applicable Standards

According to IS-138A (3.4.4), Intermodulation products must be attenuated below the rated power of the EUT by at least 43 +10log (P), equivalent to –13 dBm.

8.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1 MHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic. Two input signals are equal in level (and can be raised equally), were send to the EUT.

8.3 Test Equipment

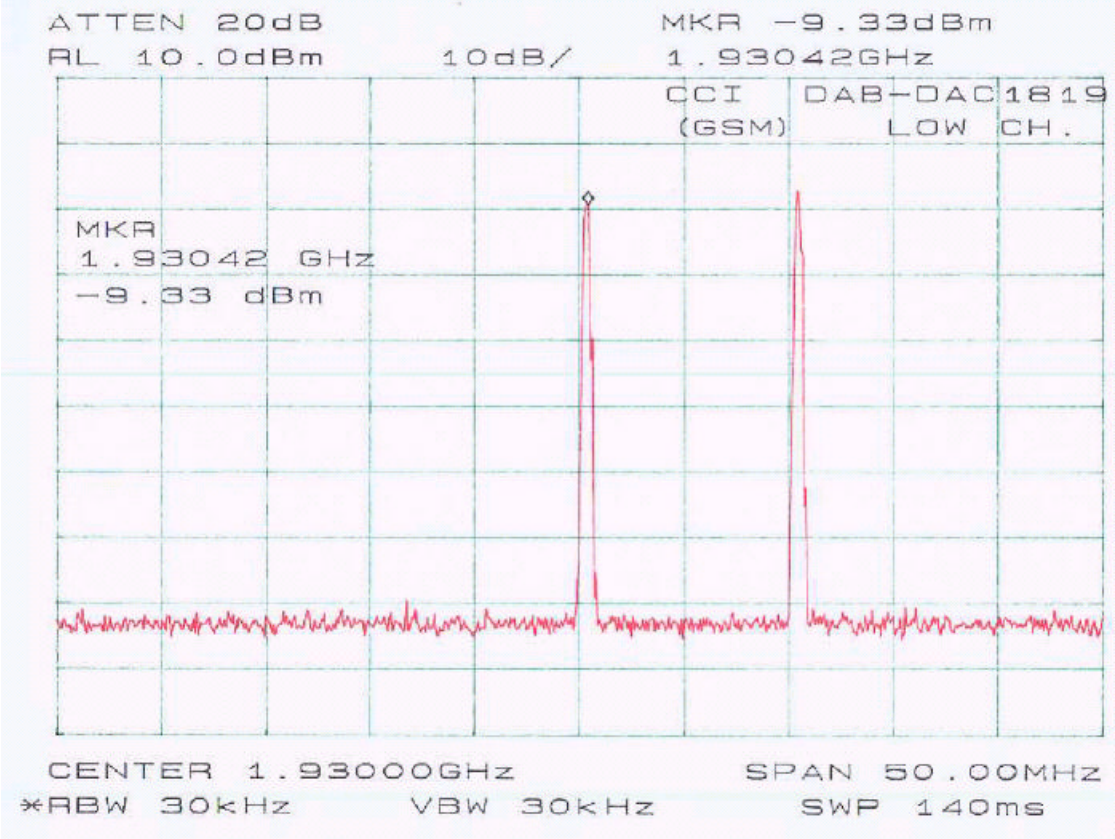
HP 8566B Spectrum Analyzer
HP 7470A Plotter
NORTEL S8000 GSM Base Transceiver

