UltraTech
Group of Labs

31040/SIT

C-1376

Canada
46390-2049

NVLAP
200093-0

00-034

BSMI
SL2-IN-E-1119R

Mar. 29, 2004

TIMCO ENGINEERING INC.
P.O. Box 370
849 N.W. State Road 45
Newberry, Florida
USA 32669

Subject: **Type Acceptance Application under FCC 47 CFR, Parts 2 and 25 (Subpart C) - Satellite Communications Operating in the frequency bands 14 - 14.5 GHz (Earth to Space).**

Applicant: **Norsat International Inc.**
Product: **40 W Portable Satellite Terminal Outdoor Unit**
Model: **3300-ODU**
FCC ID: **Q6C-090-25012-00**

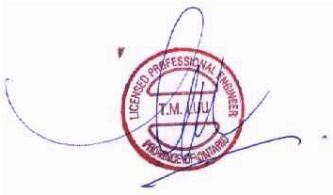
Dear Sir/Madam,

As appointed agent for **Norsat International Inc.**, we would like to submit the application to FCC Certification for the above product. Please review all necessary files uploaded to TIMCO Upload File for detailed information.

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

OUR TELEPHONE NO.: 1-877-747-6381

Yours truly,



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

TML/DH

Encl.

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

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SL2-IN-E-1119R

Mar. 29, 2004

Norsat International Inc.
300-4401 Still Creek Drive
Burnaby, British Columbia
Canada, V5C 6G9

Attn.: **Mr. Leonard Ganetsky**

Subject: **Certification Testing in accordance with FCC 47 CFR, Parts 2 and 25 (Subpart C) - Satellite Communications Operating in the frequency bands 14 - 14.5 GHz (Earth to Space).**

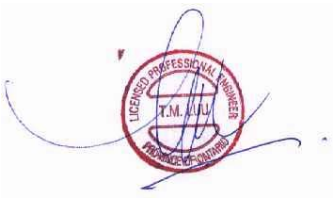
Product: **40 W Portable Satellite Terminal Outdoor Unit**
Model: **3300-ODU**
FCC ID: **Q6C-090-25012-00**

Dear Mr. Ganetsky,

The product sample has been tested in accordance with **FCC 47 CFR, Parts 2 and 25 (Subpart C) - Satellite Communications Operating in the frequency bands 14 - 14.5 GHz (Earth to Space),** and the results and observation were recorded in the engineering report, Our File No.: SWK-039FCC25

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

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

ENGINEERING TEST REPORT

40 W Portable Satellite Terminal Outdoor Unit
Model No.: 3300-ODU
FCC ID: Q6C-090-25012-00

Applicant:

Norsat International Inc.
300-4401 Still Creek Drive
Burnaby, British Columbia
Canada, V5C 6G9

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, PARTS 2 and 25 (Subpart C) – Satellite Communications

UltraTech's File No.: SWK-039FCC25

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: Mar. 29, 2004	
Report Prepared by: Tri Luu, P.Eng. Issued Date: Mar. 29, 2004	Tested by: Hung Trinh, RFI Technician Test Dates: Mar. 25-Apr. 01, 2004

- *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

TABLE OF CONTENTS

EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	Test Report	OK
1	Test Setup Photos	Photos # 1 to 3	OK
2	External Photos of EUT	Photos # 1 to 9	OK
3	Internal Photos of EUT	Photos of 1 to 49	OK
4	Cover Letters	• Letter form Ultratech for Certification Request • Letter form the Applicant to appoint Ultratech to act as an agent • Letter form the Applicant to request for Confidentiality Filing	OK
5	Attestation Statements	Manufacturer's Declaration for compliance with FCC Clauses 25.203© and 25.251	OK
6	ID Label/Location Info	ID Label Location of ID Label	OK
7	Block Diagrams	Block Diagrams	OK
8	Schematic Diagrams	Schematic Diagrams	OK
9	Parts List/Tune Up Info	Parts List/Tune Up Info	OK
10	Operational Description	Operational Description	OK
11	RF Exposure Info	RF Exposure Info	OK
12	Users Manual	Users Manual	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 25
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 and 25
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency bands 14 - 14.5 GHz (Earth to Space).
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 form Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

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

None

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2003	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions form Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	2003 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1	2003	Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Norsat International Inc.
Address:	300-4401 Still Creek Drive Burnaby, British Columbia Canada, V5C 6G9
Contact Person:	Mr. Leonard Ganetsky Phone #: 604-292-9069 Fax #: 604-292 9100 Email Address: lganetsky@norsat.com

MANUFACTURER	
Name:	Norsat International Inc.
Address:	300-4401 Still Creek Drive Burnaby, British Columbia Canada, V5C 6G9
Contact Person:	Mr. Leonard Ganetsky Phone #: 604-292-9069 Fax #: 604-292 9100 Email Address: lganetsky@norsat.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:	Norsat International Inc.
Product Name:	40 W Portable Satellite Terminal Outdoor Unit
Model Name or Number:	3300-ODU
Serial Number:	Preproducton
Type of Equipment:	Earth Station - Satellite Communications

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Power Supply Requirement:	120V 60Hz
RF Output Power Rating:	40 Watts (conducted) or 2291 Watts/4 kHz EIRP
Operating Frequency Range:	14 - 14.5 GHz (Earth to Space)
RF Output Impedance:	50 Ohms
Occupied Bandwidth (99%):	6.57 MHz
Emission Designation*:	8M23Q7W
Antenna Connector Type:	N Connector
Antenna Description:	Manufacturer: Era Technology Type: Satellite Disc Model: 10KuS Diamond Antenna Frequency Range: 10.95 – 12.75 GHz (Rx) and 13.75-14.5 GHz (Tx) In/Out Impedance: 50 Ohms Gain: 40.5 dBi at W/G output of OMT (11.7 GHz) and 42.0 dBi at W/G output of OMT (14.0 GHz)

3.4. LIST OF COMPONENTS/PARTS OF THE EUT

Please complete the following. Attach additional sheets if necessary.

