UltraTech
Group of Labs

31040/SIT

C-1376

46390-2049

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SL2-IN-E-1119R

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

Tel.: (905) 829-1570
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Website: www.ultratech-labs.com
Email: vic@ultratech-labs.com

July 11, 2003

TIMCO ENGINEERING INC.
P.O. Box 370
849 N.W. State Road 45
Newberry, Florida

Subject: **Type Acceptance Application under FCC CFR 47, Parts 2 and 74 (Subpart H) - Low Power Auxiliary Stations Operating in the frequency bands 690-715 MHz.**

Applicant: **Quantum5X Systems Inc.**
Product: **Wireless Microphone**
Model: **QT-256**
FCC ID: **Q5N-QT256**

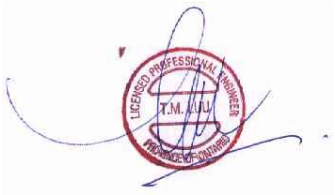
Dear Sir/Madam,

As appointed agent for **Quantum5X Systems Inc.**, we would like to submit the application for certification of the above product. Please review all necessary files uploaded to TIMCO Upload Web Site.

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

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

Yours truly,



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

TML/DH

Encl.

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Website: www.ultratech-labs.com
Email: vic@ultratech-labs.com

July 11, 2003

Quantum5X Systems Inc.
30 Adelaide Street North, Suite 12
London, Ontario
Canada, N6B 3N5

Attn.: **Mr. Allen Kool**

Subject: **Certification Testing in accordance with FCC CFR 47, Parts 2 and 74 (Subpart H) - Low Power Auxiliary Stations Operating in the frequency bands 690-715 MHz.**

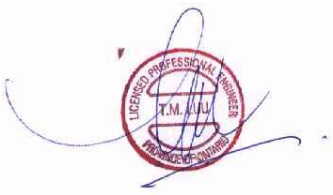
Product: **Wireless Microphone**
Model: **QT-256**
FCC ID: **Q5N-QT256**

Dear Mr. Kool,

The product sample has been tested in accordance with **FCC CFR 47, Parts 2 and 74 (Subpart H) - Low Power Auxiliary Stations Operating in the frequency bands 690-715 MHz,** and the results and observation were recorded in the engineering report, Our File No.: Q5X-001FCC74

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.

ENGINEERING TEST REPORT

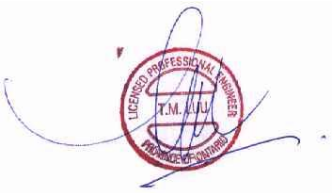
Wireless Microphone
Model No.: QT-256
FCC ID: Q5N-QT256

Applicant: **Quantum5X Systems Inc.**
30 Adelaide Street North, Suite 12
London, Ontario
Canada, N6B 3N5

Tested in Accordance With

Federal Communications Commission (FCC)
CFR 47, PARTS 2 and 74 (Subpart H)

UltraTech's File No.: Q5X-001FCC74

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: July 11, 2003	
Report Prepared by: Tri Luu, P.Eng. Issued Date: July 11, 2003	Tested by: Hung Trinh Test Dates: July 06-July 10, 2003

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com

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EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	• Exhibit 1: Submittal check lists • Exhibit 2: Introduction • Exhibit 3: Performance Assessment • Exhibit 4: EUT Operation and Configuration during Tests • Exhibit 5: Summary of test Results • Exhibit 6: Measurement Data • Exhibit 7: Measurement Uncertainty • Exhibit 8: Measurement Methods	OK
1	Test Setup Photos	Photos # 1 to 3	OK
2	External Photos of EUT	Photos # 2 of 2	OK
3	Internal Photos of EUT	Photos of 1 to 7	OK
4	Cover Letters	• Letter from Ultratech for Certification Request	OK
5	Attestation Statements	• Letter from the Applicant to appoint Ultratech to act as an agent • Letter from the Applicant to request for Confidentiality Filing	
6	ID Label/Location Info	ID Label Location of ID Label	
7	Block Diagrams	Block diagrams # 1 of 1	
8	Schematic Diagrams	Schematic diagrams # 1 of 1	
9	Parts List/Tune Up Info		
10	Operational Description		
11	RF Exposure Info		
12	Users Manual		

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 74 (Subpart H)
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 and 74 (Subpart H)
Purpose of Test:	To obtain FCC Certification Authorization for Radio operating in the frequency bands 690-715 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 0-19, 80-End	2002	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:	Quantum5X Systems Inc.
Address:	30 Adelaide Street North, Suite 12 London, Ontario Canada, N6B 3N5
Contact Person:	Mr. Allen Kool Phone #: 519-675-6999 Fax #: 519-667-2169 Email Address: akool@quantum5x.com

MANUFACTURER	
Name:	Quantum5X Systems Inc.
Address:	30 Adelaide Street North, Suite 12 London, Ontario Canada, N6B 3N5
Contact Person:	Mr. Allen Kool Phone #: 519-675-6999 Fax #: 519-667-2169 Email Address: akool@quantum5x.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:	Quantum5X Systems Inc.
Product Name:	Wireless Microphone
Model Name or Number:	QT-256
Serial Number:	Preproduction
Type of Equipment:	Broadcast Wireless Transmitter
External Power Supply:	N/A
Transmitting/Receiving Antenna Type:	Integral antenna, gain = 2.15 dBi
Primary User Functions of EUT:	Wireless microphone

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	General environments
Power Supply Requirement:	3.8 V rechargeable battery
RF Output Power Rating:	103 mili-Watts (conducted) or 169 mili-Watts EIRP
Operating Frequency Range:	690-715 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	100 kHz
Occupied Bandwidth (99%):	96.3 kHz
Emission Designation*:	128KF3E
Antenna Connector Type:	Integral

Necessary Bandwidth Calculation for Sound Broadcasting:

Bn = 2M + 2DK = 2x15 kHz + 2x49.1 kHz = 128.2 kHz

Where: M = 15 kHz, D = 49.1 kHz as measured, K =1

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	Battery charger / Microphone	1	Standard Jack	Non-shielded

3.5. ANCILLARY EQUIPMENT

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

Ancillary Equipment # 1	
Description:	Microphone

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:	3.8 V rechargeable battery

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:	N/A
Special Hardware Used:	N/A
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): ▪ 690 – 715 MHz band:	Lowest, Middle & Highest frequencies in each frequency bands that the transmitter covers: ▪ 690, 702.5 and 715 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 103 mili-Watts ▪ FM voice ▪ 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: Aug. 10, 2002.

5.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
74.861(e)(1) & 2.1046	RF Power Output	Yes
74.861(e)(2)	Transmitters may be either crystal controlled or frequency synthesized	The transmitter is frequency synthesized
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
74.861(e)(4) & 2.1055	Frequency Stability	Yes
2.1047(a)	Audio Frequency Response	Yes
74.861(e)(3) & 2.1047(b)	Modulation Limiting	Yes
74.861(e)(5)	Operating Bandwidth	Yes
74.861(e)(6) & 2.1049	Emission Limitation	Yes
74.861(e)(6), 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
74.861(e)(6), 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
Wireless Microphone, **Model No.: QT-256**, by **Quantum5X Systems Inc.** 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.		

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

5.4. DEVIATION OF STANDARD TEST PROCEDURES

None

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

6.1. TEST PROCEDURES

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

6.2. MEASUREMENT UNCERTAINTIES

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

6.3. MEASUREMENT EQUIPMENT USED:

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

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

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

6.5. RF POWER OUTPUT @ FCC 2.1046 & 74.861(E)(1)

6.5.1. Limits

FCC 74.861(e)(1) - The power of the measured unmodulated carrier power at the output of the transmitter power amplifier (antenna input power) may not exceed the following:

(i) *54-72, 76-88, and 174-216 MHz bands--50 mW*
(ii) *470-608 and 614-806 MHz bands--250 mW*

6.5.2. Method of Measurements

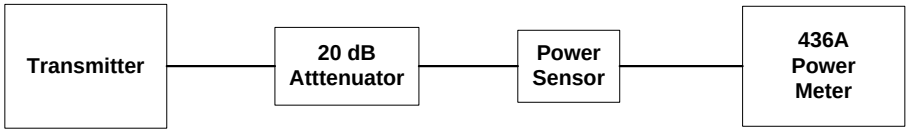
Refer to Exhibit 8, § 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8546A	…	9 kHz to 5.6 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.
Attenuator(s)	Bird	…	…	DC – 22 GHz
Attenuator(s)	Weinschel Corp	24-20-34	BJ2357	DC – 8.5 GHz
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz

6.5.4. Test Arrangement

- Power at RF Power Output Terminals



6.5.5. Test Data

Conducted Power

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured Conducted Power (mWatts)	Conducted Power Limit (mWatts)
Lowest	690.0	103.0	250.0
Middle	702.5	92.5	250.0
Highest	715.0	79.1	250.0

Note: Antenna Gain = 0 dBd or 2.15 dBi

6.6. RF EXPOSURE REQUIRMENTS @ 1.1310 & 2.1091

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
SAR Tests for Portable Transmitters • Body Tissue	• Comply with SAR limits with body tissue with the EUT and its antenna touching the phantom, please refer to SAR test report with maximum SAR level of 0.68 W/Kg. Please refer to the attached SAR test report, Ultratech File No.: Q5X-001SAR
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	N/A
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	N/A
Any other RF exposure related issues that may affect MPE compliance	N/A

6.7. FREQUENCY STABILITY @ FCC 2.1055 & 74.861(E)(4)

6.7.1. Limits

FCC 74.861(e)(4) - The frequency tolerance of the transmitter shall be 0.005 percent

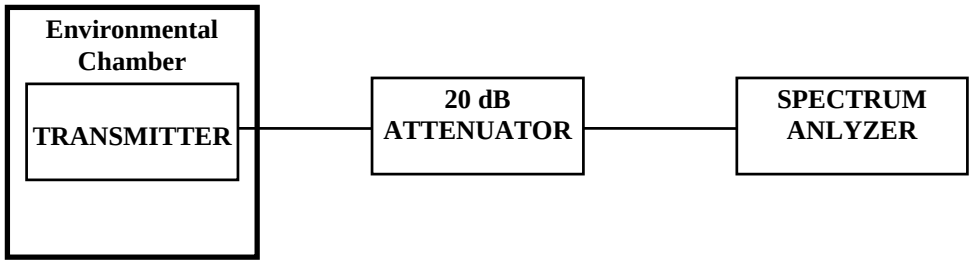
6.7.2. Method of Measurements

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

6.7.3. Test Equipment List

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

6.7.4. Test Arrangement



6.7.5. Test Data

Product Name: **Model No.:**	**Wireless Microphone** **QT-256**
Center Frequency:	690 MHz
Full Power Level:	103 mili-Watts
Frequency Tolerance Limit:	0.005%
Max. Frequency Tolerance Measured:	-8.6 kHz or 0.001%
Input Voltage Rating:	3.8 Vdc maximum

CENTER FREQUENCY & RF POWER OUTPUT VARIATION			
Ambient Temperature	**Supply Voltage (Nominal) 3.8 Volts**	**Supply Voltage at the low end of battery 2.6 Volts**	**Supply Voltage (115% of Nominal) 4.2 Volts**
(^{o}C)	**kHz**	**KHz**	**kHz**
-30	-3.5	Not required	Not required
-20	+4.5	Not required	Not required
-10	+6.8	Not required	Not required
0	+6.4	Not required	Not required
+10	+4.6	Not required	Not required
+20	0	-10.5	-10.5
+30	-2.1	Not required	Not required
+40	-8.3	Not required	Not required
+50	-8.6	Not required	Not required

Battery Voltage versus Current (Applicable for Handheld/Prtable Device)	
Voltage (Vdc)	Current (mili-Amps)
4.2	112.2
3.8	111.9
3.4	111.5
3.0	101.6
2.6	40.1
2.4 Transmitter stopped at this input voltage	18.1

6.8. AUDIO FREQUENCY RESPONSE / MODULATION REQUIREMENTS @ FCC 2.1047(A)

6.8.1. Limits

No limits. Tests are performed for information only.

