UltraTech
Group of Labs

Apr. 20, 20001

FEDERAL COMMUNICATIONS COMMISSION
7435 Oakland Mills Road
Columbia, MD 21046
USA

Subject:	**Type Acceptance Application under FCC CFR 47, Parts 2 and 90 (Subpart I) - Non-Broadcast Radio Transceivers Operating in the frequency bands 851-869 MHz (25 kHz Spacing).**
Applicant:	**Futurecom Systems Group Inc.**
Product:	**NON-BROADCAST FM VOICE/DATA RADIO REPEATER/TRANSLATOR**
Model:	**Mobexcom 800**
FCC ID:	**LO6-MBX800**

Dear Sir/Madam,

As appointed agent for **Futurecom Systems Group Inc.**, we would like to submit the application to Federal Communications Commission for certification of the above product. Please review all necessary files uploaded to FCC OET site.

If you have any queries, please do not hesitate to contact us by our TOLL FREE number:

OUR TELEPHONE NO.: 1-877-765-4173

Yours truly,

Tri Minh Luu, P. Eng.,
V.P., Engineering

TML/DH

Encl.

3000 Bristol Circle,
Oakville, Ontario, Canada
L6H 6G4

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UltraTech
Group of Labs

Apr. 20, 20001

Futurecom Systems Group Inc.
3277 Langstaff Road
Concord, Ontario
Canada, L4K 5P8

Attn.: **Mr. Adam J. Kolanski**

Subject: **Certification Testing in accordance with FCC CFR 47, Parts 2 and 90 (Subpart I) - Non-Broadcast Radio Transceivers Operating in the frequency bands 851-869 MHz (25 kHz Spacing).**

Product: **NON-BROADCAST FM VOICE/DATA RADIO REPEATER/TRANSLATOR**
Model: **Mobexcom 800**
FCC ID: **LO6-MBX800**

Dear Mr. Kolanski,

The product sample has been tested in accordance with **FCC CFR 47, Parts 2 and 90 (Subpart I) - Non-Broadcast Radio Transceivers Operating in the frequency bands 851-869 MHz,** and the results and observation were recorded in the engineering report, Our File No.: FSG-029FCC

Enclosed you will find copy of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,

Tri Minh Luu, P.Eng
Vice President - Engineering

Encl.

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ENGINEERING TEST REPORT

NON-BROADCAST FM VOICE/DATA RADIO REPEATER/TRANSLATOR
Model No.: Mobexcom 800
FCC ID: LO6-MBX800

Applicant: **Futurecom Systems Group Inc.**
3277 Langstaff Road
Concord, Ontario
Canada, L4K 5P8

Tested in Accordance With

Federal Communications Commission (FCC)
CFR 47, PARTS 2 and 90 (Subpart I)

UltraTech's File No.: FSG-029FCC

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: Apr.24, 2001	
Report Prepared by: Tri Luu Issued Date: Apr. 20, 20001	Tested by: Hung Trinh Test Dates: April 14 to 18, 2001

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

UltraTech

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EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	• Exhibit 1: Submittal check lists • Exhibit 2: Introduction • Exhibit 3: Performance Assessment • Exhibit 4: EUT Operation and Configuration during Tests • Exhibit 5: Summary of test Results • Exhibit 6: Measurement Data • Exhibit 7: Measurement Uncertainty • Exhibit 8: Measurement Methods	K
1	Test Report - Plots of Measurement Data	Plots # 1 to 38	OK
2	Test Setup Photos	Photos # 1to 2	OK
3	External Photos of EUT	Photos # 1 to 2	OK
4	Internal Photos of EUT	Photos of 1 to 15	OK
5	Cover Letters	• Letter from Ultratech for Certification Request • Letter from the Applicant to appoint Ultratech to act as an agent • Letter from the Applicant to request for Confidentiality Filing	OK OK OK
6	Attestation Statements	• Manufacturer's Declaration for Equipment Specifications, Installation (if it is professionally installed) and Production Quality Production Assurance. • Manufacturer's Declaration of Conformity (FCC DoC) for compliance with FCC Part 15, Sub. B, Class B - Computing Devices - if required	None
7	ID Label/Location Info	ID Label Location of ID Label	OK
8	Block Diagrams	Block diagrams # 1 of 1	OK
9	Schematic Diagrams	Schematic diagrams # 1 of 1	OK
10	Parts List/Tune Up Info		None
11	Operational Description		OK
12	RF Exposure Info		OK
13	Users Manual		OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 90
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency bands 851-869 MHz (25 kHz Channel Spacing).
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - 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.

2.2. RELATED SUBMITAL(S)/GRANT(S)

None

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	1998	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	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
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Futurecom Systems Group Inc.
Address:	3277 Langstaff Road Concord, Ontario Canada, L4K 5P8
Contact Person:	Mr. Adam J. Kolanski Phone #: 905-660-5548 Fax #: 905-660-6858 Email Address: adamk@futurecom.com

MANUFACTURER	
Name:	Futurecom Systems Group Inc.
Address:	3277 Langstaff Road Concord, Ontario Canada, L4K 5P8
Contact Person:	Mr. Adam J. Kolanski Phone #: 905-660-5548 Fax #: 905-660-6858 Email Address: adamk@futurecom.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Futurecom Systems Group Inc.
Product Name:	NON-BROADCAST FM VOICE/DATA RADIO REPEATER/TRANSLATOR
Model Name or Number:	Mobexcom 800
Serial Number:	01030003
Type of Equipment:	Non-broadcast Radio Communication Equipment
External Power Supply:	N/A
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	Vehicular repeater – provides coverage extension for portable radios

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	[ ] Portable [x] Mobile [ ] Base station (fixed use)
Intended Operating Environment:	[ ] Commercial [x] Light Industry & Heavy Industry
Power Supply Requirement:	13.6 Vdc
RF Output Power Rating:	15 Watts
Operating Frequency Range:	851 - 869 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	25 kHz
***Occupied Bandwidth (99%):**	9.1 kHz (Data) 15 kHz (Voice)
****Emission Designation:**	14K8F3E, 13K6F1D
Antenna Connector Type:	TNC Female

* *For an average case of commercial telephony, the Necessary Bandwidth are calculated as follows:

For FM Voice Modulation:

Channel Spacing = 25 KHz, D = 4.4 KHz max., K = 1, M = 3 KHz
B_n = 2M + 2DK = 2(3) + 2(4.4)(1) = **14.8 KHz**
Emission Designation: 14K8F3E

Channel Spacing = 25 KHz, D = 2 KHz max., K = 1, M = 9.6/2 kb/s
B_n = 2M + 2DK = 2(9.6/2) + 2(2)(1) = **13.6 KHz**
Emission Designation: 14K8F3E

RECEIVER	
Equipment Type:	[ ] Portable [x] Mobile [ ] Base station (fixed use)
Intended Operating Environment:	[ ] Commercial [x] Light Industry & Heavy Industry
Power Supply Requirement:	13.6 Vdc
Operating Frequency Range:	806 – 824 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	25 kHz
Antenna Connector Type:	SMA Female

3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Transmitter	1	SMA	Terminated with 50 Ohms load
2	Receiver	1	SMA	Terminated with 50 Ohms load
3	Antenna	1	TNC	Terminated with 50 Ohms load
4	Switching Plate Connector	2	SMA	Terminated with 50 Ohms load
5	Power	1	4-pin	Non-shielded
6	RS232	1	DB9	Shielded
7	Mobile Radio Control	2	DB25	Shielded

NOTES:

(1) ***Ports of the EUT which in normal operation*** *were connected to ancillary equipment through interconnecting cables via a representative interconnecting cable to simulate the input/output characteristics. RF input/output was correctly terminated to the 50 Ohm RF Load.*

(2) ***Ports, which are not connected to cables during normal intended operation*** *(for factory/technical services uses only): None.*

3.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	IBM ThinkPad
Brand name:	IBM
FCC ID:	ANOKAJIPENCP
Serial Number:	1S2625DEF78WWM48
Connected to EUT's Port:	RS232

EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	13.6 V dc

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	Testing software provided by the manufacturer to configure different test configuration.
Special Hardware Used:	None.
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohms RF Load.

Transmitter Test Signals	
Frequency Band(s): ▪ 851-869 MHz band:	Near lowest, near middle & near highest frequencies in each frequency bands that the transmitter covers: ▪ 851, 860, 869 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 17.8 Watts ▪ FM ▪ Internal data/external voice

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

  The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Sep. 20, 1999.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
90.205 & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
90.213 & 2.1055	Frequency Stability	Yes
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	Not applicable to new standard. However, tests are conducted under FCC's recommendation.
90.210 & 2.1047(b)	Modulation Limiting	Yes
90.209 90.210 & 2.1049	Emission Limitation & Emission Mask	Yes
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
NON-BROADCAST FM VOICE/DATA RADIO REPEATER/TRANSLATOR, **Model No.: Mobexcom 800**, by **Futurecom Systems Group Inc.** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers (806-824 MHz) and Class A Digital Devices**. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.		

