FCC PART 22 & PART 24 TYPE APPROVAL
EMI MEASUREMENT AND TEST REPORT

For

TELULAR CORPORATION

580 Old Willets Path
Hauppauge, New York 11788

FCC ID: MTFTG5112597

2003-10-21

This Report Concerns:	**Equipment Type:**
☒ Original Report	Telguard 5 Alarm System Communicator, TG5A001

Test Engineer:	Benjamin Jin /
Report No.:	R0309151
Test Date:	2003-09-17
Reviewed By:	Ling Zhang /
Prepared By:	Bay Area Compliance Laboratory Corporation 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

TABLE OF CONTENTS

1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Telular Corporation's* product, FCC ID: MTFTG5112597 *or* the "EUT" as referred to in this report is a digital cellular radio alarm transmissions device used to provide a primary transmission path (cellular) for control communicators (C/Cs). It uses the secondary transmission path (telco) when the cellular path is not available. When transmitting an alarm signal, the EUT obtains its data from the C/C by way of a telco interface. The device transmit a Link Request to the Telular operated Communication Center and when a link acknowledgement is received, the EUT handshakes with the C/C and causes the C.C to transmit the alarm data. The EUT encodes the alarm data into SMS (Sort Messaging System) protocol and transmits to the local digital cellular network provider. The signal is routed from the network providr to the decoding (message) center. The Communication Center performs like a central station receiver and issues the transmission kiss-off when the last message in the transmisson is received. After decoding and reformatting, the alarm signal is routed over telco to the appropriate alarm company central station for action.

** The test data gathered are from typical production samples provided by the manufacturer.*

1.2 Objective

This type approval report is prepared on behalf of *Telular Corporation* in accordance with Part 2, Subpart J, Part 15, Subparts A and B, and Part 22 Subpart H, of the Federal Communication Commissions rules.

It is also prepared 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 output power, , occupied bandwidth, spurious emission at antenna terminal, band edge, and radiated margin.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 22 Subpart H - Public Mobile Services
Part 24 - Personal Communications Services

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, ANSI C63.4-2001, 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 at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2001.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

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, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	2517A01610	2003-10-30
HP	Spectrum Analyzer	8593A	29190A00242	2004-05-01
HP	Amplifier	8447E	1937A01054	2004-05-01
HP	Quasi-Peak Adapter	85650A	2521A00718	2004-05-01
Com-Power	Biconical Antenna	AB-100	14012	2004-05-01
Com-Power	LISN	LI-200	12005	2004-03-28
Com-Power	LISN	LI-200	12008	2004-03-28
Com-Power	Log Periodic Antenna	AL-100	16091	2004-05-01
Com-Power	Log Periodic Antenna	AB-900	15049	2004-05-01
Rohde & Schwarz	EMI Test Receiver	ESPI	1147 8007 07	2003-12-03
Agilent	Spectrum Analyzer (9KHz – 40GHz)	8564E	08303	2004-08-01
Agilent	Spectrum Analyzer (9KHz – 50GHz)	8565EC	06042	2004-05-03
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2004-03-14
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2004-05-31

*** Statement of Traceability: Bay Area Compliance Laboratory Corp.** certifies that all calibration has been performed using suitable standards traceable to the NATIONAL INSTITUTE of STANDARDS and TECHNOLOGY (NIST).

1.7 Remote Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
Anritsu	Base Simulator	MT8802A	None	N/A

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.

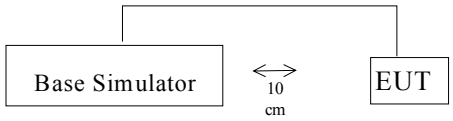
2.2 Block Diagram

Please refer to Exhibit D.

2.3 Equipment Modifications

No modifications were necessary for the EUT to comply with the applicable limits and requirements.

2.4 Test Setup Block Diagram



3 - SUMMARY OF TEST RESULTS

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1046, § 22.913 (a), § 24.232 (b)	Conducted Output Power	Compliant
§ 2.1049 § 22.917 § 24.238	Emission, Occupied Bandwidth	Compliant
§ 2.1051, § 22.917 § 24.238(a)	Spurious emissions at antenna terminals	Compliant
FCC §2.1049, §24.238	Band Edge Test	Compliant
§ 2.1053, § 22.917 § 24.238 (a)	Radiated Spurious Emission	Compliant
§ 2.1055 (a) § 2.1055 (d) § 22.355 § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 2.1093 § 24.52	Radio frequency radiation exposure evaluation Portable Device	Compliant

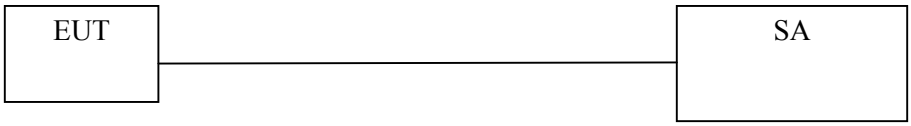
4 – CONDUCTED OUTPUT POWER

4.1 Standard Applicable

According to § 2.1046 (a) for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8).

4.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Add a correction factor to the display.



Note: The antenna is integrated with the EUT. The conducted output power may not be measured exactly.

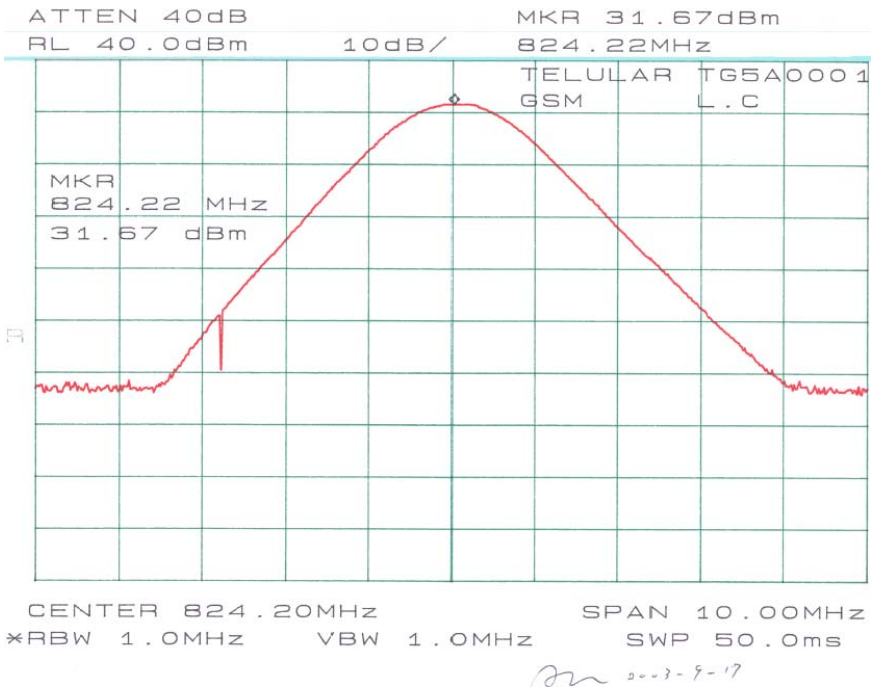
4.3 Measurement Result

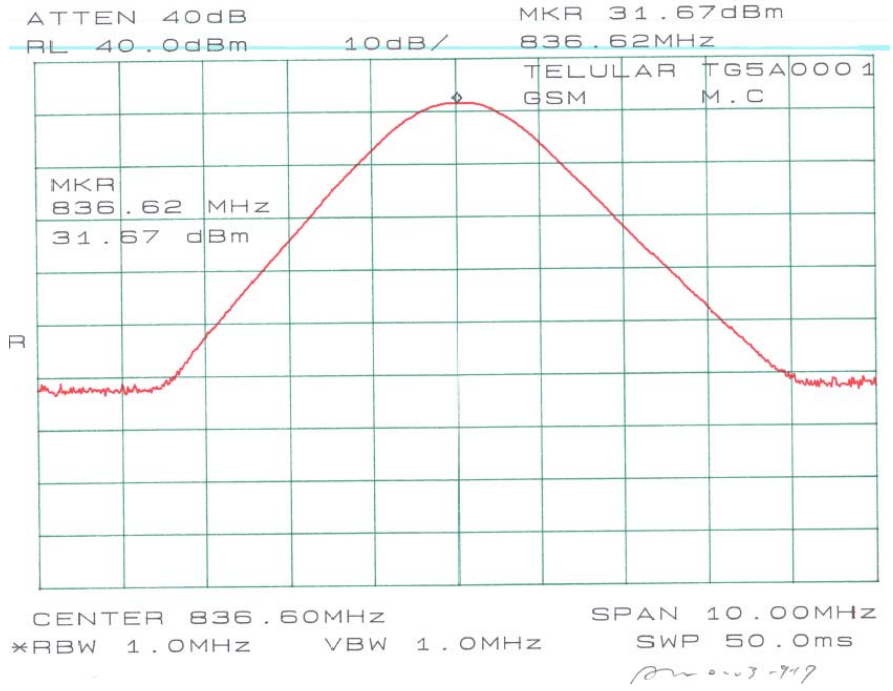
Frequency (MHz)	Output Power (dBm)	Output Power (W)	Result
824.20	31.67	1.469	Compliant
836.60	31.67	1.469	Compliant
848.80	31.50	1.413	Compliant
1850.2	21.67	0.147	Compliant
1880.00	21.83	0.152	Compliant
1909.80	20.83	0.121	Compliant

Please also refer to following plots.

4.4 Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8568B	2610A02165	2003-12-06
HP	8593B	2919A0242	2003-12-06