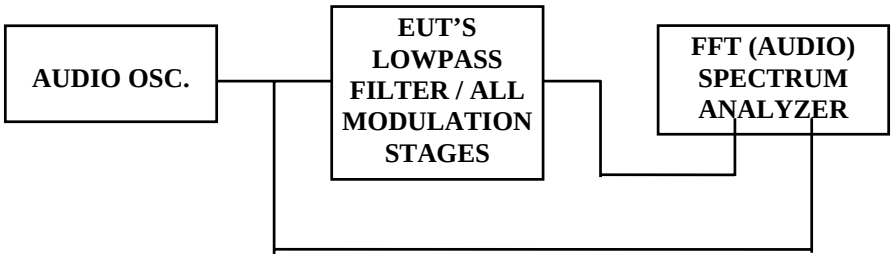
6.8.2. Method of Measurements

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

6.8.3. Test Equipment List

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

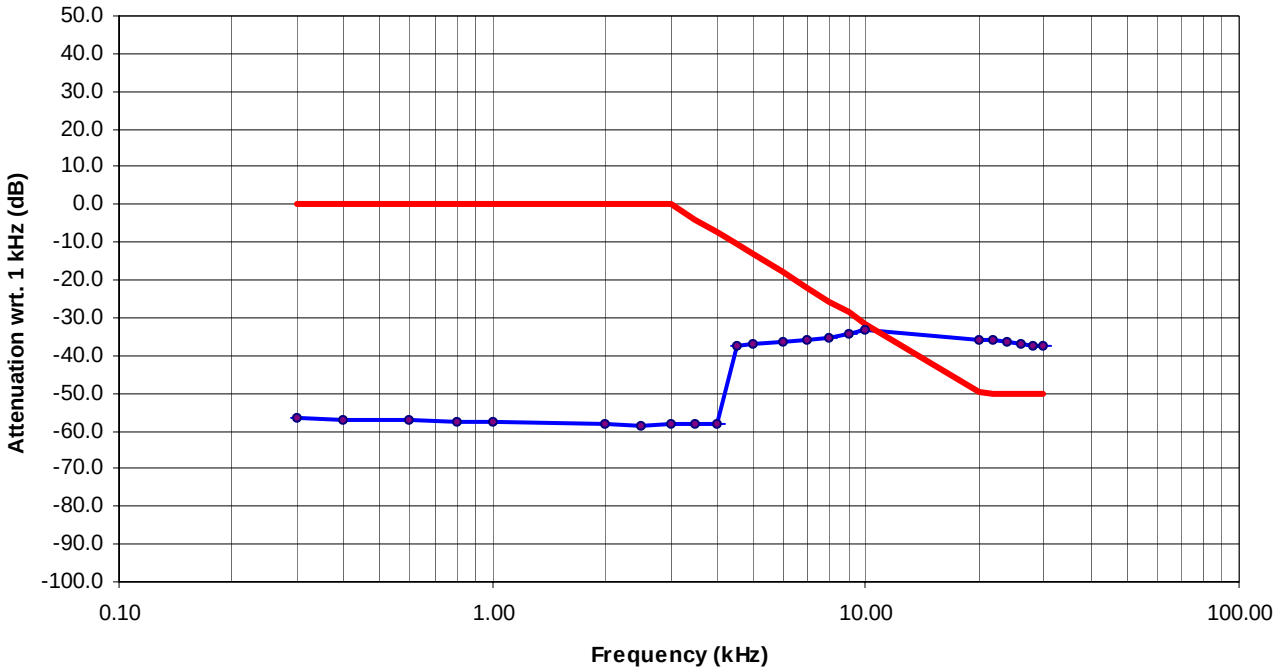
6.8.4. Test Arrangement



6.8.5. Test Data

FREQUENCY (kHz)	AUDIO IN (dBV)	AUDIO OUT (dBV)	ATTEN. (OUT - IN) (dB)	ATTEN. wrt. 1 kHz (dB)	FCC LIMIT (dB)
0.30	13.1	-14.9	-28.0	-56.8	--
0.40	13.1	-15.2	-28.3	-57.1	--
0.60	13.1	-15.4	-28.5	-57.3	--
0.80	13.0	-15.6	-28.7	-57.5	--
1.00	13.0	-15.8	-28.8	-57.6	--
2.00	12.7	-16.9	-29.6	-58.4	--
2.50	12.6	-17.0	-29.7	-58.5	--
3.00	12.6	-17.0	-29.6	-58.4	--
3.50	12.6	-17.0	-29.5	-58.3	-4.0
4.00	12.6	-16.7	-29.3	-58.1	-7.5
4.50	12.6	3.8	-8.8	-37.6	-10.6
5.00	12.4	4.0	-8.4	-37.2	-13.3
6.00	12.4	4.8	-7.6	-36.4	-18.1
7.00	12.5	5.4	-7.1	-35.9	-22.1
8.00	12.4	5.7	-6.7	-35.5	-25.6
9.00	12.4	6.9	-5.5	-34.3	-28.6
10.00	12.4	7.7	-4.7	-33.5	-31.4
20.00	12.4	5.5	-6.9	-35.7	-49.4
22.00	12.4	5.1	-7.3	-36.1	-50.0
24.00	12.4	4.7	-7.7	-36.5	-50.0
26.00	12.4	4.3	-8.1	-36.9	-50.0
28.00	12.4	3.9	-8.5	-37.3	-50.0
30.00	12.4	3.6	-8.8	-37.6	-50.0

AUDIO FREQUENCY REPSONSE @ FCC 2.987(a) & 22.915 (Portable/Mobile)
Quantum5X Systems Inc.
Wireless Microphone, Model: QT-256
FCC ID: Q5N-QT256



6.9. MODULATION LIMITING @ FCC 2.1047(B) & 74.861(E)(6)

6.9.1. Limits

FCC 74.961(e)(3) *- Any form of modulation may be used. A maximum deviation of ±75 kHz is permitted when frequency modulation is employed*

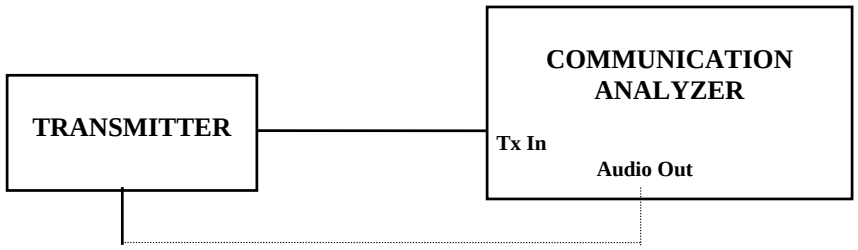
6.9.2. Method of Measurements

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

6.9.3. Test Equipment List

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

6.9.4. Test Arrangement



6.9.5. Test Data

6.9.5.1. Voice Modulation Limiting:

Manufacturer's Audio Input Rating: 900 mVrms

MODULATING SIGNAL LEVEL	PEAK FREQUENCY DEVIATION (kHz) at the following modulating frequency:						MAXIMUM LIMIT
(mVrms)	0.1 kHz	0.5 kHz	1.0 kHz	3.0 kHz	5.0 kHz	15.0 kHz	(kHz)
20	26.2	25.0	25.2	29.2	29.3	25.7	75
40	31.5	31.8	31.7	31.9	31.9	32.2	75
60	33.1	33.5	33.1	31.9	31.9	39.2	75
80	33.3	33.7	33.0	31.8	31.8	39.3	75
100	33.2	33.7	33.0	32.8	32.7	39.6	75
200	35.2	36.6	37.7	46.6	46.5	39.3	75
300	44.2	47.4	47.7	45.1	44.9	39.1	75
400	53.3	49.1	47.0	44.6	44.5	39.5	75
500	57.2	49.0	46.4	44.3	44.2	39.3	75
600	59.6	48.7	46.1	44.2	44.2	39.1	75
700	61.3	48.6	45.9	44.2	44.2	39.2	75
800	62.4	48.6	45.9	44.3	44.2	39.2	75
900	63.3	48.4	45.8	44.2	44.2	39.2	75

Voice Signal Input Level = STD MOD Level + 20 dB = 48.6 dBmVrms + 20 = 68.6 dBVrms

MODULATING FREQUENCY (KHz)	PEAK FREQUENCY DEVIATION (KHz)	MAXIMUM LIMIT (KHz)
0.1	41.0	75
0.2	41.1	75
0.4	39.1	75
0.6	37.6	75
0.8	36.7	75
1.0	36.3	75
1.2	35.8	75
1.4	35.5	75
1.6	35.3	75
1.8	34.8	75
2.0	34.6	75
2.5	33.9	75
3.0	33.3	75
3.5	32.8	75
4.0	32.1	75
4.5	31.6	75
5.0	31.1	75
6.0	30.5	75
7.0	30.0	75
8.0	28.6	75
9.0	26.5	75
10.0	26.1	75
11.0	24.5	75
12.0	24.4	75
13.0	24.3	75
14.0	24.2	75
15.0	24.1	75