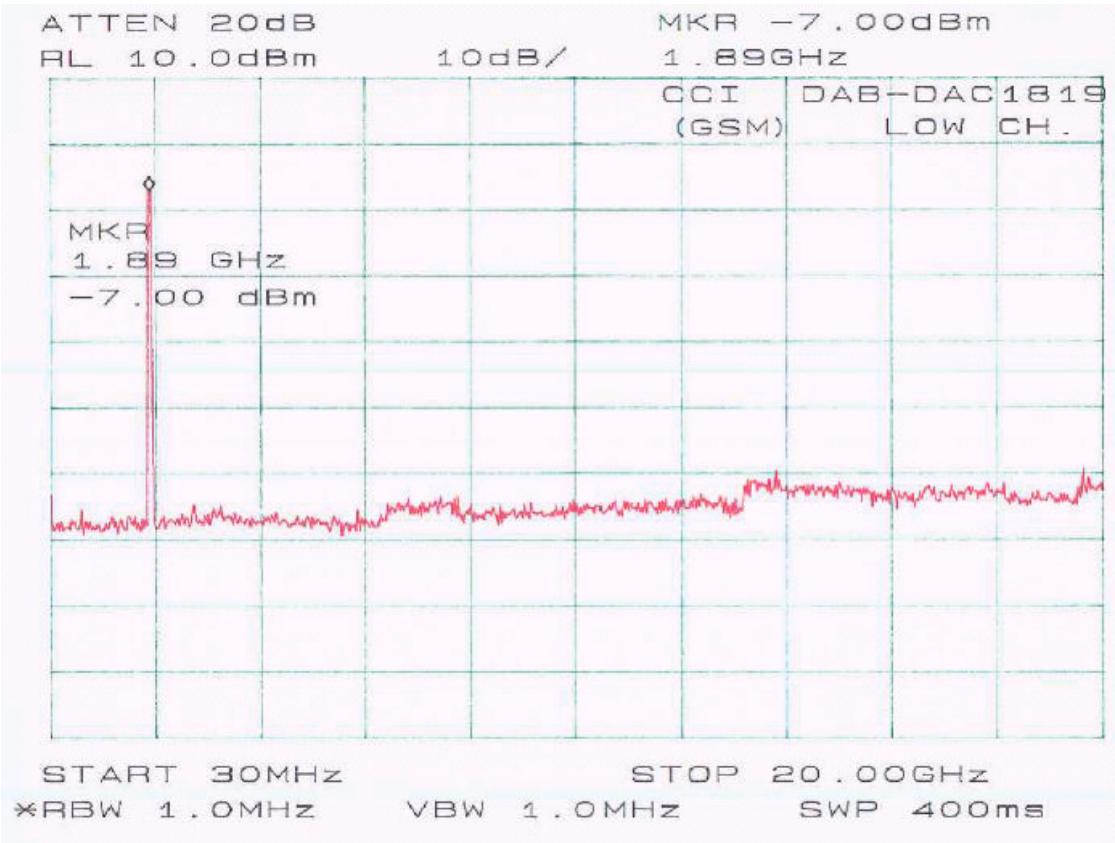
8.4 Test Results

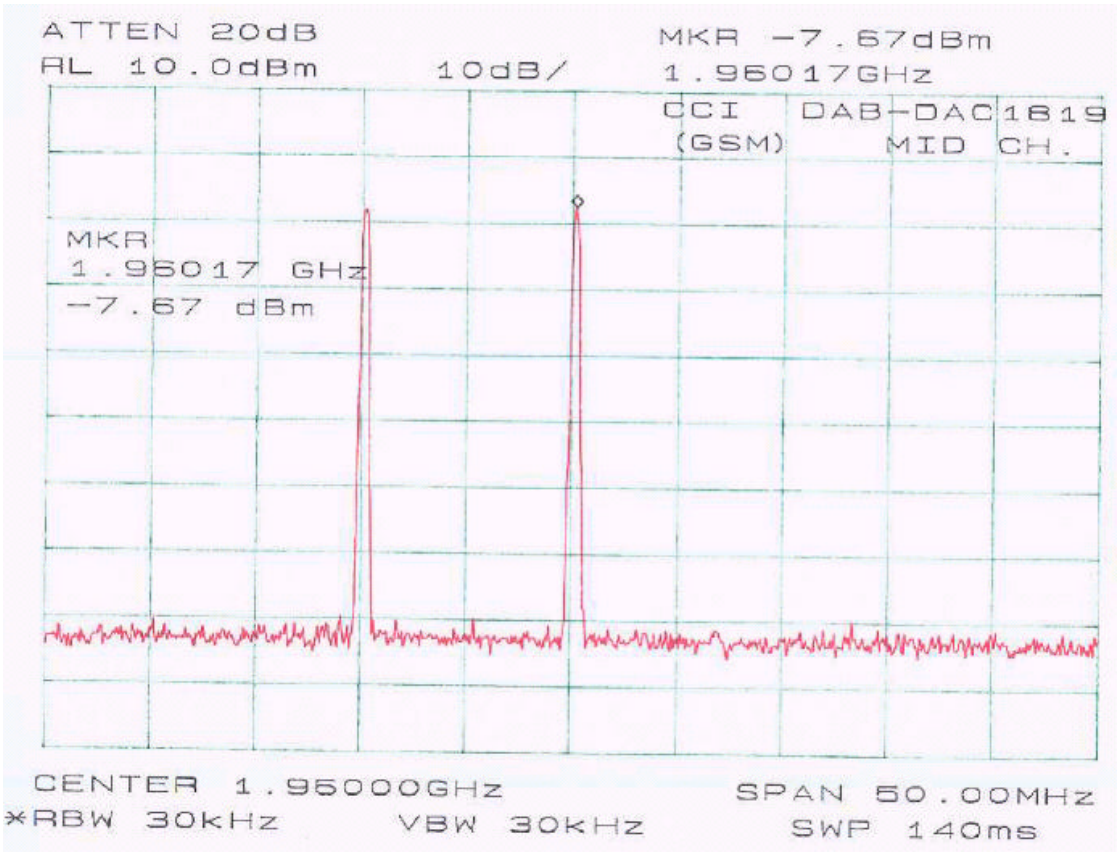
Modulation Type	Channel	Measured
GSM	Low	< -13dBm
GSM	Mid	< -13dBm
GSM	High	< -13dBm