ATTEN 40dB
RL 40.0dBm
10dB/
MKR 31.67dBm
824.22MHz
TELULAR TG5A0001
GSM L.C
MKR
824.22 MHz
31.67 dBm
CENTER 824.20MHz
SPAN 10.00MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms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10dB/
MKR 31.67dBm
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TELULAR TG5A0001
GSM M.C
MKR
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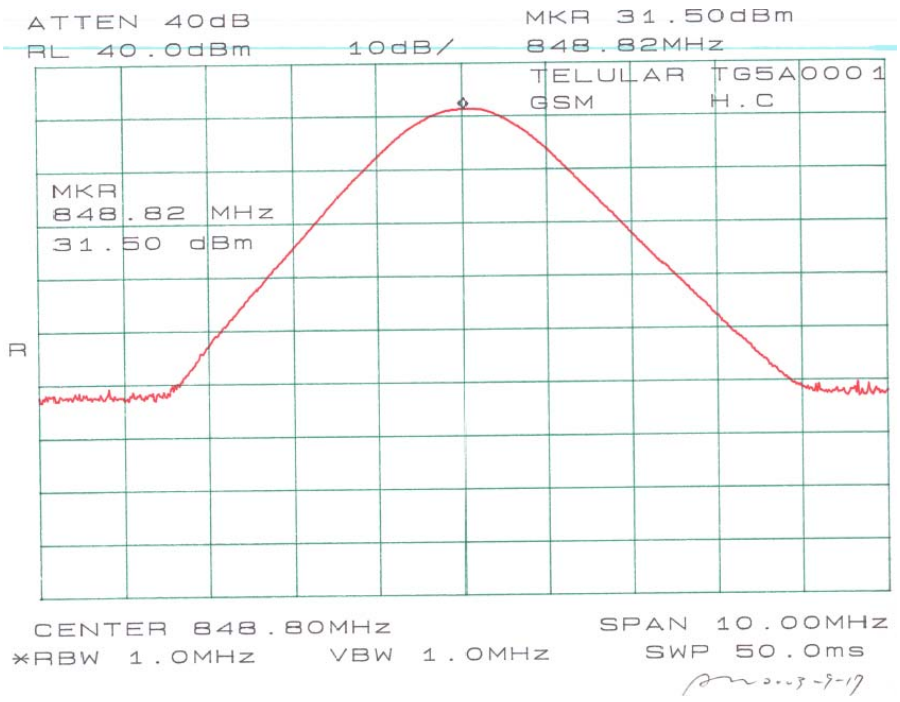
31.67 dBm
CENTER 836.60MHz
SPAN 10.00MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms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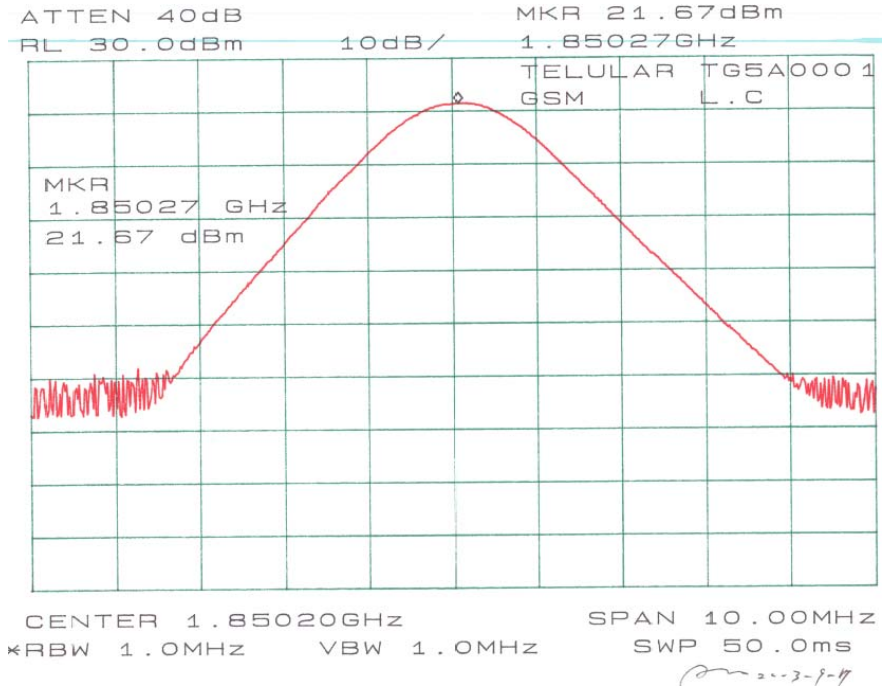
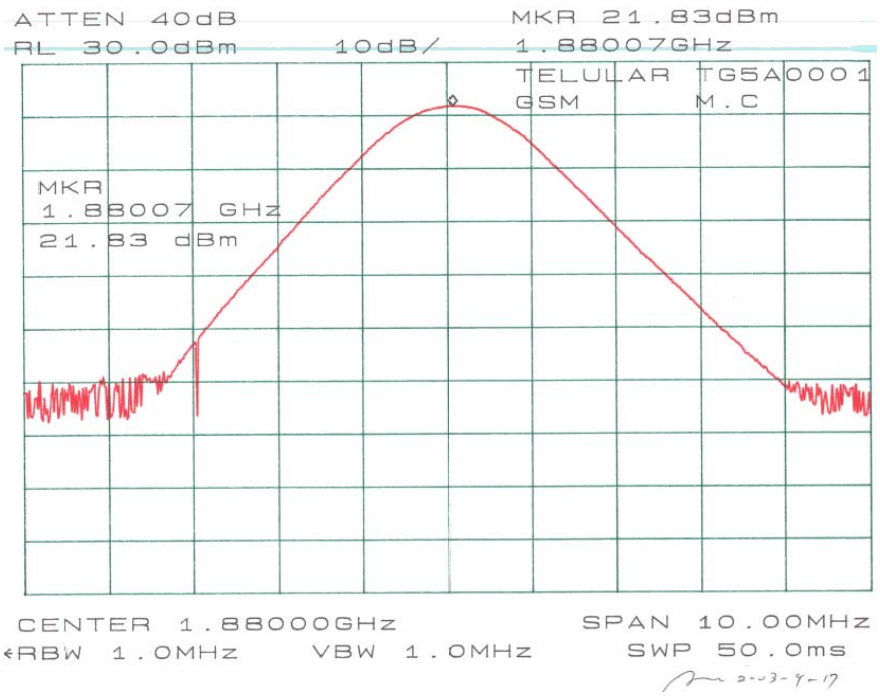
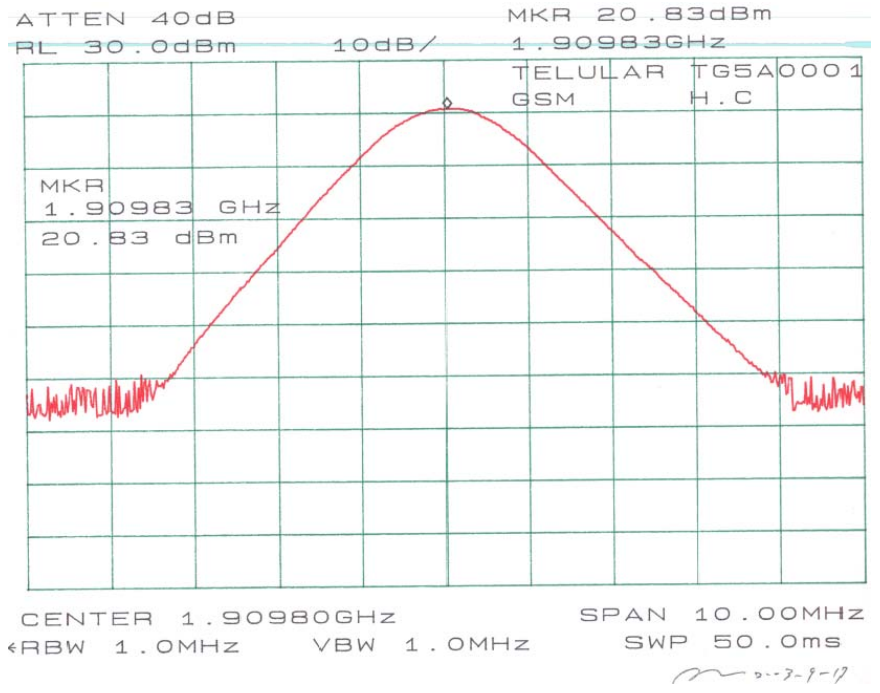
RL 40.0dBm
10dB/
MKR 31.50dBm
848.82MHz
TELULAR TG5A0001
GSM H.C
MKR
848.82 MHz
31.50 dBm
R
CENTER 848.80MHz
SPAN 10.00MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 21.67dBm
1.85027GHz
TELULAR TG5A0001
GSM L.C
MKR
1.85027 GHz
21.67 dBm
CENTER 1.85020GHz
SPAN 10.00MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 21.83dBm
1.88007GHz
TELULAR TG5A0001
GSM M.C
MKR
1.88007 GHz
21.83 dBm
CENTER 1.88000GHz
SPAN 10.00MHz
RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 20.83dBm
1.90983GHz
TELULAR TG5A0001
GSM H.C
MKR
1.90983 GHz
20.83 dBm
CENTER 1.90980GHz
SPAN 10.00MHz
RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms

5 – RF OUTPUT POWER

5.1 Applicable Standard

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts. According to FCC § 24.232(b), EIRP peak power for mobile/portable stations are limited to 2 watts.

5.2 Test Procedure

1. On a test site, the EUT shall be placed at 1.5m height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a tuned dipole (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

5.3 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

5.4 Test Results

FCC Rules	Frequcny (MHz)	Substitution Reading (dBm)	Subtitution Antenna Gain	Substitution Cable Loss (dBm)	Output Power (dBm)	Limit (W)
PART22	824.20	30.45	0	0.1	30.35 (ERP)	7 (ERP)
	836.60	30.18	0	0.1	30.08 (ERP)	7 (ERP)
	848.80	30.02	0	0.1	29.92 (ERP)	7 (ERP)
PART24	1850.20	14.63	6.7	0.3	21.03 (EIRP)	2 (EIRP)
	1880.00	13.54	6.7	0.3	19.94 (EIRP)	2 (EIRP)
	1909.80	13.63	6.7	0.3	20.03 (EIRP)	2 (EIRP)

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

30.45 + 0 – 0.1 = 30.35

6 - OCCUPIED BANDWIDTH

6.1 Applicable Standard

Requirements: CFR 47, Section 2.1049, Section 22.905, and Section 22.911. All channels have a bandwidth of 40kHz and are designed by their center frequencies in MegaHertz.

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.

6.2 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 30 KHz and the spectrum was recorded.

