UltraTech
Group of Labs

Dec. 08, 2000

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

Subject: Type Acceptance Application under FCC CFR 47, Parts 2 and 22 (Subpart H) - Cellular RadioTelephone Service in the frequency bands 824-849 MHz (30kHz Channel Spacing).

Applicant:	**Sur-Gard Security Systems Ltd.**
Product:	**SG-Skyroute Radio Transceiver Module**
Model:	**Skyroute, Skyroute Max or Skyroute UT**
FCC ID:	**PED-SKYROUTE**

Dear Sir/Madam,

As appointed agent for **Sur-Gard Security Systems Ltd.**, we would like to submit the application to the Federal Communications Commission for certification of the above product. Please review all necessary files uploaded to FCC OET site for detailed information.

- Multiple Listing: The Skyroute Radio Transceiver Module consists of the following parts:
  (1) A Radio Transceiver Module, manufactured by Standard Communications Corporation (STC), Model Number: CU81KAB, FCC ID: APV0896. This radio is used and sold as it is set by the Manufacturer, there is no tuning or modifications required for use in the SG Skyroute assembly.
  (2) A SG Skyroute Digital Interface Board, manufactured by Digital Security Controls Ltd.
  (3) A ¼ Wave dipole Antenna, manufactured by Valtrie, Model Number CDU019B, Frequency: 821-896 MHz, Connector: TNC.

  Since the only antenna is changed in the STC Radio Module, we would like to apply for the Class II Permissive Change authorization under Sur-Gard Security Systems Ltd. Please refer to the FCC ID: APV0896 for all information about the STC radio transceiver.

- Limited Modular Transmitter Approval Request- This application is subject to the FCC certification for a modular transceiver, please kindly refer to the Section 6.5 of the submitted test report for clarification of compliance for this modular transmitter with FCC Public Notice DA 00-1407.

  Limited Application: This radio module is sold to OEM manufacturers and Security Service Company only for the application of Security Purpose. It is installed inside a security system at an User's place by a Security Service Company.

  This radio module is only intended for use as a fixed station (Security Systems in Home, Commercial and Industrial Environments.

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

Telephone (905) 829-1570
Facsimile (905) 829-8050

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- Compliance with RF Exposure Requirements:
  > The transmitter complies with FCC 2.1091 with the minimum RF safety distance of 30 cm. Please refer to page 2 of the Users Manual for details of the antenna installation instruction for details.

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

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

Yours truly,

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

TML/AK

Encl.

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Dec. 08, 2000

Sur-Gard Security Systems Ltd.
3301 Langstaff Road
Concord, Ontario
Canada, L4K 4L2

Attn.: **Mr. Dan Anita**

Subject: **Certification Testing in accordance with FCC CFR 47, Parts 2 and 22 (Subpart H) - Cellular RadioTelephone Service in the frequency bands 824-849 MHz (30kHz Channel Spacing).**

Product: **SG-Skyroute Radio Transceiver Module**
Model: **Skyroute, Skyroute Max or Skyroute UT**
FCC ID: **PED-SKYROUTE**

Dear Mr. Anita,

The product sample has been tested in accordance with **FCC CFR 47, Parts 2 and 22 (Subpart H) - Cellular RadioTelephone Service in the frequency bands 824-849 MHz (30kHz Channel Spacing),** and the results and observation were recorded in the engineering report, Our File No.: SSS-018FTX

Enclosed you will find copies 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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Oakville, Ontario, Canada
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ENGINEERING TEST REPORT

SG-Skyroute Radio Transceiver Module
Model No.: Skyroute, Skyroute Max or Skyroute UT
FCC ID: PED-SKYROUTE

Applicant: **Sur-Gard Security Systems Ltd.**
3301 Langstaff Road
Concord, Ontario
Canada, L4K 4L2

Tested in Accordance With

Federal Communications Commission (FCC)
CELLULAR RADIOTELEPHONE SERVICE
CFR 47, PARTS 2 and 22 (Subpart H)

UltraTech's File No.: SSS-018FTX

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: Dec. 08, 2000

Report Prepared by: Tri Luu, P.Eng. . Issued Date: Dec. 08, 2000	Tested by: Hung Trinh, EMI/RFI Technician Test Dates: Dec. 5-6, 2000

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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Website: www.ultratech-labs.com Email: vhk.ultratech@sympatico.ca

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EXHIBIT 1. SUBMITTAL CHECK LIST

