

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.



June 18, 2001

KAVAL WIRELESS TECHNOLOGIES INC.

60 Gough Road
Markham, Ontario
Canada, L3R 8X7

Attn.: Mr. Alan Aslett

Subject: Certification Testing in accordance with FCC CFR 47, Parts 2, 22 and 90 - Non-Broadcast Bi-directional Radio Amplifiers operating in the frequency band 806 – 940 MHz.

**Product: LINKNET LNKA800 RF 800-900 MHZ AMPLIFIER
MODULE**

Model: LNKA 800

Dear Mr. Aslett,

The product sample has been tested in accordance with **FCC CFR 47, Parts 2, 22 and 90 - Non-Broadcast Bi-directional Radio Amplifiers Operating in the frequency bands 806 – 940 MHz.**, and the results and observation were recorded in the engineering report, Our File No.: KTI-017FCC

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

Yours truly,



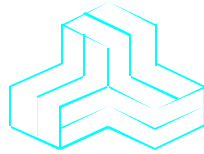
Tri Minh Luu, P.Eng
Vice President - Engineering

Encl.

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

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

ENGINEERING TEST REPORT



LINKNET LNKA800 RF 800-900 MHZ AMPLIFIER MODULE
(806 - 940 MHz)
Model No.: LNKA 800
FCC ID: H6M-LNKA800

Applicant: **KAVAL WIRELESS TECHNOLOGIES INC.**
60 Gough Road
Markham, Ontario
Canada, L3R 8X7

Tested in Accordance With

Federal Communications Commission (FCC)
CFR 47, Parts 2, 22 and 90

UltraTech's File No.: KTI-017FCC

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

Date: June 18, 2001



Report Prepared by: Tri M. Luu

Tested by: Mr. Hung Trinh, EMI/RFI Technician

Issued Date: June 18, 2001

Test Dates: May 24 – June 07, 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	<ul style="list-style-type: none"> • 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
1	Test Report - Plots of Measurement Data	Plots # 1 to 271	OK OK
2	Test Setup Photos	Photos # 1 to 4	OK
3	External Photos of EUT	Photos # 1 to 6	OK
4	Internal Photos of EUT	Photos of 1 to 12	OK
5	Cover Letters	<ul style="list-style-type: none"> • 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	ID Label/Location Info	ID Label Location of ID Label	OK OK
7	Block Diagrams	Refer to Users Manual , Annex 11	OK
8	Schematic Diagrams	Schematic diagrams # 1 to 2 (SCH000000028 & SCH000000045)	OK
9	Parts List/Tune Up Info	None	None
10	Operational Description	Operation Description of EUT	OK
11	Users Manual		OK

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EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2, 22 and 90
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2, 22 & 90
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency bands 806 – 940 MHz (including FCC certifiable bands: 824-849, 869-894, 896-901, 935-940, 929-930, 806-821, 821-824, 851-866, 866-869 MHz).
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 2, 22, 24 , 90	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

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EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	KAVAL WIRELESS TECHNOLOGIES INC.
Address:	60 Gough Road Markham, Ontario Canada, L3R 8X7
Contact Person:	Mr. Alan Aslett Phone #: 905-946-3397 Fax #: 905-946-3392 Email Address: asslet@kaval.com

MANUFACTURER	
Name:	KAVAL WIRELESS TECHNOLOGIES INC.
Address:	60 Gough Road Markham, Ontario Canada, L3R 8X7
Contact Person:	Mr. Alan Aslett Phone #: 905-946-3397 Fax #: 905-946-3392 Email Address: asslet@kaval.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:	KAVAL WIRELESS TECHNOLOGIES INC.
Product Name:	LINKNET LNKA800 RF 800-900 MHZ AMPLIFIER MODULE
Model Name or Number:	LNKA 800
Serial Number:	Pre-production
Type of Equipment:	Non-broadcast Bi-directional Amplifier
External Power Supply:	None
Transmitting/Receiving Antenna Type:	Not provided by the manufacturer
Primary User Functions of EUT:	Bi-directional amplifier

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3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile & Base station (fixed use) The LNKA800 will be physically mounted indoors. The SatelLink LNKFIB-R01. It transmit indoors in the downlink direction, and outdoors in the uplink direction.
Intended Operating Environment:	[x] Commercial [x] Light Industry & Heavy Industry
Power Supply Requirement:	120V 60Hz
Operating Frequency Range & RF Nominal Output Power:	<ul style="list-style-type: none"> ▪ 806 – 940 MHz * 1 input/output signal: 5.0 Watts * 2 input/output signals: 0.66 Watts * 3 input/output signals: 0.36 Watts * 4 input/output signals: 0.34 Watts <p>Please Pages 6 and 8 of Users Manual for recommended maximum RF Output Powers</p>
Gain	+34 to 84 dB
RF Output Impedance:	50 Ohms
Channel Spacing:	N/A
Occupied Bandwidth (99%):	N/A
Emission Designation*:	EXTENDER
Antenna Connector Type:	SMA

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	1 RF Input Port	1	SMA	Shielded
2	1 RF Output Port	1	SMA	Shielded