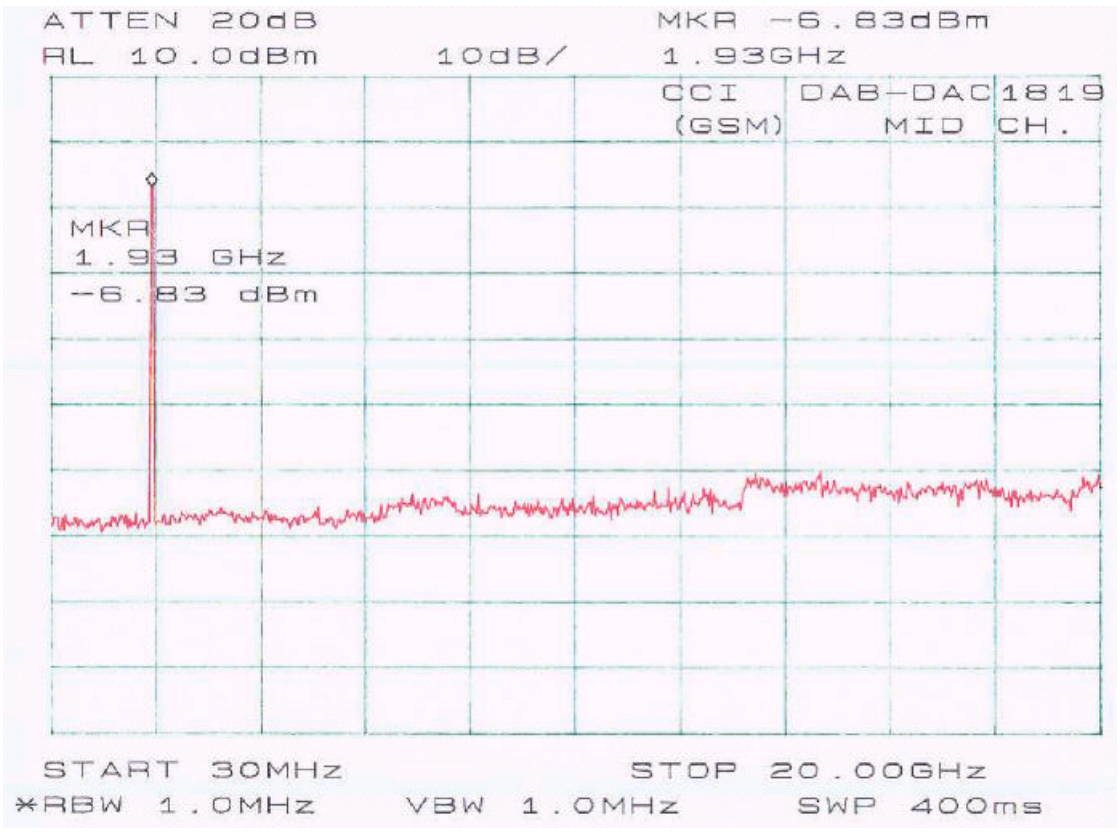
8.5 Plots of Two-Tone Test Result

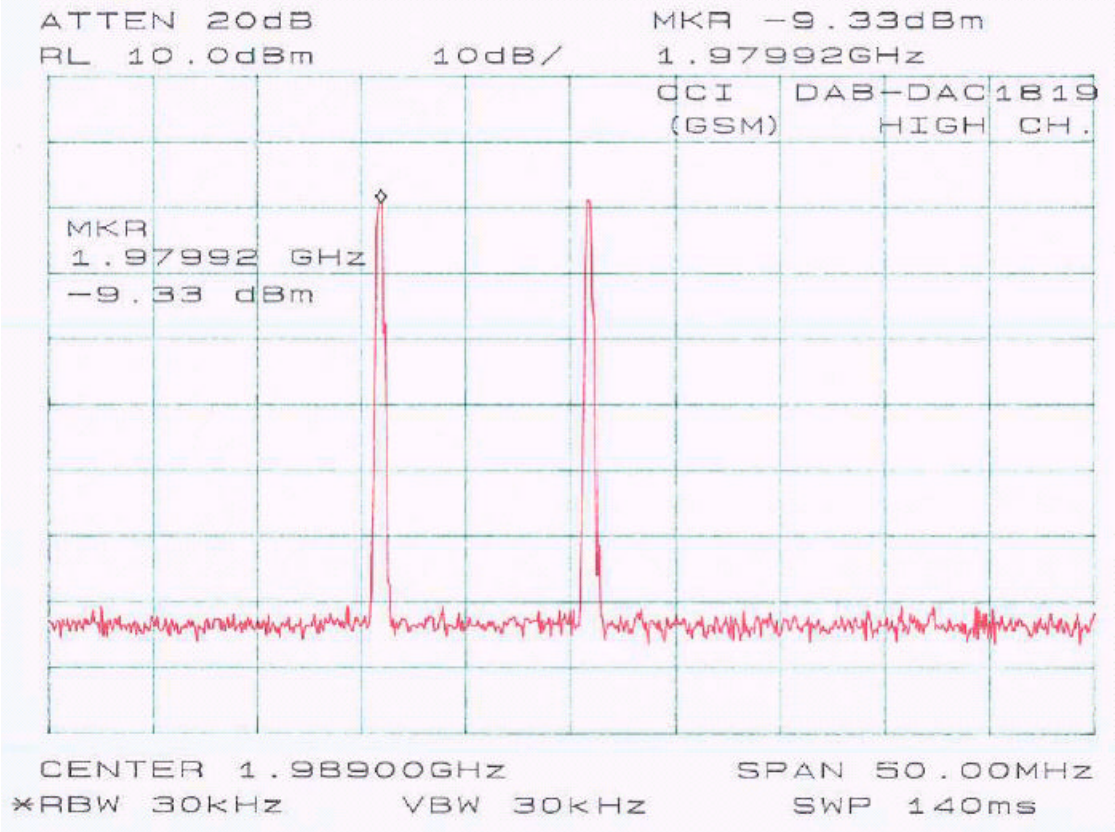
Please refer to plots hereinafter.