Exhibit No.	Exhibit Type	Description of Contents	Quality Check (OK)
1 through 8	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	OK
9	Test Report - Plots of Measurement Data	None	None
10	Test Setup Photos	Photos # 1 to 3	OK
11	External Photos of EUT	Photos # 1 to 5	OK
12	Internal Photos of EUT	Photos of 1 to 4	OK
13	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	None
14	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 None
15	Application Forms	Form 731 Form 159 Confirmation of Exhibits sent to FCC Status of Exhibits sent to FCC	OK
16	ID Label/Location Info	ID Label Location of ID Label	OK OK
17	Block Diagrams	Please refer to FCC ID: APV0896 of Standards Communications Corporation for details	None
18	Schematic Diagrams	Please refer to FCC ID: APV0896 of Standards Communications Corporation for details	None
19	Parts List/Tune Up Info	Please refer to FCC ID: APV0896 of Standards Communications Corporation for details	None
20	Operational Description	Please refer to the introduction of the user's manual	OK
21	RF Exposure Info	Refer to page 2 of the User's Manual	OK
22	Users Manual		OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 22 (Subpart H): 1999
Title	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 22
Purpose of Test:	To obtain the FCC Limited Modular Approval Certification Authorization for Radio operating in the frequency bands 824-849 MHz (30kHz Channel Spacing). • Limited Modular Transmitter Approval Request- This application is subject to the FCC certification for a modular transceiver, please kindly refer to the Section 6.5 of the submitted test report for clarification of compliance for this modular transmitter with FCC Public Notice DA 00-1407. Limited Application: This radio module is sold to OEM manufacturers and Security Service Company only for the application of Security Purpose. It is installed inside a security system at an User's place by a Security Service Company. The radio module is sold together with the following parts as a whole assembly: (1) SG Digital Interface Board (2) Valtrie ¼ Wave dipole Antenna, Model Number CDU019B, Frequency: 821-896 MHz, Connector: TNC. • This radio module is only for use as a fixed station (Security Systems in Home, Commercial and Industrial Environments
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. NORMATIVE REFERENCES

Publication	YEAR	Title
FCC CFR Parts 2 and 22	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:	Sur-Gard Security Systems Ltd.
Address:	3301 Langstaff Road Concord, Ontario Canada, L4K 4L2
Contact Person:	Mr. Dan Anita Phone #: 905-760-3000 (2706) Fax #: 905-760-3020 Email Address: nitad@sur-gard.com

MANUFACTURER:	
Name:	Standard Communications Corporation
Address:	PO Box 92151 Los Angeles, CA USA 90009,
Contact Person:	Mr. Ron Blanchard

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	Sur-Gard Security Systems Ltd.
Product Name	SG-Skyroute Radio Transceiver Module
Model Name or Number	Skyroute, Skyroute Max or Skyroute UT
Serial Number	02U514126
Type of Equipment	Radio Communication Equipment
External Power Supply	None
Transmitting/Receiving Antenna Type	Non-integral TNC connector
Primary User Functions of EUT:	The Skyroute transceiver offers a new wireless communication method for transmission of event information using Cellemetry service. Events are transmitted from the Skyroute transceiver via Cellemetry network to the clearing house and then to the Central Station in a fast manner; maximum 2 seconds on every transmitter's activation.

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Base station (fixed use)
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	12 Vdc regulated
RF Output Power Rating:	3.0 Watts maximum
Duty Cycle:	The transmitter will be automatically deactivated after 2 seconds from the time it is activated
Operating Frequency Range:	824-849 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	30 kHz
Necessary Occupied Bandwidth:	40 kHz max.
Emission Designation*:	40K0F1D
Antenna Connector Type:	TNC
Antenna Description:	Valtrie ¼ Wave Dipole Antenna, Part No.:CDU019B, Frequency: 821-896 MHz, Connector: TNC, Gain: 3 dBi

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	RF IN/OUT Port	1	TNC	No cable. Direct connection
2	I/O Communication Bus and DC supply port	1	8 conductor terminal block	Non-shielded wireleads

3.5. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

3.6. 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:	Sur-gard Security System was used to operate run the Radio Module in an intended application. The radio frequency was changed by using a keypad connected to the Sur-gard Security System which communicated to the Radio through the Sur-Gard Skyroute Interface Board.

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:	12 Vdc regulated

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:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohm RF Load.