3.5. ANCILLARY EQUIPMENT

None

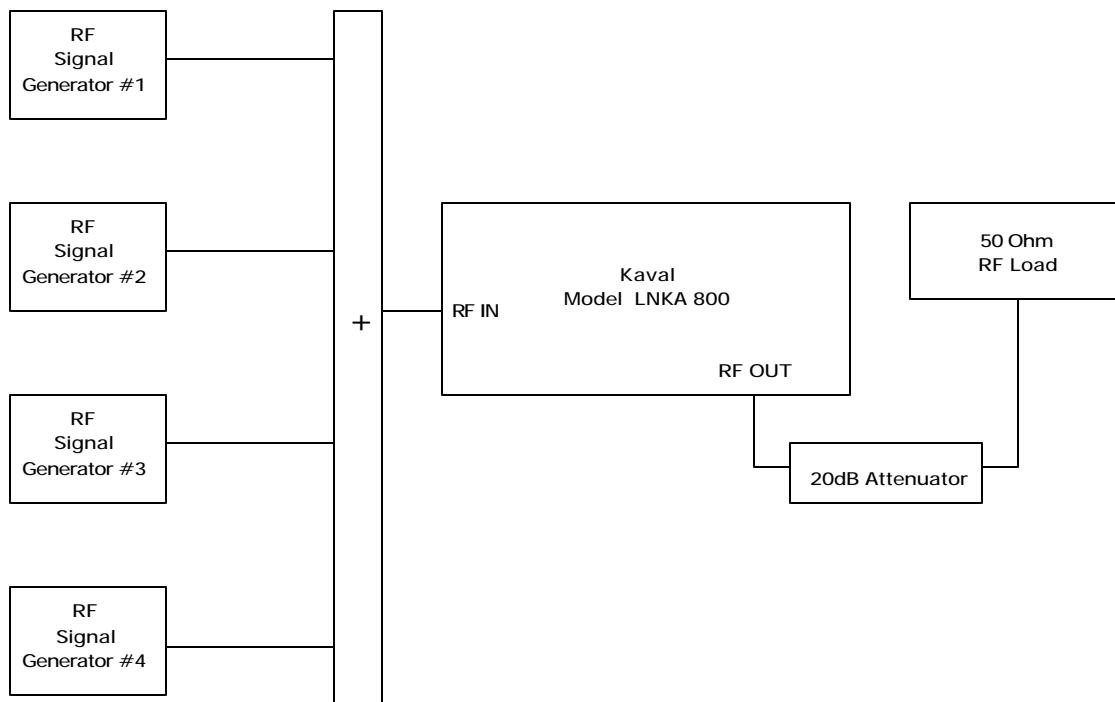
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3.6. TEST SETUP



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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:	120V 60Hz

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:	Utility software provided by Kaval was used for selecting frequency bands of the amplifier.
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):	Near lowest, near middle & near highest frequencies in each frequency bands that the transmitter covers:
<ul style="list-style-type: none"> ▪ 824 – 849 MHz ▪ 869 – 894 MHz ▪ 896 – 901 MHz ▪ 935 – 940 MHz ▪ 929 – 930 MHz ▪ 806 – 821 MHz ▪ 821 – 824 MHz ▪ 851 – 866 MHz ▪ 866 – 869 MHz 	<ul style="list-style-type: none"> ▪ Lowest, middle and highest ▪ Lowest, middle and highest ▪ Lowest and highest ▪ Lowest and highest ▪ Middle ▪ Lowest, middle and highest ▪ Lowest and highest ▪ Lowest, middle and highest ▪ Lowest, middle and highest
Transmitter Wanted Output Test Signals:	<ul style="list-style-type: none"> ▪ The EUT was adjusted for maximum gain output by the manufacturer. ▪ The RF input signal sources is FM Modulated with Analog & Digital ▪ External
RF Input Level:	Maximum specified by the manufacturer (-45.0 dBm)

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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, 90.205 & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	N/A for base station
90.213 & 2.1055	Frequency Stability	Not applicable for Amplifier since the output signal tracks input signal exactly.
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	Not applicable for Amplifier since the output signal tracks input signal exactly.
90.210 & 2.1047(b)	Modulation Limiting	Not applicable for Amplifier since the output signal tracks input signal exactly.
22.217, 90.210 & 2.1049	Emission Limitation & Emission Mask	The output signal tracks input signal exactly. Therefore, only comparison tests were conducted for proof.
22.217, 90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
22.217, 90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
LINKNET LNKA800 RF 800-900 MHZ AMPLIFIER MODULE, Model No.: LNKA 800, by KAVAL WIRELESS TECHNOLOGIES INC. has also been tested and found to comply with FCC Part 15, Subpart B - Radio Receivers and Class A Digital Devices . The engineering test report has been documented and kept in file and it is available anytime upon FCC request.		

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5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

5.4. DEVIATION OF STANDARD TEST PROCEDURES

None

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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.