6.10. OPERATING BANDWIDTH @ FCC 74.861(E)(5)

6.10.1. Limits

FCC 74.861(e)(5) *- The operating bandwidth shall not exceed 200 kHz*

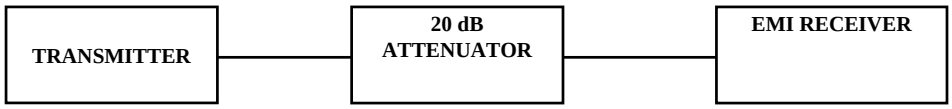
6.10.2. Method of Measurements

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

6.10.3. Test Equipment List

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

6.10.4. Test Arrangement

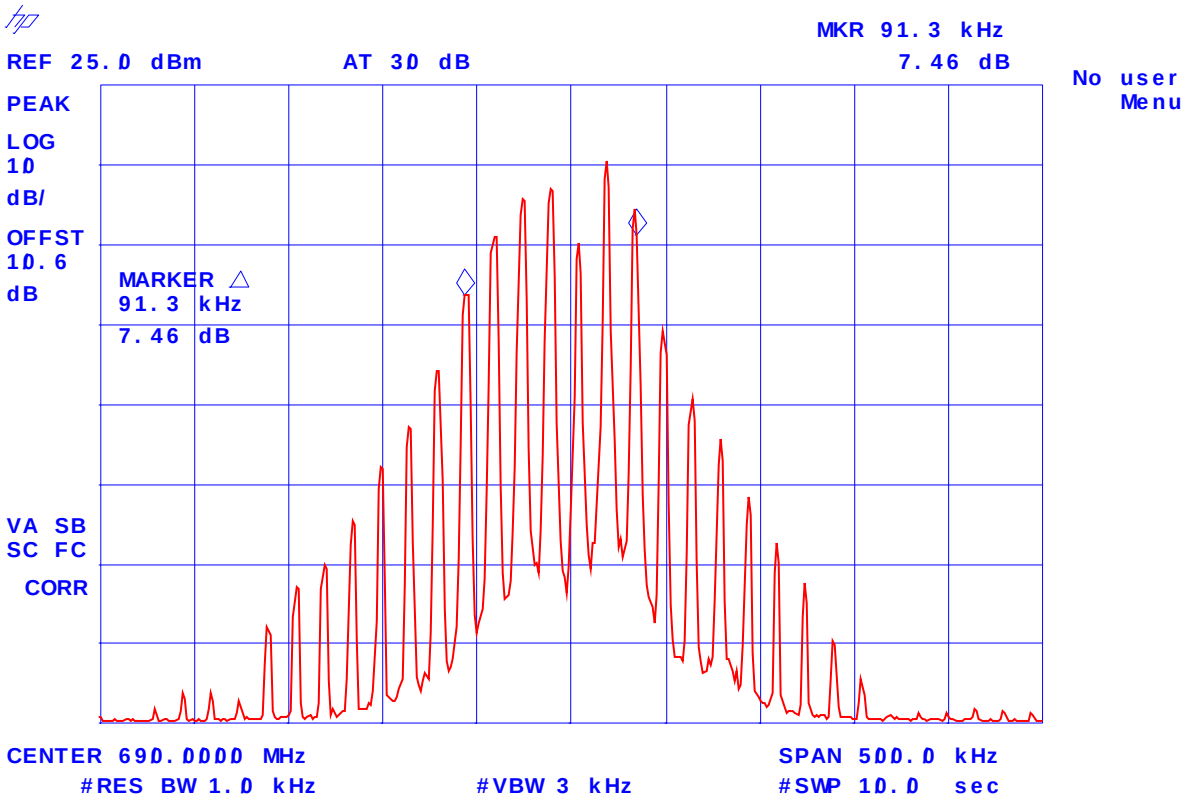


6.10.5. Test Data

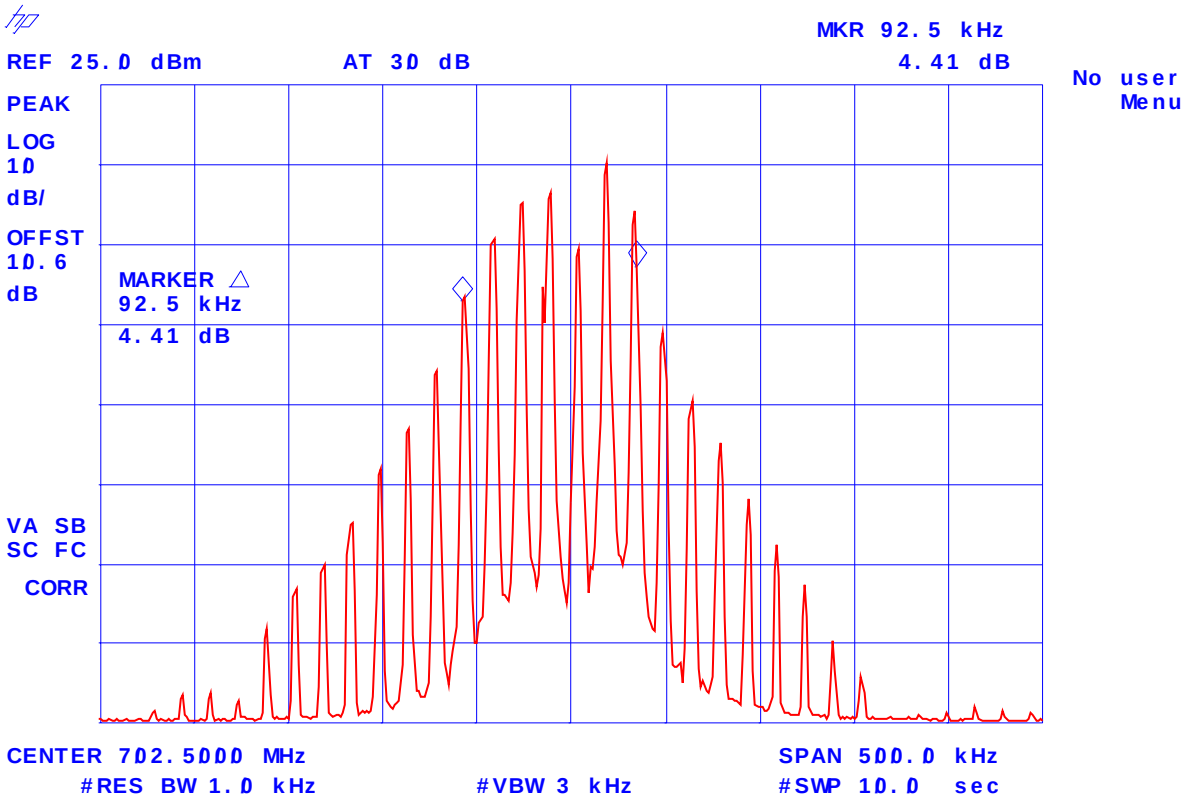
Frequency (MHz)	Measured 99% OBW (kHz)	99% OBW Limit (kHz)
690.0	91.3	200
702.5	92.5	200
715.0	96.3	200

Note: The above tests were performed with the 15 kHz modulating sine wave signal, frequency deviation: 39.6 kHz maximum. The maximum modulation was applied for tests since the 85% modulation of 75 kHz is larger than the maximum frequency deviation that the EUT is limited to.

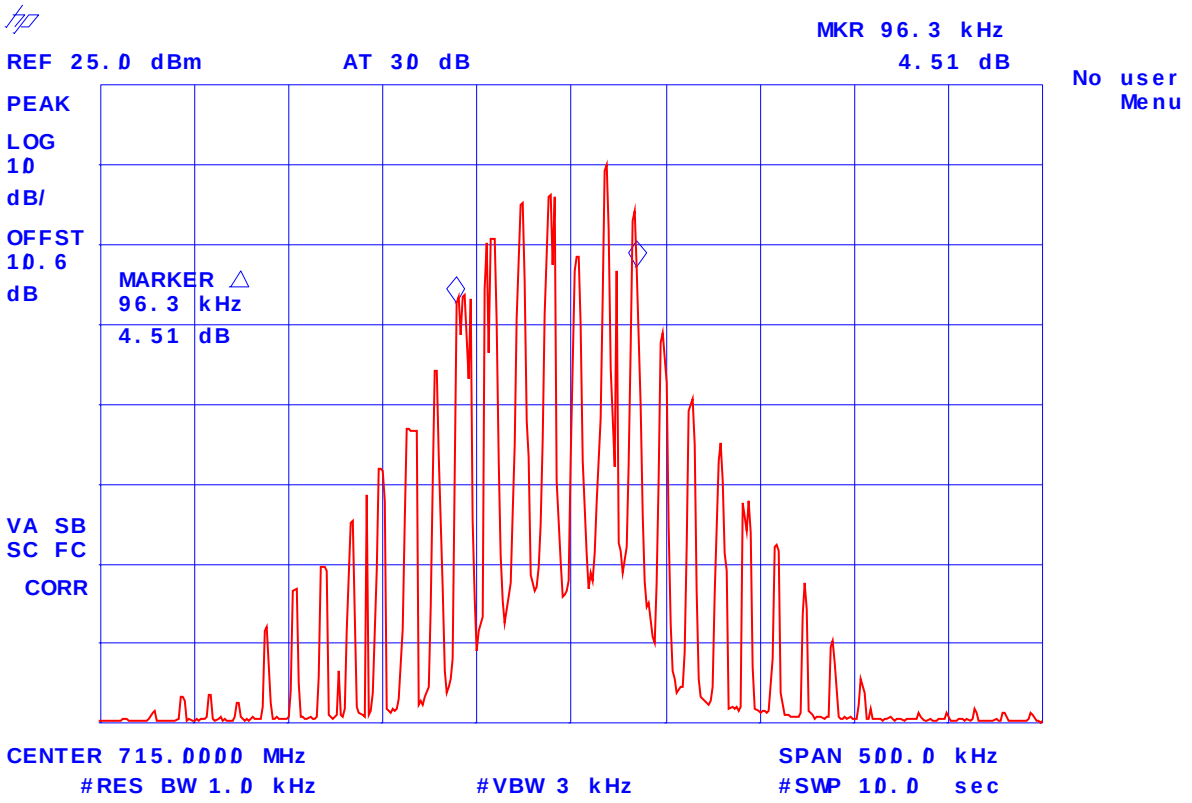
Plot #1: **99% OBW - Low Channel, 690 MHz, Power Output 20.13 dBm**
Modulation: FM Modulation with 15 kHz Sine Wave signal, Maximum Frequency Deviation: 39.6 kHz



Plot #2: **99% OBW - Mid Channel, 702.5 MHz, Power Output 19.66 dBm**
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



Plot #3: **99% OBW - High Channel, 715 MHz, Power Output 18.98 dBm**
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

6.11. EMISSION LIMITATION @ FCC 2.1049, 74.861(E)(6)

6.11.1. Limits

FCC 74.861(e)(6) *- The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:*

i) *On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;*

ii) *On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;*

ii)i *On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43+10log<INF>10</INF> (mean output power in watts) dB.*