Transmitter Test Signals:	
Frequencies: 824 – 849 MHz	Near lowest, near middle & near highest frequencies each frequency bands that the transmitter covers: 824.95, 836.188 and 848 MHz
Transmitter Wanted Output Test Signals: - RF Power Output (measured maximum output power): - Normal Test Modulation - Modulating signal source:	 3.0 Watts FM Data Internal

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)
22.913 & 2.985	Effective Radiated Power (ERP) Limits	Yes. Note 2
22.101(a) & 2.995	Frequency Stability	Note 1
22.915(d) & 2.987(a)	Audio Filter Characteristics	N/A for Data
22.915 (a), (b) & (c) & 2.987(b)	Modulation Requirements	Note 1
22.917(a),(b),(c)&9 (d) & 2.989	Emission Limitation/Emission Masks	Note 1
22.917(e), (f) & (g), 2.997 & 2.991	Emission Limits – Spurious Emissions at Antenna Terminal	Note 1
22.917(e), (f) & (g), 2.997 & 2.993	Emission Limits - Field Strength of Spurious Emissions	Yes. Note 2

Note 1: Since there is no change on this FCC certified radio supplied by Standards Communications Corporation, this test is not required to be conducted

Note 2: These tests needed to be performed since the transmitter antenna is changed from its original FCC authorization under FCC ID: APV0896

SG-Skyroute Radio Transceiver Module, **Model No.: Skyroute, Skyroute Max or Skyroute UT**, by **Sur-Gard Security Systems Ltd.** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers and Class B Digital Devices**. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.

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 7 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 6 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 MANUACTURER:

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

6.5. EFFECTIVE RADIATED POWER (ERP) LIMITS @ FCC 2.985 & 22.913

6.5.1. Limits @ FCC 22.913

The effective radiated power (EIRP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section:

	Maximum ERP (Watts)
Mobile Transmitters & Auxiliary Test Transmitters (824-849 MHz)	7 Watts

6.5.2. Method of Measurements

Please refer to Exhibit 8, Sec. 8.1 for test procedures and test setup.

6.5.3. 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
Dipole Antenna	EMCO	3121C	8907-434	20-1000 MHz
Dipole Antenna	EMCO	3121C	8907-440	20-1000 MHz
Average Power Meter	Hewlett Packard	HP436A	…	DC to 22 GHz

6.5.4. Test Data

	Measured Average Conducted Power (P) – dBm	
FUNDAMENTAL FREQUENCY (MHz)	Digital	LIMIT (dBm)
824.950	35.0	38.5
836.188	34.4	38.5
848.000	32.7	38.5

	Average ERP (dBm) Transmitter's Antenna Gain of 3 dBi (Substitution Method)		
FUNDAMENTAL FREQUENCY (MHz)	Vertical	Horizontal	LIMIT (dBm)
824.950	35.5	35.9	38.5
836.188	33.5	33.2	38.5
848.000	36.2	31.3	38.5

6.6. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 22.917(E), (F) & (G)

6.6.1. Limits @ 22.917(e), (f) & (g)

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

FCC RULES	ATTENUATION LIMIT
FCC 22.917(e)	43+10*log(P) dBc, P is power in watts
FCC 22.917(f) for Mobile emissions	Mean power in 869-894 MHz band shall be less than –80 dBm
FCC 22.917(g)	If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

6.6.2. Method of Measurements

Please refer to the Exhibit 8, Sec. 8. 5 of this test report and ANSI C63-4:1992 for radiated emissions test method.

6.6.3. 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		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	EMCO	3160-09	..	18 GHz – 26.5 GHz
Horn Antenna	EMCO	3160-10	..	26.5 GHz – 40 GHz
Mixer	Tektronix	118-0098-00	..	18 GHz – 26.5 GHz
Mixer	Tektronix	119-0098-00	..	26.5 GHz – 40 GHz