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6.5. RF POWER OUTPUTS & INTERMODULATION @ FCC 2.1046, 22.913 & 90.205

6.5.1. Limits

Please refer to FCC CFR 47, Paragraphs 22.913 and 90.205 for power limits in different frequency bands:

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 power meter 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
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
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
Synthesized RF Signal Generator	Gigatronic	6061A	5130408	10kHz – 1050 MHz

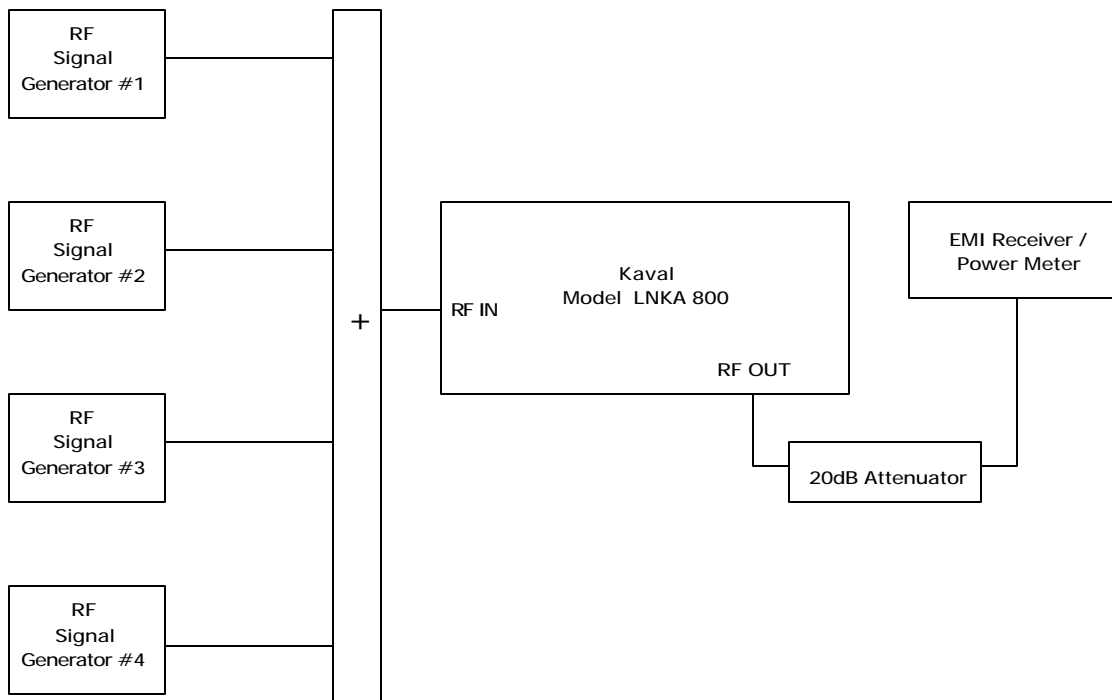
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6.5.4. Test Arrangement



6.5.5. Plots

- Please refer to Plots # 104 to 187 for measurement details
- Plots # 85 – 103 show the 20 dB bandwidths the amplifier with respect to its switching bands.

6.5.6. Test Data

Remark:

- Unmodulated output power is measured through out the power measurement since this power amplifier's rf output power characteristics are independent on modulation.
- Please refer to Page 6 & 8 of the Users' Manual.

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6.5.6.1. Operation in 824 – 849 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
824	Un-modulated	1	+37.0	+37.0
824 & 24.03	Un-modulated	2	+27.7	+26.0
824, 824.03, 824.06	Un-modulated	3	+25.5	+24.0
824, 824.03, 824.06 & 824.09	Un-modulated	4	+24.4	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
826.5	Un-modulated	1	+36.8	+37.0
836.5 & 836.53	Un-modulated	2	+27.6	+26.0
836.47, 836.50 & 836.53	Un-modulated	3	+25.5	+24.0
836.44, 836.47, 836.50 & 836.5	Un-modulated	4	+24.4	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
849	Un-modulated	1	+36.8	+37.0
848.97 & 489	Un-modulated	2	+27.5	+26.0
848.94, 848.97 & 849	Un-modulated	3	+25.6	+24.0
848.91, 848.94, 848.97 & 849	Un-modulated	4	+24.1	+22.0

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6.5.6.2. Operation in 869 - 894 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
869	Un-modulated	1	+37.0	+37.0
869 & 869.03	Un-modulated	2	+27.5	+26.0
869, 869.03 & 869.06	Un-modulated	3	+25.4	+24.0
869, 869.03, 869.06 & 869.09	Un-modulated	4	+24.5	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
881.5	Un-modulated	1	+36.9	+37.0
881.5 & 881.53	Un-modulated	2	+27.5	+26.0
881.47, 881.50 & 881.53	Un-modulated	3	+25.5	+24.0
881.44, 881.47, 881.50 & 881.53	Un-modulated	4	+24.7	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
894	Un-modulated	1	+36.8	+37.0
893.97 & 894	Un-modulated	2	+27.7	+26.0
893.97, 893.97 & 894	Un-modulated	3	+25.6	+24.0
893.91, 893.94, 893.97 & 894	Un-modulated	4	+24.3	+22.0

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6.5.6.3. Operation in 896 - 901 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
896	Un-modulated	1	+36.9	+37.0
896 & 896.0125	Un-modulated	2	+27.3	+26.0
896, 896.0125, 896.025	Un-modulated	3	+25.1	+24.0
896, 896.0125, 896.025 & 896.0375	Un-modulated	4	+24.8	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
901	Un-modulated	1	+37.0	+37.0
900.9875 & 901	Un-modulated	2	+28.2	+26.0
900.975, 900.9875 & 901	Un-modulated	3	+25.6	+24.0
900.9625, 900.975, 900.9875 & 901	Un-modulated	4	+25.3	+22.0