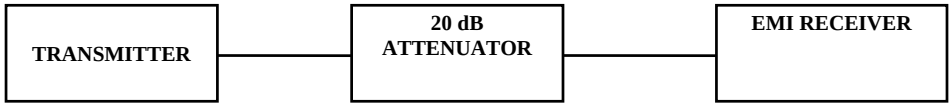
6.11.2. Method of Measurements

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

6.11.3. Test Equipment List

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

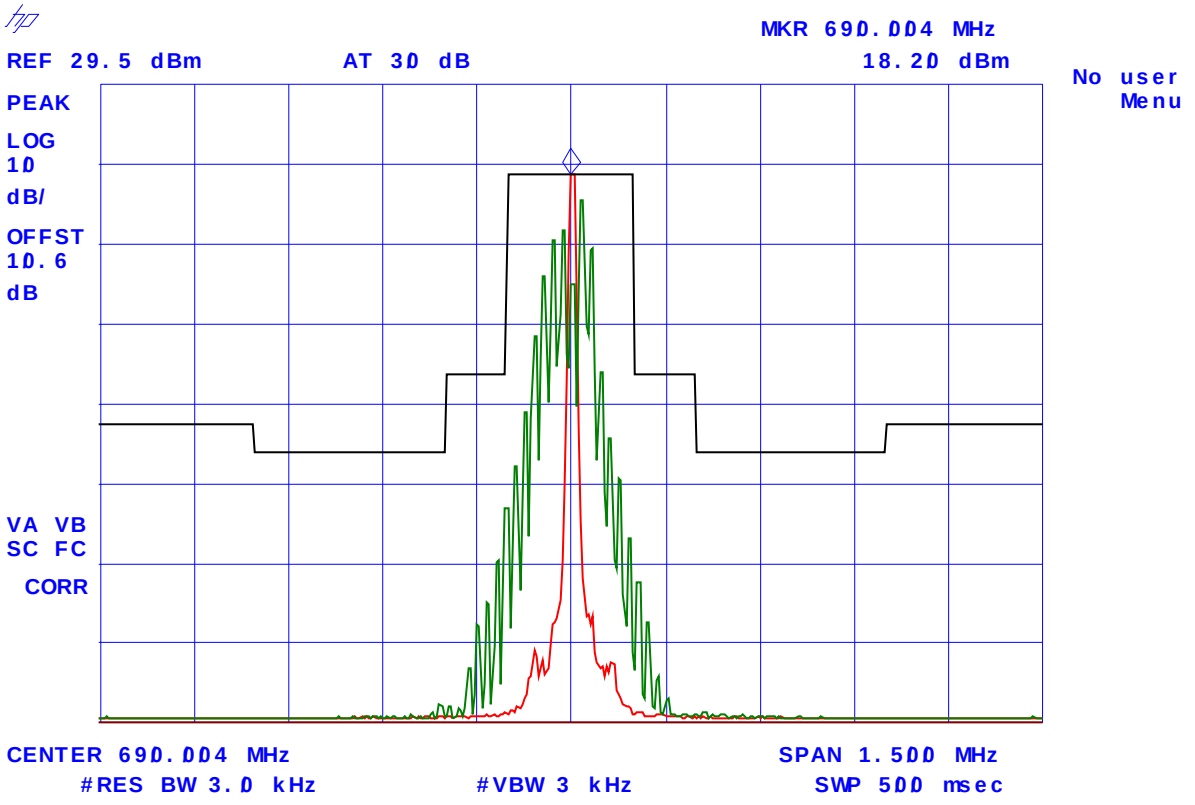
6.11.4. Test Arrangement



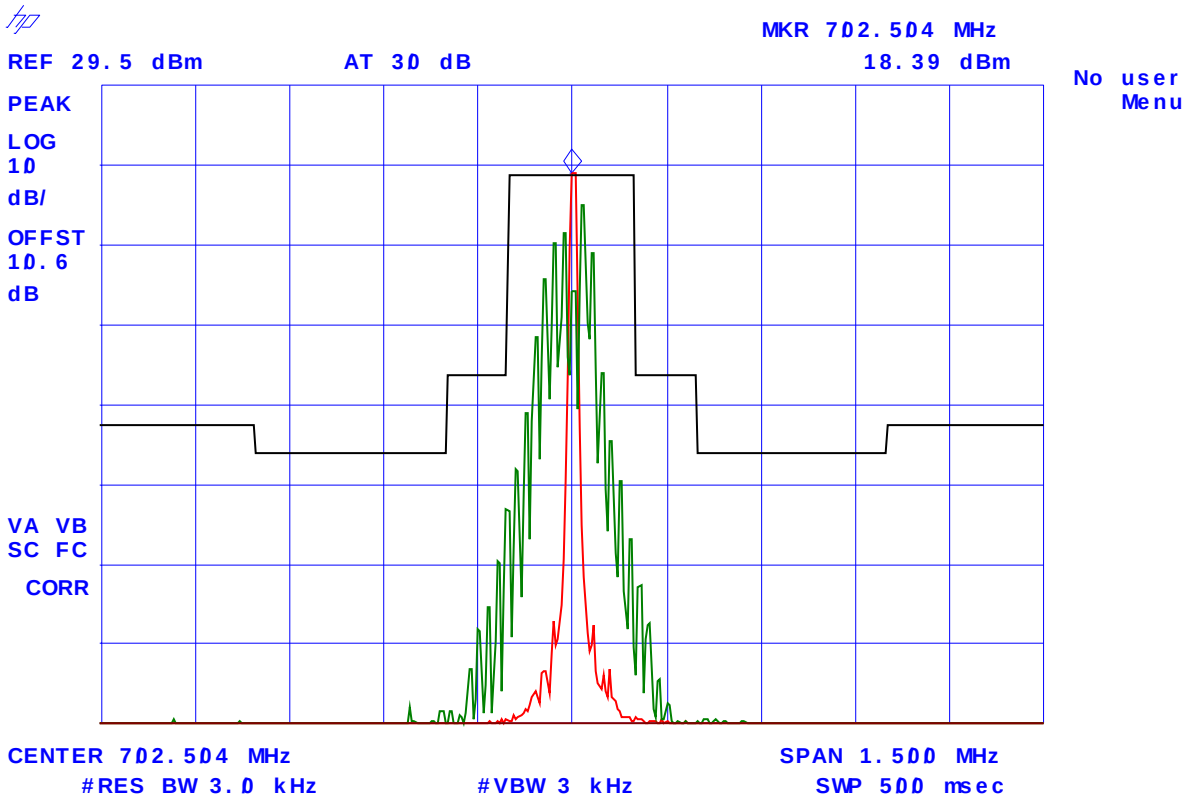
6.11.5. Test Data

Conform. Please refer to Plots # 4 through # 9 for Details of measurements

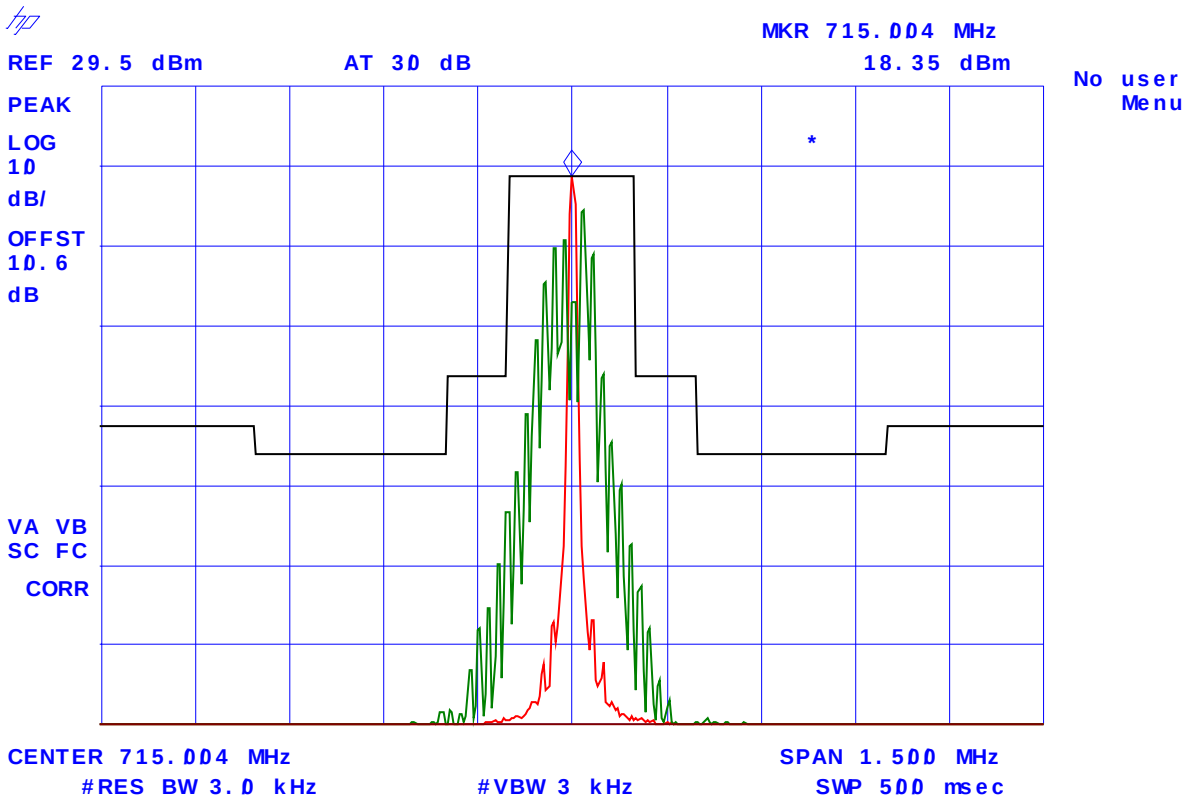
Plot #4: **Emission Mask - Low Channel, 690 MHz, Power Output 20.13 dBm**
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



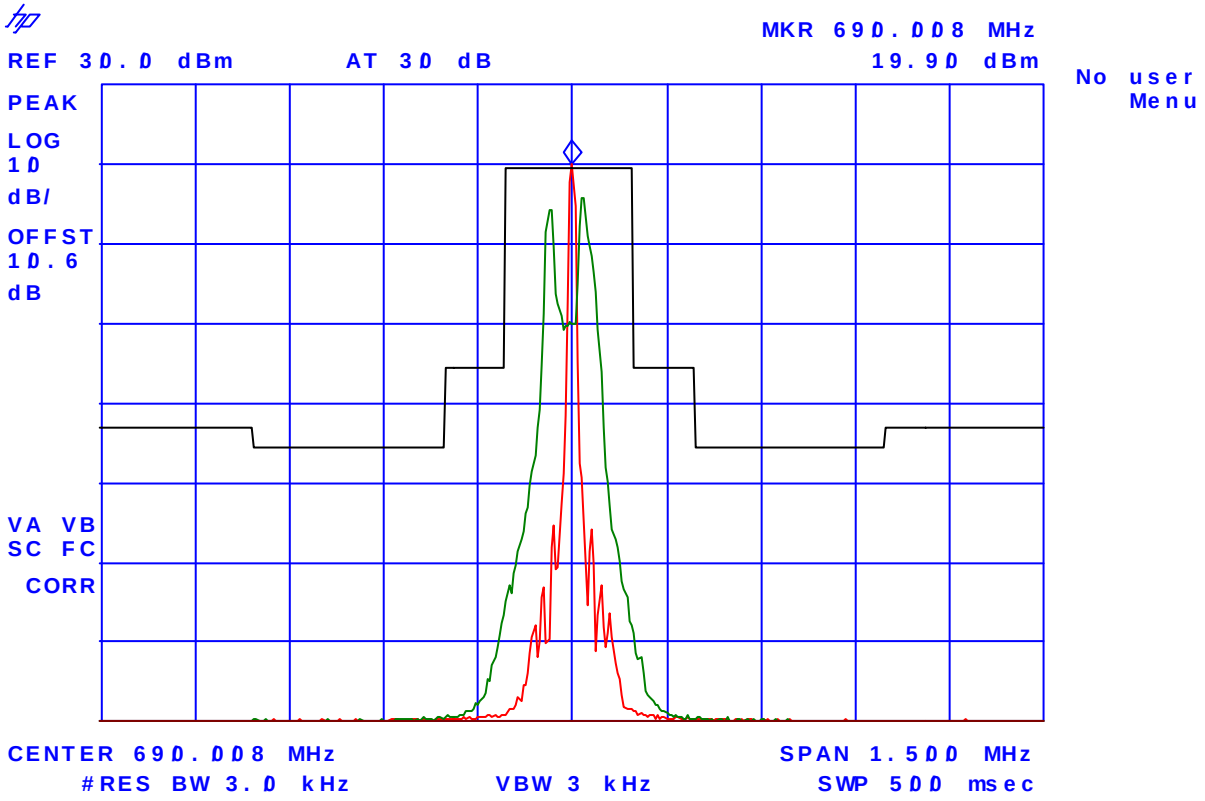
Plot #5: **Emission Mask - Mid Channel, 702.5 MHz, Power Output 19.66 dBm**
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



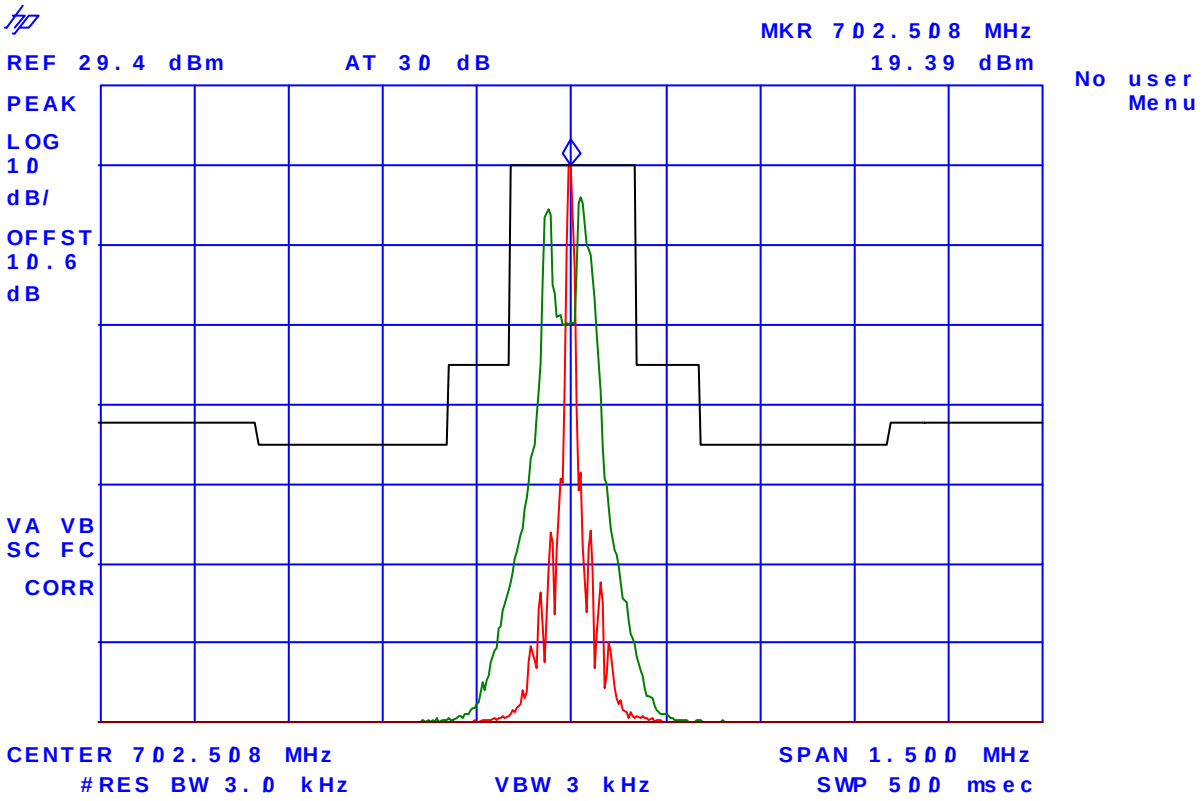
Plot #6: **Emission Mask - High Channel, 715 MHz, Power Output 18.98 dBm**
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