6.6.4. Photographs of Test Setup

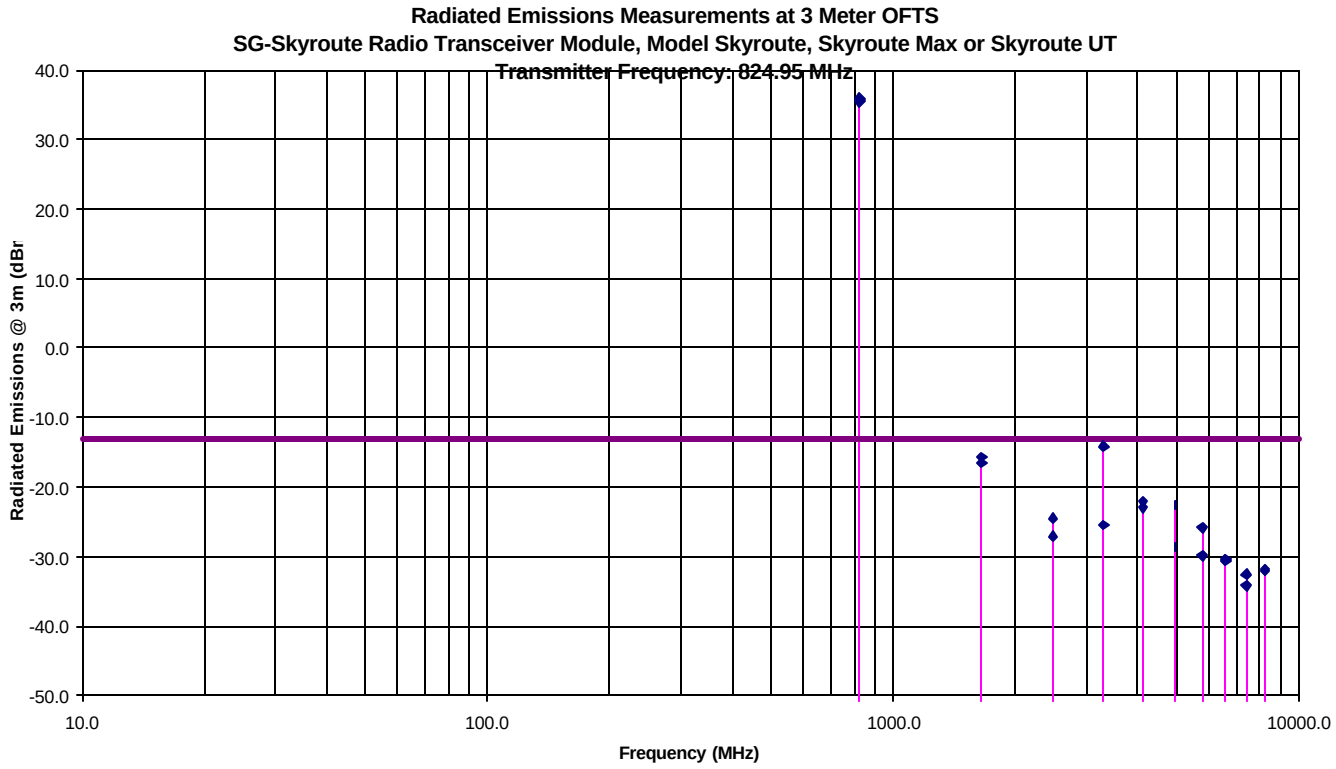
Please refer to Photos # 1 to 3 in Exhibit 10 for detailed information of the test setup

6.6.5. Test Data

6.6.5.1. Lowest Frequency (824.95 MHz)

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	ERP RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT @3m (dBm)	MARGIN (dB)	PASS/ FAIL
824.95	138.5	35.5 (ERP)	PEAK	V	38.5	-3.0	PASS
824.95	137.4	35.9 (ERP)	PEAK	H	38.5	-2.6	PASS
1649.90	81.8	-15.7	PEAK	V	-13.0	-2.7	PASS
1649.90	81.0	-16.5	PEAK	H	-13.0	-3.5	PASS
2474.85	73.0	-24.5	PEAK	V	-13.0	-11.5	PASS
2474.85	70.4	-27.1	PEAK	H	-13.0	-14.1	PASS
3299.80	83.4	-14.1	PEAK	V	-13.0	-1.1	PASS
3299.80	72.0	-25.5	PEAK	H	-13.0	-12.5	PASS
4124.75	74.6	-22.9	PEAK	V	-13.0	-9.9	PASS
4124.75	75.4	-22.1	PEAK	H	-13.0	-9.1	PASS
4949.70	68.9	-28.6	PEAK	V	-13.0	-15.6	PASS
4949.70	74.9	-22.6	PEAK	H	-13.0	-9.6	PASS
5774.65	67.7	-29.8	PEAK	V	-13.0	-16.8	PASS
5774.65	71.7	-25.8	PEAK	H	-13.0	-12.8	PASS
6599.60	67.1	-30.4	PEAK	V	-13.0	-17.4	PASS
6599.60	66.9	-30.6	PEAK	H	-13.0	-17.6	PASS
7424.55	63.3	-34.2	PEAK	V	-13.0	-21.2	PASS
7424.55	64.9	-32.6	PEAK	H	-13.0	-19.6	PASS
8249.50	65.6	-31.9	PEAK	V	-13.0	-18.9	PASS
8249.50	65.5	-32.0	PEAK	H	-13.0	-19.0	PASS