Index Number	Parts Description	Parts Number/ Model Number	FCC/CE Compliance (FCC & CE)
1	**Antenna/RF Unit (2 cases)**	097-20003-01	
2	Transmitter	1020XRT	CE
3	25W SSPA	090-25603-03	
4	Ku-L Downconverter	090-20701-02	
5	Interface/Indicator	090-20003-01	
6	Antenna, Feed and Boom	ERA assembly	
7	LNB	1000HA	CE
8	Az/El Tripod Assembly	024-20003-02	
9	**Baseband/IF Unit (1 case)**	097-20003-02	
10	Base Band Module	097-20003-06	
11	User Interface Module (this is the Rugged Notebook W120 Computer)	097-20003-07	FCC Class B, CE, UL, CUL and CSA
12	Power Supply Module	097-20003-08	

3.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description User Interface & PS Module:	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Audio output	1	1/8 mini jack	not used
2	Audio input	1	1/8 mini jack	not used
3	serial port	1	9 pin sub min D	not used
4	parallel port	1		not used
5	modem jack	1	RJ11	not used
6	PCMCIA	1		not used
7	USB port	1	USB	internal connection
8	Ethernet port	1	RJ45	internal connection
9	Lap Top DC input	1	RCA jack	internal connection
7	AC input	1	IEC 320 male	3 conductor unshielded
8	Ground stud	1	stud	available to user
9	DC Power Output	1	Amphenol 12-4	internal connection
10	Control Output	1	Amphenol 12-8	internal connection

Port Number	EUT's Port Description Base Band Module	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Unbalanced audio input	4	RCA(f)	1 pr shielded or unshielded
2	Balanced audio input	4	XLR(f)	3 conductor shielded or unshielded
3	Composite video input	1	75 ohm BNC(f)	75 ohm coaxial cable
4	Composite video input	1	RCA(f)	75 ohm coaxial cable
5	SDI video input	1	75 ohm BNC(f)	75 ohm coaxial cable
6	Audio output	2	1/8 mini jack	3 conductor
7	Transmit monitor	1	Type F(f)	75 ohm coaxial cable
8	Receive monitor	1	Type F(f)	75 ohm coaxial cable
9	Receive output	1	Type N(f)	50 ohm coaxial cable
10	70 MHz output	1	50ohm BNC(f)	50 ohm coaxial cable
11	70 MHz input	1	50ohm BNC(f)	50 ohm coaxial cable
12	Control	1	Amphenol 12-8	internal connection
13	DC input	1	Amphenol 12-4	internal connection
14	Transmit IF	1	Type N(f)	internal connection
15	Receive IF	1	Type N(f)	internal connection
16	Transmit monitor	1	Type N(f)	internal connection
17	Control and Monitor	1	Amphenol 14-12	internal connection
18	ground stud	1	stud	available to user