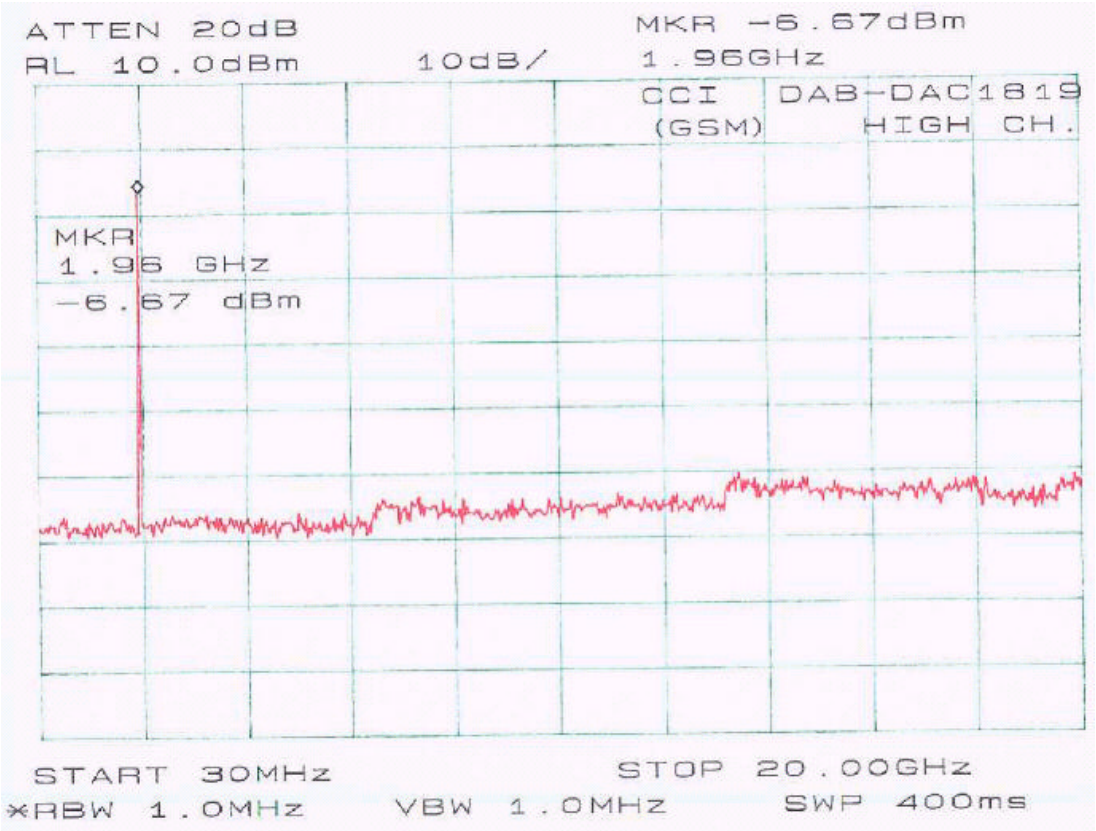

ATTEN 20dB
RL 10.0dBm
10dB/
MKR -9.33dBm
1.93042GHz
CCI (GSM)
DAB-DAC1819 LOW CH.
MKR
1.93042 GHz
-9.33 dBm
CENTER 1.93000GHz
SPAN 50.00MHz
*RBW 30kHz
VBW 30kHz
SWP 140ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -7.00dBm
1.89GHz
CCI (GSM)
DAB-DAC1819 LOW CH.
MKR
1.89 GHz
-7.00 dBm
START 30MHz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 400ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -7.67dBm
1.96017GHz
CCI DAB-DAC 1819
(GSM) MID CH.
MKR
1.96017 GHz
-7.67 dBm
CENTER 1.95000GHz
SPAN 50.00MHz
*RBW 30kHz
VBW 30kHz
SWP 140ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -6.83dBm
1.93GHz
CCI DAB-DAC 1819
(GSM) MID CH.
MKR
1.93 GHz
-6.83 dBm
START 30MHz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 400ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -9.33dBm
1.97992GHz
CCI (GSM)
DAB-DAC1819 HIGH CH.
MKR
1.97992 GHz
-9.33 dBm
CENTER 1.98900GHz
SPAN 50.00MHz
*RBW 30kHz
VBW 30kHz
SWP 140ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -6.67dBm
1.96GHz
CCI (GSM)
DAB-DAC1819 HIGH CH.
MKR
1.96 GHz
-6.67 dBm
START 30MHz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 400ms

9 - RADIATED SPURIOUS RADIATION

9.1 Applicable Standards

Requirements: CFR 47, § 22.917 and § 24.238 (a), on any freqeuncy outside a licensee's frquency block. The power of any emission shall be attenuated below the transmitter power (P) by at least 43+10lg(P) dB, equivalent to –13dBm.

In the event it is either impractical or impossible to make open field measurement [e.g. a broadcast transmitter installed in a building] measurement will be accepted of equipment as installed.