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4:1992 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER:

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. RF POWER OUTPUT @ FCC 2.1046 & 90.205

6.5.1. Limits @ FCC 90.205

Please refer to FCC CFR 47, Part 90, Subpart I, Para. 90.205 for specification details.

6.5.2. Method of Measurements

Refer to Exhibit 8, § 8.1 of this report for measurement details

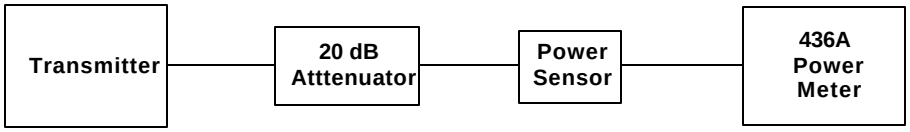
- *The transmitter terminal was coupled to the Spectrum Analyzer through a 20 dB attenuator*
- *Power of the transmitter channel near the lowest, middle and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and cable loss.*
- *The RF Output was turned on with standard modulation applied.*

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz
Attenuator(s)	Bird	…	…	DC – 22 GHz
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz – 26.5 GHz
Attenuator(s)	Weinschel Corp	24-20-34	BJ2357	DC – 8.5 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 MHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 MHz – 1 GHz
Synthesized RF Signal Generator	Gigatronic	6061A	5130408	10kHz – 1050 MHz

6.5.4. Test Arrangement

- Power at RF Power Output Terminals



6.5.5. Test Data

Conducted Power

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured (Average) Power (dBm)	Average Power Rating (dBm)
Lowest	851	41.5	41.7
Middle	860	41.4	41.7
Highest	869	41.5	41.7

6.6. RF EXPOSURE REQUIRMENTS @ 1.1310 & 2.1091

6.6.1. Limits

- **FCC 1.1310:-** The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz

6.6.2. Method of Measurements

Refer to FCC @ 1.1310, 2.1091 and Public Notice DA 00-705 (March 30, 2000)

- Spread spectrum transmitters operating under section 15.247 are categorically from routine environmental evaluation to demonstrating RF exposure compliance with respect to MPE and/or SAR limits. These devices are not exempted from compliance (As indicated in Section 15.247(b)(4), these transmitters are required to operate in a manner that ensures that exposure to public users and nearby persons) does not exceed the Commission's RF exposure guidelines (see Section 1.1307 and 2.1093). Unless a device operates at substantially low power levels, with a low gain antenna(s), supporting information is generally needed to establish the various potential operating configurations and exposure conditions of a transmitter and its antenna(s) in order to determine compliance with the RF exposure guidelines.

- In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

(1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
(2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
(3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
(4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$S = PG/4\Pi r^2 = EIRP/4\Pi r^2$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$r = \sqrt{PG/4\Pi S}$

FCC radio frequency exposure limits may not be exceeded at distances closer than r cm from the antenna of this device

- For portable transmitters (see Section 2.1093), or devices designed to operate next to a person's body, compliance is determined with respect to the SAR limit (define in the body tissues) for near-field exposure conditions. If the maximum average output power, operating condition configurations and exposure conditions are comparable to those of existing cellular and PCS phones., an SAR evaluation may be required in order to determine if such a device complies with SAR limit. When SAR evaluation data is not available, and the additional supporting information cannot assure compliance, the Commission may request that an SAR evaluation be performed, as provided for in Section 1.1307(d)

6.6.3. Test Data

6.6.3.1. RF Exposure Distance for Antenna Gain = 0 dBi

Frequency (MHz)	Conducted Output Power (Watts)	Measured Total EIRP (Watts)	Laboratory's Recommended Minimum RF Safety Distance r (cm)	Manufacturer's Specification of RF Safety Distance in Users Manual (cm)
851	14.1	14.1	44.5	47
860	13.8	13.8	44.0	47
869	14.1	14.1	44.5	47

Note 1: RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$
$S = F/1500 = 851/1500 = 0.567\ mW/cm^2$

6.6.3.2. RF Exposure Distance for Antenna Gain = 3 dBi

Frequency (MHz)	Conducted Output Power (Watts)	Measured Total EIRP (Watts)	Laboratory's Recommended Minimum RF Safety Distance r (cm)	Manufacturer's Specification of RF Safety Distance in Users Manual (cm)
851	14.1	28.2	62.9	67
860	13.8	27.6	62.2	67
869	14.1	28.2	62.9	67

Note 1: RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$
$S = F/1500 = 851/1500 = 0.567\ mW/cm^2$

6.6.3.3. RF Exposure Distance for Antenna Gain = 6 dBi maximum allowable by manufacturer

Frequency (MHz)	Conducted Output Power (Watts)	Measured Total EIRP (Watts)	Laboratory's Recommended Minimum RF Safety Distance r (cm)	Manufacturer's Specification of RF Safety Distance in Users Manual (cm)
851	14.1	56.1	88.7	94
860	13.8	54.9	87.8	94
869	14.1	56.1	88.7	94

Note 1: RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$
$S = F/1500 = 851/1500 = 0.567\ mW/cm^2$

REMARKS: please refer to page 4 of the users manual for detailed information of the RF Exposure Information to Users.

6.7. FREQUENCY STABILITY @ FCC 2.1055 & 90.213

6.7.1. Limits @ FCC 90.213

Please refer to FCC CFR 47, Part 90, Subpart I, Para. 90.213 for specification details.

FREQUENCY RANGE (MHz)	FIXED & BASE STATIONS (ppm)	MOBILE STATIONS (ppm)	
		> 2 W	≤ 2 W
851-866	1.5	2.5	2.5
866-869	1.0	1.5	1.5

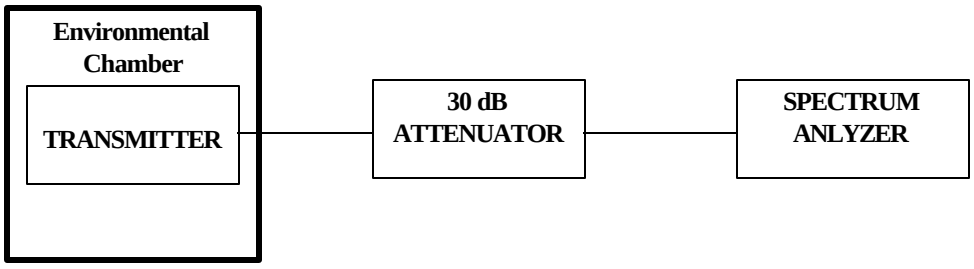
6.7.2. Method of Measurements

Refer to Exhibit 8, § 8.2 of this report for measurement details

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Attenuator(s)	Bird	..	…	DC – 22 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40° to +60 ° C range

6.7.4. Test Arrangement



6.7.5. Test Data

Product Name: **Model No.:**	**NON-BROADCAST FM VOICE/DATA RADIO REPEATER/TRANSLATOR** **Mobexcom 800**
Center Frequency:	851 MHz
Full Power Level:	15 Watts
Frequency Tolerance Limit:	1.5 ppm or 1276.5 Hz at 851 MHz
Max. Frequency Tolerance Measured:	580 Hz or 0.682 ppm
Input Voltage Rating:	13.6 Vdc

CENTER FREQUENCY & RF POWER OUTPUT VARIATION							
Ambient Temperature (°C)	**Keyed-On Time (Minutes)**	**Supply Voltage (Nominal) 13.6 Volts**		**Supply Voltage (85% of Nominal) 11.6 Volts**		**Supply Voltage (115% of Nominal) 15.6 Volts**	
		Hz	**dB**	**Hz**	**dB**	**Hz**	**dB**
-30	0	Note 1	N/A	N/A	N/A	N/A	N/A
	1	Note 1	N/A	N/A	N/A	N/A	N/A
	2	Note 1	N/A	N/A	N/A	N/A	N/A
	3	Note 1	N/A	N/A	N/A	N/A	N/A
	4	Note 1	N/A	N/A	N/A	N/A	N/A
	5	Note 1	N/A	N/A	N/A	N/A	N/A
	6	Note 1	N/A	N/A	N/A	N/A	N/A
	7	Note 1	N/A	N/A	N/A	N/A	N/A
	8	Note 1	N/A	N/A	N/A	N/A	N/A
	9	Note 1	N/A	N/A	N/A	N/A	N/A
	10	Note 1	N/A	N/A	N/A	N/A	N/A
-20	0	+562	N/A	N/A	N/A	N/A	N/A
	1	+568	N/A	N/A	N/A	N/A	N/A
	2	+580	N/A	N/A	N/A	N/A	N/A
	3	+580	N/A	N/A	N/A	N/A	N/A
	4	+580	N/A	N/A	N/A	N/A	N/A
	5	+565	N/A	N/A	N/A	N/A	N/A
	6	+568	N/A	N/A	N/A	N/A	N/A
	7	+570	N/A	N/A	N/A	N/A	N/A
	8	+562	N/A	N/A	N/A	N/A	N/A
	9	+582	N/A	N/A	N/A	N/A	N/A
	10	+575	N/A	N/A	N/A	N/A	N/A

Note 1: The transmitter shut down at extreme temperature, no test could be performed.