3.6. ANCILLARY EQUIPMENT

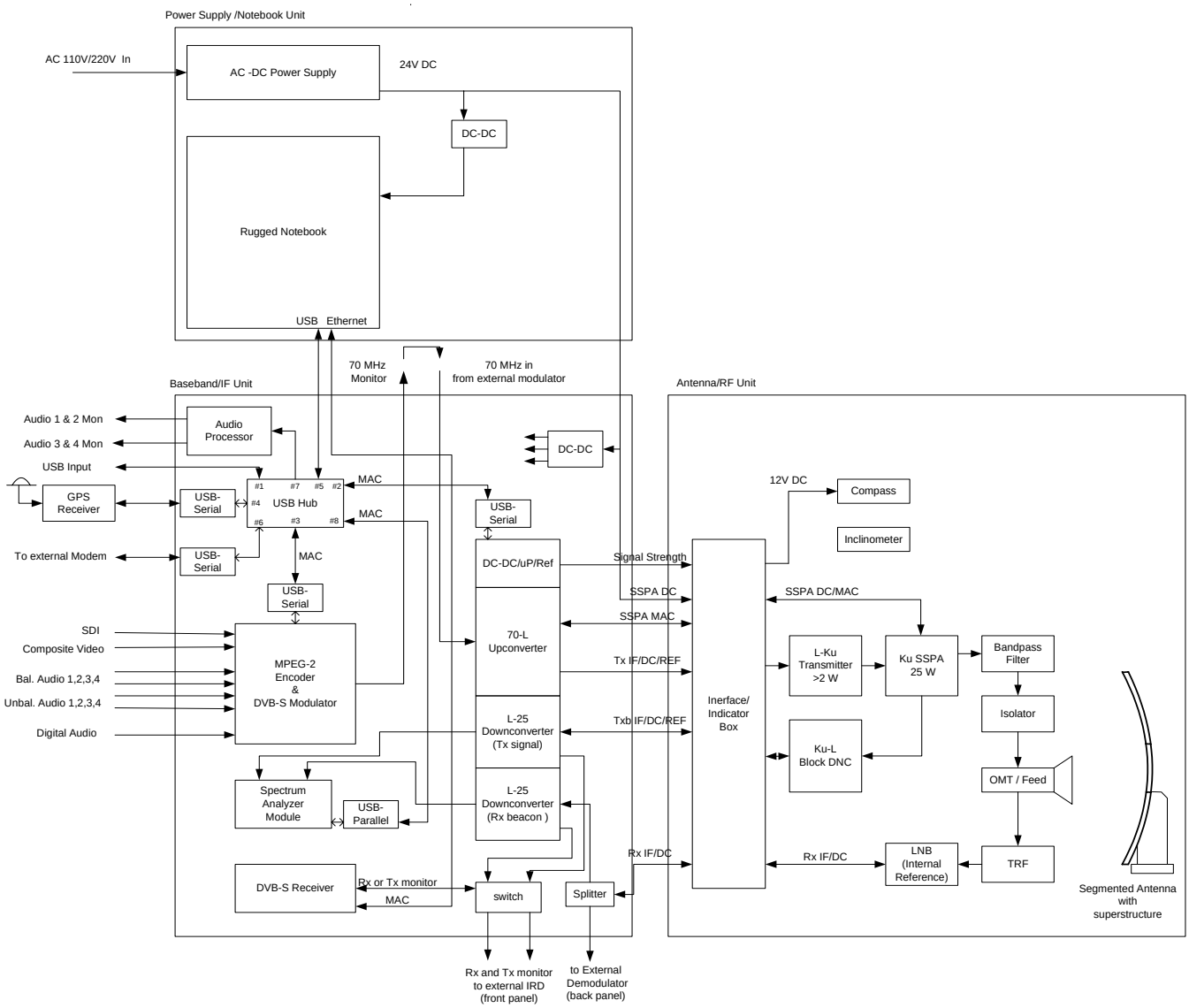
The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Brand name:	DVD Players, Video cameras, professional quality video tape recorders (VTRs) e.g. Sony Betacam
Connected to EUT's Port:	BB/IF Module RCA Video Input; BNC Video Input; SDI Video Input

Ancillary Equipment # 2	
Brand name:	DVD Players, Video cameras, VTRs
Connected to EUT's Port:	BB/IF Module XLR balanced audio inputs; RCA unbalanced audio inputs

Ancillary Equipment # 3	
Brand name:	speaker or audio amplifier
Connected to EUT's Port:	BB/IF Module 1/8 Mini Audio Output Jacks;

3.7. DRAWING OF TEST SETUP



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

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

The EUT is a portable satellite terminal. It is primarily intended to transmit a modulated signal to a satellite. The terminal also contains a means of receiving a modulated signal form the satellite.

Typically a camera or VTR will be connected to the EUT to provide a video input and one or more audio inputs. The audio and video inputs are MPEG-2 compressed and the resulting digital stream is modulated (70 MHz) and upconverted first to L-band and then to Ku band. The Ku-band signal is then amplified and transmitted to a satellite via the antenna. The MPEG-2 compression, modulation and upconversion to L-band occurs within the BB-IF Unit. Upconversion to Ku-band and final amplification takes place at the Antenna/RF Unit. The transmission of MPEG-2 compressed signals is the normal mode of operation. Note that normally none of the video and audio input ports will be terminated .

The Ku Band signal (14.0 to 14.5 GHz) at the output of the final amplifier (SSPA) is coupled and downconverted to L-band and supplied to the BB-IF Unit. This Transmit monitor signal is provided to the monitor port on the BB-IF Unit and to the internal Spectrum Analyzer. The transmit monitor function is used to monitor the transmitted signal.

A Ku band signal (10.95 to 12.75 GHz) within the LNB passband will be received by the Antenna/RF Unit, amplified, downconverted to L-band and then supplied to the BB-IF Unit. The L-band signal is provided to two output ports on the BB-IF Unit, to the DVB-S receiver and to the internal Spectrum Analyzer. The receiver is typically used to align the antenna with the satellite and possibly to monitor the NewsLink / SecureLink signal received form the satellite.

All the above functionality is controlled and monitored by a rugged laptop computer. The control and monitor is primarily via a USB interface. An Ethernet interface provides a video stream form the DVB-S receiver to the computer.

An internal AC-DC power supply provides power to all parts of he EUT.

Note that the EUT is an intentional radiator. To use/test this equipment a waveguide load be attached to the antenna feed to prevent harmful radiation.

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: Feb. 17, 2004.

5.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
25.203(c) & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
25.202(d) & 2.1055	Frequency Tolerance	Yes
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	Not applicable to new standard. However, tests are conducted under FCC's recommendation.
25.202(f) & 2.1047(b)	Modulation Limiting	Yes
25.202(f) & 2.1049	Emission Limitation & Emission Limitation	Yes
25.202(f), 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
25.202(f), 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
40 W Portable Satellite Terminal Outdoor Unit, **Model No.: 3300-ODU**, by **Norsat International 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.		

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 form radios over RF link.