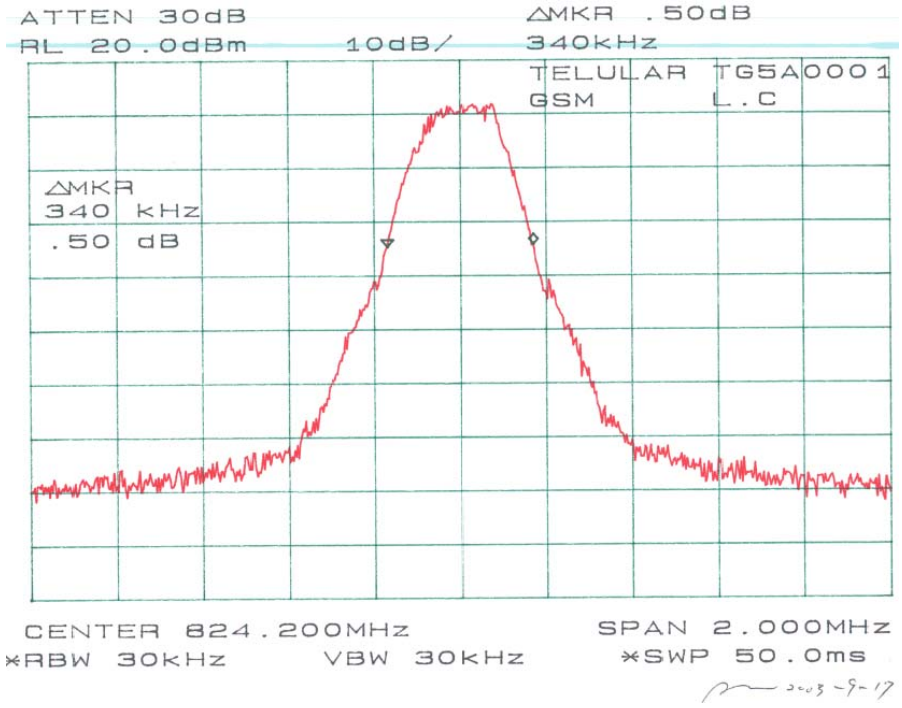
6.3 Test Equipment

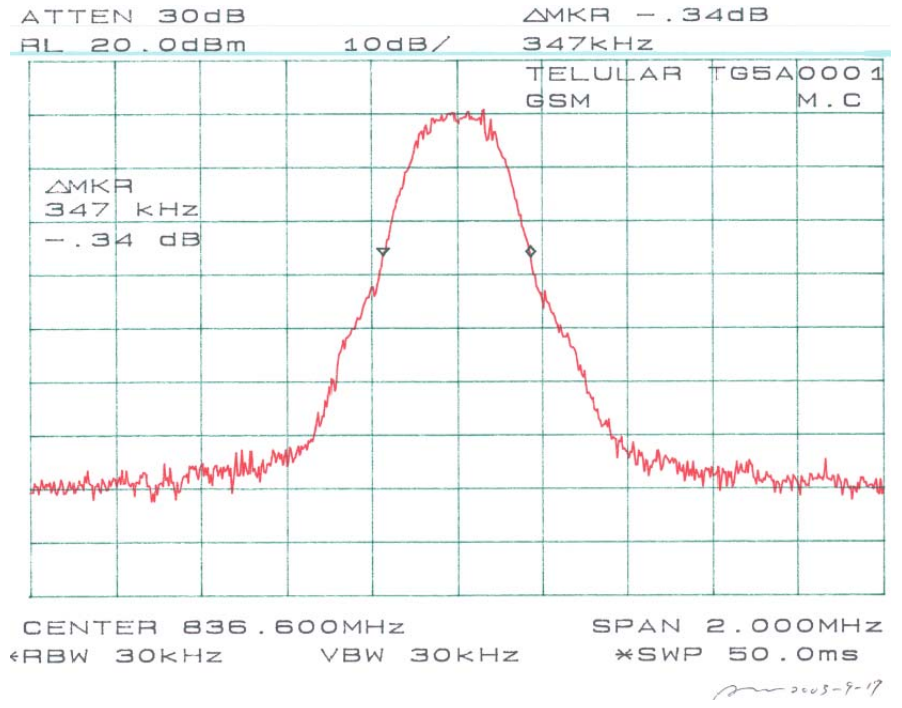
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

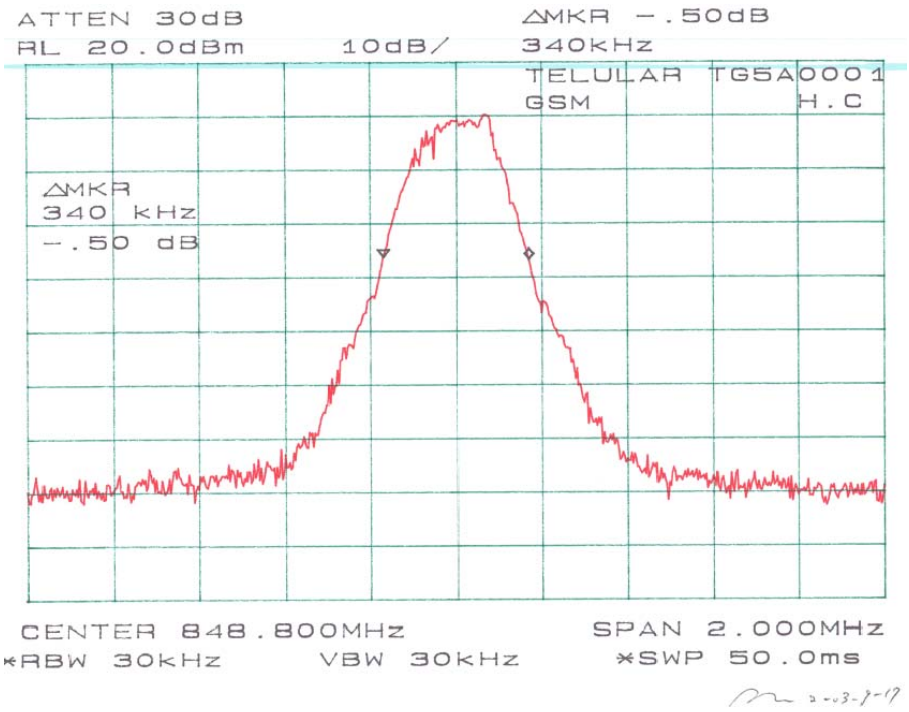
6.4 Test Results

Please refer to the hereinafter plots.

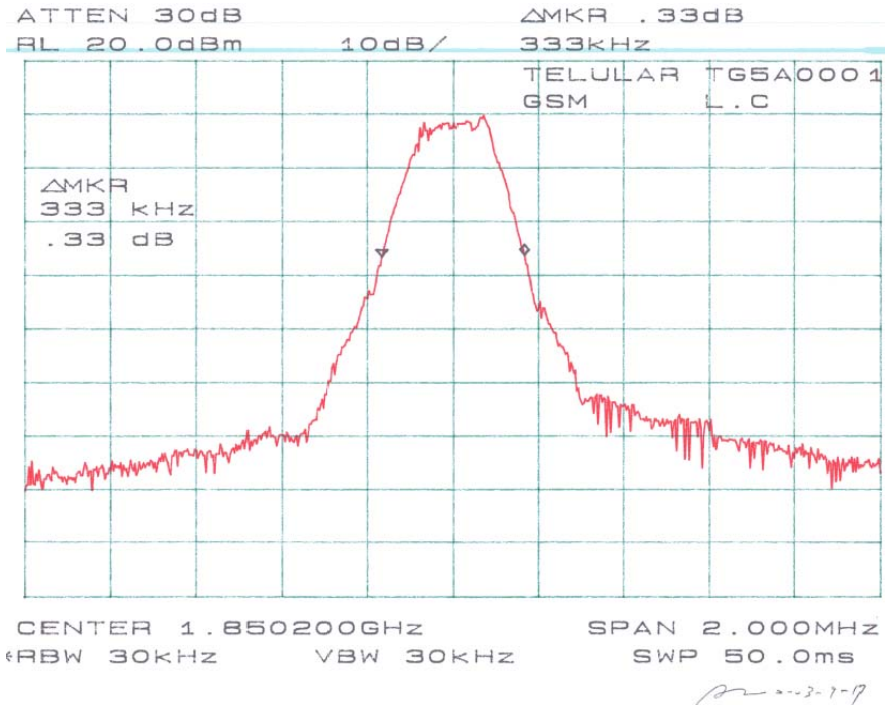
Plots of Occupied Bandwidth for FCC Part22

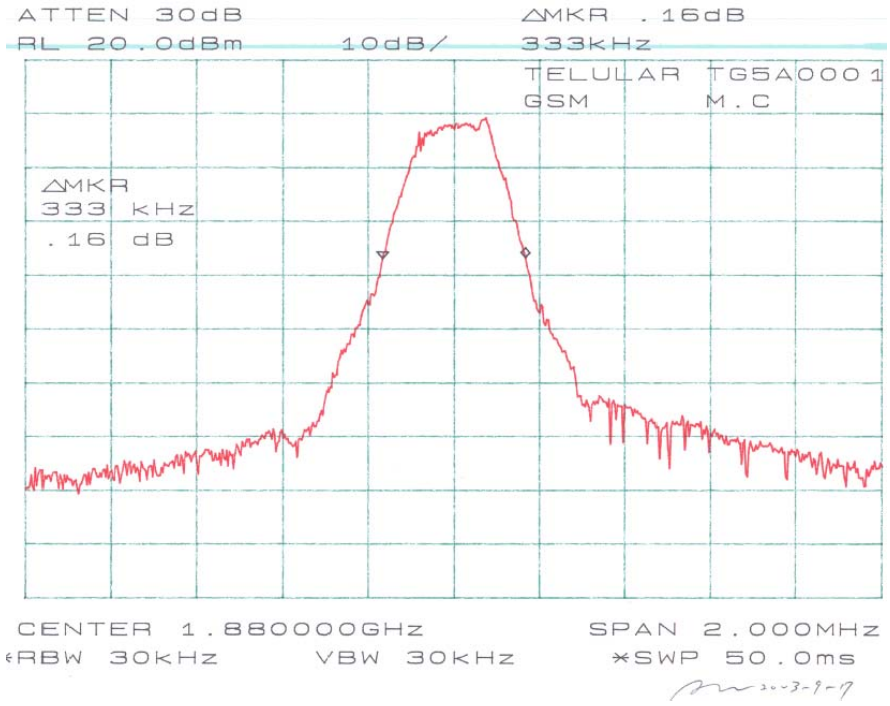


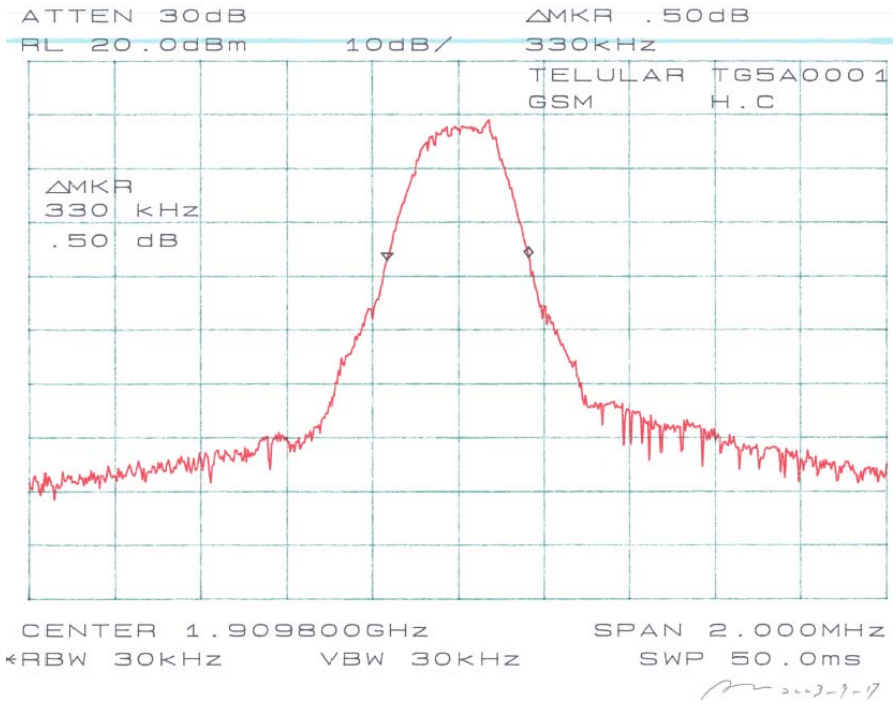




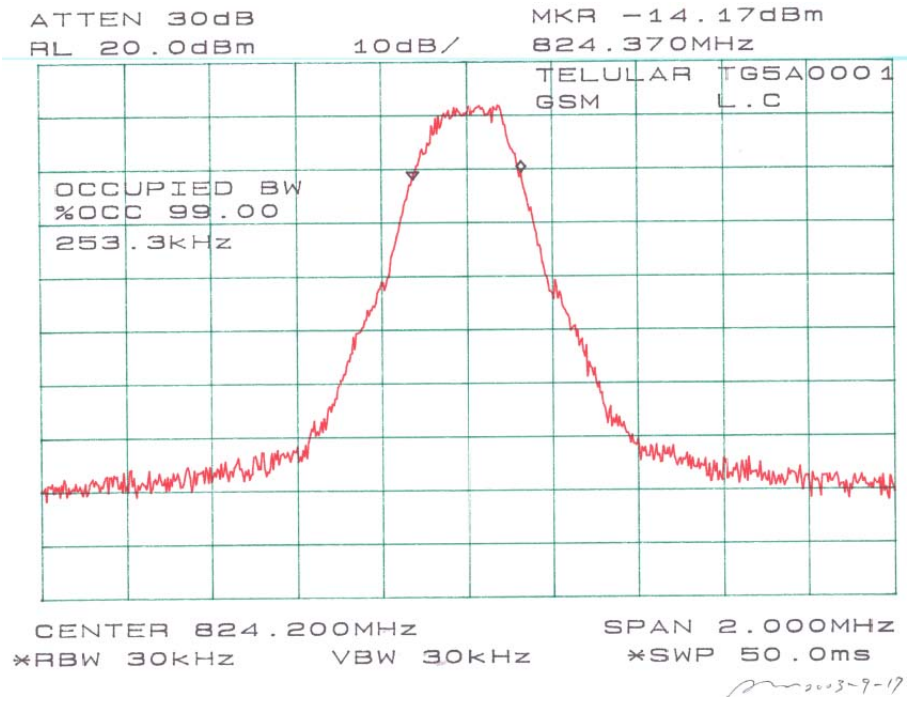
Plots of Occupied Bandwidth for FCC Part24