CENTER FREQUENCY & RF POWER OUTPUT VARIATION							
Ambient Temperature (^{o}C)	**Keyed-On Time (Minutes)**	**Supply Voltage (Nominal) 13.6 Volts**		**Supply Voltage (85% of Nominal) 11.6 Volts**		**Supply Voltage (115% of Nominal) 15.6 Volts**	
		Hz	**dB**	**Hz**	**dB**	**Hz**	**dB**
-10	0	+357	N/A	N/A	N/A	N/A	N/A
	1	+263	N/A	N/A	N/A	N/A	N/A
	2	+268	N/A	N/A	N/A	N/A	N/A
	3	+260	N/A	N/A	N/A	N/A	N/A
	4	+260	N/A	N/A	N/A	N/A	N/A
	5	+265	N/A	N/A	N/A	N/A	N/A
	6	+268	N/A	N/A	N/A	N/A	N/A
	7	+257	N/A	N/A	N/A	N/A	N/A
	8	+263	N/A	N/A	N/A	N/A	N/A
	9	+265	N/A	N/A	N/A	N/A	N/A
	10	+263	N/A	N/A	N/A	N/A	N/A
0	0	-20	N/A	N/A	N/A	N/A	N/A
	1	-6	N/A	N/A	N/A	N/A	N/A
	2	-12	N/A	N/A	N/A	N/A	N/A
	3	-10	N/A	N/A	N/A	N/A	N/A
	4	-15	N/A	N/A	N/A	N/A	N/A
	5	-8	N/A	N/A	N/A	N/A	N/A
	6	-10	N/A	N/A	N/A	N/A	N/A
	7	-12	N/A	N/A	N/A	N/A	N/A
	8	-6	N/A	N/A	N/A	N/A	N/A
	9	-9	N/A	N/A	N/A	N/A	N/A
	10	-8	N/A	N/A	N/A	N/A	N/A
+10	0	-43	N/A	N/A	N/A	N/A	N/A
	1	-32	N/A	N/A	N/A	N/A	N/A
	2	-15	N/A	N/A	N/A	N/A	N/A
	3	-46	N/A	N/A	N/A	N/A	N/A
	4	-29	N/A	N/A	N/A	N/A	N/A
	5	-35	N/A	N/A	N/A	N/A	N/A
	6	-52	N/A	N/A	N/A	N/A	N/A
	7	-45	N/A	N/A	N/A	N/A	N/A
	8	-40	N/A	N/A	N/A	N/A	N/A
	9	-38	N/A	N/A	N/A	N/A	N/A
	10	-45	N/A	N/A	N/A	N/A	N/A

CENTER FREQUENCY & RF POWER OUTPUT VARIATION							
Ambient Temperature (^{o}C)	**Keyed-On Time (Minutes)**	**Supply Voltage (Nominal) 13.6 Volts**		**Supply Voltage (85% of Nominal) 11.6 Volts**		**Supply Voltage (115% of Nominal) 15.6 Volts**	
		Hz	**dB**	**Hz**	**dB**	**Hz**	**dB**
+20	0	0	+0.2	0	+0.2	+23	+0.2
	1	-3	+0.2	+5	+0.2	+28	+0.2
	2	-6	+0.2	+5	+0.2	+25	+0.2
	3	-6	+0.2	-3	+0.2	+25	+0.2
	4	-3	+0.2	+8	+0.2	+17	+0.2
	5	+20	+0.2	+3	+0.2	+5	+0.2
	6	+37	+0.2	+8	+0.2	+25	+0.2
	7	+31	+0.2	+3	+0.2	+17	+0.2
	8	+37	+0.2	-17	+0.2	+14	+0.2
	9	+28	+0.2	-3	+0.2	+8	+0.2
	10	+14	+0.2	-3	+0.2	+0	+0.2
+30	0	-50	N/A	N/A	N/A	N/A	N/A
	1	-42	N/A	N/A	N/A	N/A	N/A
	2	-46	N/A	N/A	N/A	N/A	N/A
	3	-50	N/A	N/A	N/A	N/A	N/A
	4	-5	N/A	N/A	N/A	N/A	N/A
	5	-16	N/A	N/A	N/A	N/A	N/A
	6	-20	N/A	N/A	N/A	N/A	N/A
	7	-17	N/A	N/A	N/A	N/A	N/A
	8	-16	N/A	N/A	N/A	N/A	N/A
	9	-20	N/A	N/A	N/A	N/A	N/A
	10	-20	N/A	N/A	N/A	N/A	N/A
+40	0	+92	N/A	N/A	N/A	N/A	N/A
	1	+95	N/A	N/A	N/A	N/A	N/A
	2	+91	N/A	N/A	N/A	N/A	N/A
	3	+100	N/A	N/A	N/A	N/A	N/A
	4	+90	N/A	N/A	N/A	N/A	N/A
	5	+87	N/A	N/A	N/A	N/A	N/A
	6	+92	N/A	N/A	N/A	N/A	N/A
	7	+98	N/A	N/A	N/A	N/A	N/A
	8	+91	N/A	N/A	N/A	N/A	N/A
	9	+107	N/A	N/A	N/A	N/A	N/A
	10	+101	N/A	N/A	N/A	N/A	N/A

CENTER FREQUENCY & RF POWER OUTPUT VARIATION							
Ambient Temperature (^{o}C)	**Keyed-On Time (Minutes)**	**Supply Voltage (Nominal) 13.6 Volts**		**Supply Voltage (85% of Nominal) 11.6 Volts**		**Supply Voltage (115% of Nominal) 15.6 Volts**	
		Hz	**dB**	**Hz**	**dB**	**Hz**	**dB**
+50	0	+131	N/A	N/A	N/A	N/A	N/A
	1	+138	N/A	N/A	N/A	N/A	N/A
	2	+122	N/A	N/A	N/A	N/A	N/A
	3	+122	N/A	N/A	N/A	N/A	N/A
	4	+141	N/A	N/A	N/A	N/A	N/A
	5	+120	N/A	N/A	N/A	N/A	N/A
	6	+121	N/A	N/A	N/A	N/A	N/A
	7	+110	N/A	N/A	N/A	N/A	N/A
	8	+115	N/A	N/A	N/A	N/A	N/A
	9	+120	N/A	N/A	N/A	N/A	N/A
	10	+114	N/A	N/A	N/A	N/A	N/A
+60	0	+26	N/A	N/A	N/A	N/A	N/A
	1	+29	N/A	N/A	N/A	N/A	N/A
	2	+27	N/A	N/A	N/A	N/A	N/A
	3	+29	N/A	N/A	N/A	N/A	N/A
	4	+27	N/A	N/A	N/A	N/A	N/A
	5	+29	N/A	N/A	N/A	N/A	N/A
	6	+30	N/A	N/A	N/A	N/A	N/A
	7	+36	N/A	N/A	N/A	N/A	N/A
	8	+42	N/A	N/A	N/A	N/A	N/A
	9	+39	N/A	N/A	N/A	N/A	N/A
	10	+52	N/A	N/A	N/A	N/A	N/A

6.8. AUDIO FREQUENCY RESPONSE @ FCC 2.1047(A) & 90.242(B)(8)

6.8.1. Limits @ FCC 2.1047(a) and 90.242(b)(8)

No limit is required by FCC for audio frequency response. However, FCC recommends the Audio Frequency Response to be tested to show the roll-off curve at 3 kHz.

Recommended Limits: The attenuation of lowpass filter between the frequencies of 3 KHz and 20 KHz shall be greater than the attenuation at 1KHz by at least: $60\text{Log}_{10}(f/3)$ decibels where "f" is the frequency in KHz. At frequency above 20 KHz, the attenuation shall be 50 dB greater than the attenuation at 1 KHz.