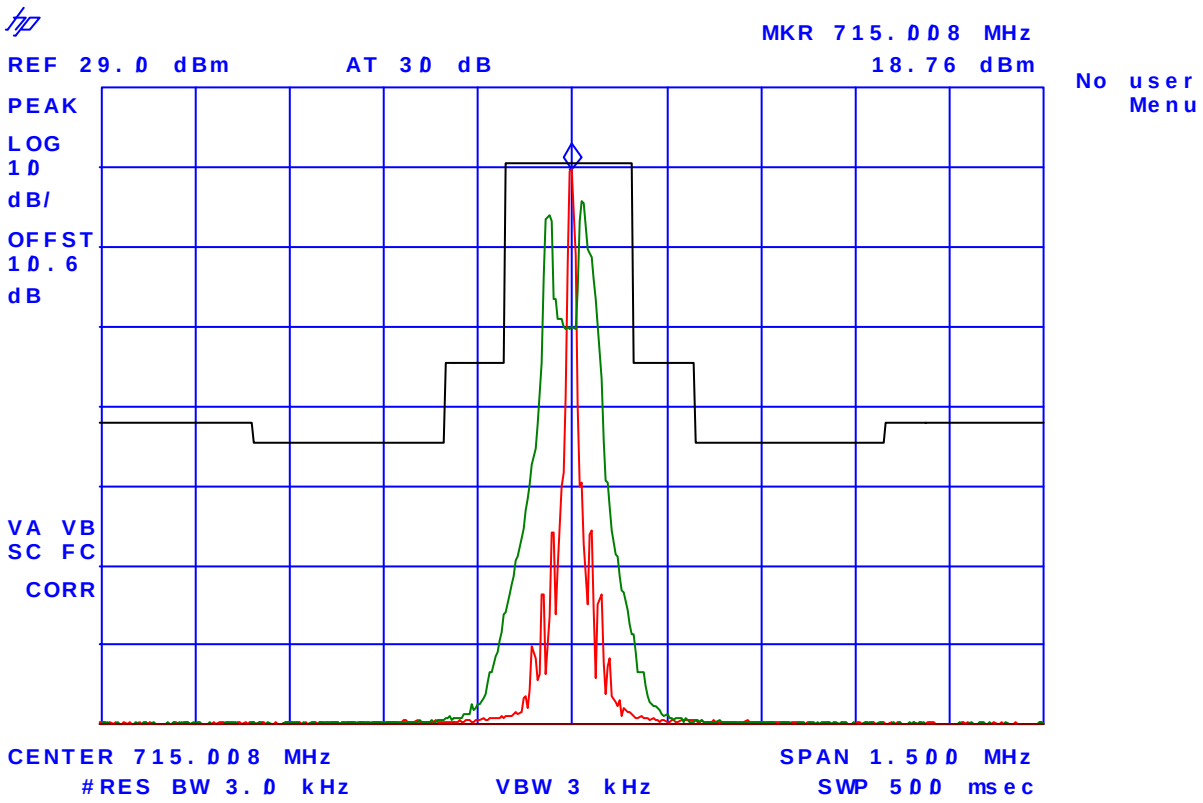
Plot #7: **Emission Mask - Low Channel, 690 MHz, Power Output 20.13 dBm**
Modulation: FM Modulation with 2.5 kHz Sine Wave Signal, Frequency Deviation: 33.9 kHz Max.



Plot #8: **Emission Mask - Mid Channel, 702.5 MHz, Power Output 19.66 dBm**
Modulation: FM Modulation with 2.5 kHz Sine Wave Signal, Frequency Deviation: 33.9 kHz Max.



Plot #9: **Emission Mask - High Channel, 715 MHz, Power Output 18.98 dBm**
Modulation: FM Modulation with 2.5 kHz Sine Wave Signal, Frequency Deviation: 33.9 kHz Max.



6.12. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 74.861(E)(6)

6.12.1. Limits

FCC 74.861(e)(6) - Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Frequency Range	Attenuation Limit (dBc)
74.861(e)(6)	10 MHz to Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	43+10*log(P)

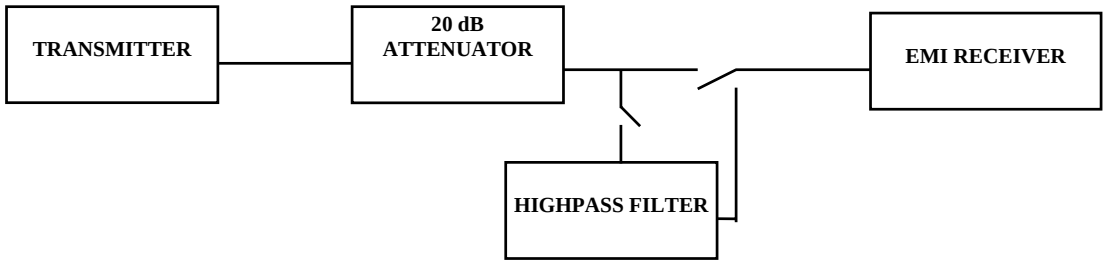
6.12.2. Method of Measurements

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

6.12.3. Test Equipment List

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

6.12.4. Test Arrangement



6.12.5. Test Data

6.12.5.1. Lowest Frequency (690 MHz)

Fundamental Frequency: 690 MHz
RF Output Power: 20.1 dBm (conducted)
Modulation: FM modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

FREQUENCY (MHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS (dBm)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
690.00	20.1	--	--	--	--
1380.00	-28.9	-49.0	-33.1	-15.9	PASS
2070.00	-53.3	-73.4	-33.1	-40.3	PASS
2760.00	-35.6	-55.7	-33.1	-22.6	PASS
3450.00	-41.3	-61.4	-33.1	-28.3	PASS
4140.00	-58.3	-78.4	-33.1	-45.3	PASS
4830.00	-61.4	-81.5	-33.1	-48.4	PASS
7590.00	-52.8	-72.9	-33.1	-39.8	PASS

- The emissions were scanned from 10 MHz to 8 GHz and all emissions within 50 dB below the limits were recorded.
- Refer to Plots 7, 8 & 9 for detailed measurements

6.12.5.2. Middle Frequency (702.5 MHz)

Fundamental Frequency: 702.5 MHz
RF Output Power: 19.7 dBm (conducted)
Modulation: FM modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

FREQUENCY (MHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS (dBm)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
702.50	19.7	--	--	--	--
1405.00	-31.2	-50.9	-32.7	-18.2	PASS
2107.50	-51.3	-71.0	-32.7	-38.3	PASS
2810.00	-36.7	-56.4	-32.7	-23.7	PASS
3512.50	-44.3	-64.0	-32.7	-31.3	PASS
4215.00	-56.7	-76.4	-32.7	-43.7	PASS
4917.50	-62.1	-81.8	-32.7	-49.1	PASS
7727.50	-55.4	-75.1	-32.7	-42.4	PASS

- The emissions were scanned from 10 MHz to 8 GHz and all emissions within 50 dB below the limits were recorded.
- Refer to Plots 10, 11 & 12 for detailed measurements

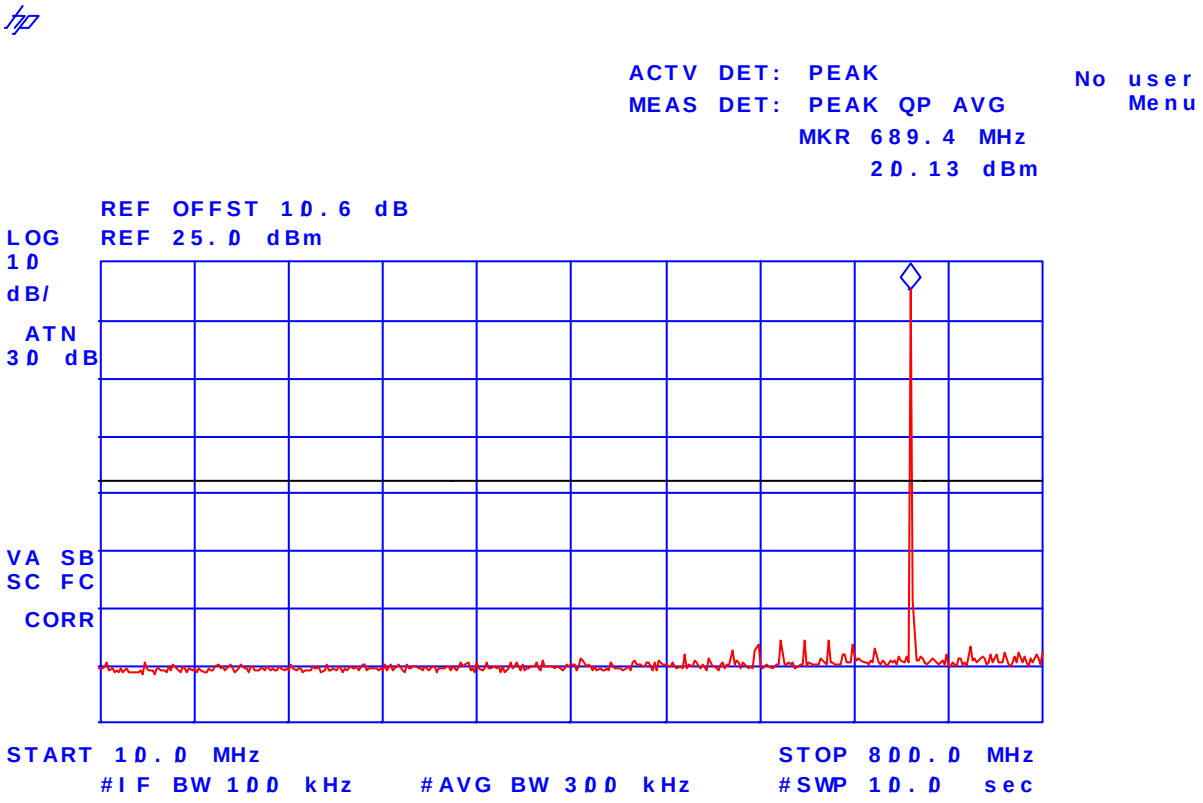
6.12.5.3. Highest Frequency (715 MHz)

Fundamental Frequency: 715 MHz
RF Output Power: 19 dBm (conducted)
Modulation: FM modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

FREQUENCY (MHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS (dBm)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
715.00	19.0	--	--	--	--
1430.00	-33.8	-52.8	-32.0	-20.8	PASS
2145.00	-48.1	-67.1	-32.0	-35.1	PASS
2860.00	-36.6	-55.6	-32.0	-23.6	PASS
3575.00	-43.8	-62.8	-32.0	-30.8	PASS
4290.00	-55.7	-74.7	-32.0	-42.7	PASS
7150.00	-50.0	-69.0	-32.0	-37.0	PASS
7865.00	-55.8	-74.8	-32.0	-42.8	PASS