6.5. FREQUENCY COORDINATION @ FCC 25.203(C), 25.251 & 101.103

6.5.1. Limits

Sec. 25.203(c) – Choice of Site and Frequencies

Prior to the filing of its application, an earth station applicant shall coordinate the proposed frequency usage with existing terrestrial users and with applicants for terrestrial station authorizations with previously filed applications in accordance with the following procedure:

(1) An applicant for an earth station authorization shall perform an interference analysis in accordance with the procedures set forth in Sec. 25.251 for each terrestrial station, for which a license or construction permit has been granted or for which an application has been accepted for filing, which is or is to be operated in a shared frequency band to be used by the proposed earth station and which is located within the great circle coordination distance contour(s) of the proposed earth station.

(2) The earth station applicant shall provide each such terrestrial station licensee, permittee, and prior filed applicant with the technical details of the proposed earth station and the relevant interference analyses that were made. At a minimum, the earth station applicant shall provide the terrestrial user with the following technical information:

(i) The geographical coordinates of the proposed earth station antenna(s),
(ii) Proposed operating frequency band(s) and emission(s),
(iii) Antenna center height above ground and ground elevation above mean sea level,
(iv) Antenna gain pattern(s) in the plane of the main beam,
(v) Longitude range of geostationary satellite orbit (GSO) satellites at which antenna may be pointed, for proposed earth station antenna(s) accessing GSO satellites,
(vi) Horizon elevation plot,
(vii) Antenna horizon gain plot(s) determined in accordance with Sec. 25.251 for satellite longitude range specified in paragraph (**c**)(2)(v) of this section, taking into account the provisions of Sec. 25.251 for earth stations operating with non-geostationary satellites,
(viii) Minimum elevation angle,
(ix) Maximum equivaLeonardt isotropically radiated power (e.i.r.p.) density in the main beam in any 4 kHz band, (dBW/4 kHz) for frequency bands below 15 GHz or in any 1 MHz band (dBW/MHz) for frequency band above 15 GHz,
(x) Maximum available RF transmit power density in any 1 MHz band and in any 4 kHz band at the input terminals of the antenna(s),
(xi) Maximum permissible RF interference power level as determined in accordance with Sec. 25.251 for all applicable percentages of time, and
(xii) A plot of great circle coordination distance contour(s) and rain scatter coordination distance contour(s) as determined by Sec. 25.251.

(3) The coordination procedures specified in Sec. 101.103 of this chapter and Sec. 25.251 shall be applicable except that the information to be provided shall be that set forth in paragraph (**c**)(2) of this section, and that the 30-day period allowed for response to a request for coordination may be increased to a maximum of 45 days by mutual consent of the parties.

(4) Where technical problems are resolved by an agreement or operating arrangement between the parties that would require special procedures be taken to reduce the likelihood of harmful interference (such as the use of artificial site shielding) or would result in lessened quality or capacity of either system, the details thereof shall be contained in the application.

(5) The Commission may, in the course of examining any application, require the submission of additional showings, complete with pertinent data and calculations in accordance with Sec. 25.251, showing that harmful interference is not likely to result form the proposed operation.

Sec. 25.251 - Special requirements for coordination.

a) The administrative aspects of the coordination process are set forth in Sec. 101.103 of this chapter in the case of coordination of terrestrial stations with earth stations, and in Sec. 25.203 in the case of coordination of earth stations with terrestrial stations.

b) The technical aspects of coordination are based on Appendix S7 of the International Telecommunication Union Radio Regulations and certain recommendations of the ITU Radiocommunication Sector (available at the FCC's Reference Information Center, Room CY-A257, 445 12th Street, SW., Washington, DC 20554).

6.5.2. Manufacturer Declaration for Compliance with FCC 25.203(c) & 25.251

Please see attached Manufacturer's Declaration for compliance with FCC Clauses 25.203(c) and 25.251

6.6. MAXIMUM EQUIVALEONARDT ISOTROPICALLY RADIATED POWER (E.I.R.P.) DENSITY AND MAXIMUM AVAILABLE RF TRANSMIT POWER DENSITY AT ANTENNA TERMINAL @ FCC 25.203(C)(IX) & (X) & 25.204(A)

6.6.1. Limits

FCC 25.203(c)(ix):- Maximum equivaLeonardt isotropically radiated power (e.i.r.p.) density in the main beam in any 4 kHz band, (dBW/4 kHz) for frequency bands below 15 GHz or in any 1 MHz band (dBW/MHz) for frequency band above 15 GHz,

FCC 25.203(c)(x):- Maximum available RF transmit power density in any 1 MHz band and in any 4 kHz band at the input terminals of the antenna(s).

FCC 25.204(a) - In bands shared coequally with terrestrial radio communication services, the equivaLeonardt isotropically radiated power transmitted in any direction towards the horizon by an earth station operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (**c**) of this section:

+40 dBW in any 4 KHz band for <INF>[thetas]:</INF>0[deg]
+40+3 <INF>[thetas]</INF> dBW in any 4 KHz band for
<INF>[thetas]</INF><0[deg][lE]05[deg]

6.6.2. Method of Measurements

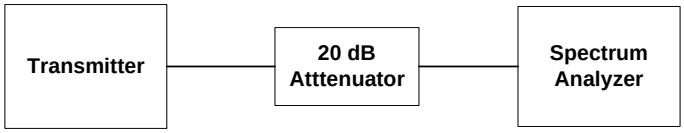
Refer to Exhibit 8, § 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

6.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3182	110401382	9 kHz to 40 GHz with external mixer to extend the upper frequency range - RMS, QP, Average & Peak Detectors.
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
Synthesize Sweeper	Hewlett Packard	83752B	3610A00457	0.01 – 20 GHz