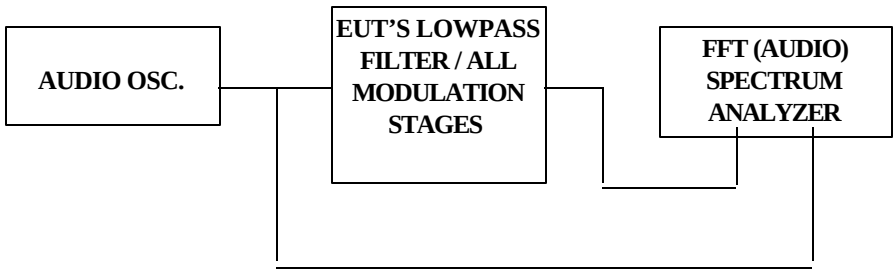
6.8.2. Method of Measurements

The rated audio input signal was applied to the input of the audio lowpass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT (Audio) spectrum analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 kHz.

6.8.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
FFT (audio) Spectrum Analyzer	Advantest	R9211E	…	10 mHz – 100 kHz, 1 MHz Input Impedance
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz

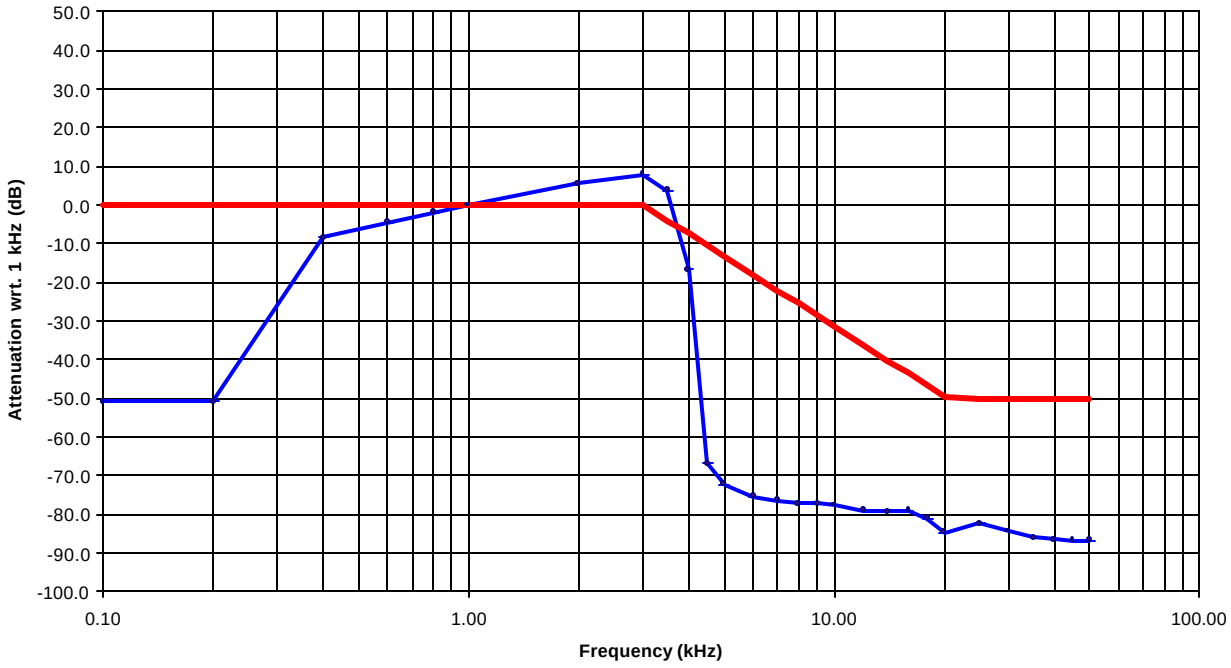
6.8.4. Test Arrangement



6.8.5. Test Data

FREQUENCY (kHz)	AUDIO IN (dBV)	AUDIO OUT (dBV)	ATTEN. (OUT - IN) (dB)	ATTEN. wrt. 1 kHz (dB)	FCC LIMIT @22.915D (dB)	PASS/ FAIL
0.10	13.9	-51.2	-65.1	-50.9	0	PASS
0.20	13.9	-51.2	-65.1	-50.9	0.0	PASS
0.40	0.6	-21.9	-22.5	-8.3	0.0	PASS
0.60	0.6	-18.2	-18.8	-4.6	0.0	PASS
0.80	0.7	-15.5	-16.2	-2.0	0.0	PASS
1.00	0.7	-13.5	-14.2	0.0	0.0	PASS
2.00	0.8	-7.8	-8.6	5.6	0.0	PASS
3.00	0.8	-5.6	-6.4	7.8	0.0	PASS
3.50	0.8	-9.5	-10.3	3.9	-4.0	PASS
4.00	0.8	-30.1	-30.9	-16.7	-7.5	PASS
4.50	0.8	-80.2	-81.0	-66.8	-10.6	PASS
5.00	0.8	-85.6	-86.4	-72.2	-13.3	PASS
6.00	0.8	-88.7	-89.5	-75.3	-18.1	PASS
7.00	0.8	-89.7	-90.5	-76.3	-22.1	PASS
8.00	0.8	-90.5	-91.3	-77.1	-25.6	PASS
9.00	0.8	-90.5	-91.3	-77.1	-28.6	PASS
10.00	0.7	-91.1	-91.8	-77.6	-31.4	PASS
12.00	0.7	-92.4	-93.1	-78.9	-36.1	PASS
14.00	0.7	-92.7	-93.4	-79.2	-40.1	PASS
16.00	0.7	-92.5	-93.2	-79.0	-43.6	PASS
18.00	0.6	-94.6	-95.2	-81.0	-46.7	PASS
20.00	0.6	-98.2	-98.8	-84.6	-49.4	PASS
25.00	0.5	-96.1	-96.6	-82.4	-50.0	PASS
30.00	0.5	-98.0	-98.5	-84.3	-50.0	PASS
35.00	0.5	-99.6	-100.1	-85.9	-50.0	PASS
40.00	0.4	-100.2	-100.6	-86.4	-50.0	PASS
45.00	0.3	-100.5	-100.8	-86.6	-50.0	PASS
50.00	0.2	-100.7	-100.9	-86.7	-50.0	PASS

AUDIO FREQUENCY REPSONSE @ FCC 2.987(a) & 22.915 (Portable/Mobile)
Futurecom Mobexcom 800 MHz



6.9. MODULATION LIMITING @ FCC 2.1047(B) & 90.210

6.9.1. Limits @ FCC 2.1047(b) and 90.210

The EUT shall be installed with a modulation limiter which limits the deviation of the FM carrier less than manufacturer's setting provided that the rf output spectrum must meet the required MASK

Recommendation:

- 1.25 kHz for 6.25 kHz Channel Spacing System
- 2.5 kHz for 12.5 kHz Channel Spacing
- 5 kHz for 25 kHz Channel Spacing System

6.9.2. Method of Measurements

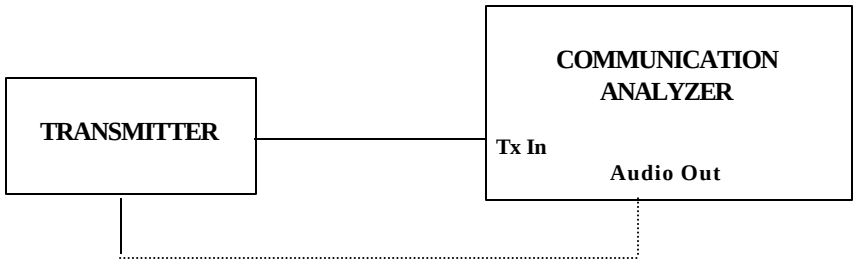
For Audio Transmitter:- The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

For Data Transmitter with Maximum Frequency Deviation set by Factory:- The EUT was set at maximum frequency deviation, and its peak frequency deviation was then measured using EUT's internal random data source.

6.9.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Communication Analyzer	Rohde & Schawrz	SMF02	879988/057	400 kHz - 1000 MHz including AF & RF Signal Generators, SINAD, DISTORTION, DEVIATION meters and etc

6.9.4. Test Arrangement



6.9.5. Test Data

6.9.5.1. Data Modulation Limiting: FM modulation with random data and Modulation Limiter set at a Maximum Frequency Deviation (Factory Setting).