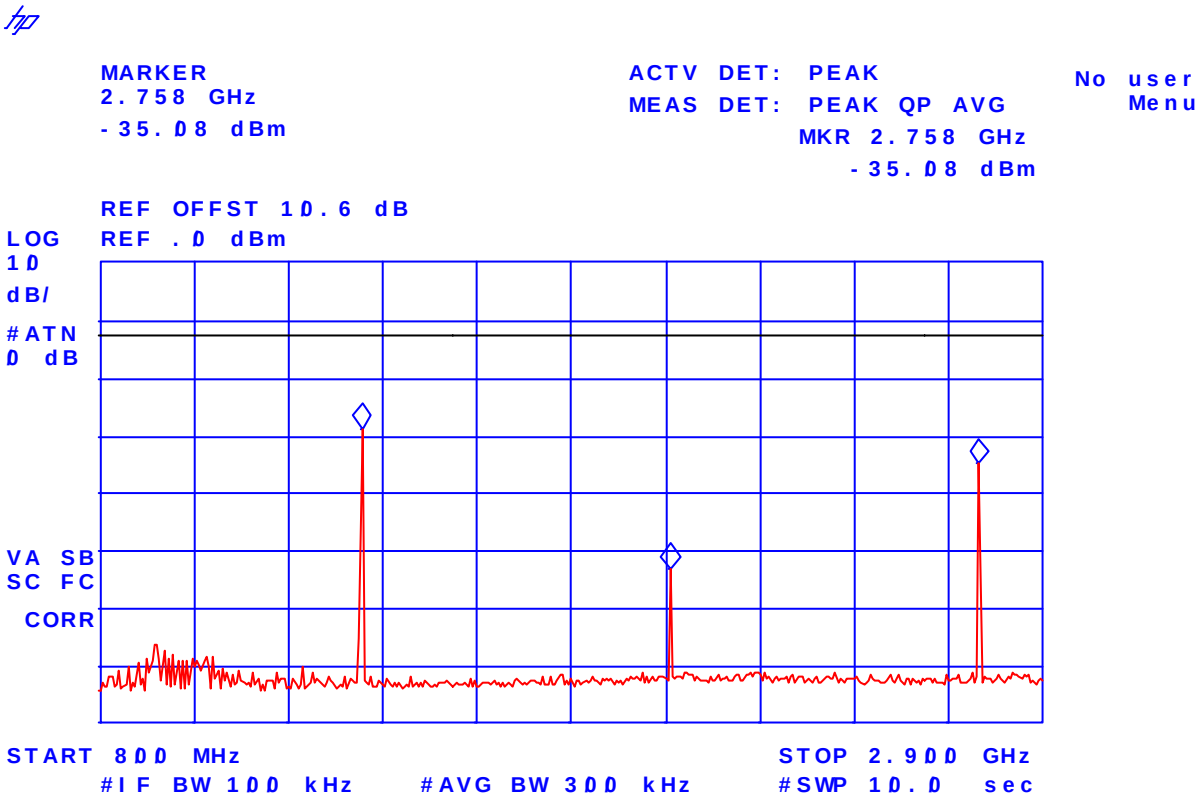
- The emissions were scanned from 10 MHz to 8 GHz and all emissions within 50 dB below the limits were recorded.
- Refer to Plots 13, 14 & 15 for detailed measurements

Plot # 7: **Transmitter Antenna Power Conducted Emissions**
Low Channel, 690 MHz, Power Output 20.13 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



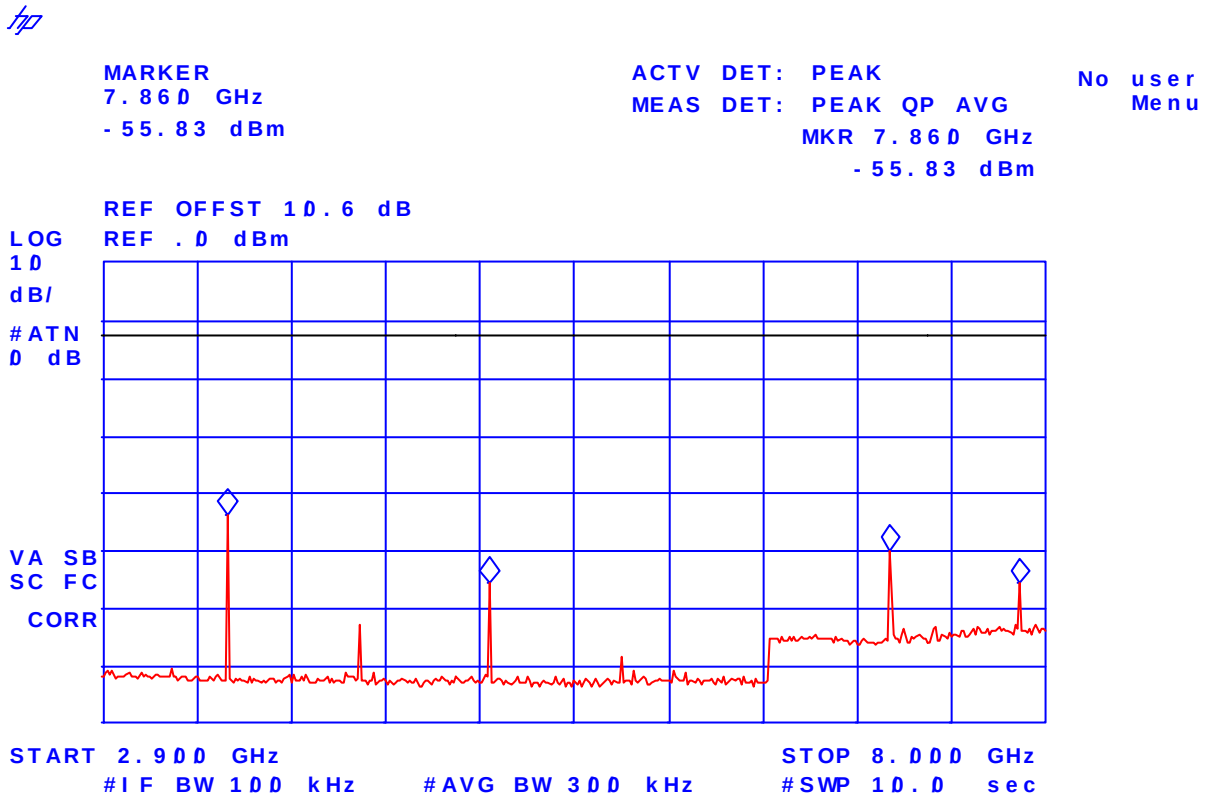
Plot # 8: **Transmitter Antenna Power Conducted Emissions**
Low Channel, 690 MHz, Power Output 20.13 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

(1) 1383 MHz, -28.93 dBm
(2) 2071 MHz, -53.25 dBm
(3) 2758 MHz, -35.58 dBm



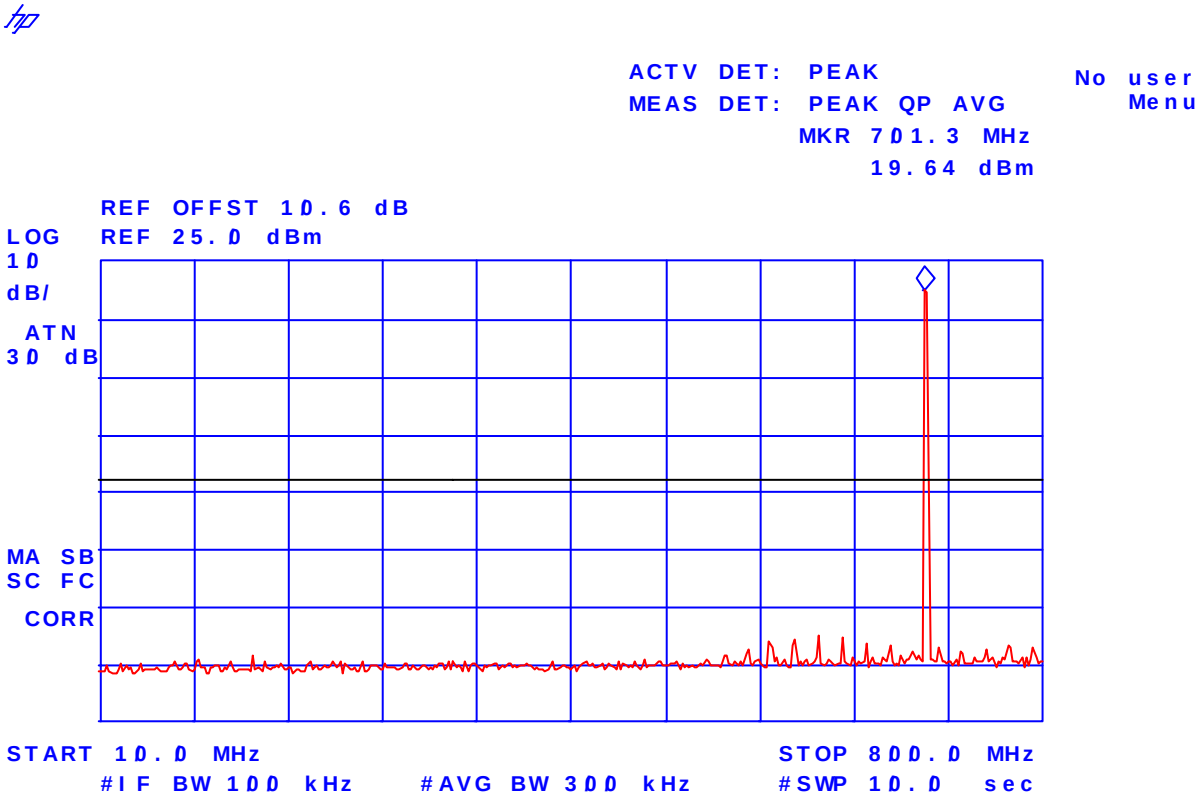
Plot # 9: **Transmitter Antenna Power Conducted Emissions**
High Channel, 715 MHz, Power Output 18.98 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

(4) 3576 MHz, -43.79 dBm
(5) 4991 MHz, -55.74 dBm
(6) 7159 MHz, -50.01 dBm
(7) 7860 MHz, -55.83 dBm



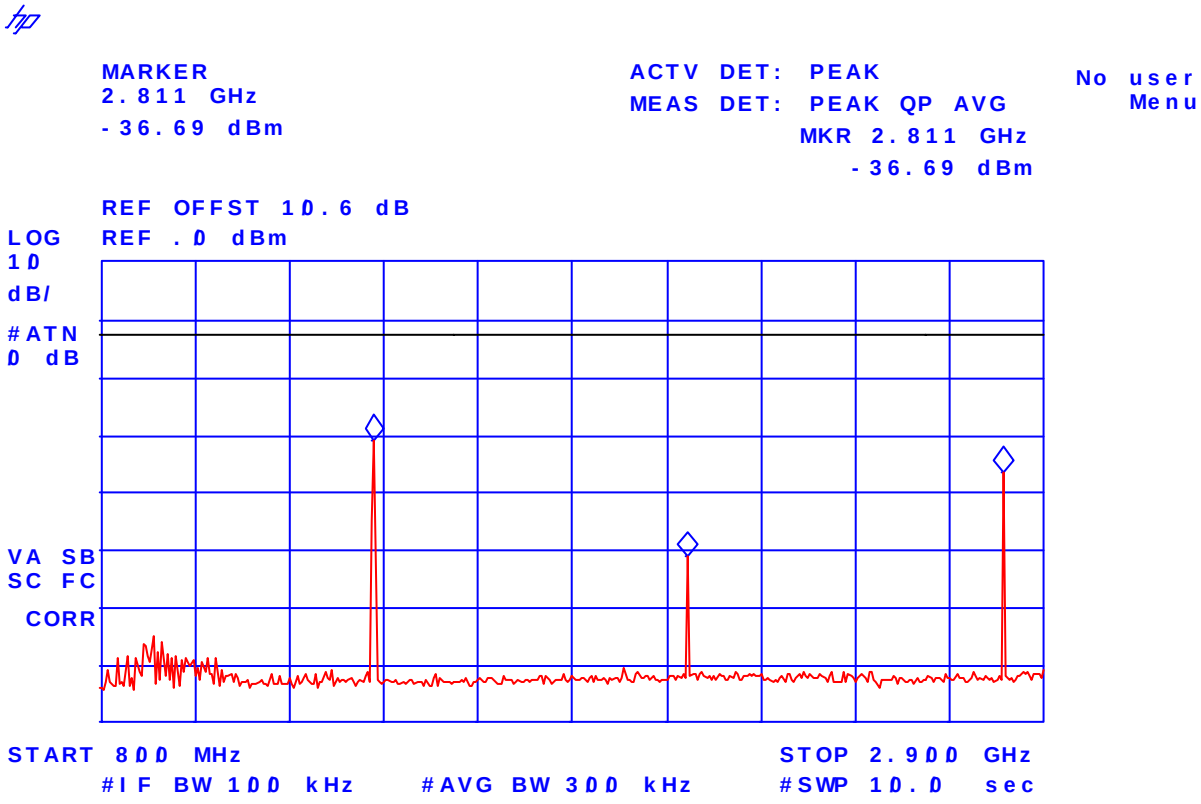
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot # 10: **Transmitter Antenna Power Conducted Emissions**
Mid Channel, 702.5 MHz, Power Output 19.66 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