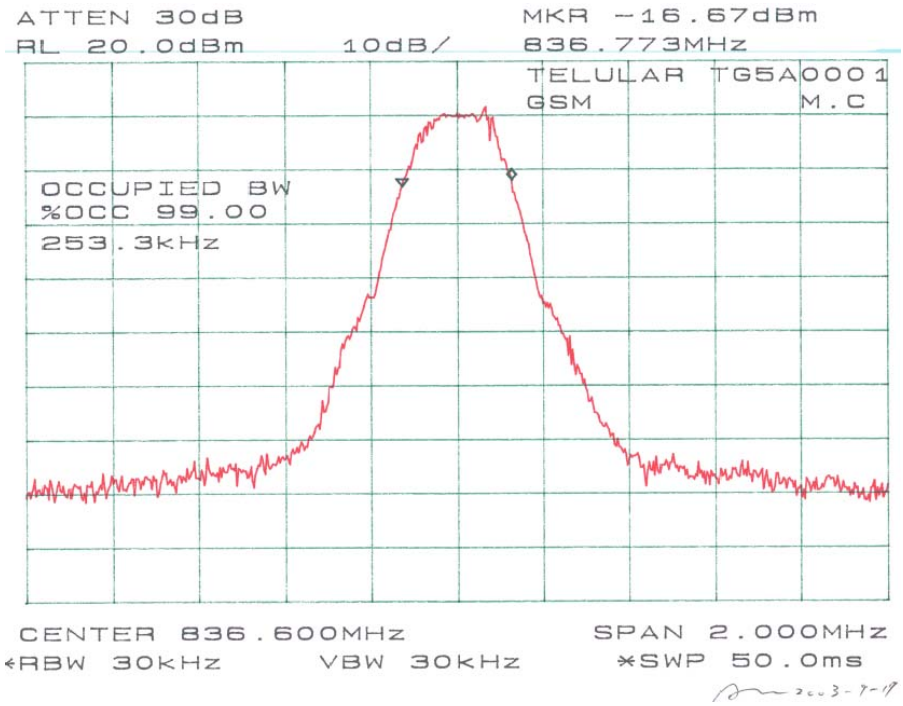


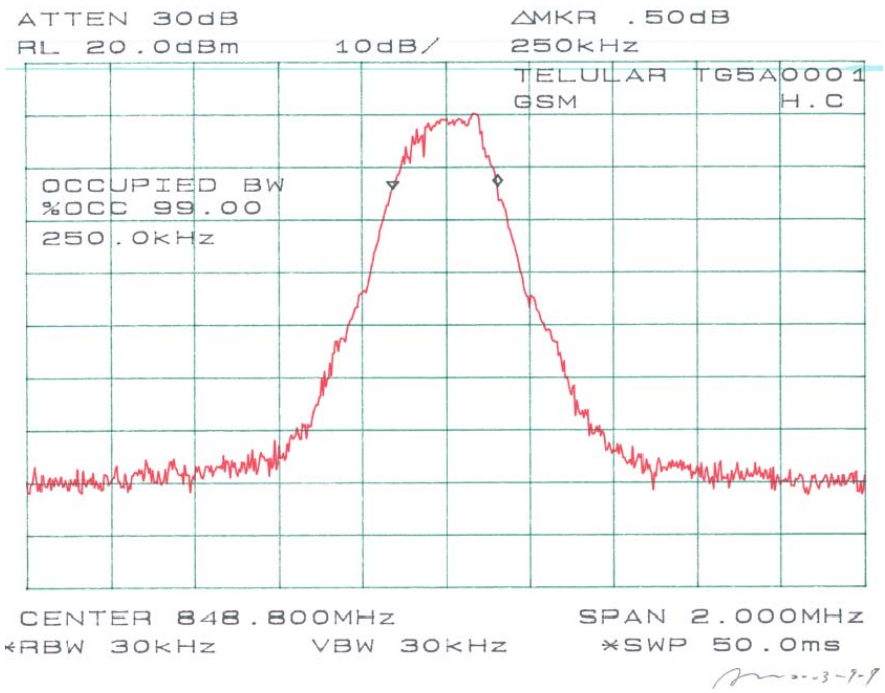

ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR .16dB
333kHz
TELULAR TG5A0001
GSM M.C
ΔMKR
333 kHz
.16 dB
CENTER 1.880000GHz
SPAN 2.000MHz
*RBW 30kHz
VBW 30kHz
*SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR .50dB
330kHz
TELULAR TG5A0001
GSM H.C
ΔMKR
330 kHz
.50 dB
CENTER 1.909800GHz
SPAN 2.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms

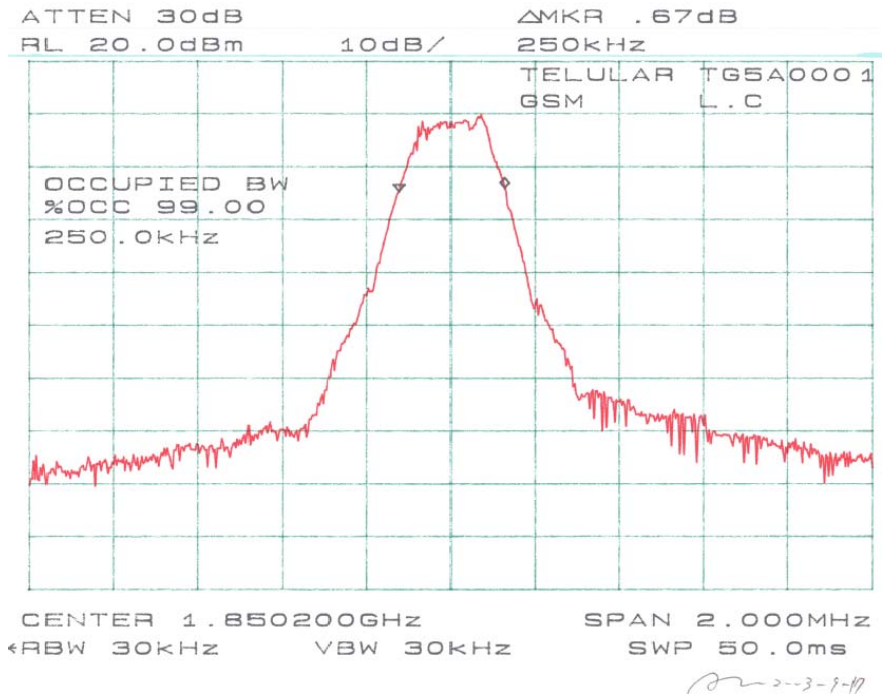
Plots of 99% Occupied Bandwidth for FCC Part22

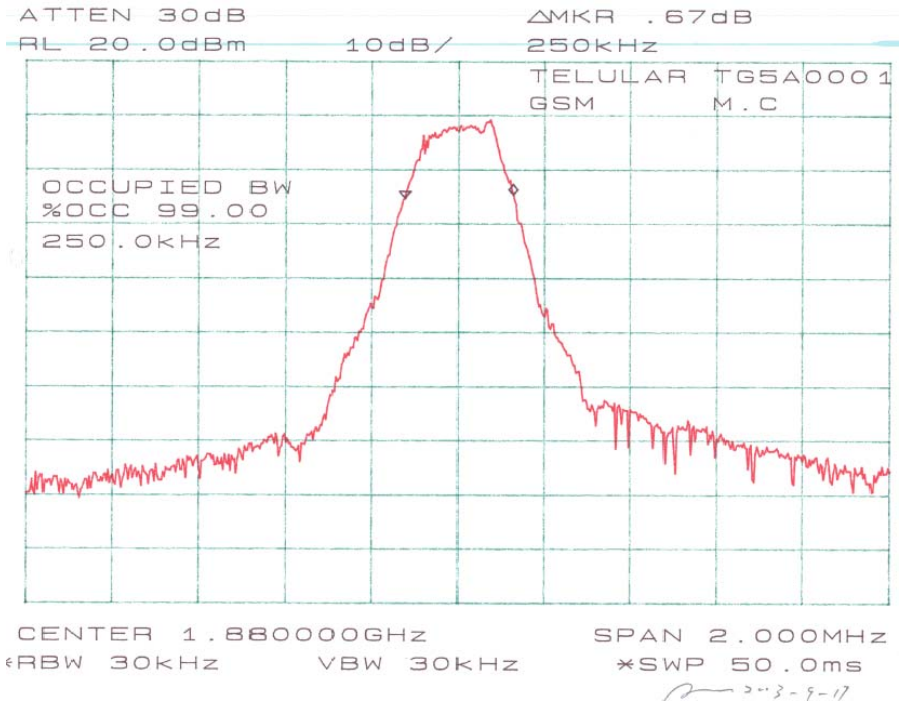


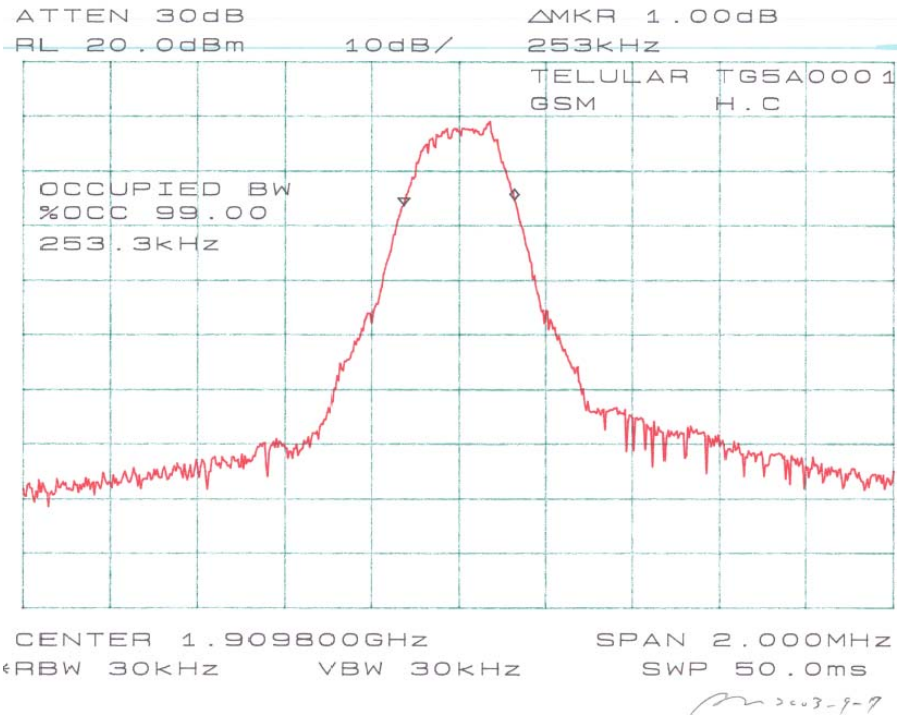




Plots of 99% Occupied Bandwidth for FCC Part24




ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR .67dB
250kHz
TELULAR TG5A0001
GSM M.C
OCCUPIED BW
%OCC 99.00
250.0kHz
CENTER 1.880000GHz
SPAN 2.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms
2003-9-17


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 1.00dB
253kHz
TELULAR TG5A0001
GSM H.C
OCCUPIED BW
%OCC 99.00
253.3kHz
CENTER 1.909800GHz
SPAN 2.000MHz
RBW 30kHz
VBW 30kHz
SWP 50.0ms
2003-9-9

7 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

7.1 Test Procedure

Requirements: CFR 47, § 22.917, § 2.1051, § 2.1057, § 24.238 (a)

(e) Out of Band Emissions.