Data Baud Rate	Peak Deviation (kHz)	Maximum Limit (kHz)
9600	2.0	5.0

6.9.5.2. Voice Modulation Limiting:

MODULATING SIGNAL LEVEL	PEAK FREQUENCY DEVIATION (kHz) at the following modulating frequency:					MAXIMUM LIMIT
(Vrms)	0.1 kHz	0.5 kHz	1.0 kHz	3.0 kHz	5.0 kHz	(kHz)
0.1	0	0.1	0.3	0.7	0	5
0.2	0	0.3	0.5	1.3	0	5
0.3	0	0.4	0.8	2.0	0	5
0.4	0	0.5	1.1	2.6	0	5
0.5	0	0.6	1.4	3.1	0	5
0.6	0	0.8	1.6	3.5	0	5
0.7	0	0.9	1.8	3.7	0	5
0.8	0.1	1.1	2.0	3.7	0	5
0.9	0.1	1.2	2.2	3.7	0	5
1.0	0.1	1.4	2.5	3.7	0	5
1.1	0.1	1.5	2.7	3.7	0	5
1.2	0.1	1.7	2.9	3.8	0	5
1.3	0.1	1.8	3.1	3.8	0	5
1.4	0.1	1.9	3.3	3.8	0	5
1.5	0.2	2.1	3.5	3.8	0	5
1.6	0.2	2.2	3.7	3.8	0	5
1.7	0.2	2.3	3.8	3.8	0	5
1.8	0.2	2.4	3.9	3.8	0	5
1.9	0.2	2.4	4.1	3.8	0	5
2.0	0.2	2.7	4.1	3.8	0	5
2.5	0.3	3.4	4.4	3.9	0	5
3.0	0.3	4.0	4.4	4.0	0	5
3.5	0.4	4.0	4.4	4.0	0	5

Voice Signal Input Level = STD MOD Level + 16 dB = 2.3 dBVrms + 16 = 18.3 dBVrms or 8.2 Vrms

MODULATING FREQUENCY (KHz)	PEAK FREQUENCY DEVIATION (KHz)	MAXIMUM LIMIT (KHz)
0.1	0.3	5
0.2	0.8	5
0.4	1.9	5
0.6	3.6	5
0.8	3.7	5
1.0	4.2	5
1.2	4.4.	5
1.4	4.4	5
1.6	4.4	5
1.8	4.2	5
2.0	4.0	5
2.5	4.3	5
3.0	4.1	5
3.5	2.0	5
4.0	1.9	5
4.5	0.0	5
5.0	0.0	5
6.0	0.0	5
7.0	0.0	5
8.0	0.0	5
9.0	0.0	5
10.0	0.0	5

6.10. EMISSION MASK @ FCC 2.1049, 90.208 & 90.210

6.10.1. Limits @ FCC 90.209 & 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FREQUENCY RANGE (MHz)	Maximum Authorized BW (KHz)	CHANNEL SPACING (KHz)	Recommended Max. FREQ. DEVIATION (KHz)	FCC APPLICABLE MASK @ FCC 90.210
851-866	20	25	5	MASK B (Voice) & MASK G (Data)
866-869	20	12.5	5	MASK B (Voice) & MASK H (Data)

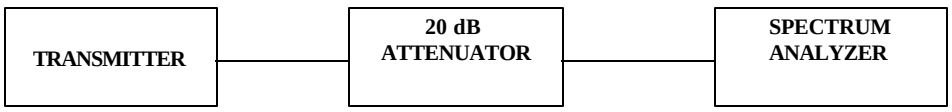
6.10.2. Method of Measurements

Refer to Exhibit 8, § 8.3 of this report for measurement details

6.10.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Attenuator(s)	Bird	..	…	DC – 22 GHz
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz

6.10.4. Test Arrangement



6.10.5. Test Data

Conform.

- Please refer to Plot # 1 to 6 in Annex 1 for 99% OWB (Voice and Data)
- Please refer to Plot # 7 to 10 in Annex 1 for Mask B Emissions (Voice) @ "Translator" mode in 851-869 MHz.
- Please refer to Plot # 11 to 13 in Annex 1 for Mask G Emissions (Data) @ "Translator" mode in 851-866 MHz
- Please refer to Plot # 14 to 16 in Annex 1 for Mask H Emissions (Data) @ "Translator" mode. In 866-869 MHz
- Please refer to Plot # 17 to 19 in Annex 1 for Mask B Emissions (Voice) @ "Transmitter" mode in 851-869 MHz.
- Please refer to Plot # 20 to 21 in Annex 1 for Mask G Emissions (Data) @ "Transmitter" mode in 851-866 MHz
- Please refer to Plot # 22 to 23 in Annex 1 for Mask H Emissions (Data) @ "Transmitter" mode. In 866-869 MHz

6.11. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 90.210

6.11.1. Limits @ 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC RULES	WORST CASE EMISSIONS LIMIT	ATTENUATION LIMIT (dBc)
FCC 90.210 (b) (g),(h)	FCC 90.210 (b)(g) & (h)	-13 dBm

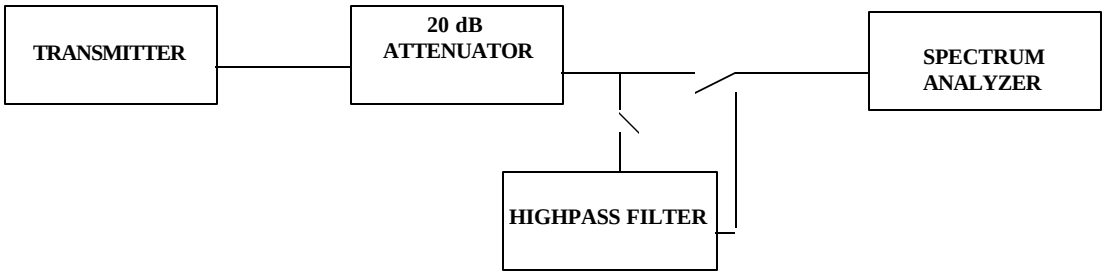
6.11.2. Method of Measurements

Refer to Exhibit 8 § 8.4 of this report for measurement details

6.11.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Attenuator(s)	Bird	..	…	DC – 22 GHz
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz
Highpass Filter, Microphase	Microphase	CR220HID	IITI11000AC	Cut-off Frequency at 600 MHz, 1.3 GHz or 4 GHz

6.11.4. Test Arrangement



6.11.5. Test Data

6.11.5.1. Near Lowest Frequency (851 MHz)

Fundamental Frequency: 851 MHz
RF Output Power: 15 Watts
Modulation: FM modulation with 2.5 kHz Sine Wave Signal

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1702.00	-21.2	-13.0	-8.2	PASS
2553.00	-30.2	-13.0	-17.2	PASS
3404.00	-35.3	-13.0	-22.3	PASS
4255.00	-34.8	-13.0	-21.8	PASS
5106.00	-27.4	-13.0	-14.4	PASS
5957.00	-40.4	-13.0	-27.4	PASS
6808.00	-45.9	-13.0	-32.9	PASS
7659.00	-51.9	-13.0	-38.9	PASS

- The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits
- Refer to Plot # 24 and 25 in Annex 1 for details of measurements

Fundamental Frequency: 851 MHz
RF Output Power: 15 Watts
Modulation: FM modulation with 9600 b/s internal random data source

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1702.00	-21.0	-13.0	-8.0	PASS
2553.00	-30.2	-13.0	-17.2	PASS
3404.00	-35.0	-13.0	-22.0	PASS
4255.00	-35.0	-13.0	-22.0	PASS
5106.00	-26.9	-13.0	-13.9	PASS
5957.00	-40.3	-13.0	-27.3	PASS
6808.00	-46.3	-13.0	-33.3	PASS
7659.00	-54.0	-13.0	-41.0	PASS

- The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits
- Refer to Plot # 24 and 25 in Annex 1 for details of measurements

6.11.5.2. Near Middle Frequency (860 MHz)

Fundamental Frequency: 860 MHz
RF Output Power: 15 Watts
Modulation: FM modulation with 2.5 kHz Sine Wave Signal

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1720.00	-22.1	-13.0	-9.1	PASS
2580.00	-25.1	-13.0	-12.1	PASS
3440.00	-38.4	-13.0	-25.4	PASS
4300.00	-35.3	-13.0	-22.3	PASS
5160.00	-26.0	-13.0	-13.0	PASS
6020.00	-41.5	-13.0	-28.5	PASS
6880.00	-50.1	-13.0	-37.1	PASS
7740.00	-53.5	-13.0	-40.5	PASS

- The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits
- Refer to Plot # 28 and 29 in Annex 1 for details of measurements

Fundamental Frequency: 860 MHz
RF Output Power: 15 Watts
Modulation: FM modulation with 9600 b/s internal random data source

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1720.00	-22.0	-13.0	-9.0	PASS
2580.00	-24.9	-13.0	-11.9	PASS
3440.00	-38.3	-13.0	-25.3	PASS
4300.00	-35.3	-13.0	-22.3	PASS
5160.00	-26.5	-13.0	-13.5	PASS
6020.00	-40.8	-13.0	-27.8	PASS
6880.00	-49.4	-13.0	-36.4	PASS
7740.00	-52.4	-13.0	-39.4	PASS