6.6.4. Test Arrangement

- Power at RF Power Output Terminals



6.6.5. Test Data

Antenna Gain: 42.0 dBi

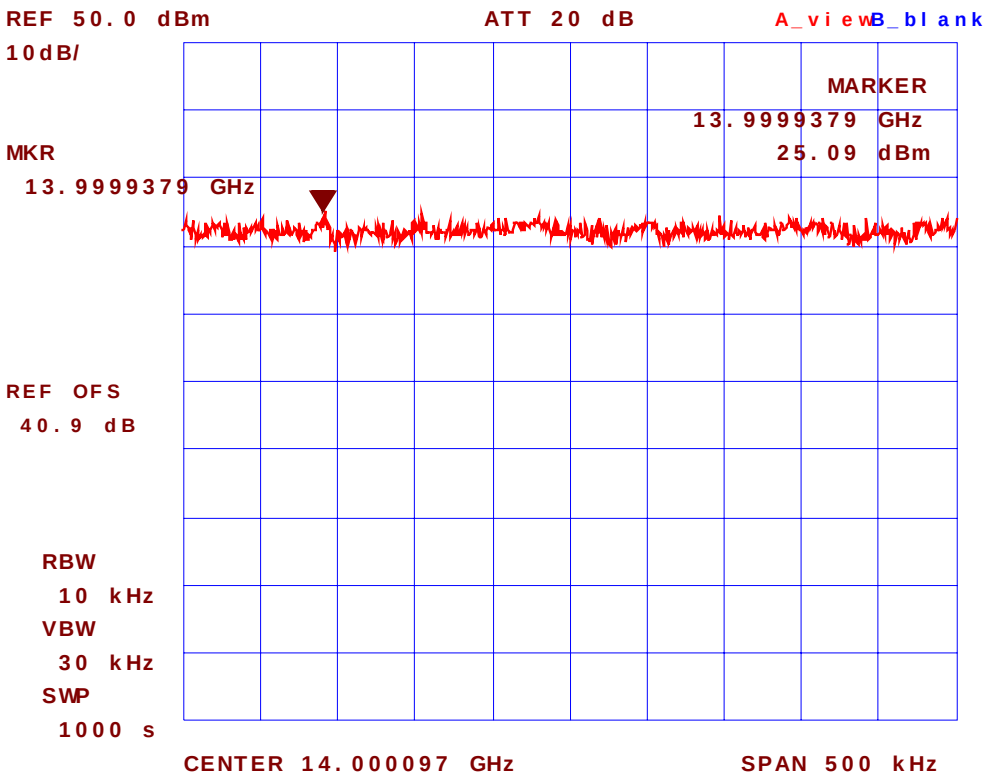
Transmitter Frequency (GHz)	RF Transmit Power Density at Antenna Port in 10 kHz BW (dBm)	(1) RF Transmit Power Density at Antenna Port in 4 kHz BW (dBm)	RF Transmit Power Density at Antenna Port in 1 MHz BW (dBm)	RF Transmit Power Density at Antenna Port (Total Peak Power) (dBm)	EIRPD in 4 kHz BW (dBm)	(2) EIRPD LIMIT in 4 KHz BW (dBm)
14.00	25.1	21.1	40.5	46.0	63.1	70.0
14.25	24.8	20.8	40.2	46.0	62.8	70.0
14.50	25.6	21.6	40.8	46.0	63.6	70.0

Notes:

(1) Since the 4 KHz Power Density can not be measured the Power Density in 10 kHz was measured and converted to 4 kHz using the following formula: **PD(4kHz) = PD(10kHz) + 10*log(4kHz/10kHz)**

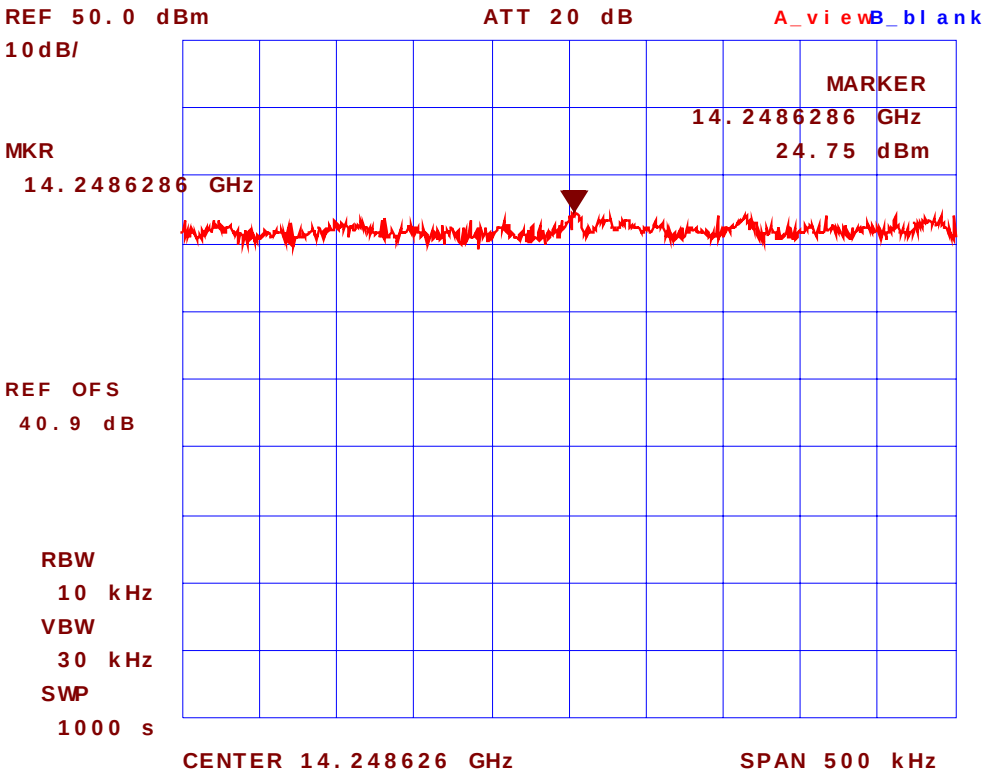
(2) FCC EIRP Density Limit = 40 dBW = 70 dBm in 4 kHz RBW