The means power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by at least 43 + 10 log P dB.

(f) Mobile Emissions in Base Frequency Range.

The mean power of any emissions appearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not to exceed –80 dBm at the transmit antenna connector.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

7.2 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 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

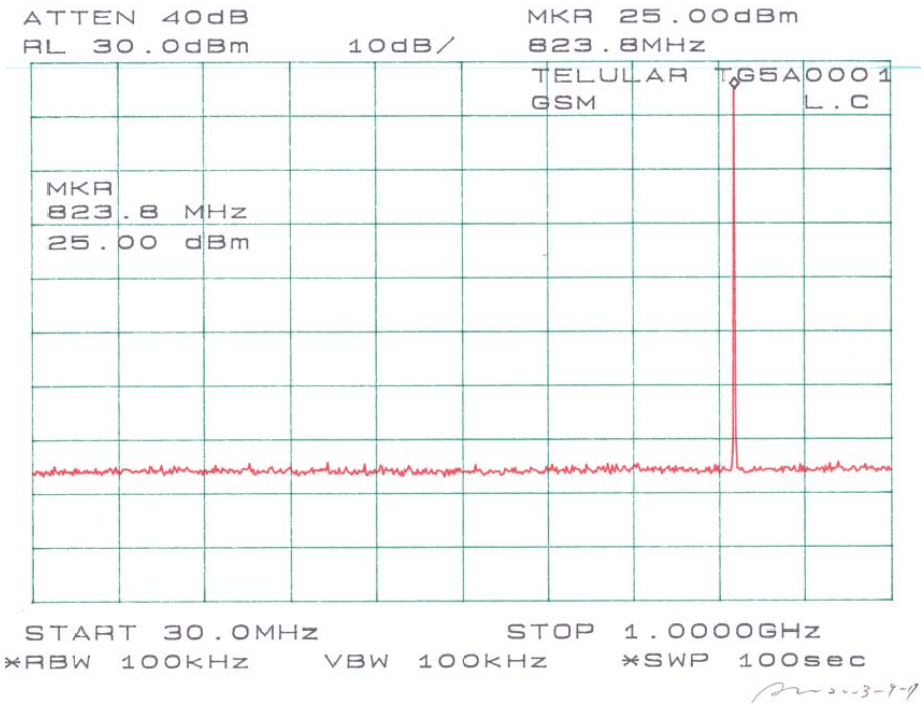
7.3 Test Equipment

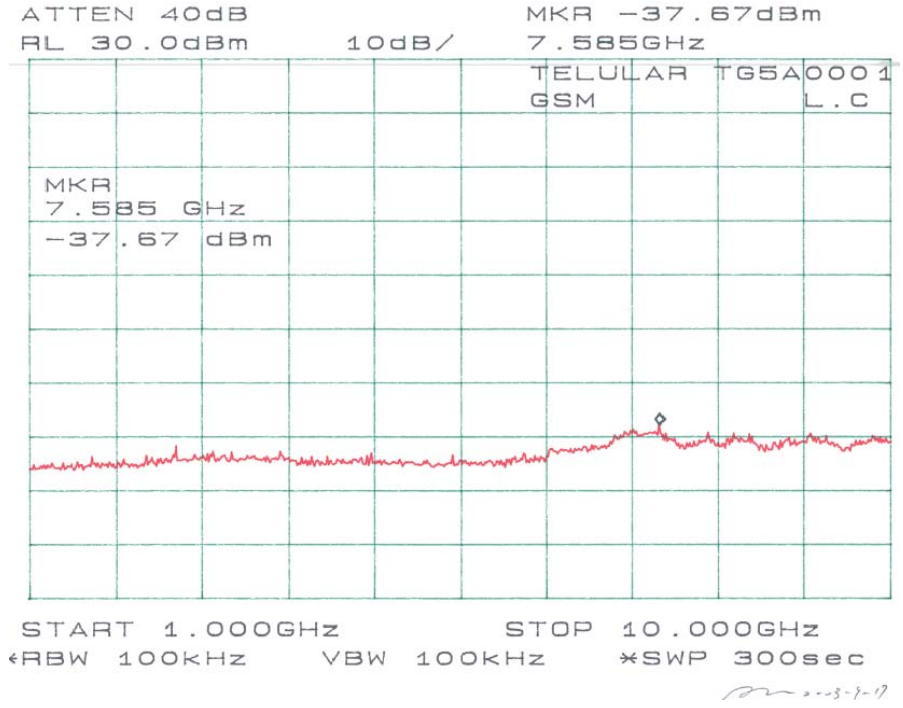
HP 8566B Spectrum Analyzer
HP 7470A Plotter
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

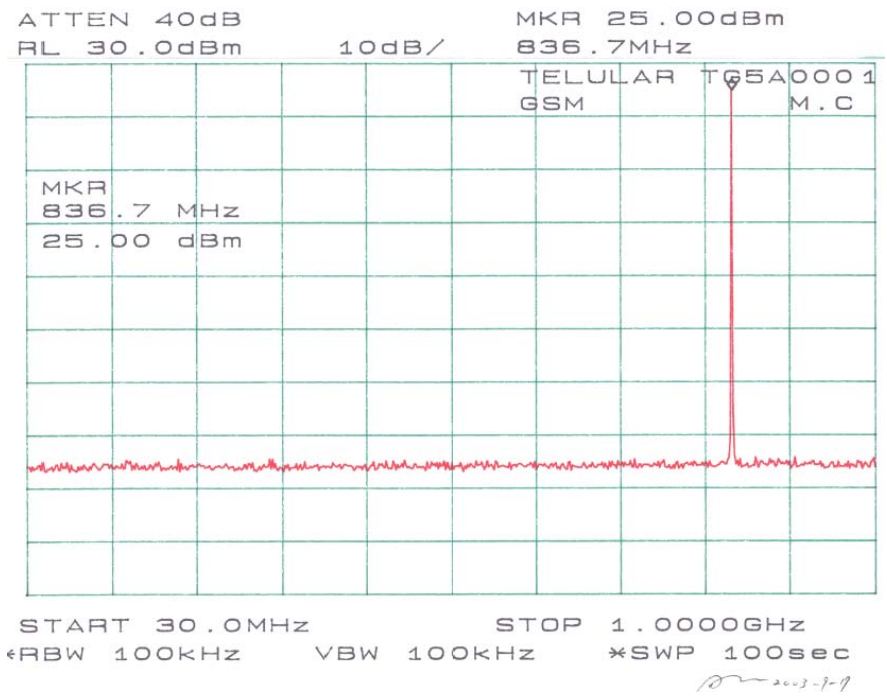
7.4 Test Results

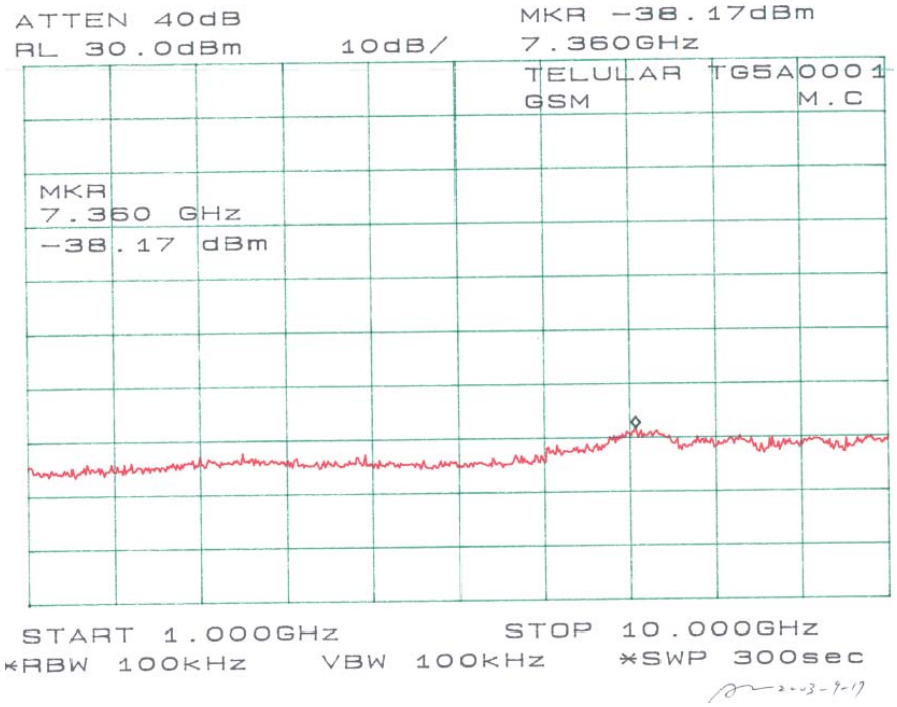
Please refer to the hereinafter plots.