6.5.6.4. Operation in 929 - 930 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
929.5	Un-modulated	1	+37.0	+37.0
929.5 & 929.525	Un-modulated	2	+27.9	+26.0
929.475, 929.5 & 929.525	Un-modulated	3	+25.4	+24.0
929.45, 929.475, 929.5 & 929.525	Un-modulated	4	+23.6	+22.0

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6.5.6.5. Operation in 935 - 940 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
935	Un-modulated	1	+37.0	+37.0
935 & 935.0125	Un-modulated	2	+28.1	+26.0
935, 935.0125 & 935.025	Un-modulated	3	+25.4	+24.0
935, 935.0125, 935.025 & 935.0375	Un-modulated	4	+23.6	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
940	Un-modulated	1	+36.8	+37.0
939.9875 & 940	Un-modulated	2	+28.0	+26.0
939.975, 939.9875 & 940	Un-modulated	3	+25.3	+24.0
939.9625, 939.975, 939.9875 & 940	Un-modulated	4	+23.6	+22.0

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6.5.6.6. Operation in 806 - 821 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
806	Un-modulated	1	+36.9	+37.0
806 & 806.025	Un-modulated	2	+27.6	+26.0
806, 806.025 & 806.05	Un-modulated	3	+25.1	+24.0
806, 806.025, 806.05 & 806.075	Un-modulated	4	+23.3	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
813.5	Un-modulated	1	+36.7	+37.0
813.5 & 813.525	Un-modulated	2	+27.6	+26.0
813.475, 813.5 & 813.525	Un-modulated	3	+25.3	+24.0
813.475, 813.5, 813.525 & 813.55	Un-modulated	4	+24.5	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
821	Un-modulated	1	+36.9	+37.0
820.975 & 821	Un-modulated	2	+27.3	+26.0
820.95, 820.975 & 821	Un-modulated	3	+24.9	+24.0
820.925, 820.95, 820.975 & 821	Un-modulated	4	+23.8	+22.0

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6.5.6.7. Operation in 821 - 824 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
821	Un-modulated	1	+36.9	+37.0
821 & 821.0125	Un-modulated	2	+27.2	+26.0
821, 821.0125 & 821.025	Un-modulated	3	+24.6	+24.0
821, 821.0125, 821.025 & 821.0375	Un-modulated	4	+23.7	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
824	Un-modulated	1	+37.0	+37.0
823.9875 & 824	Un-modulated	2	+27.4	+26.0
823.975, 823.9875 & 824	Un-modulated	3	+24.8	+24.0
823.9625, 823.975, 823.9875 & 824	Un-modulated	4	+23.3	+22.0

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6.5.6.8. Operation in 851 - 866 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
851	Un-modulated	1	+37.0	+37.0
851 & 851.025	Un-modulated	2	+26.8	+26.0
851, 851.025 & 851.05	Un-modulated	3	+24.1	+24.0
851, 851.025, 851.05 & 851.075	Un-modulated	4	+23.0	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
858.5	Un-modulated	1	+37.0	+37.0
858.475 & 858.5	Un-modulated	2	+27.0	+26.0
858.475, 858.5 & 858.525	Un-modulated	3	+24.4	+24.0
858.45, 858.475, 858.5 & 858.525	Un-modulated	4	+22.9	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
866	Un-modulated	1	+37.0	+37.0
865.975 & 866	Un-modulated	2	+26.8	+26.0
865.95, 865.975 & 866	Un-modulated	3	+24.0	+24.0
865.925, 865.95, 865.975 & 866	Un-modulated	4	+22.3	+22.0

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6.5.6.9. Operation in 866 - 869 MHz Band

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
866	Un-modulated	1	+37.0	+37.0
866 & 866.0125	Un-modulated	2	+26.9	+26.0
866, 866.0125 & 866.025	Un-modulated	3	+24.0	+24.0
866, 866.0125, 866.025 & 866.0375	Un-modulated	4	+22.3	+22.0

Fundamental Frequency (MHz)	Modulation *	Number of RF I/O Channels	Measured Peak Power (dBm)	Manufacturer's Recommended Power (dBm)
869	Un-modulated	1	+37.0	+37.0
868.9875 & 869	Un-modulated	2	+26.8	+26.0
868.975, 868.9875 & 869	Un-modulated	3	+24.1	+24.0
868.9625, 868.975, 868.9875 & 869	Un-modulated	4	+22.2	+22.0

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6.6. EMISSION MASK @ FCC 2.1049, 22.217 & 90.210

6.6.1. Limits

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

Frequency Range (MHz)	FCC Rules	FCC Applicable Mask
824-849 / 869-894 MHz (Portable/Mobile & Base Cellular)	Part 22	<ul style="list-style-type: none"> 22.217(b) for Analog Voice – Mask B 22.217(d) for Digital – Mask D
896-901 / 935-940 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (i) for Analog Voice – Mask I 90.210 (j) for Digital – Mask J
929-930 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G
806-821 / 851-866 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G
821-824 / 866-869 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (h) for Digital – Mask H
806-821 / 851-866 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G