Plot # 1: Lowest Channel: 14 GHz, Power Density in 4 kHz



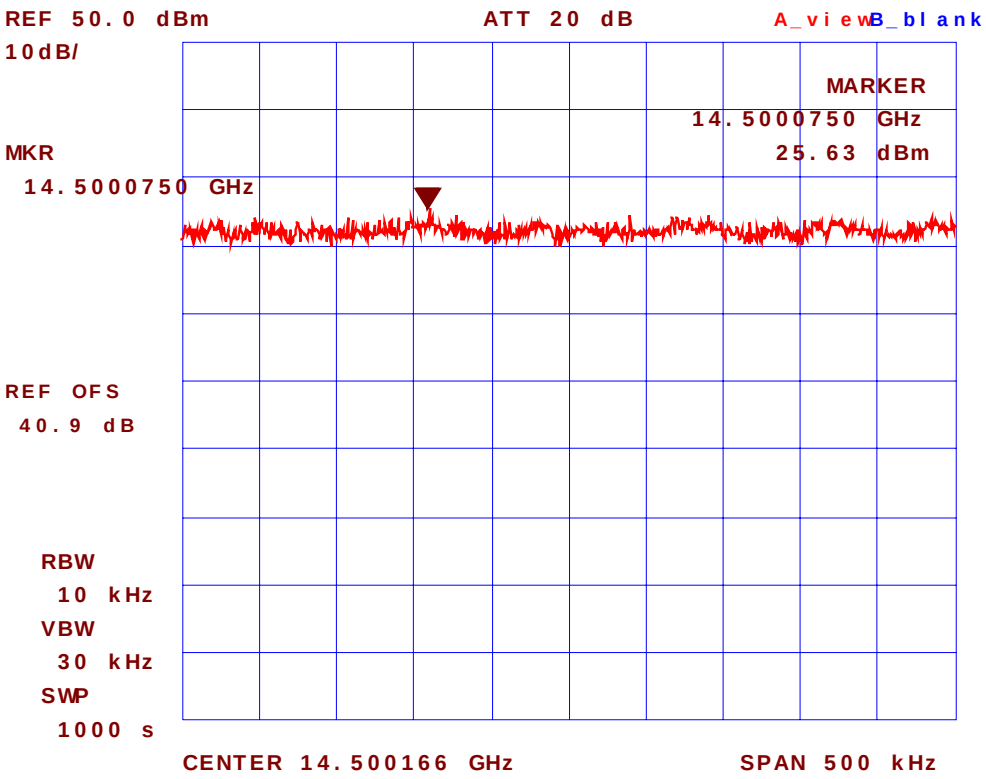
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #2: Mid Channel: 14.25 GHz, Power Density in 4 kHz