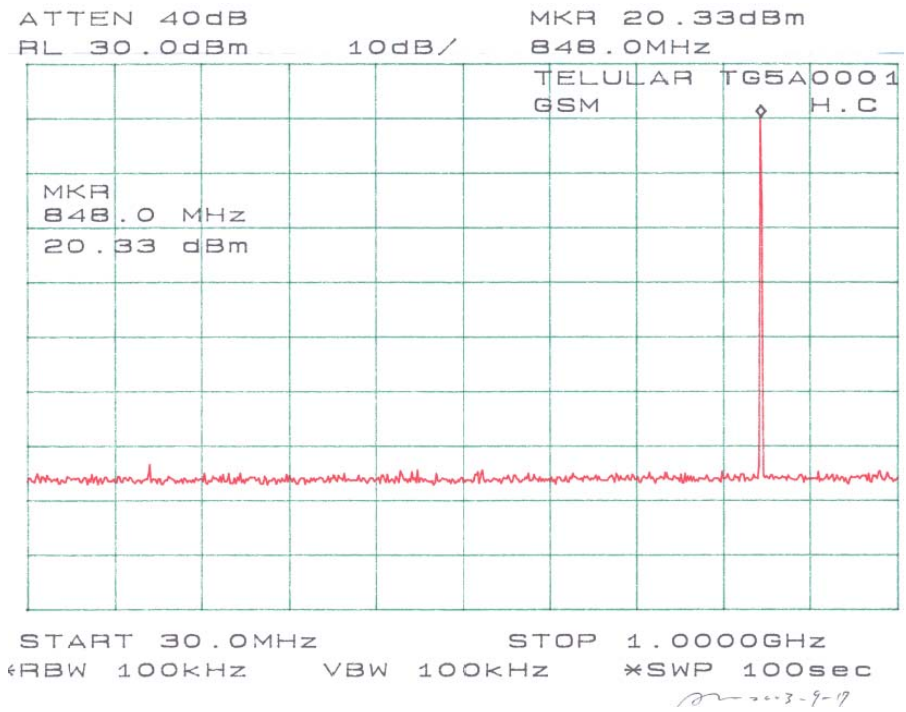
Plots of Spurious Emissions at Antenna Port For FCC Part22

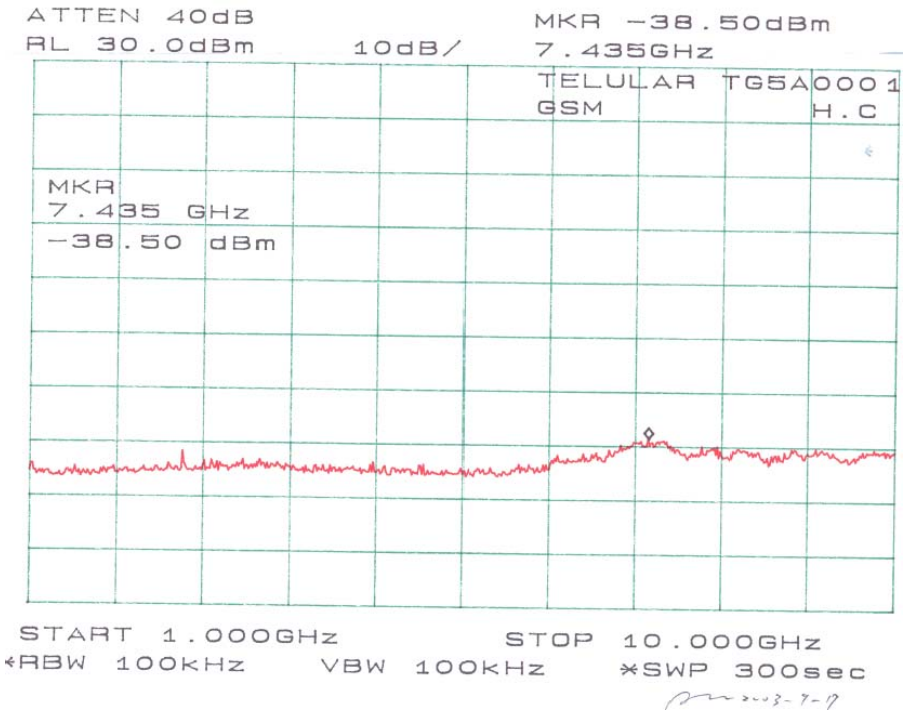




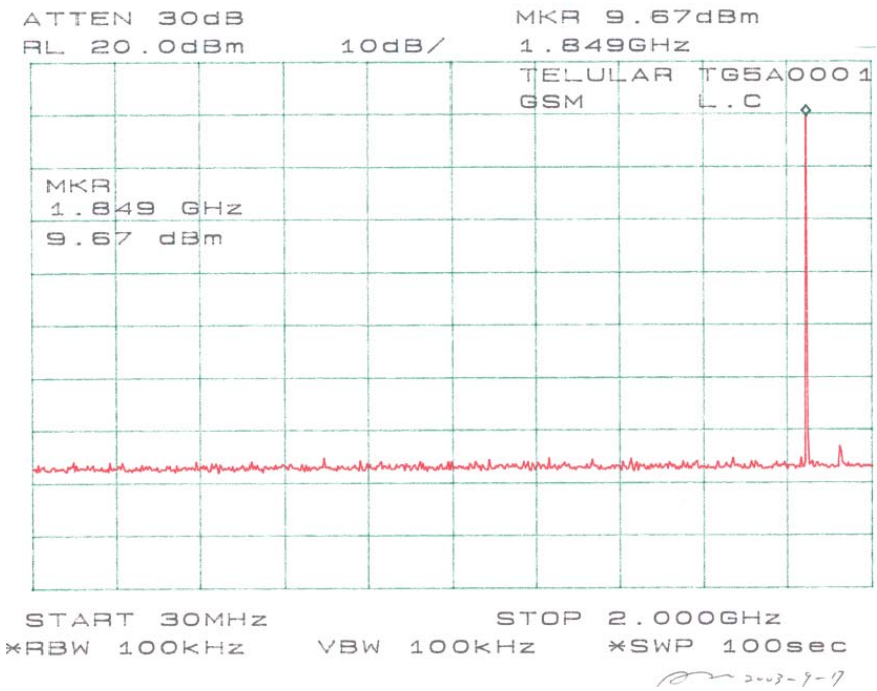

ATTEN 40dB
RL 30.0dBm
10dB/
MKR 25.00dBm
836.7MHz
TELULAR TG5A0001
GSM M.C
MKR
836.7 MHz
25.00 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 100sec

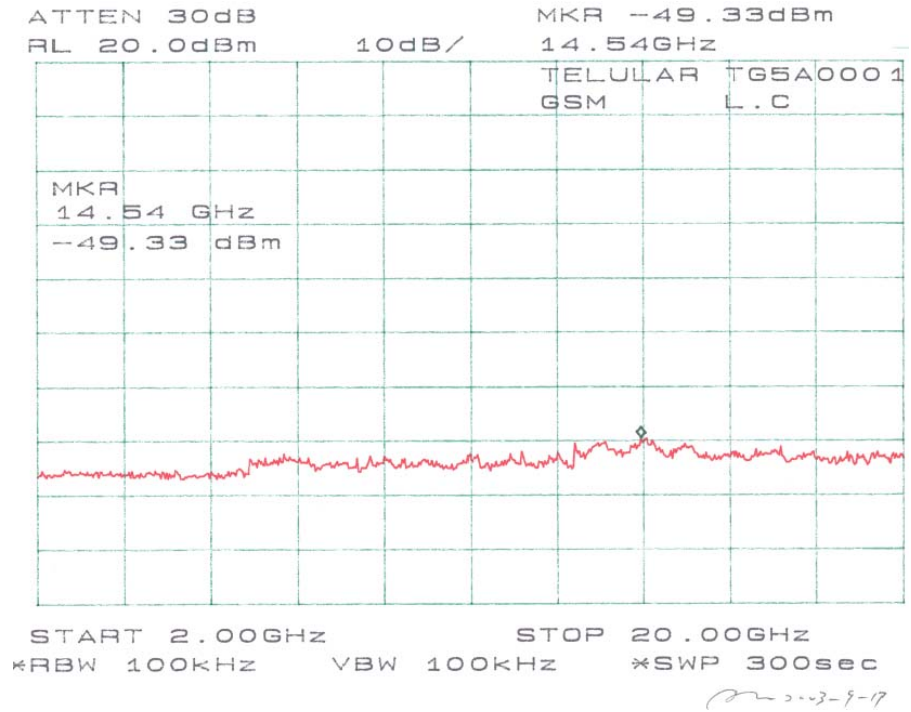

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -38.17dBm
7.360GHz
TELULAR TG5A0001
GSM M.C
MKR
7.360 GHz
-38.17 dBm
START 1.000GHz
STOP 10.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 300sec

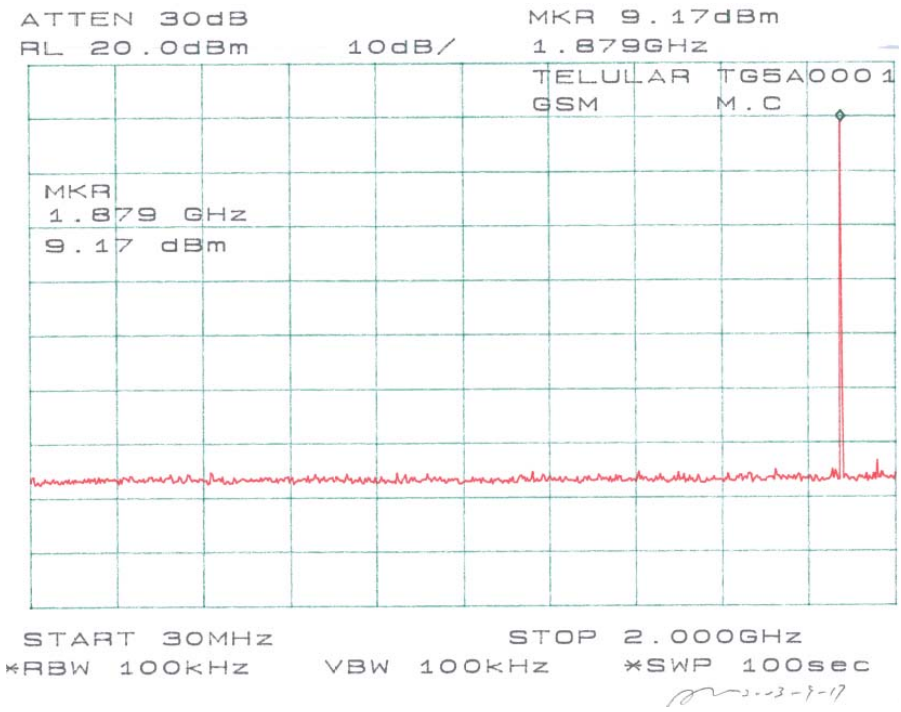

ATTEN 40dB
RL 30.0dBm
10dB/
MKR 20.33dBm
848.0MHz
TELULAR TG5A0001
GSM
H.C
MKR
848.0 MHz
20.33 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 100sec

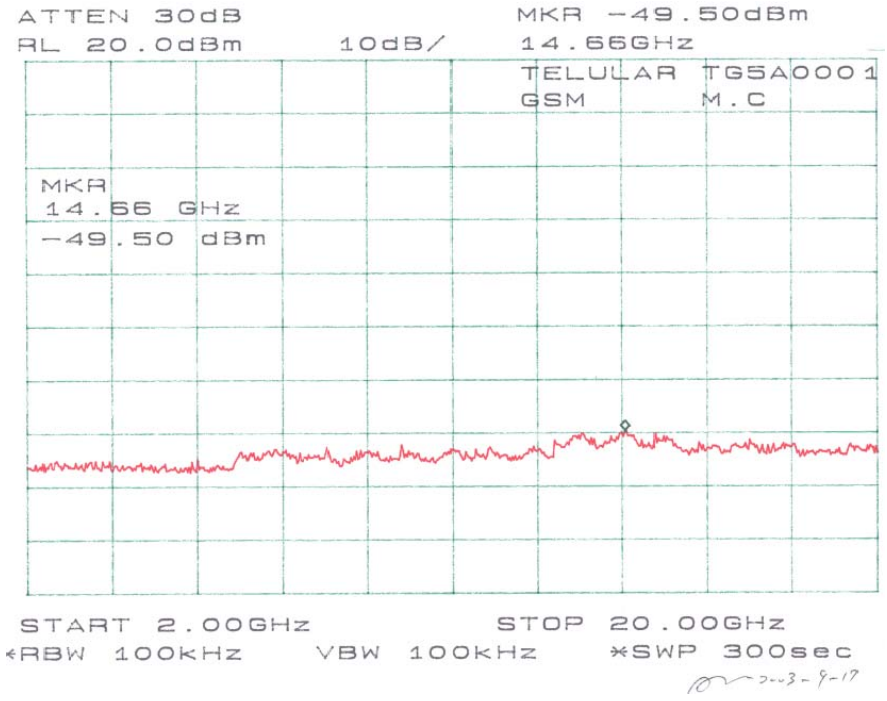

ATTEN 40dB
RL 30.0dBm
10dB/
MKR −38.50dBm
7.435GHz
TELULAR TG5A0001
GSM
H.C
MKR
7.435 GHz
−38.50 dBm
START 1.000GHz
STOP 10.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 300sec