6.6.2. Method of Measurements

Refer to FCC Rules 2.1049, 22.217 and 90.210

6.6.3. 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

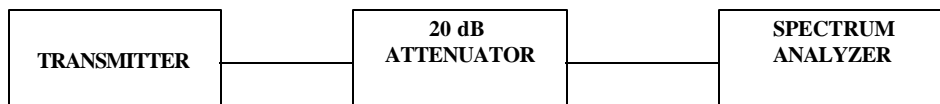
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6.6.4. Test Arrangement



6.6.5. Test Data

Note: Since the output signal tracks input signal exactly, only comparison tests were conducted for proof

Conform. Please refer to Plot # 1 through # 84 in Annex 1 for Details of measurements

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6.7. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 2.1049, 22.217 & 90.210

6.7.1. Limits

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

Frequency Range (MHz)	FCC Rules	FCC Applicable Mask
824-849 / 869-894 MHz (Portable/Mobile & Base Cellular)	Part 22	<ul style="list-style-type: none"> 22.217(b) for Analog Voice – Mask B 22.217(d) for Digital – Mask D
896-901 / 935-940 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (i) for Analog Voice – Mask I 90.210 (j) for Digital – Mask J
929-930 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G
806-821 / 851-866 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G
821-824 / 866-869 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (h) for Digital – Mask H
806-821 / 851-866 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G

Note: The Lowest Limits from the above Rules were used, Limit = -20 dBm

6.7.2. Method of Measurements

Refer to Exhibit 8 § 8.1 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
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz

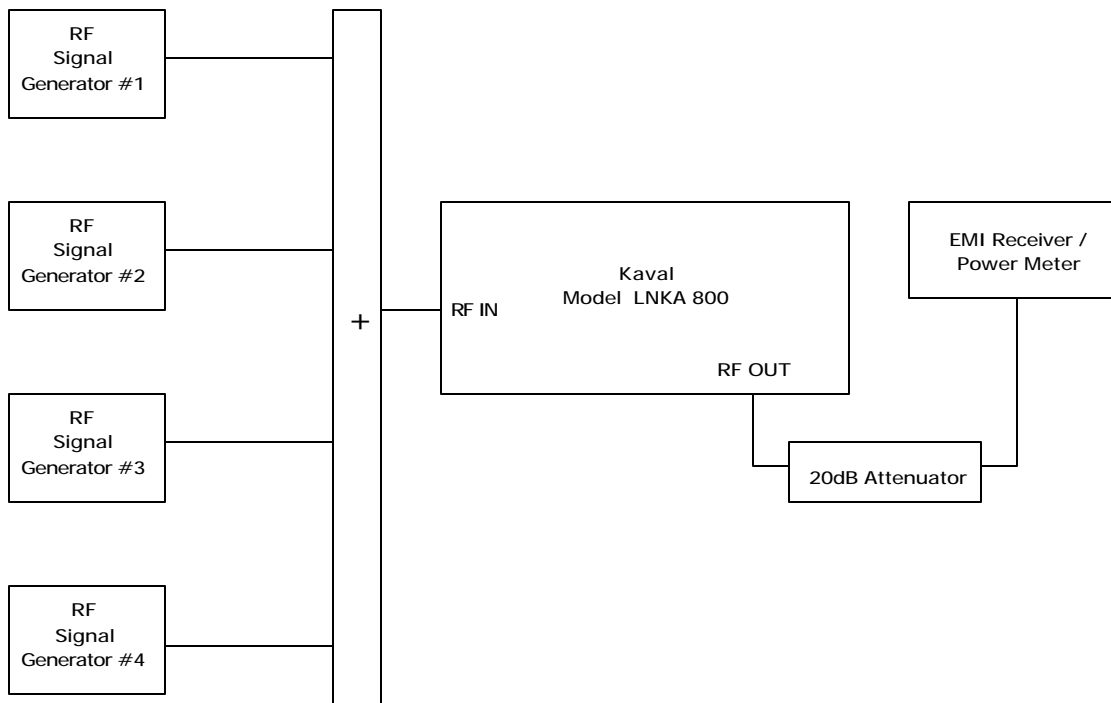
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6.7.4. Test Arrangement



6.7.5. Plots

Please refer to plots # 188 through # 271 in Annex 1 for details of measurements

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6.7.6. Test Data

6.7.6.1. Operation in 824 – 849 MHz Band

6.7.6.1.1. Lowest Channel Frequency

Fundamental Frequency: 824 MHz (1 Channel Input/Output)				
RF Output Power: +37 dBm				
Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
2466.00	-49.3	-20.0	-29.3	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 824, 824.03, 824.06 & 824.09 MHz (4 Channel Inputs/Outputs)				
RF Output Power: +24.4 dBm per Channel				
Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.1.2. Middle Channel Frequency

Fundamental Frequency: 836.5 MHz				
RF Output Power: +37.0 dBm				
Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

Fundamental Frequency: 836.44, 836.47, 836.50 & 836.5 MHz				
RF Output Power: +24.4 dBm per channel				
Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.1.3. Highest Channel Frequency

Fundamental Frequency: 849 MHz RF Output Power: +37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
2543.00	-49.6	-20.0	-29.6	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 848.91, 848.94, 848.97 & 849 MHz RF Output Power: +24.1 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.2. Operation in 869 - 894 MHz Band