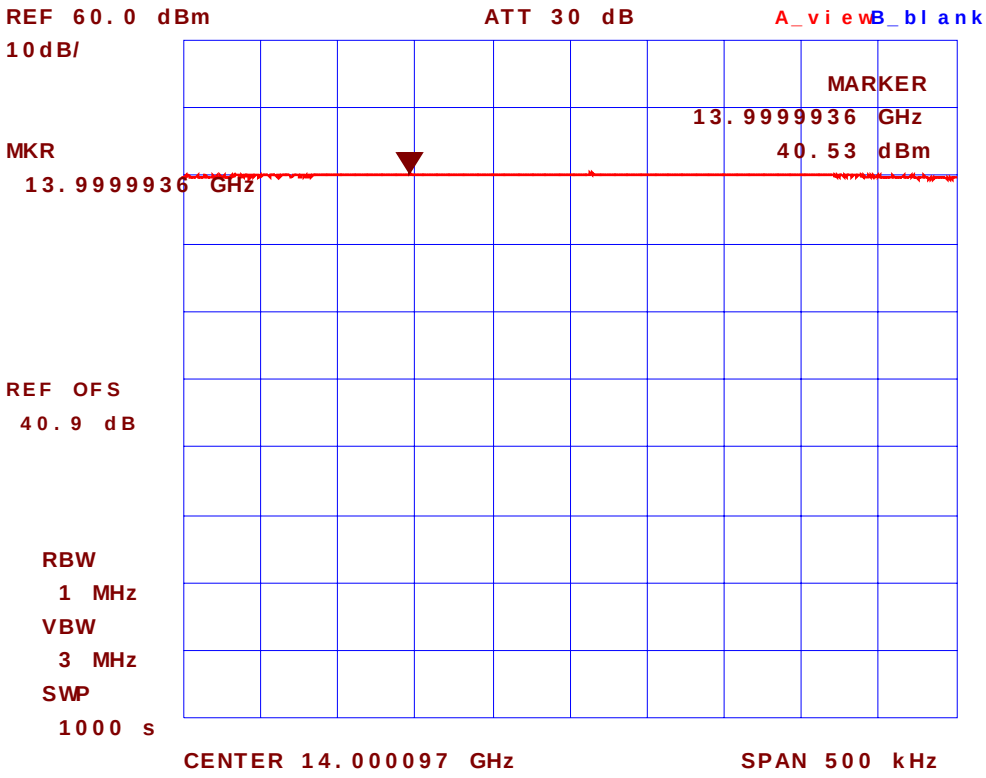


- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #3: Highest Channel: 14.5 GHz, Power Density in 4 kHz

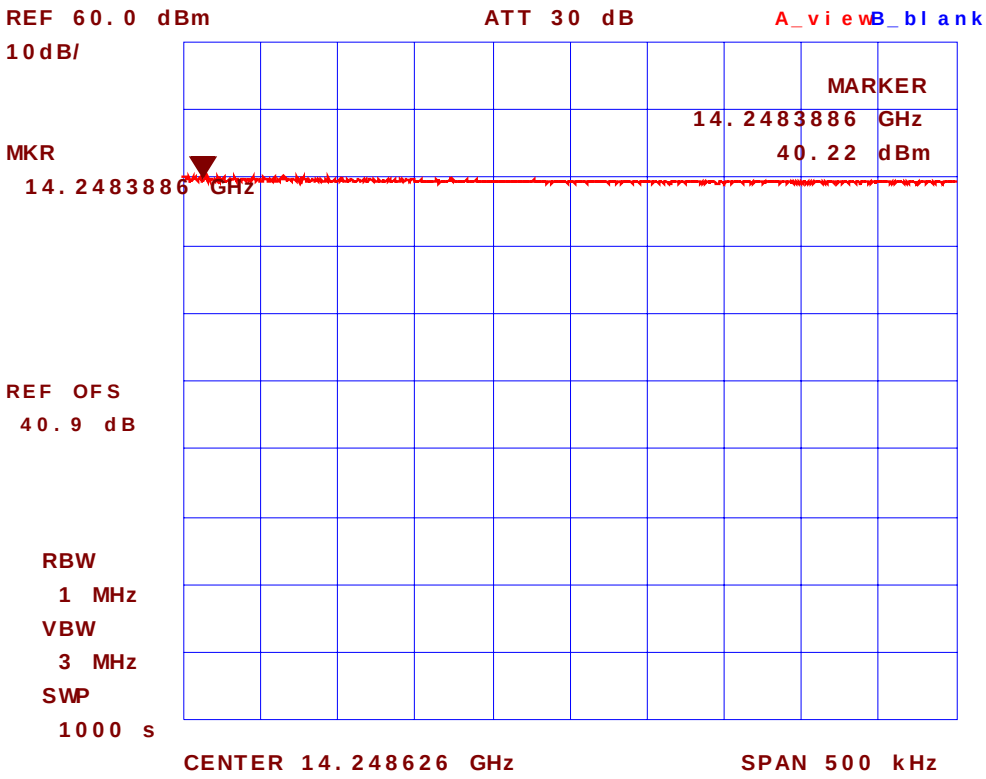


Plot #4: Lowest Channel: 14 GHz, Power Density in 1 MHz

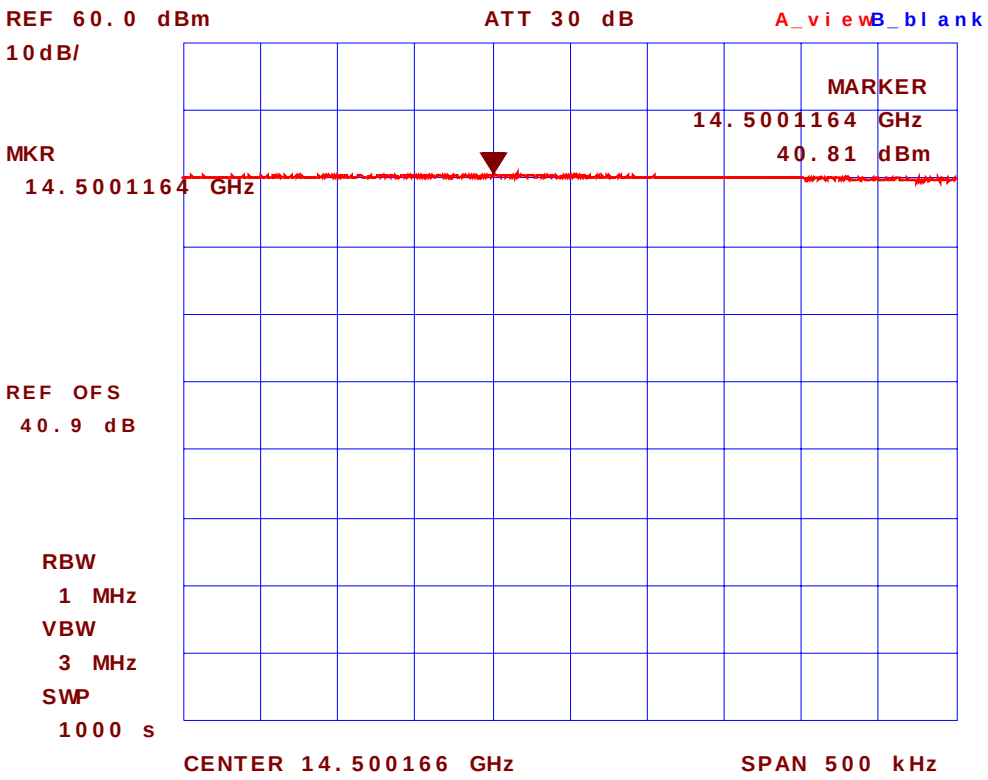


- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #5: Mid Channel: 14.25 GHz, Power Density in 1 MHz