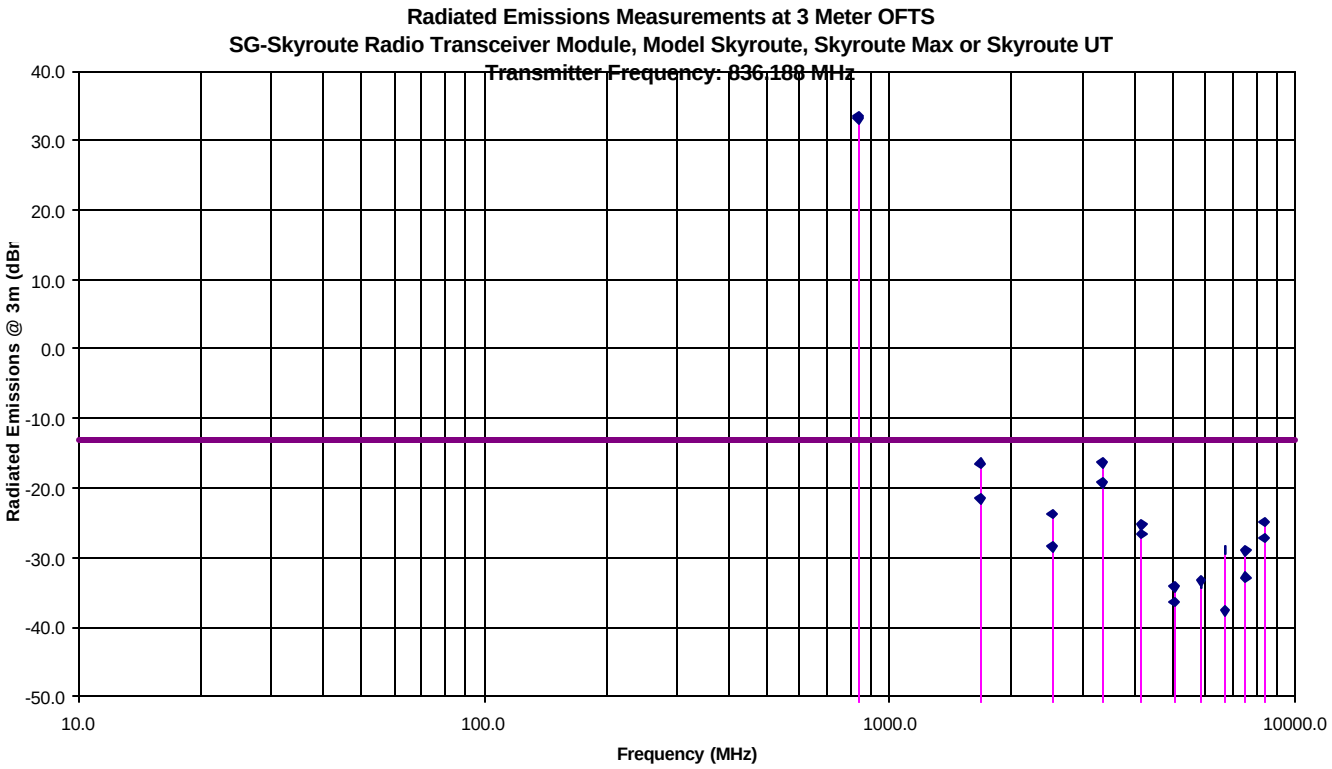
- The emissions were scanned from 10 MHz to 9 GHz and all emissions less than 20 dB below the limits were recorded.
- No rf emissions were observed in the base cellular band of 869-894 MHz with the EMI receiver noise floor set at least 90dBc.