6.7.6.2.1. Lowest Channel Frequency

Fundamental Frequency: 869 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
2607.00	-49.7	-20.0	-29.7	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 869, 869.03, 869.06 & 869.09 MHz RF Output Power: +24.5 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.2.2. Middle Channel Frequency

Fundamental Frequency: 881.5 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1759.00	-51.0	-20.0	-31.0	PASS
2633.00	-48.1	-20.0	-28.1	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 881.44, 881.47, 881.5 & 881.53 MHz RF Output Power: +24.7 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.2.3. Highest Channel Frequency

Fundamental Frequency: 894 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 893.91, 893.94, 893.97 & 894 MHz RF Output Power: +24.3 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.3. Operation in 896 - 901 MHz Band

6.7.6.3.1. Lowest Channel Frequency

Fundamental Frequency: 896 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

Fundamental Frequency: 896, 896.0125, 896.025 & 896.0375 MHz RF Output Power: +24.8 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.3.2. Highest Channel Frequency

Fundamental Frequency: 901 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

Fundamental Frequency: 900.9625, 900.975, 900.9875 & 901 MHz RF Output Power: +25.3 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.4. Operation in 935 - 940 MHz Band

6.7.6.4.1. Lowest Channel Frequency

Fundamental Frequency: 935 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1861.00	-50.1	-20	-30.1	PASS
2800.00	-50.4	-20	-30.4	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 935, 935.0125, 935.025 & 935.0375 MHz RF Output Power: +24.7 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.4.2. Highest Channel Frequency

Fundamental Frequency: 940 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1974.00	-50.6	-20	-30.6	PASS
2813.00	-51.1	-20	-31.1	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 939.9625, 939.975, 939.9875 & 940 MHz RF Output Power: +23.6 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.5. Operation in 929 - 930 MHz Band

6.7.6.5.1. Middle Channel Frequency

Fundamental Frequency: 929.5 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1849.00	-51.6	-20	-31.6	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 929.45, 929.475, 929.5 & 929.525 MHz RF Output Power: +23.6 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.6. Operation in 806 - 821 MHz Band

6.7.6.6.1. Lowest Channel Frequency

Fundamental Frequency: 806 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
4021.00	-52.4	-20	-32.4	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 806, 806.025, 806.05 & 806.075 MHz RF Output Power: +23.3 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.6.2. Middle Channel Frequency

Fundamental Frequency: 813.5 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1617.00	-51.7	-20	-31.7	PASS
2453.00	-52.1	-20	-32.1	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 813.475, 813.5, 813.525 & 813.55 MHz RF Output Power: +24.5 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.6.3. Highest Channel Frequency

Fundamental Frequency: 821 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1630.00	-50.1	-20	-30.1	PASS
2453.00	-49.3	-20	-29.3	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 820.925, 820.95, 820.975 & 821 MHz RF Output Power: +24.7 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.7. Operation in 821 - 824 MHz Band

6.7.6.7.1. Lowest Channel Frequency

Fundamental Frequency: 821 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
2453.00	-48.8	-20	-28.8	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 820.925, 820.95, 820.975 & 821 MHz RF Output Power: +23.7 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.7.2. Highest Channel Frequency

Fundamental Frequency: 824 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1643.00	-49.6	-20	-29.6	PASS
2466.00	-48.8	-20	-28.8	PASS
4934.00	-49.8	-20	-29.8	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 823.9625, 823.975, 823.9875 & 824 MHz RF Output Power: +23.3 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.8. Operation in 851 - 866 MHz Band

6.7.6.8.1. Lowest Channel Frequency

Fundamental Frequency: 851 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

Fundamental Frequency: 851, 851.025, 851.05 & 851.075 MHz RF Output Power: +23.0 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.8.2. Middle Channel Frequency

Fundamental Frequency: 858.5 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1707.00	-50.1	-20	-30.1	PASS
2569.00	-54.3	-20	-34.3	PASS
5153.00	-52.8	-20	-32.8	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 858.45, 858.475, 858.5 & 858.525 MHz RF Output Power: +22.9 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.8.3. Highest Channel Frequency

Fundamental Frequency: 866 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1720.00	-49.6	-20	-29.6	PASS
2594.00	-53.5	-20	-33.5	PASS
5204.00	-50.3	-20	-30.3	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 865.925, 865.95, 865.975 & 866 MHz RF Output Power: +22.3 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.7.6.9. Operation in 866 - 869 MHz Band

6.7.6.9.1. Lowest Channel Frequency

Fundamental Frequency: 866 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1720.00	-49.1	-20	-29.1	PASS
2594.00	-52.0	-20	-32.0	PASS
2191.00	-46.2	-20	-26.2	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 865.925, 865.95, 865.975 & 866 MHz RF Output Power: +22.3 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

6.7.6.9.2. Highest Channel Frequency

Fundamental Frequency: 869 MHz RF Output Power: + 37 dBm Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
1733.00	-50.2	-20	-30.2	PASS
2607.00	-43.0	-20	-23.0	PASS
5204.00	-38.4	-20	-18.4	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 30 dB below the limits were recorded.				

Fundamental Frequency: 868.9625, 868.975, 868.9875 & 869 MHz RF Output Power: +22.2 dBm per channel Modulation: unmodulated				
Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
10 – 10,000	<<	-20.0	<<	Pass
The emissions were scanned from 10 MHz to 10 GHz and no significant rf emissions were found.				