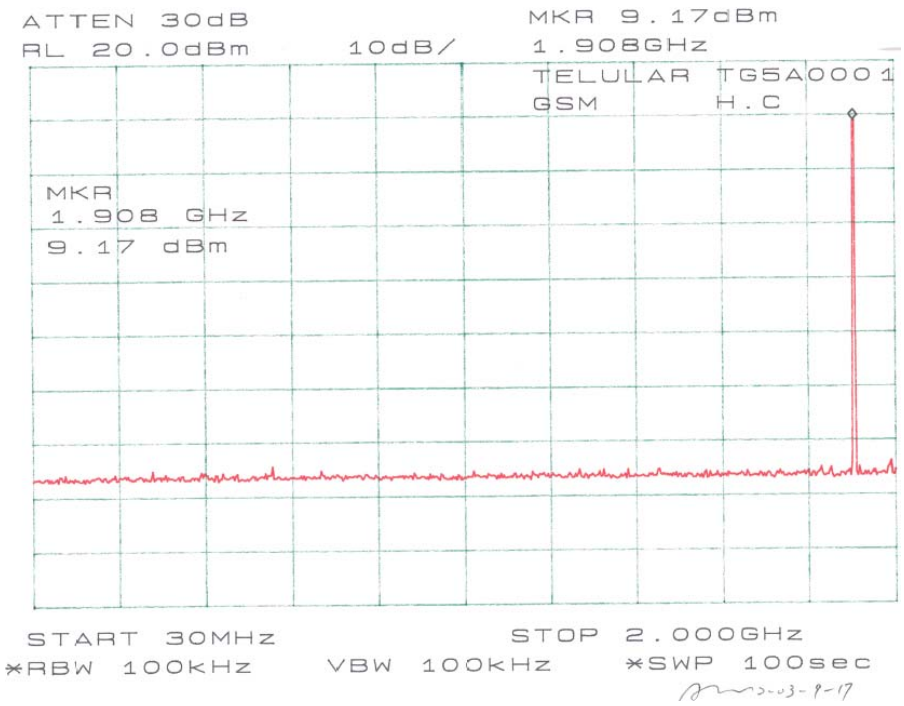
Plots of Supurious Emissions at Antenna Terminial for FCC Part24

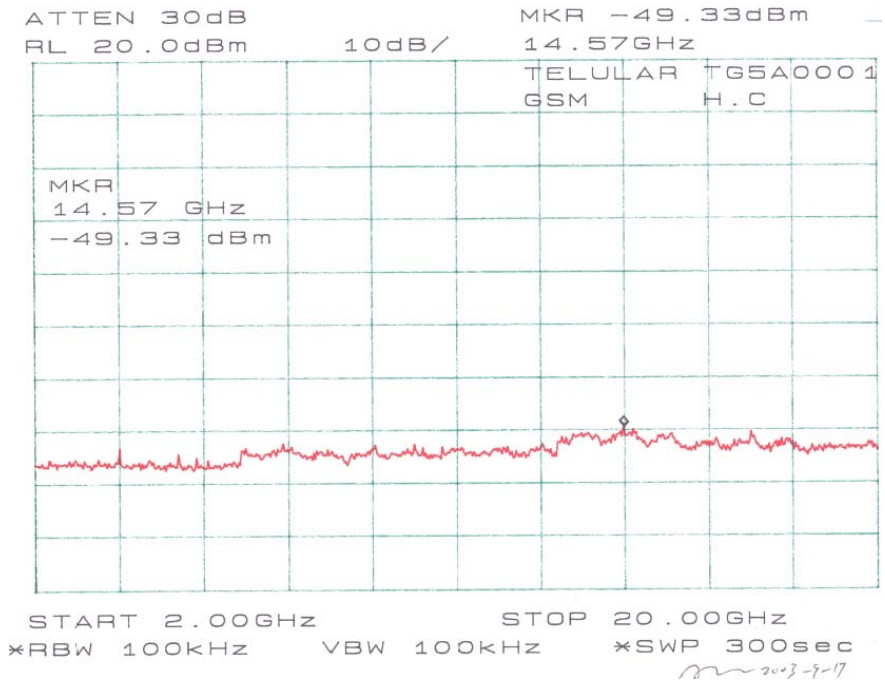





ATTEN 30dB
RL 20.0dBm
10dB/
MKR 9.17dBm
1.879GHz
TELULAR TG5A0001
GSM M.C
MKR
1.879 GHz
9.17 dBm
START 30MHz
STOP 2.000GHz
*RBW 100KHz
VBW 100KHz
*SWP 100sec


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -49.50dBm
14.66GHz
TELULAR TG5A0001
GSM M.C
MKR
14.66 GHz
-49.50 dBm
START 2.00GHz
STOP 20.00GHz
*RBW 100KHz
VBW 100KHz
*SWP 300sec


ATTEN 30dB
RL 20.0dBm
10dB/
MKR 9.17dBm
1.908GHz
TELULAR TG5A0001
GSM H.C
MKR
1.908 GHz
9.17 dBm
START 30MHz
STOP 2.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 100sec
2003-9-17


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -49.33dBm
14.57GHz
TELULAR TG5A0001
GSM H.C
MKR
14.57 GHz
-49.33 dBm
START 2.00GHz
STOP 20.00GHz
*RBW 100kHz
VBW 100kHz
*SWP 300sec
2003-9-17

8 - BAND EDGE TEST

8.1 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.

8.2 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.

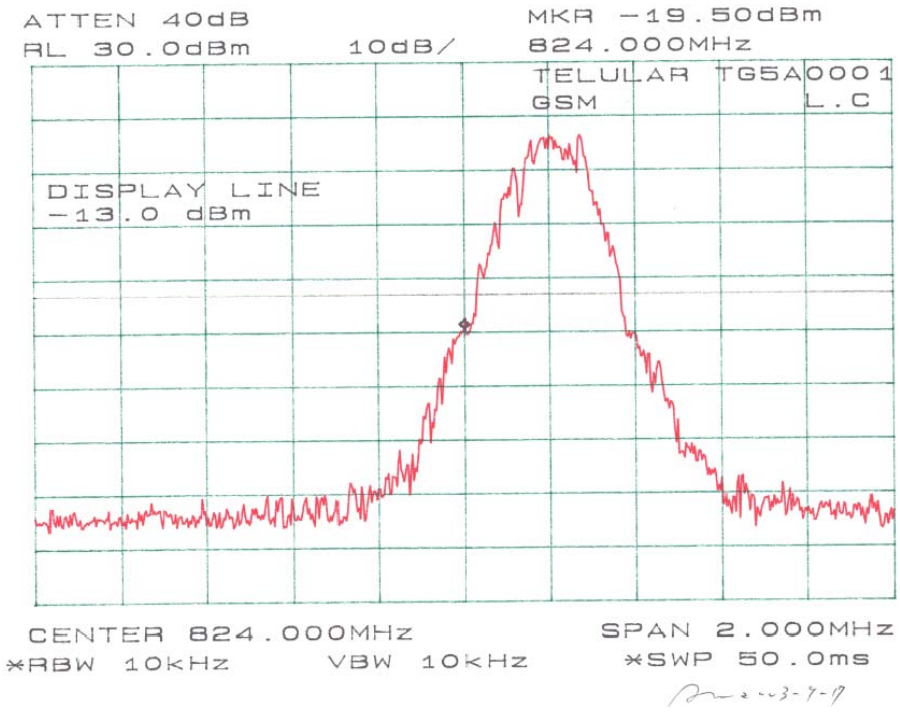
8.3 Test Equipment

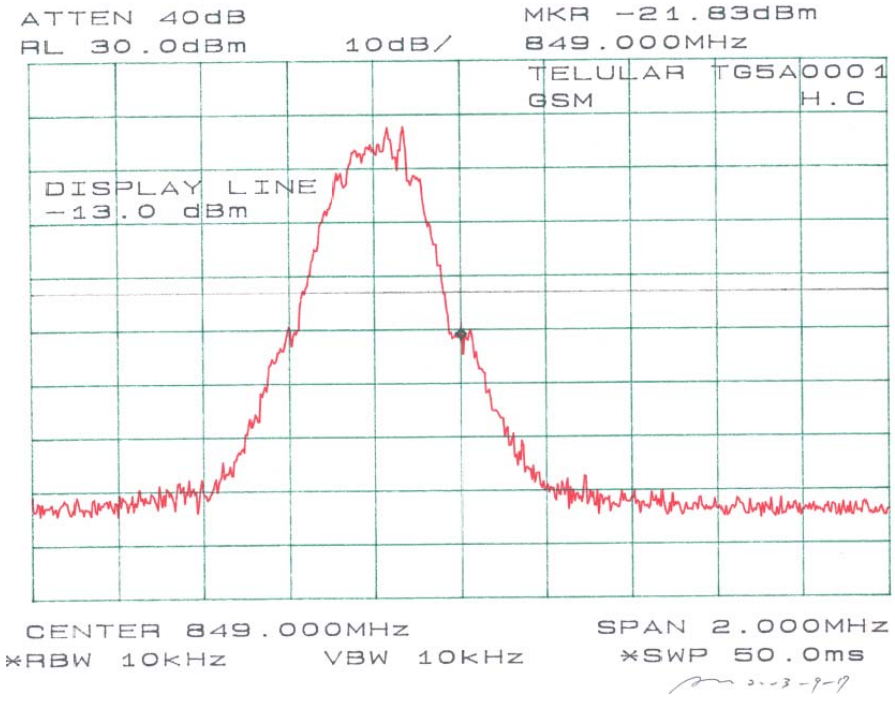
Agilent 8565EC Spectrum Analyzer
HP 7470A Plotter
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Rohde & Schwarz SMIQ03B Signal Generator
Rohde & Schwarz AMIQ I/Q Modulation Generator
Hewlett Packard 8449 Amplifier
A.H. Systems, Inc SAS-200/571 Horn Antenna