- The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits
- Refer to Plot # 30 and 31 in Annex 1 for details of measurements

6.11.5.3. Near Highest Frequency (869 MHz)

Fundamental Frequency: 869 MHz
RF Output Power: 15 Watts
Modulation: FM modulation with 2.5 kHz Sine Wave Signal

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1738.00	-24.8	-13.0	-11.8	PASS
2607.00	-18.8	-13.0	-5.8	PASS
3476.00	-27.8	-13.0	-14.8	PASS
4345.00	-36.3	-13.0	-23.3	PASS
5214.00	-25.8	-13.0	-12.8	PASS
6083.00	-43.8	-13.0	-30.8	PASS
6952.00	-46.7	-13.0	-33.7	PASS
7821.00	-46.4	-13.0	-33.4	PASS

- The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits
- Refer to Plot # 32 and 33 in Annex 1 for details of measurements

Fundamental Frequency: 869 MHz
RF Output Power: 15 Watts
Modulation: FM modulation with 9600 b/s internal random data source

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1738.00	-24.4	-13.0	-11.4	PASS
2607.00	-18.8	-13.0	-5.8	PASS
3476.00	-23.1	-13.0	-10.1	PASS
4345.00	-35.9	-13.0	-22.9	PASS
5214.00	-25.8	-13.0	-12.8	PASS
6083.00	-45.4	-13.0	-32.4	PASS
6952.00	-44.8	-13.0	-31.8	PASS
7821.00	-46.6	-13.0	-33.6	PASS

- The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits
- Refer to Plot # 34 and 35 in Annex 1 for details of measurements

6.12. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 90.210

6.12.1. Limits @ FCC 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC RULES	WORST CASE EMISSIONS LIMIT	WORST LIMIT (dBm)
FCC 90.210 (b) (g),(h)	FCC 90.210 (b), (g) & (h)	-13 dBm

6.12.2. Method of Measurements

Refer to Exhibit 8, § 8.5 of this report for measurement details

6.12.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A	3116A00661	1 GHz to 26.5 GHz
Active Loop Antenna	EMCO	6507	8906-1167	1 kHz – 30 MHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna with Mixer	EMCO	3160-09	1007	18 GHz – 26.5 GHz
Horn Antenna with Mixer	EMCO	3160-10	1001	26.5 GHz – 40 GHz

6.12.4. Photograph of Tets Setup

Refer to Photos # 1 and 2 in Annex 2 for details of test setup.

6.12.5. Test Data

Remarks:

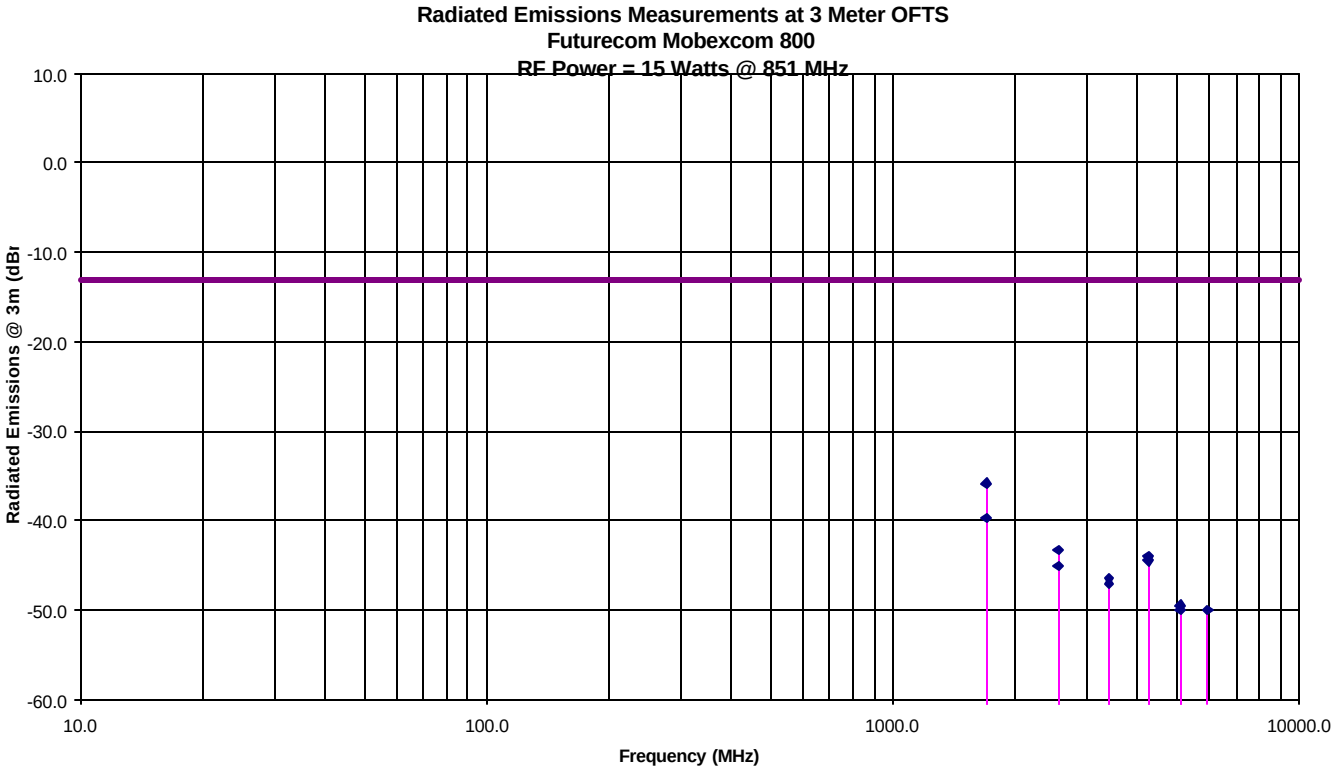
- The conducted rf spurious/harmonic emission characteristics for different modulations, FM voice and FM data, were found approximately the same in Sec. 6.11 of this test report. Therefore, tests with FM data modulation will be conducted and represent the product compliance with FCC 90.
- The Radiated emissions were performed at 3 meters distance.

6.12.5.1. Near Lowest Frequency (851 MHz)

Fundamental Frequency: 851 MHz
RF Output Power: 15 Watts
Modulation: FM modulation with 9600 bps internal random data source

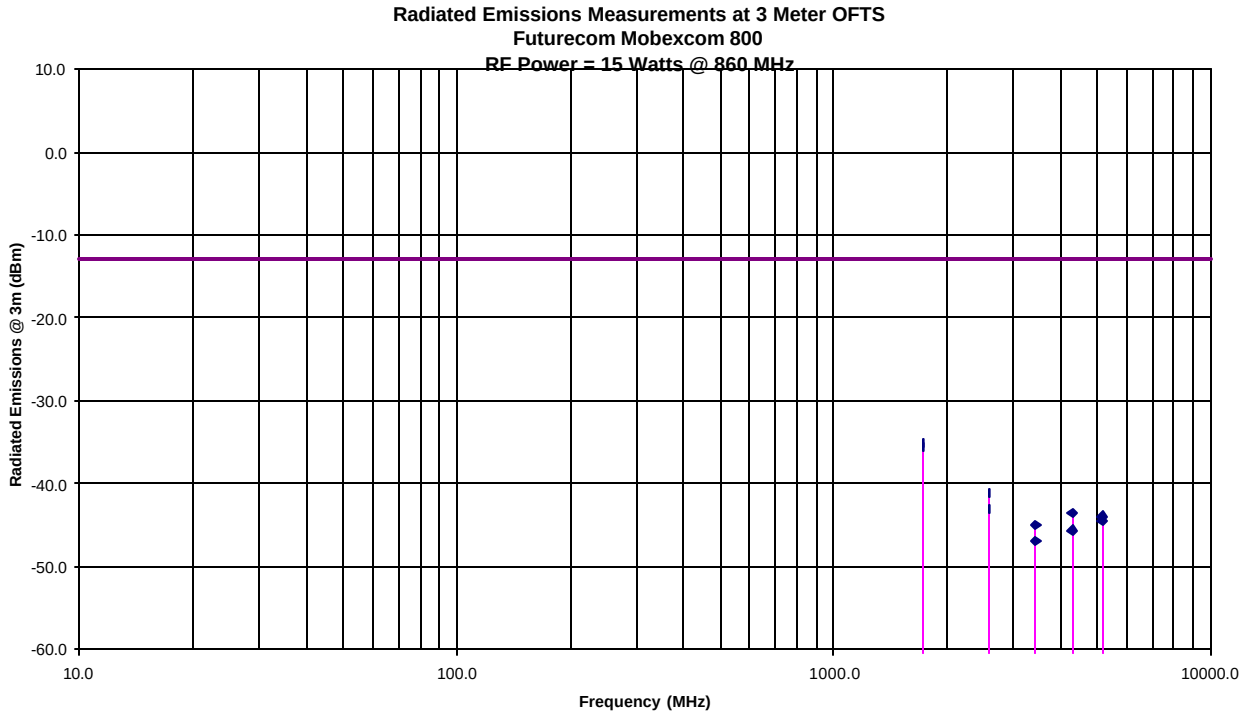
Frequency (MHz)	RF Field Level @ 3 m (dBµV/m)	RF Power Level (dBm)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limit @ 3 m (dBm)	Margin (dB)	Pass/ Fail
1702.00	57.8	-39.7	PEAK	V	-13.0	-26.7	PASS
1702.00	61.7	-35.8	PEAK	H	-13.0	-22.8	PASS
2553.00	52.4	-45.1	PEAK	V	-13.0	-32.1	PASS
2553.00	54.2	-43.3	PEAK	H	-13.0	-30.3	PASS
3404.00	50.5	-47.0	PEAK	V	-13.0	-34.0	PASS
3404.00	51.0	-46.5	PEAK	H	-13.0	-33.5	PASS
4255.00	53.5	-44.0	PEAK	V	-13.0	-31.0	PASS
4255.00	53.0	-44.5	PEAK	H	-13.0	-31.5	PASS
5106.00	47.5	-50.0	PEAK	V	-13.0	-37.0	PASS
5106.00	48.0	-49.5	PEAK	H	-13.0	-36.5	PASS
5957.00	47.5	-50.0	PEAK	H	-13.0	-37.0	PASS