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6.8. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 2.1049, 22.217 & 90.210

6.8.1. Limits

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

Frequency Range (MHz)	FCC Rules	FCC Applicable Mask
824-849 / 869-894 MHz (Portable/Mobile & Base Cellular)	Part 22	<ul style="list-style-type: none"> 22.217(b) for Analog Voice – Mask B 22.217(d) for Digital – Mask D
896-901 / 935-940 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (i) for Analog Voice – Mask I 90.210 (j) for Digital – Mask J
929-930 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G
806-821 / 851-866 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G
821-824 / 866-869 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (h) for Digital – Mask H
806-821 / 851-866 MHz	Part 90	<ul style="list-style-type: none"> 90.210 (b) for Analog Voice – Mask B 90.210 (g) for Digital – Mask G

Note: The Lowest Limits from the above Rules were used, Limit = -20 dBm

6.8.2. Method of Measurements

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

6.8.3. 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

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6.8.4. Test Arrangement

Refer to Photograph # 1 and 2 in Annex 2 for detailed test setup.

6.8.5. Test Data

REMARK: WORST LIMIT = -20 dBm WAS APPLIED THOROUGHOUT DIFFERENT FREQUENCY BANDS

6.8.5.1. Operation in 824 – 849 MHz Band

6.8.5.1.1. Lowest Channel Frequency

Fundamental Frequency: 824 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1648.00	45.5	-52.0	PEAK	V	-20.0	-32.0	PASS
1648.00	44.3	-53.2	PEAK	H	-20.0	-33.2	PASS
4944.00	49.1	-48.4	PEAK	V	-20.0	-28.4	PASS
4944.00	48.7	-48.8	PEAK	H	-20.0	-28.8	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.1.2. Middle Channel Frequency

Fundamental Frequency: 836.5 MHz							
RF Output Power: +37 dBm dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1673.00	55.5	-42.0	PEAK	V	-20.0	-22.0	PASS
1673.00	61.9	-35.6	PEAK	H	-20.0	-15.6	PASS
5019.00	54.4	-43.1	PEAK	V	-20.0	-23.1	PASS
5019.00	56.8	-40.7	PEAK	H	-20.0	-20.7	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

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6.8.5.1.3. Highest Channel Frequency

Fundamental Frequency: 849 MHz RF Output Power: +37.0 dBm Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
1698.00	55.5	-42.0	PEAK	V	-20.0	-22.0	PASS
1698.00	61.9	-35.6	PEAK	H	-20.0	-15.6	PASS
5094.00	52.2	-45.3	PEAK	V	-20.0	-25.3	PASS
5094.00	49.0	-48.5	PEAK	H	-20.0	-28.5	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.2. Operation in 869 - 894 MHz Band

6.8.5.2.1. Lowest Channel Frequency

Fundamental Frequency: 869 MHz RF Output Power: +37.0 dBm Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
10 – 10,000	<<	<<		V & H	-20.0	<<	PASS
The emissions were scanned from 10 MHz to 10 GHz and all no significant emissions.							

6.8.5.2.2. Middle Channel Frequency

Fundamental Frequency: 881.5 MHz RF Output Power: +37 dBm Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
10 – 10,000	<<	<<		V & H	-20.0	<<	PASS
The emissions were scanned from 10 MHz to 10 GHz and all no significant emissions.							

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6.8.5.2.3. Highest Channel Frequency

Fundamental Frequency: 894 MHz RF Output Power: +37 dBm Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
10 – 10,000	<<	<<		V & H	-20.0	<<	PASS
The emissions were scanned from 10 MHz to 10 GHz and all no significant emissions.							

6.8.5.3. Operation in 896 - 901 MHz Band

6.8.5.3.1. Lowest Channel Frequency

Fundamental Frequency: 869 MHz RF Output Power: +37.0 dBm Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
10 – 10,000	<<	<<		V & H	-20.0	<<	PASS
The emissions were scanned from 10 MHz to 10 GHz and all no significant emissions.							

6.8.5.3.2. Highest Channel Frequency

Fundamental Frequency: 901 MHz RF Output Power: +37 dBm Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
10 – 10,000	<<	<<		V & H	-20.0	<<	PASS
The emissions were scanned from 10 MHz to 10 GHz and all no significant emissions.							

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6.8.5.4. Operation in 935 - 940 MHz Band

6.8.5.4.1. Lowest Channel Frequency

Fundamental Frequency: 935 MHz							
RF Output Power: +37.0 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
1870.00	42.7	-54.8	PEAK	V	-20.0	-34.8	PASS
1870.00	41.8	-55.7	PEAK	H	-20.0	-35.7	PASS
2805.00	45.2	-52.3	PEAK	V	-20.0	-32.3	PASS
2805.00	45.2	-52.3	PEAK	H	-20.0	-32.3	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.4.2. Highest Channel Frequency

Fundamental Frequency: 940 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
1880.00	42.8	-54.7	PEAK	V	-20.0	-34.7	PASS
1880.00	42.8	-54.7	PEAK	H	-20.0	-34.7	PASS
2820.00	43.3	-54.2	PEAK	V	-20.0	-34.2	PASS
2820.00	44.7	-52.8	PEAK	H	-20.0	-32.8	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