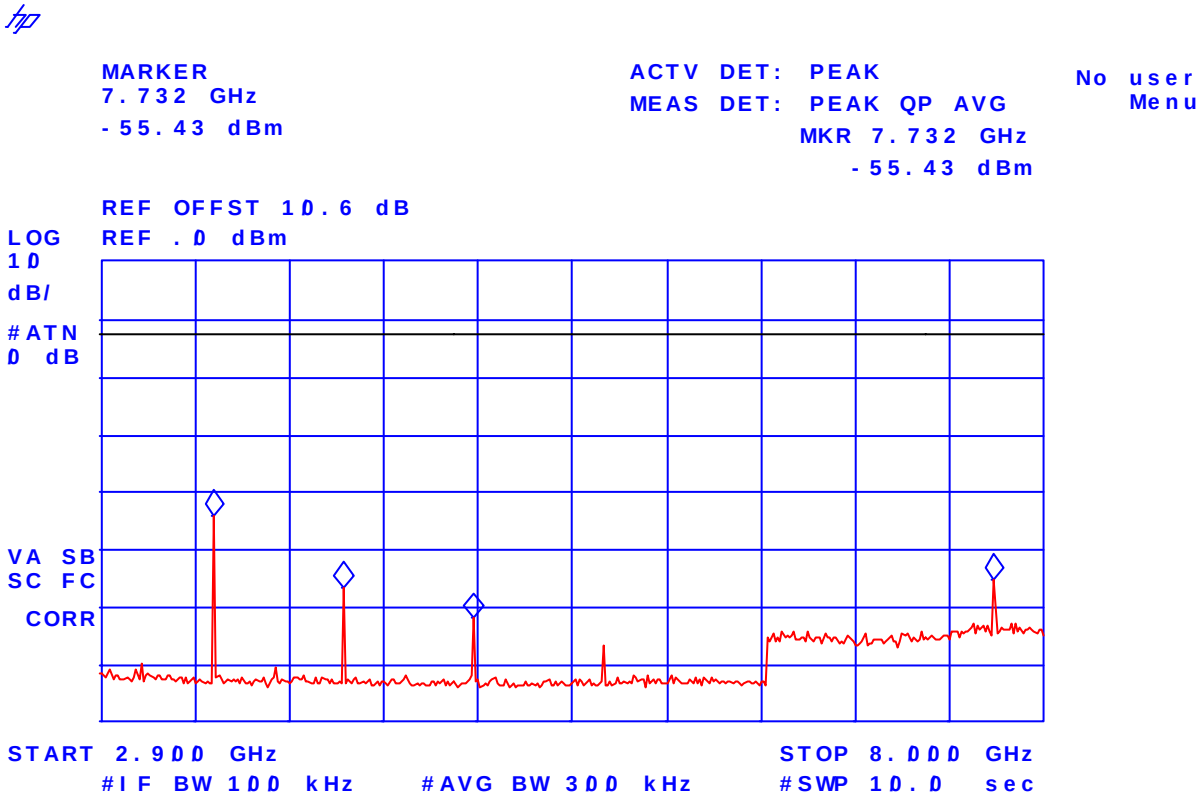
Plot # 11: Transmitter Antenna Power Conducted Emissions
Mid Channel, 702.5 MHz, Power Output 19.66 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

(1) 1409 MHz, -31.15 dBm
(2) 2107 MHz, -51.34 dBm
(3) 2811 MHz, -36.69 dBm



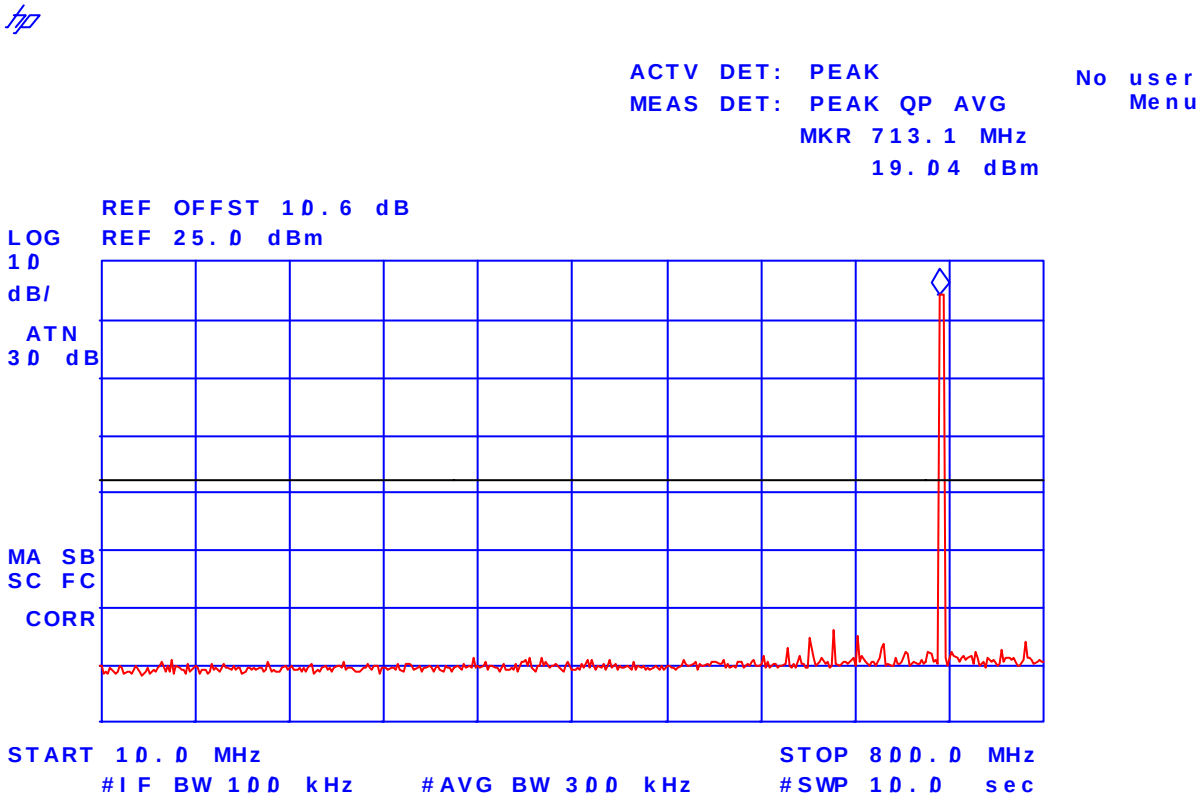
Plot # 12: **Transmitter Antenna Power Conducted Emissions**
Mid Channel, 702.5 MHz, Power Output 19.66 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

(4) 3512 MHz, -44.32 dBm
(5) 4213 MHz, -56.69 dBm
(6) 4915 MHz, -62.05 dBm
(7) 7732 MHz, -55.43 dBm



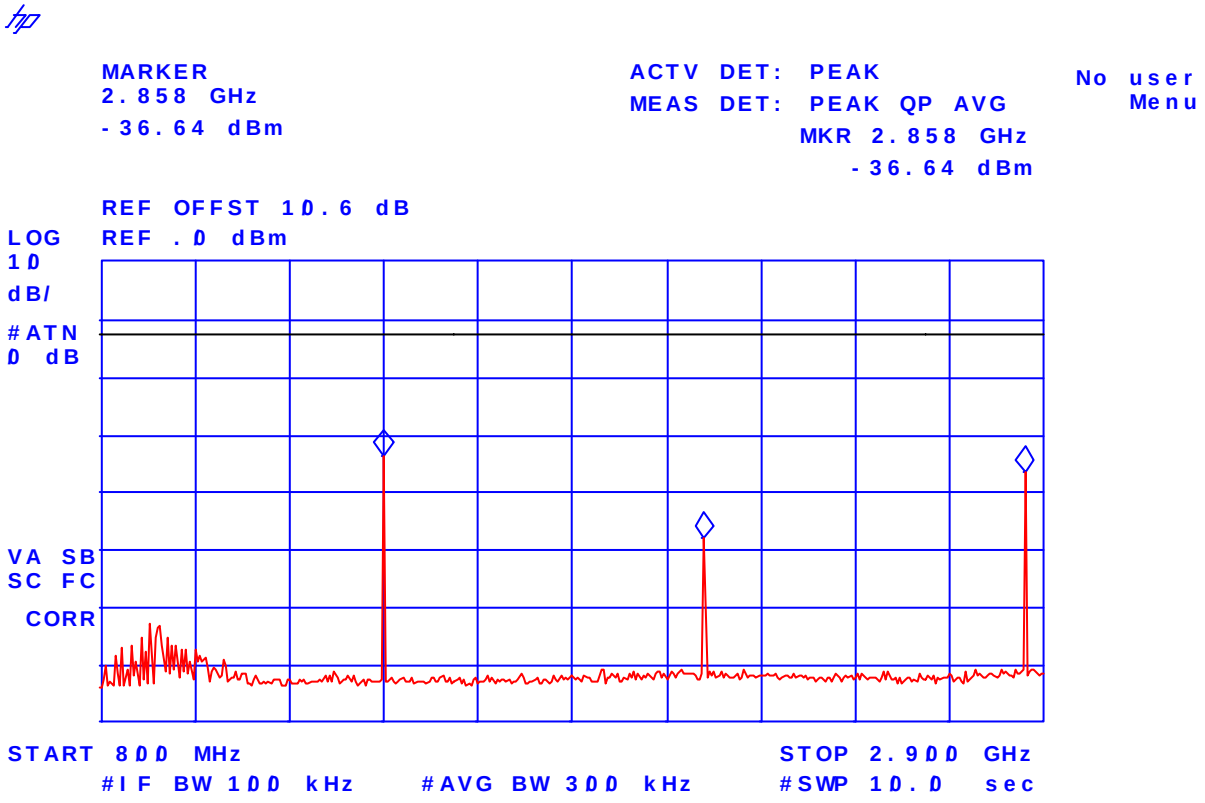
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot # 13: **Transmitter Antenna Power Conducted Emissions**
High Channel, 715 MHz, Power Output 18.98 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.