The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits were recorded.


Radiated Emissions Measurements at 3 Meter OFTS
Futurecom Mobexcom 800
RF Power = 15 Watts @ 851 MHz
Radiated Emissions @ 3m (dBr
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
10.0
100.0
1000.0
10000.0
Frequency (MHz)

6.12.5.2. Near Middle Frequency (860 MHz)

Fundamental Frequency:	860 MHz						
RF Output Power:	15 Watts						
Modulation:	FM modulation with 9600 bps internal random data source						
Frequency (MHz)	RF Field Level @ 3 m (dBµV/m)	RF Power Level (dBm)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limit @ 3 m (dBm)	Margin (dB)	Pass/ Fail
1720.00	62.0	-35.5	PEAK	V	-13.0	-22.5	PASS
1720.00	62.4	-35.1	PEAK	H	-13.0	-22.1	PASS
2580.00	54.5	-43.0	PEAK	V	-13.0	-30.0	PASS
2580.00	56.4	-41.1	PEAK	H	-13.0	-28.1	PASS
3440.00	52.5	-45.0	PEAK	V	-13.0	-32.0	PASS
3440.00	50.5	-47.0	PEAK	H	-13.0	-34.0	PASS
4300.00	53.9	-43.6	PEAK	V	-13.0	-30.6	PASS
4300.00	51.9	-45.6	PEAK	H	-13.0	-32.6	PASS
5160.00	53.6	-43.9	PEAK	V	-13.0	-30.9	PASS
5160.00	53.0	-44.5	PEAK	H	-13.0	-31.5	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits were recorded.							


Radiated Emissions Measurements at 3 Meter OFTS
Futurecom Mobexcom 800
RF Power = 15 Watts @ 860 MHz
Radiated Emissions @ 3m (dBm)
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
10.0
100.0
1000.0
10000.0
Frequency (MHz)

6.12.5.3. Near Highest Frequency (869 MHz)

Fundamental Frequency:	869 MHz
RF Output Power:	15 Watts
Modulation:	FM modulation with 9600 bps internal random data source

Frequency (MHz)	RF Field Level @ 3 m (dBµV/m)	RF Power Level (dBm)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limit @ 3 m (dBm)	Margin (dB)	Pass/ Fail
1738.00	62.7	-34.8	PEAK	V	-13.0	-21.8	PASS
1738.00	63.2	-34.3	PEAK	H	-13.0	-21.3	PASS
2607.00	54.8	-42.7	PEAK	V	-13.0	-29.7	PASS
2607.00	50.1	-47.4	PEAK	H	-13.0	-34.4	PASS
3476.00	49.6	-47.9	PEAK	V	-13.0	-34.9	PASS
3476.00	50.1	-47.4	PEAK	H	-13.0	-34.4	PASS
4345.00	49.9	-47.6	PEAK	V	-13.0	-34.6	PASS
4345.00	50.0	-47.5	PEAK	H	-13.0	-34.5	PASS
5214.00	57.0	-40.5	PEAK	V	-13.0	-27.5	PASS
5214.00	58.5	-39.0	PEAK	H	-13.0	-26.0	PASS
6083.00	48.0	-49.5	PEAK	H	-13.0	-36.5	PASS

The emissions were scanned from 10 MHz to 10 GHz and all emissions within 20 dB below the limits were recorded.

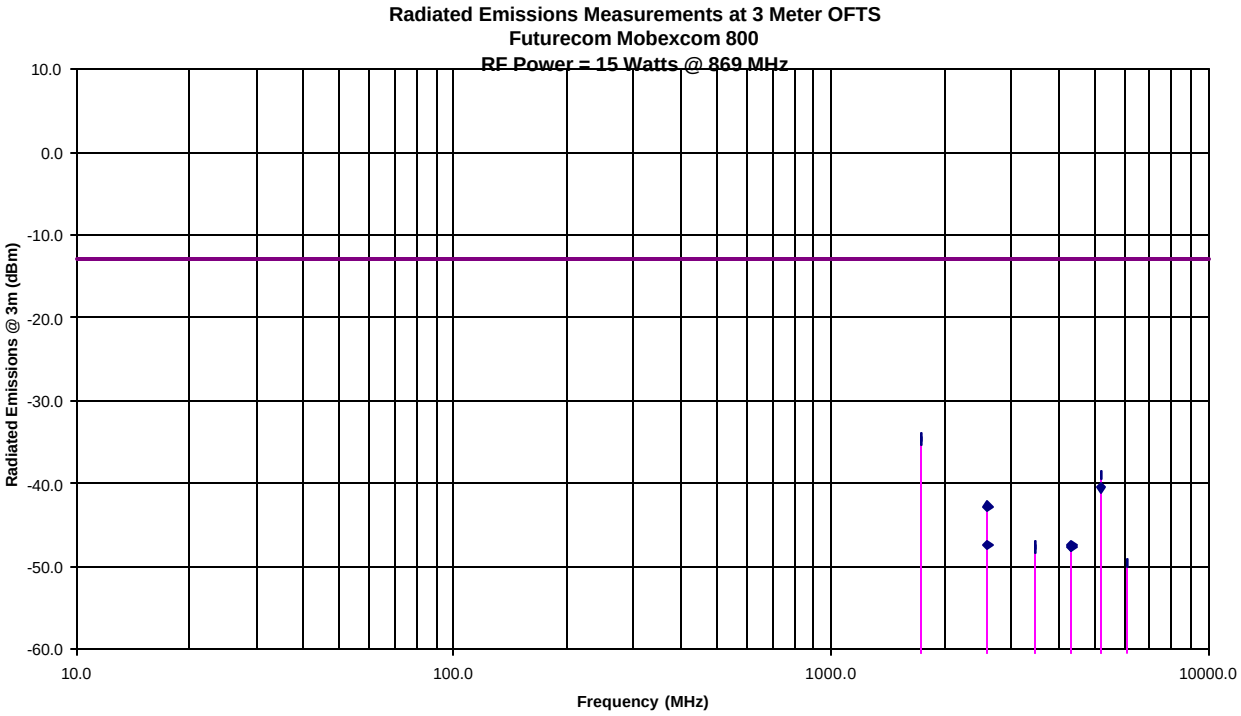

Radiated Emissions Measurements at 3 Meter OFTS
Futurecom Mobexcom 800
RF Power = 15 Watts @ 869 MHz
Radiated Emissions @ 3m (dBm)
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
10.0
100.0
1000.0
10000.0
Frequency (MHz)

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$(Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1\pm\Gamma_1\Gamma_R)$	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 8. MEASUREMENT METHODS

8.1. EFFECTIVE RADIATED POWER (ERP) MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- I f the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements

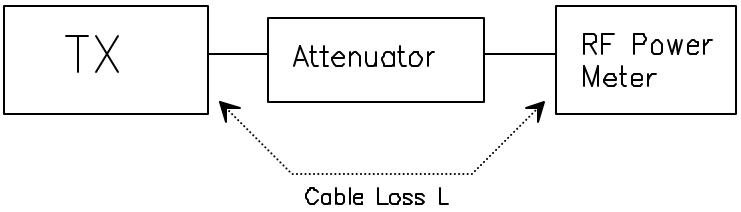
- Using a spectrum analyzer with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with $0<x<1$, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

Figure 1.