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6.8.5.5. Operation in 929 - 930 MHz Band

6.8.5.5.1. Middle Channel Frequency

Fundamental Frequency: 929.5 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
1859.00	40.4	-57.1	PEAK	V	-20.0	-37.1	PASS
1859.00	42.5	-55.0	PEAK	H	-20.0	-35.0	PASS
2788.50	41.6	-55.9	PEAK	V	-20.0	-35.9	PASS
2788.50	45.5	-52.0	PEAK	H	-20.0	-32.0	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.6. Operation in 806 - 821 MHz Band

6.8.5.6.1. Lowest Channel Frequency

Fundamental Frequency: 806 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
2418.00	44.8	-52.7	PEAK	V	-20.0	-32.7	PASS
2418.00	44.3	-53.2	PEAK	H	-20.0	-33.2	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.6.2. Middle Channel Frequency

Fundamental Frequency: 813.5 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
2440.00	43.2	-54.3	PEAK	V	-20.0	-34.3	PASS
2440.00	43.1	-54.4	PEAK	H	-20.0	-34.4	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

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6.8.5.6.3. Highest Channel Frequency

Fundamental Frequency: 821 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2463.00	43.1	-54.4	PEAK	V	-20.0	-34.4	PASS
2463.00	43.3	-54.3	PEAK	H	-20.0	-34.3	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.7. Operation in 821 - 824 MHz Band

Same as Section 6.8.5.6.3 & 6.8.5.1.1 of this test report.

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6.8.5.8. Operation in 851 - 866 MHz Band

6.8.5.8.1. Lowest Channel Frequency

Fundamental Frequency: 851 MHz							
RF Output Power: +37.0 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
2553.00	45.7	-51.8	PEAK	V	-20.0	-31.8	PASS
2553.00	46.9	-50.6	PEAK	H	-20.0	-30.6	PASS
5106.00	50.2	-47.3	PEAK	V	-20.0	-27.3	PASS
5106.00	50.2	-47.3	PEAK	H	-20.0	-27.3	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.8.2. Middle Channel Frequency

Fundamental Frequency: 858.5 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
2575.50	44.5	-53.0	PEAK	V	-20.0	-33.0	PASS
2575.50	46.1	-51.4	PEAK	H	-20.0	-31.4	PASS
5151.00	51.0	-46.5	PEAK	V	-20.0	-26.5	PASS
5151.00	51.8	-45.7	PEAK	H	-20.0	-25.7	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

6.8.5.8.3. Highest Channel Frequency

Fundamental Frequency: 866 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/FAIL
2598.00	44.6	-52.9	PEAK	V	-20.0	-32.9	PASS
2598.00	46.3	-51.2	PEAK	H	-20.0	-31.2	PASS
5196.00	49.8	-47.7	PEAK	V	-20.0	-27.7	PASS
5196.00	50.1	-47.4	PEAK	H	-20.0	-27.4	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

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6.8.5.9. Operation in 866 - 869 MHz Band

6.8.5.9.1. Lowest Channel Frequency

Fundamental Frequency: 866 MHz
RF Output Power: +37 dBm
Modulation: FM voice, data and un-modulated
Same as Section 6.8.5.8.3 of this report

6.8.5.9.2. Highest Channel Frequency

Fundamental Frequency: 869 MHz							
RF Output Power: +37 dBm							
Modulation: FM voice, data and un-modulated							
FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	RF DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
5214.00	49.7	-47.8	PEAK	V	-20.0	-27.8	PASS
5214.00	48.3	-49.2	PEAK	H	-20.0	-29.2	PASS
The emissions were scanned from 10 MHz to 10 GHz and all emissions within 60 dB below the limits were recorded.							

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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 (\pm 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 $\Gamma_I = 0.2$ Antenna VRC $\Gamma_R = 0.67$ (Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1 \pm \Gamma_I \Gamma_R)$	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:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$

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EXHIBIT 8. GENERAL MEASUREMENT METHODS

8.1. 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 \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 10th 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 30 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 30 dB below the permissible value need not be specified.

8.2. 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 10th 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 30 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

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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° 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:

$$S = P / (4 \times \text{PI} \times D^2)$$

Where: S: Power density in watts per square feet
P: Transmitted power in watts
PI: 3.1416
D: Distance in meters

The power density S (W/m²) and electric field E (V/m) is related by:

$$S = E^2 / (120 \times \text{PI})$$

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

$$E = (30 \times P)^{1/2} / D = 5.5 \times (P)^{1/2} / D$$

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

$$S = (1.64 \times P) / (4 \times \pi \times D^2)$$
$$E = (49.2 \times P)^{1/2} \times D = 7.01 \times (P)^{1/2} / D$$

$$P = (E \times D / 7.01)^2$$

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

$$P(W) = [E(V/m) \times D / 7.01]^2$$
$$P(mW) = P(W) \times 1000$$
$$\Rightarrow P(dBm) = 10 \log P(mW)$$
$$= 20 \log E(V/m) + 20 \log(D) - 20 \log(7.01) + 10 \log 1000$$
$$= E(dBV/m) + 20 \log D + 13$$
$$= E(dBuV/m) - 120 + 20 \log(D) + 13$$
$$= E(dBuV/m) + 20 \log(D) - 107$$

The Transmitted Power @ D = 3 Meters

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

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