9.2 Test Procedure

The EUT was placed in the base station, and connected to the base transmitter. Turned on the base, then the EUT transmitted signal into a non-radiated load. The test antenna was placed at a distance of 3 meters from the EUT. In order to identify the maximum level of emission from the EUT, the antenna height and polarization were varied during the test, also the antenna azimuth was varied by moving the antenna around the EUT.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Replace the EUT with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

9.3 Test Equipment

CDI B100/200/300 Biconical Antennas
EMCO Bi-logcon Antenna
EMCO 3115 Horn Antenna
HP 8566B Spectrum Analyzer
Preamplifiers
HP8640 Generator
Non-radiating Load
NORTEL S8000 GSM Base Transceiver

9.4 Test Result

Low Frequency: -11.6dBm at 3860.4MHz
Middle Frequency: -12.4dBm at 3920.0MHz
High Frequency: -13.9dBm at 3979.6MHz

Primary scan at 1930.2MHz (Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Gain Correction	Loss dB	Leval dBm	dBm	dB
1930.2	99.5	60	1.2	v	1930.2	37.2	7.4	v	6.6	0.5	43.3		
1930.2	87.3	30	1.2	h	1930.2	31.8	7.4	h	6.6	0.5	37.9		
3860.4	46.2	150	1	v	3860.4	-32.8	3.7	v	8.9	0.7	-24.6	-13	-11.6
3860.4	43.7	90	1	h	3860.4	-36.9	3.7	h	8.9	0.7	-28.7	-13	-15.7
5790.6	45.8	0	1.5	v	5790.6	-35.2	2.5	v	9.2	0.9	-26.9	-13	-13.9
5790.6	41.5	60	1.5	h	5790.6	-39.9	2.5	h	9.2	0.9	-31.6	-13	-18.6
7720.8	42.2	240	1.2	v	7720.8	-37.6	1.8	v	9.5	1.1	-29.2	-13	-16.2
7720.8	38.3	270	1.2	h	7720.8	-40.8	1.8	h	9.5	1.1	-32.4	-13	-19.4

Primary scan at 1960MHz (Mid. CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Gain Correction	Loss dB	Leval dBm	dBm	dB
1960	99.3	90	1.2	v	1960	36.8	7.3	v	6.6	0.5	42.9		
1960	87.2	120	1.5	h	1960	31.1	7.3	h	6.6	0.5	37.2		
3920	46.1	0	1	v	3920	-33.6	3.6	v	8.9	0.7	-25.4	-13	-12.4
3920	42.5	330	1	h	3920	-39.7	3.6	h	8.9	0.7	-31.5	-13	-18.5
5880	45.3	210	1.2	v	5880	-35.6	2.4	v	9.2	0.9	-27.3	-13	-14.3
5880	41.9	240	1.2	h	5880	-39.3	2.4	h	9.2	0.9	-31	-13	-18
7840	41.4	150	1.2	v	7840	-39.5	1.8	v	9.5	1.1	-31.1	-13	-18.1
7840	38.1	180	1.2	h	7840	-41.9	1.8	h	9.5	1.1	-33.5	-13	-20.5

Primary scan at 1989.8MHz (High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Gain Correction	Loss dB	Leval dBm	dBm	dB
1989.8	97.1	0	1.2	v	1989.8	36.2	7.2	v	6.6	0.5	42.3		
1989.8	86.4	30	1.2	h	1989.8	30.4	7.2	h	6.6	0.5	36.5		
3979.6	45.5	120	1	v	3979.6	-35.1	3.5	v	8.9	0.7	-26.9	-13	-13.9
3979.6	41.2	90	1	h	3979.6	-39.4	3.5	h	8.9	0.7	-31.2	-13	-18.2
5969.4	43.6	0	1.5	v	5969.4	-38.3	2.3	v	9.2	0.9	-30	-13	-17
5969.4	40.1	60	1.5	h	5969.4	-41.1	2.3	h	9.2	0.9	-32.8	-13	-19.8
7959.2	39.7	270	1.2	v	7959.2	-41.8	1.8	v	9.5	1.1	-33.4	-13	-20.4
7959.2	37.1	240	1.2	h	7959.2	-42.6	1.8	h	9.5	1.1	-34.2	-13	-21.2

Compliance Statement:

According to FCC Part 15, at 3-meter distance the emission from an intentional radiator shall not exceed the field strength level 40dBuV/m within 30-88MHz, 43.5dBuV/m within 88-216 MHz, 46dBuV/m within 226-960MHz, 54dBuV/m above 960MHz. The level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The levels of unwanted emission of this device were below the above limits. This device was compliant with the FCC Part 15.

10 – MODULATION CHARACTERISTICS

This EUT only is an amplifier, it is not a transmitter. There is no modulating circuit in the EUT and no modulating characteristics measurement required.

11 - FREQUENCY STABILITY

This EUT only is an amplifier, it is not a transmitter. There is no oscillator circuit in the EUT, and no frequency stability measurement required.