Step 3: Substitution Method. See Figure 2

(a) The measurements was performed in the absence of modulation (un-modulated)
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The dipole test antenna was used and tuned to the transmitter carrier frequency.
(e) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.

(h) The substitution dipole antenna and the signal generator replaced the transmitter and antenna under test in the same position, and the substitution dipole antenna was placed in vertical polarization. The test dipole antenna was lowered or raised as necessary to ensure that the maximum signal is stilled received.
(i) The input signal to the substitution antenna was adjusted in level until an equal or a known related level to that detected from the transmitter was obtained in the test receiver. The maximum carrier radiated power is equal to the power supply by the generator.
(j) The substitution antenna gain and cable loss were added to the signal generator level for the corrected ERP level.
(k) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(l) Actual gain of the EUT's antenna is the difference of the measured ERP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2

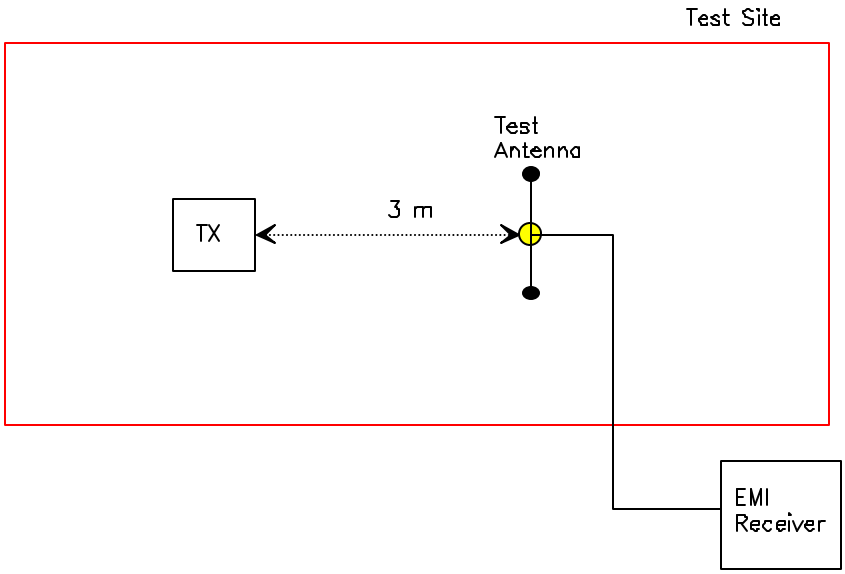
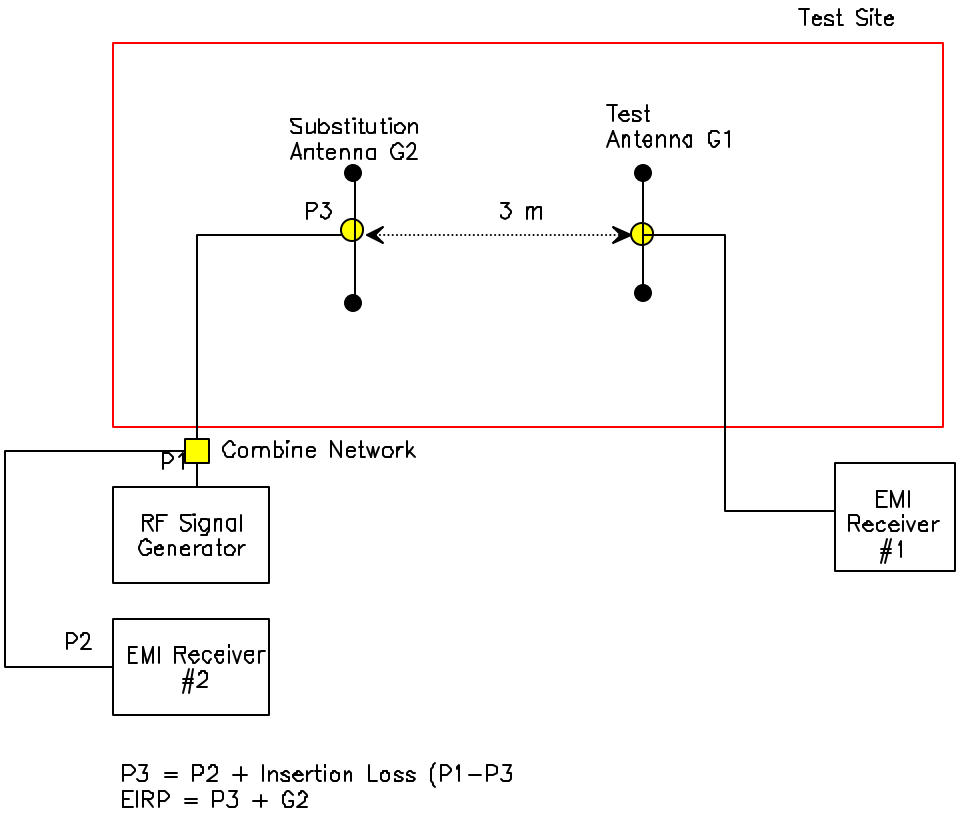


Figure 3


Test Site
Substitution Antenna G2
Test Antenna G1
P3
3 m
P1
Combine Network
RF Signal Generator
EMI Receiver #1
P2
EMI Receiver #2
P3 = P2 + Insertion Loss (P1–P3
EIRP = P3 + G2

8.2. FREQUENCY STABILITY

Refer to FCC @ 2.1055.

(a) The frequency stability shall be measured with variation of ambient temperature as follows: From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.

(b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.

(d) The frequency stability supply shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).

8.3. EMISSION MASK

Voice or Digital Modulation Through a Voice Input Port @ 2.1049(c)(i):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: ±2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @ 2.1049(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, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

The following spectrum analyzer bandwidth shall be used for measurement of Emission Mask/Out-of-Band Emission Measurements:

(1) For 25 kHz Channel Spacing: RBW = 300 Hz
(2) For 12.5 kHz or 6.25 kHz Channel Spacing: RBW = 100 Hz

The all cases the Video Bandwidth shall be equal or greater than the measuring bandwidth.

8.4. SPURIOUS EMISSIONS (CONDUCTED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 30 kHz minimum , VBW ≥ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.1057 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.1051 - Spurious Emissions at Antenna Terminal:- 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 the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

8.5. SPURIOUS EMISSIONS (RADIATED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 100 kHz minimum , VBW $\geq$ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.1057 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.1053 - Field Strength Spurious Emissions

(a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.1049(c) as appropriate. For equipment operating on frequencies below 1 GHz , an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

Maximizing RF Emission Level:

(a) The measurements was performed with standard modulation
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The biconilog Antenna (20 MHz to 1 GHz) or Horn Antenna (1 GHz to 18 GHz) was used for measuring.
(e) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.

(h) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(i) The field strength level measured at 3m is converted to the power in dBm by subtracting a constant factor of 97.5 dB

METHOD OF CALCULATION FOR TRANSMITTED POWER (P) FROM THE MEASURED FIELD STRENGTH LEVEL (E):

According to IEC 801-3, the power density can be calculated as follows:

$S = P / (4xPIxD^2)$ Where: S: Power density in watts per square feet
P: Transmitted power in watts
PI: 13.1415
D: Distance in meters

The power density S (W/m^2) and electric field E (V/m) is related by:

$S = E^2/(120xPI)$

Accordingly, the field intensity of isotropic radiator in free space can be expressed as follows:

$E = (30xP)^{1/2}/D = 5.5x(P)^{1/2}/D$

For Halfwave dipole antenna or other antennas correlated to dipole in direction of maximum radiation:

$S = (1.64xP)/(4xPIxD^2)$
$E = (49.2xP)^{1/2}xD = 7.01x(P)^{1/2}/D$

$$P = (ExD/7.01)^2$$

Calculation of transmitted power P (dBM) given a measured field intensity E (dBuV/m):

$P(W) = [E(V/m)xD/7.01]^2$
$P(mW) = P(W)x1000$
=> $P(dBm) = 10logP(mW)$
$= 20logE(V/m) + 20log(D) - 20log(7.01) + 10log1000$
$= E(dBV/m) + 20logD + 13$
$= E(dBuV/m) - 120 + 20log(D) + 13$
$= E(dBuV/m) + 20log(D) - 107$

The Transmitted Power @ D = 3 Meters

P(dBm) = E(dBuV/m) - 97.5