Radiated Emissions Measurements at 3 Meter OFTS
SG-Skyroute Radio Transceiver Module, Model Skyroute, Skyroute Max or Skyroute UT
Transmitter Frequency: 824.95 MHz
Radiated Emissions @ 3m (dBr
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
10.0
100.0
1000.0
10000.0
Frequency (MHz)

6.6.5.2. Middle Frequency (836.188 MHz)

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	ERP RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT @3m (dBm)	MARGIN (dB)	PASS/ FAIL
836.19	137.4	33.5 (ERP)	PEAK	V	38.5	-5.0	PASS
836.19	136.6	33.2 (ERP)	PEAK	H	38.5	-5.3	PASS
1672.38	81.1	-16.4	PEAK	V	-13.0	-3.4	PASS
1672.38	76.0	-21.5	PEAK	H	-13.0	-8.5	PASS
2508.56	73.8	-23.7	PEAK	V	-13.0	-10.7	PASS
2508.56	69.1	-28.4	PEAK	H	-13.0	-15.4	PASS
3344.75	81.2	-16.3	PEAK	V	-13.0	-3.3	PASS
3344.75	78.3	-19.2	PEAK	H	-13.0	-6.2	PASS
4180.94	70.9	-26.6	PEAK	V	-13.0	-13.6	PASS
4180.94	72.3	-25.3	PEAK	H	-13.0	-12.3	PASS
5017.13	63.3	-34.2	PEAK	V	-13.0	-21.2	PASS
5017.13	61.1	-36.4	PEAK	H	-13.0	-23.4	PASS
5853.32	64.2	-33.3	PEAK	V	-13.0	-20.3	PASS
5853.32	63.7	-33.8	PEAK	H	-13.0	-20.8	PASS
6689.50	68.6	-28.9	PEAK	V	-13.0	-15.9	PASS
6689.50	59.9	-37.6	PEAK	H	-13.0	-24.6	PASS
7525.69	68.5	-29.0	PEAK	V	-13.0	-16.0	PASS
7525.69	64.7	-32.8	PEAK	H	-13.0	-19.8	PASS
8361.88	70.3	-27.2	PEAK	V	-13.0	-14.2	PASS
8361.88	72.6	-24.9	PEAK	H	-13.0	-11.9	PASS

- The emissions were scanned from 10 MHz to 9 GHz and all emissions less than 20 dB below the limits were recorded.
- No rf emissions were observed in the base cellular band of 869-894 MHz with the EMI receiver noise floor set at least 90dBc.


Radiated Emissions Measurements at 3 Meter OFTS
SG-Skyroute Radio Transceiver Module, Model Skyroute, Skyroute Max or Skyroute UT
Transmitter Frequency: 836.188 MHz
Radiated Emissions @ 3m (dBr
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
10.0
100.0
1000.0
10000.0
Frequency (MHz)

6.6.5.3. Highest Frequency (848.000 MHz)

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	ERP RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT @3m (dBm)	MARGIN (dB)	PASS/ FAIL
848.00	136.8	33.4	PEAK	V	38.5	-5.1	PASS
848.00	135.9	31.3	PEAK	H	38.5	-7.2	PASS
1696.00	82.3	-15.2	PEAK	V	-13.0	-2.2	PASS
1696.00	76.3	-21.2	PEAK	H	-13.0	-8.2	PASS
2544.00	67.4	-30.1	PEAK	V	-13.0	-17.1	PASS
2544.00	68.4	-29.1	PEAK	H	-13.0	-16.1	PASS
3392.00	81.7	-15.8	PEAK	V	-13.0	-2.8	PASS
3392.00	74.0	-23.5	PEAK	H	-13.0	-10.5	PASS
4240.00	65.7	-31.8	PEAK	V	-13.0	-18.8	PASS
4240.00	61.8	-35.7	PEAK	H	-13.0	-22.7	PASS
5088.00	63.1	-34.4	PEAK	V	-13.0	-21.4	PASS
5088.00	59.6	-37.9	PEAK	H	-13.0	-24.9	PASS
5936.00	62.3	-35.2	PEAK	V	-13.0	-22.2	PASS
5936.00	61.8	-35.7	PEAK	H	-13.0	-22.7	PASS
6784.00	64.8	-32.7	PEAK	V	-13.0	-19.7	PASS
6784.00	61.4	-36.1	PEAK	H	-13.0	-23.1	PASS
7632.00	65.3	-32.2	PEAK	V	-13.0	-19.2	PASS
7632.00	63.9	-33.6	PEAK	H	-13.0	-20.6	PASS
8480.00	66.5	-31.0	PEAK	V	-13.0	-18.0	PASS
8480.00	64.4	-33.1	PEAK	H	-13.0	-20.1	PASS

- The emissions were scanned from 10 MHz to 9 GHz and all emissions less than 20 dB below the limits were recorded.
- No rf emissions were observed in the base cellular band of 869-894 MHz with the EMI receiver noise floor set at least 90dBc.