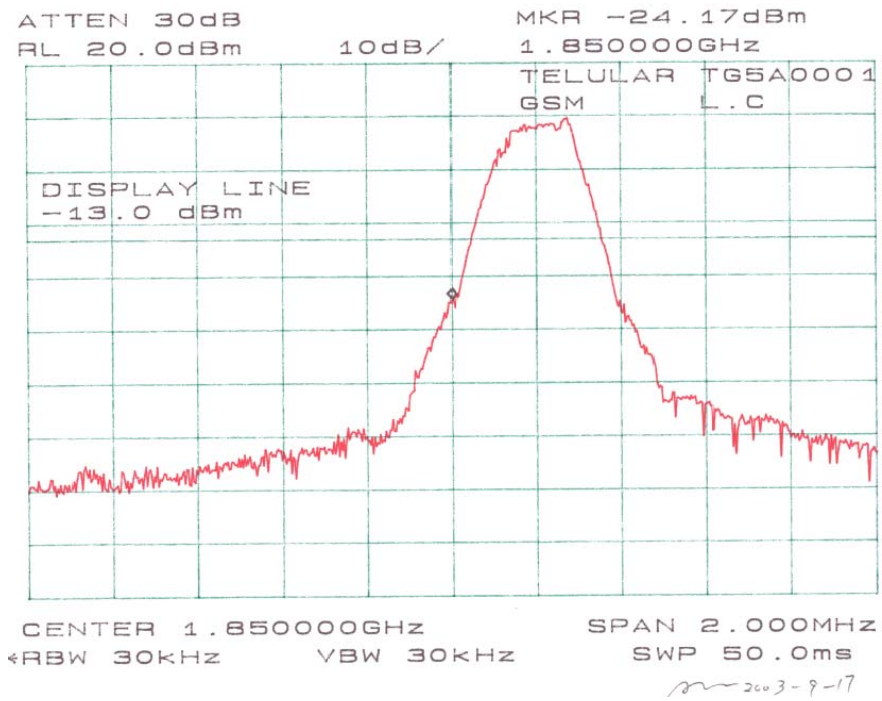
8.4 Plots of Band Edge

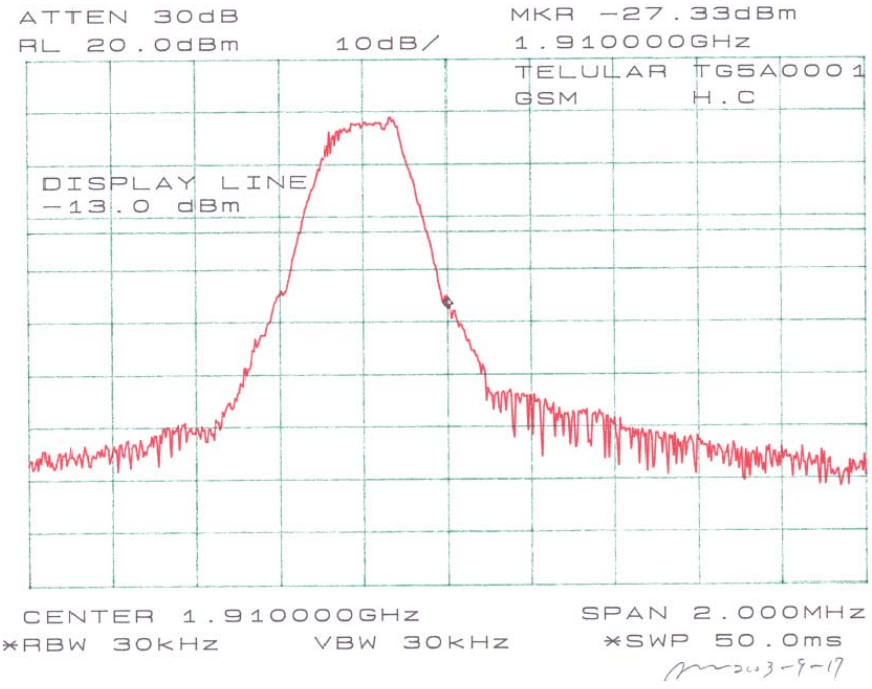
Please refer to plots hereinafter.

Plots of Band Edge Test for FCC Part22






ATTEN 30dB
RL 20.0dBm
10dB/
MKR -24.17dBm
1.850000GHz
TELULAR TG5A0001
GSM L.C
DISPLAY LINE
-13.0 dBm
CENTER 1.850000GHz
SPAN 2.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms
2003-9-17


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -27.33dBm
1.910000GHz
TELULAR TG5A0001
GSM H.C
DISPLAY LINE
-13.0 dBm
CENTER 1.910000GHz
SPAN 2.000MHz
*RBW 30kHz
VBW 30kHz
*SWP 50.0ms
2003-9-17

9 - RADIATED SPURIOUS EMISSION

9.1 Test Procedure

Requirements: CFR 47, § 2.1053, § 22.917 and § 24.238 (a).

9.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

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

Remove the EUT and replace it 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

9.4 Test Result

EGSM850: Low Frequency: -26.6dB at 1648.4 MHz
Middle Frequency: -26.9dB at 1673.2 MHz
High Frequency: -27.1dB at 1697.6 MHz

GSM1900: Low Frequency: -14.5dB at 3700.4 MHz
Middle Frequency: -14.9dB at 3760.0 MHz
High Frequency: -14.7dB at 3819.6 MHz

Test Data for EGSM850

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dB	Level dBm	Limit dBm	Margin DBm
LOW CHANNEL, 1-10 GHz												
824.2	121.2	0	1.6	V	824.2	30.45	V	0	0.1	30.35		
824.2	120.3	300	2.2	H	824.2	29.62	H	0	0.1	29.52		
1648.4	59.1	90	1.5	V	1648.4	-46.10	V	6.8	0.3	-39.6	-13	-26.6
1648.4	55.6	120	1.5	H	1648.4	-48.70	H	6.8	0.3	-42.2	-13	-29.2
2472.6	50.9	180	1.6	V	2472.6	-54.60	V	7.5	0.5	-47.6	-13	-34.6
2472.6	47.7	230	1.8	H	2472.6	-57.30	H	7.5	0.5	-50.3	-13	-37.3
MIDDLE CHANNEL, 1-10 GHz												
836.6	121.1	180	1.8	V	836.6	30.18	V	0	0.1	30.08		
836.6	119.7	90	1.5	H	836.6	29.31	H	0	0.1	29.21		
1673.2	58.8	200	1.7	V	1673.2	-46.40	V	6.8	0.3	-39.90	-13	-26.9
1673.2	55.1	270	2.0	H	1673.2	-49.20	H	6.8	0.3	-42.70	-13	-29.7
2509.8	50.7	0	1.8	V	2509.8	-54.80	V	7.5	0.5	-47.80	-13	-34.8
2509.8	47.3	270	1.5	H	2509.8	-57.90	H	7.5	0.5	-50.90	-13	-37.9
HIGH CHANNEL, 1-10 GHz												
848.8	121.0	0	1.8	V	848.8	30.02	V	0	0.1	29.92		
848.8	119.3	45	1.6	H	848.8	29.15	H	0	0.1	29.05		
1697.6	58.6	0	2.3	V	1697.6	-46.60	V	6.8	0.3	-40.10	-13	-27.1
1697.6	54.7	90	2.2	H	1697.6	-49.50	H	6.8	0.3	-43.00	-13	-30.00
2546.4	50.5	0	2.0	V	2546.4	-55.10	V	7.5	0.5	-48.10	-13	-35.1
2546.4	47.1	270	1.5	H	2546.4	-58.30	H	7.5	0.5	-51.30	-13	-38.3

Test Data for GSM1900

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dB	Level dBm	Limit dBm	Margin DBm
LOW CHANNEL, 1-20 GHz												
1850.2	129.1	310	1.8	V	1850.2	14.63	V	6.7	0.3	21.03		
1850.2	120.2	330	2.1	H	1850.2	8.75	H	6.7	0.3	15.15		
3700.4	58.7	160	1.5	V	3700.4	-35.70	V	8.8	0.6	-27.50	-13	-14.5
3700.4	55.2	180	1.5	H	3700.4	-38.90	H	8.8	0.6	-30.70	-13	-17.7
5550.6	50.6	180	1.6	V	5550.6	-42.10	V	9.1	0.8	-33.80	-13	-20.8
5550.6	47.3	270	1.8	H	5550.6	-46.40	H	9.1	0.8	-38.10	-13	-25.1
MIDDLE CHANNEL, 1-20 GHz												
1880.0	128.6	30	1.8	V	1880	13.54	V	6.7	0.3	19.94		
1880.0	119.8	120	1.5	H	1880	8.26	H	6.7	0.3	14.66		
3760.0	58.1	330	2.0	V	3760	-36.10	V	8.8	0.6	-27.90	-13	-14.9
3760.0	54.7	150	2.2	H	3760	-39.30	H	8.8	0.6	-31.10	-13	-18.1
5640.0	50.2	300	1.8	V	5640	-42.60	V	9.1	0.8	-34.30	-13	-21.3
5640.0	46.8	150	2.2	H	5640	-49.80	H	9.1	0.8	-41.50	-13	-28.5
HIGH CHANNEL, 1-20 GHz												
1909.8	128.7	180	1.6	V	1909.8	13.63	V	6.7	0.3	20.03		
1909.8	119.7	180	2.2	H	1909.8	8.15	H	6.7	0.3	14.55		
3819.6	58.3	330	2.5	V	3819.6	-35.90	V	8.8	0.6	-27.70	-13	-14.7
3819.6	54.5	90	2.5	H	3819.6	-39.40	H	8.8	0.6	-31.20	-13	-18.2
5729.4	50.3	100	2.2	V	5729.4	-42.30	V	9.1	0.8	-34.00	-13	-21.0
5729.4	46.6	150	2.2	H	5729.4	-49.90	H	9.1	0.8	-41.60	-13	-28.6

10 - FREQUENCY STABILITY

10.1 Applicable Standard

Requirements: FCC § 2.1055 (a), § 2.1055 (d) and § 24.235

10.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

10.3 Test Equipment

Temperature Chamber -50^0 to $+100^0$C
Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303

10.4 Test Results

1) GSM 850

Frequency Stability Versus Temperature

Reference Frequency: 824.2 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
60	13.5	824.1997	-0.36
50	13.5	824.1998	-0.24
40	13.5	824.1998	-0.24
30	13.5	824.2000	0.00
20	13.5	824.2000	0.00
10	13.5	824.2000	0.00
0	13.5	824.2003	0.36
-10	13.5	824.2003	0.36
-20	13.5	824.2005	0.60
-30	13.5	824.2005	0.60

Frequency Stability Versus Input Voltage

	Reference Frequency: 824.2 MHz, Limit: 2.5 ppm					
Power Supplied (Vdc)	Frequency Measure with Time Elapsed					
	2 Minutes		5 Minutes		10 Minutes	
	MHz	PPM	MHz	PPM	MHz	PPM
8	824.2002	0.24	824.2002	0.24	824.2002	0.24

Battery end point: 8 Vdc

Conclusion: The EUT complied with the applicable Frequency Stability Limits.

2) GSM 1900

Frequency Stability Versus Temperature

Reference Frequency : 1880.0000MHz, Limit 2.5ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
50	13.5	1879.9993	- 0.37
40	13.5	1879.9995	- 0.26
30	13.5	1879.9998	- 0.11
20	13.5	1880.0000	0.00
10	13.5	1880.0000	0.00
0	13.5	1880.0002	0.11
-10	13.5	1880.0002	0.11
-20	13.5	1880.0004	0.11
-30	13.5	1880.0004	0.21

Frequency Stability Versus Input Voltage

Reference Frequency : 1880.0000MHz, Limit 2.5ppm		
Power supplied	Frequency Measure with Time Elapsed	
Vdc	MHz	Error ppm
8	1880.0002	0.11.

Battery end point: 8 Vdc

Conclusion: The EUT complied with the applicable Frequency Stability Limits.

11 – CONDUCTED EMISSIONS

Not Applicable.