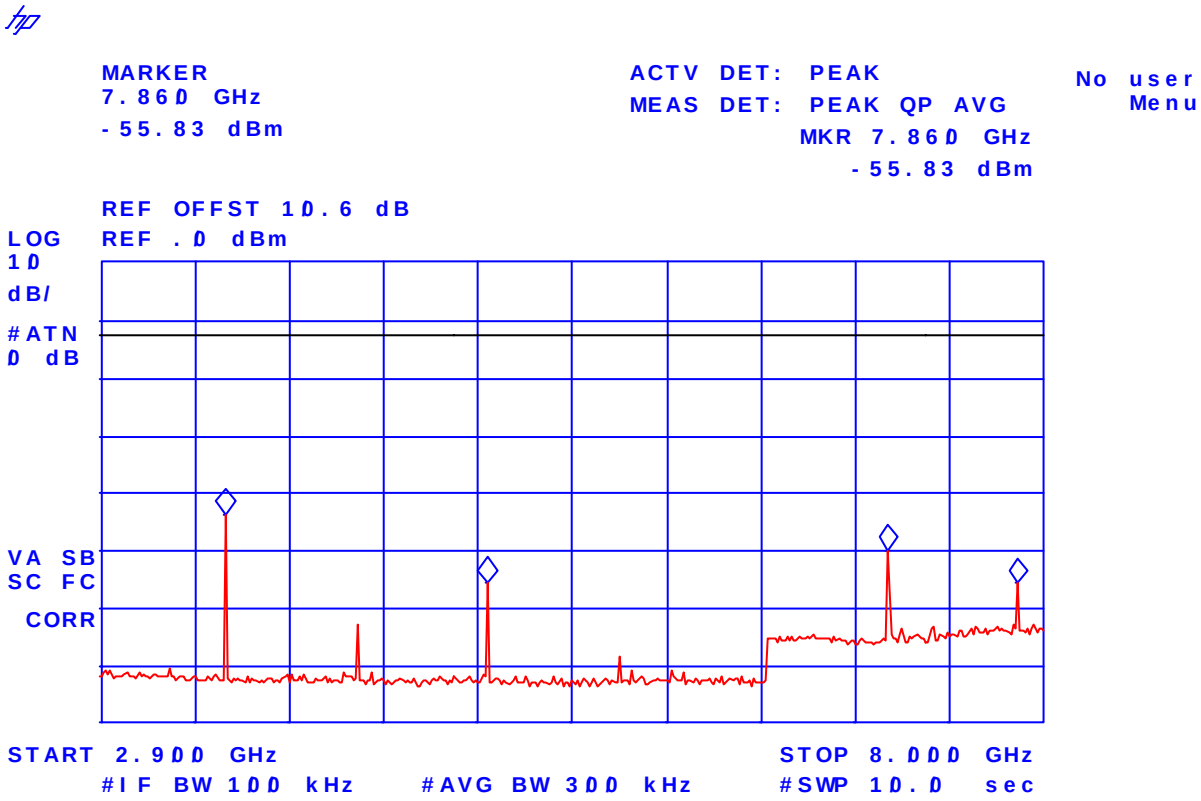
Plot # 14: **Transmitter Antenna Power Conducted Emissions**
High Channel, 715 MHz, Power Output 18.98 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

(1) 1430 MHz, -33.77 dBm
(2) 2144 MHz, -48.05 dBm
(3) 2858 MHz, -36.64 dBm



Plot # 15: Transmitter Antenna Power Conducted Emissions
High Channel, 715 MHz, Power Output 18.98 dBm
Modulation: FM Modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

(4) 3576 MHz, -43.79 dBm
(5) 4991 MHz, -55.74 dBm
(6) 7159 MHz, -50.01 dBm
(7) 7860 MHz, -55.83 dBm



6.13. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 74.861(E)(6)

6.13.1. Limits

FCC 74.861(e)(6) - Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Frequency Range	Attenuation Limit (dBc)
74.861(e)(6)	10 MHz to Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	43+10*log(P)

6.13.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in Exhibit 8, § 8.2 of this report and its value in dBc is calculated as follows:

(1) If the transmitter's antenna is an integral part of the EUT, the ERP is measured using substitution method.
(2) If the transmitter's antenna is non-integral and diverse, the lowest ERP of the carrier with 0 dBi antenna gain is used for calculation of the spurious/harmonic emissions in dBc:
Lowest ERP of the carrier = EIRP – 2.15 dB = Pc + G - 2.15 dB = xxx dBm (conducted) + 0 dBi – 2.15 dB
(3) Spurious /harmonic emissions levels expressed in dBc (dB below carrier) are as follows:

ERP of spurious/harmonic (dBc) = ERP of carrier (dBm) – ERP of spurious/harmonic emission (dBm)

6.13.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8546A	…	9 kHz to 5.6 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.
RF Amplifier	Com-Power	PA-102		1 MHz to 1 GHz, 30 dB gain nomimal
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz, 30 dB nominal
Biconilog Antenna	EMCO	3142	10005	30 MHz to 2 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 GHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 GHz – 1 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz

6.13.4. Test Setup

Please refer to Photo # 2 to 4 in Annex 1 for detailed of test setup.

6.13.5. Test Data

6.13.5.1. Lowest Frequency (690 MHz)

Fundamental Frequency: 690 MHz
RF Output Power: 20.1 dBm (conducted) or 22.3 dBm eirp
Modulation: FM modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

FREQUENCY (MHz)	E-FIELD @3m (dBuV/m)	ERP measured by Substitution Method (dBm)	(dBc)	EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
10-8000	**	**	--	PEAK	V	-35.3	--	PASS

The emissions were scanned from 10 MHz to 8 GHz and all emissions are more than 20 below the FCC limits.

6.13.5.2. Middle Frequency (702.5 MHz)

Fundamental Frequency: 702.5 MHz
RF Output Power: 19.7 dBm (conducted) or 21.9 eirp
Modulation: FM modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

FREQUENCY (MHz)	E-FIELD @3m (dBuV/m)	ERP measured by Substitution Method (dBm)	(dBc)	EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
10-8000	**	**	--	PEAK	V	-32.7	--	PASS

The emissions were scanned from 10 MHz to 8 GHz and all emissions are more than 20 below the FCC limits.

6.13.5.3. Highest Frequency (715 MHz)

Fundamental Frequency: 715 MHz
RF Output Power: 19 dBm (conducted) or 21.2 dBm eirp
Modulation: FM modulation with 15 kHz Sine Wave Signal, Frequency Deviation: 39.6 kHz Max.

FREQUENCY (MHz)	E-FIELD @3m (dBuV/m)	ERP measured by Substitution Method (dBm)	(dBc)	EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
10-8000	**	**	--	PEAK	V	-34.2	--	PASS

The emissions were scanned from 10 MHz to 8 GHz and all emissions are more than 20 below the FCC limits.

EXHIBIT 7. MEASUREMENT UNCERTAINTY

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

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna 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 $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$(Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1\pm\Gamma_1\Gamma_R)$	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

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

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

EXHIBIT 8. MEASUREMENT METHODS

8.1. CONDUCTED POWER 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 if the transmitter's transmission is transient

- Using a EMI Receiver 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.

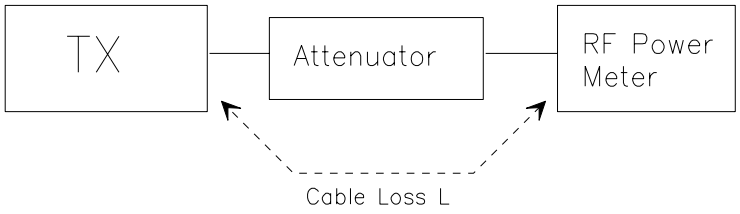
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average 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)

{ X = 1 for continuous transmission => 10log(1/x) = 0 dB }

Figure 1.



- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

8.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. Maximizing RF Emission Level (E-Field)

(a) The measurements was performed with full rf output power and 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) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies

8.2.2. Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	10 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where: P: Actual RF Power fed into the substitution antenna port after corrected.
P1: Power output from the signal generator
P2: Power measured at attenuator A input
P3: Power reading on the Average Power Meter
EIRP: EIRP after correction
ERP: ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.:

Figure 2

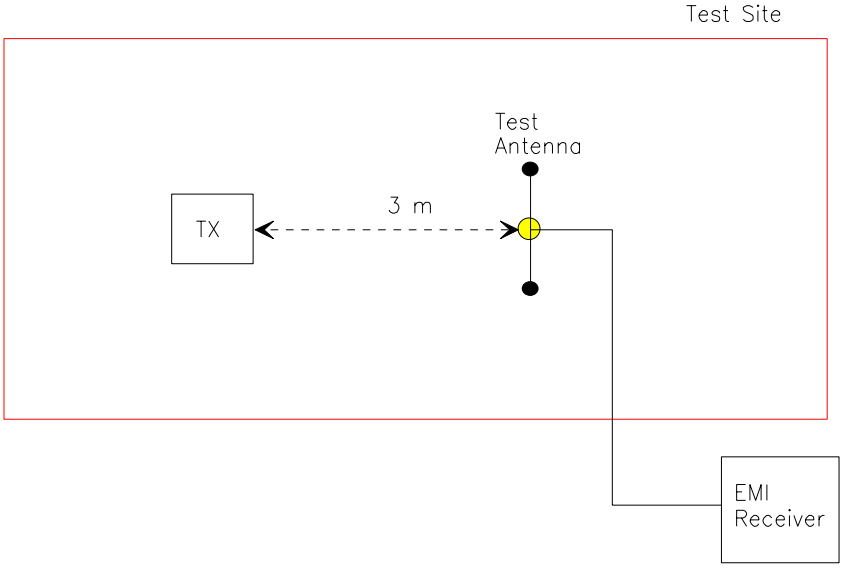
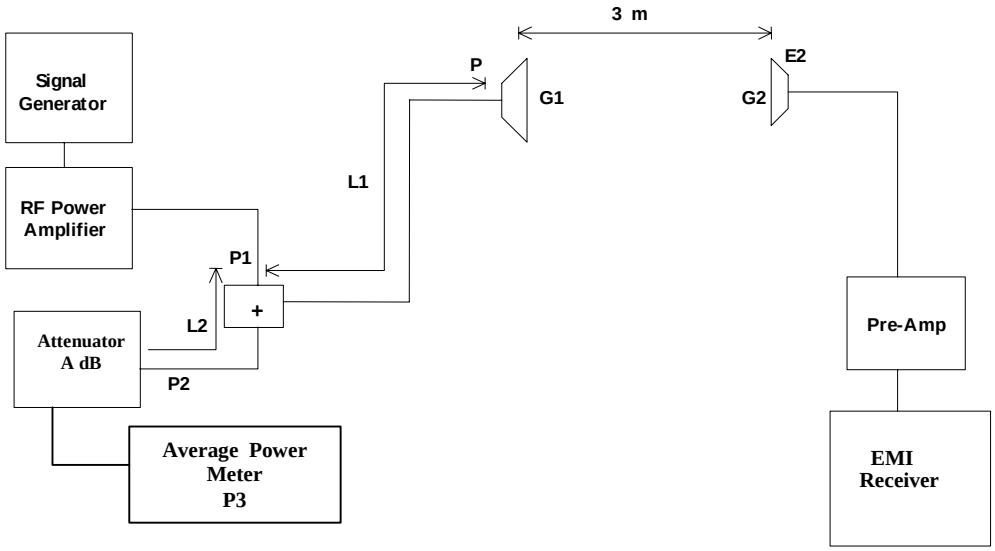


Figure 3



8.3. FREQUENCY STABILITY

Refer to FCC @ 2.1055.

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

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

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

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

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

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

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

8.4. EMISSION LIMITATION

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

Digital Modulation Through a Data Input Port @ 2.1049(h):- Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Limitations 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 EMI Receiver bandwidth shall be used for measurement of Emission Limitation/Out-of-Band Emission Measurements:

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

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

8.5. 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 EMI Receiver controls set as RBW = 30 kHz minimum , VBW ≥ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

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

FCC CFR 47, Para. 2.1051 - Spurious Emissions at Antenna Terminal:- The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.