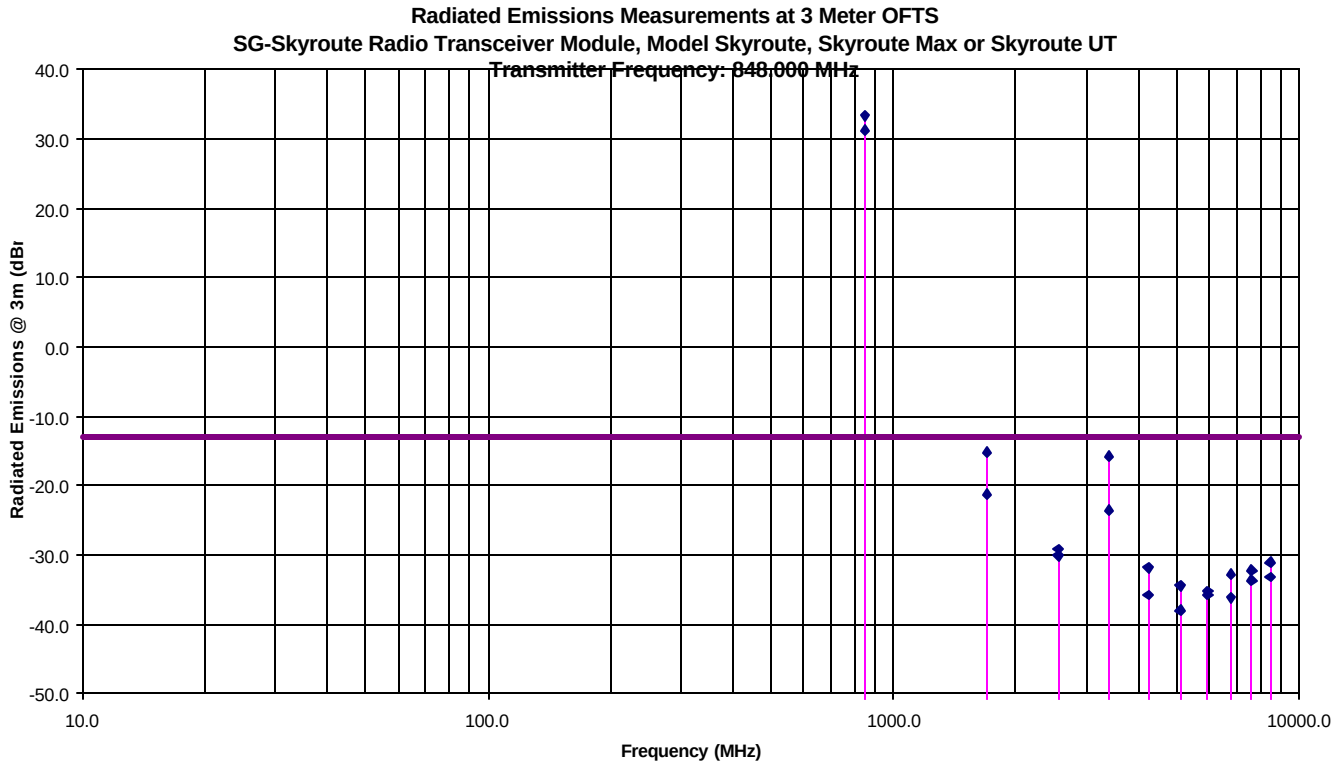

Radiated Emissions Measurements at 3 Meter OFTS
SG-Skyroute Radio Transceiver Module, Model Skyroute, Skyroute Max or Skyroute UT
Transmitter Frequency: 848.000 MHz
Radiated Emissions @ 3m (dBr
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
10.0
100.0
1000.0
10000.0
Frequency (MHz)

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. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	±1.5	±1.5
LISN coupling specification	Rectangular	±1.5	±1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	±0.3	±0.5
Mismatch: Receiver VRC Γ_1 = 0.03 LISN VRC Γ_R = 0.8(9 kHz) 0.2 (30 MHz) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	±0.2	±0.3
System repeatability	Std. deviation	±0.2	±0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	±1.25	±1.30
Expanded uncertainty U	Normal (k=2)	±2.50	±2.60

Sample Calculation for Measurement Accuracy in 150 kHz to 30 MHz Band:

$u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30$ dB

$U = 2u_c(y) = \pm 2.6$ dB

7.2. 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 Directivit	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 Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	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.

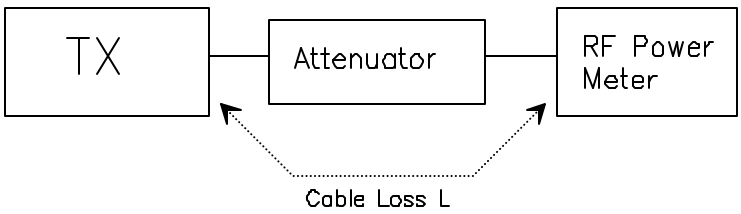
Step 2: Calculation of Average EIRP. See Figure 1

- 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

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

- 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.

- The substitution antenna gain and cable loss were added to the signal generator level for the corrected ERP level.
- Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
- 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

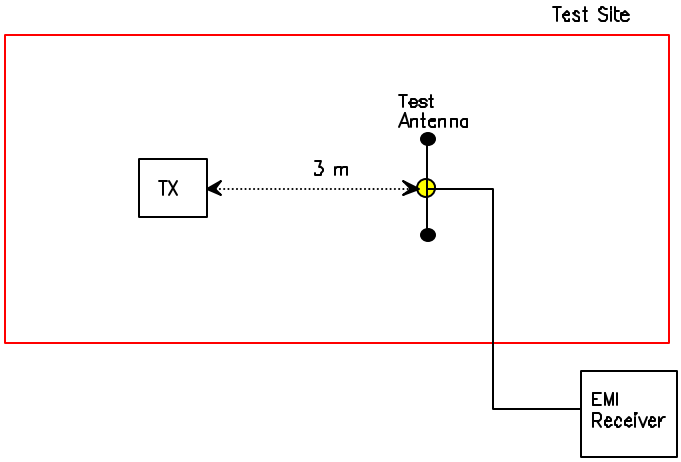
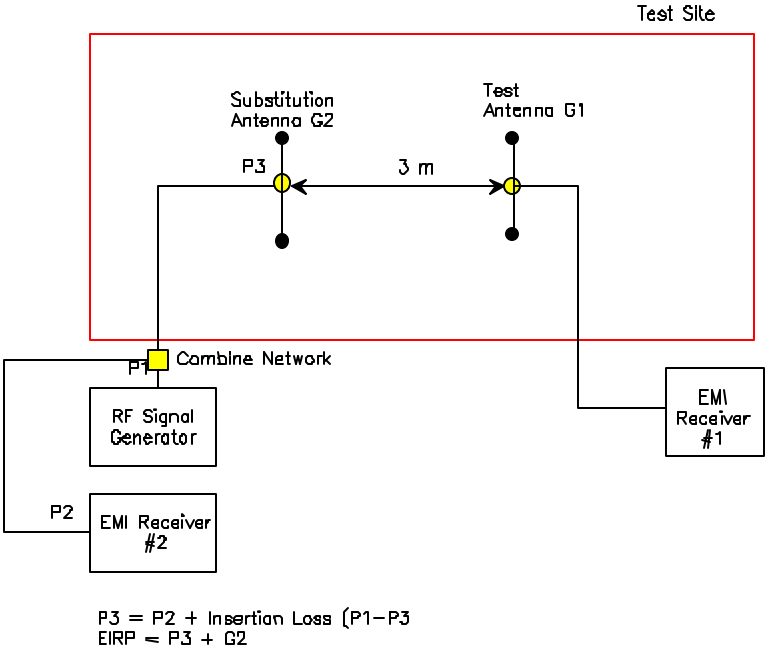


Figure 3



8.2. FREQUENCY STABILITY

Refer to FCC @ 2.995.

(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.

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 @ 2.989(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 @ 2.989(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 spurious emissions:

When operating in the radio telephony mode or the supervisory audio Tone mode:
- Any emission not more than 45 kHz removed from the carrier frequency: 300 Hz
- Any emission more than 45 kHz removed from the carrier frequency: 30 kHz

When operating in the wideband data mode or the signaling tone mode:
- Any emission not more than 60 kHz removed from the carrier frequency: 300 Hz
- Any emission more than 60 kHz removed from the carrier frequency: 30 kHz

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 @ 2.989, 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. 2.997 - 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. 2.991 - 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 2.989 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 @ 2.989, 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. 2.997 - 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. 2.993 - 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 2.989(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:

- The measurements was performed with standard modulation
- Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
- The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
- The biconilog Antenna (20 MHz to 1 GHz) or Horn Antenna (1 GHz to 18 GHz) was used for measuring.
- 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.
- The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
- The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
- The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.

- 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