Plot #6: Highest Channel: 14.5 GHz, Power Density in 1 MHz



6.7. RF EXPOSURE REQUIREMENTS @ 1.1310 & 2.1091

6.7.1. Limits

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

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

F = Frequency in MHz

6.7.2. Method of Measurements

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

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

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

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz
67297 RF Detector (Diode Detector)	Herotex	DZ122-553	63400	..
Storage Oscilloscope	Philips	PM3320A	ST9907959	--

Calculation Method of RF Safety Distance:

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

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

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

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

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

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

6.7.4. Test Data

Channel Frequency (GHz)	Measured Peak Conducted Transmit Power (total) (dBm)	Maximum Antenna Gain (dBi)	Peak Total EIRP (dBm)	Laboratory's Recommended Minimum RF Safety Distance r (meters)
14.00 – 14.50	46.0	42.0	88.0	7.1

Note 1: **RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\Pi S)^{1/2} = (EIRP/4\Pi S)^{1/2}$**
$S = 1.0$ mW/cm^2

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: 7.1 meters	Manufacturer' instruction for separation distance between antenna and persons required: 7.1 meters Please refer to page # 1 of the Users/ Manual and FCC RF Exposure folder
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Please refer to page # 1 of the Users/ Manual and FCC RF Exposure folder
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Please refer to page # 1 of the Users/ Manual and FCC RF Exposure folder
Any other RF exposure related issues that may affect MPE compliance	N/A

6.8. FREQUENCY TOLERANCE FOR EARTH STATIONS @ FCC 2.1055 & 25.202(D)

6.8.1. Limits @ FCC 25.202(d)

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

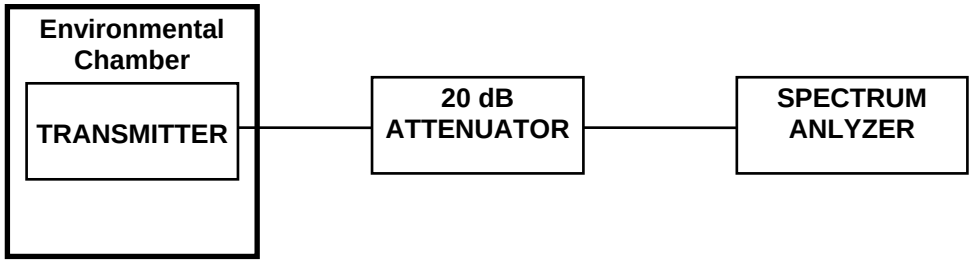
6.8.2. Method of Measurements

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

6.8.3. 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^{o} to +60^{o} C range

6.8.4. Test Arrangement



6.8.5. Test Data

Center Frequency:	14 GHz
Full Power Level:	46.0 dBm total peak power
Frequency Tolerance Limit:	0.001%
Max. Frequency Tolerance Measured:	+1.7 kHz or 0.000012%
Input Voltage Rating:	120 V, 60Hz

CENTER FREQUENCY & RF POWER OUTPUT VARIATION			
Ambient Temperature (^{o}C)	**Supply Voltage (Nominal) 120 Volts**	**Supply Voltage (85% of Nominal) 102 Volts**	**Supply Voltage (115% of Nominal) 138 Volts**
	kHz	**kHz**	**kHz**
-30	+1.7	N/A	N/A
-20	+1.6	N/A	N/A
-10	+1.6	N/A	N/A
0	+1.4	N/A	N/A
+10	+1.4	N/A	N/A
+20	0	0.43	+0.71
+30	+1.4	N/A	N/A
+40	+1.6	N/A	N/A
+50	+1.6	N/A	N/A

6.9. 99% OCCUPIED BANDWIDTH & EMISSION LIMITATION @ FCC 2.1049, 25.202(F)

6.9.1. Limits @ FCC 25.202(f)

The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(1) In any 4 kHz band, the center frequency of which is removed form the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;
(2) In any 4 kHz band, the center frequency of which is removed form the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;
(3) In any 4 kHz band, the center frequency of which is removed form the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;
(4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f)

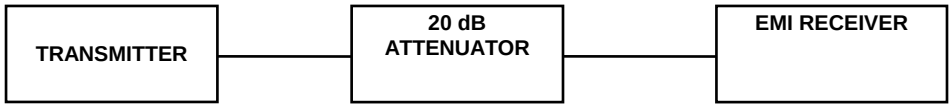
6.9.2. Method of Measurements

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

6.9.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3182	110401382	9 kHz to 40 GHz with external mixer to extend the upper frequency range - RMS, QP, Average & Peak Detectors.
Attenuator(s)	Bird	..	…	DC – 22 GHz

6.9.4. Test Arrangement

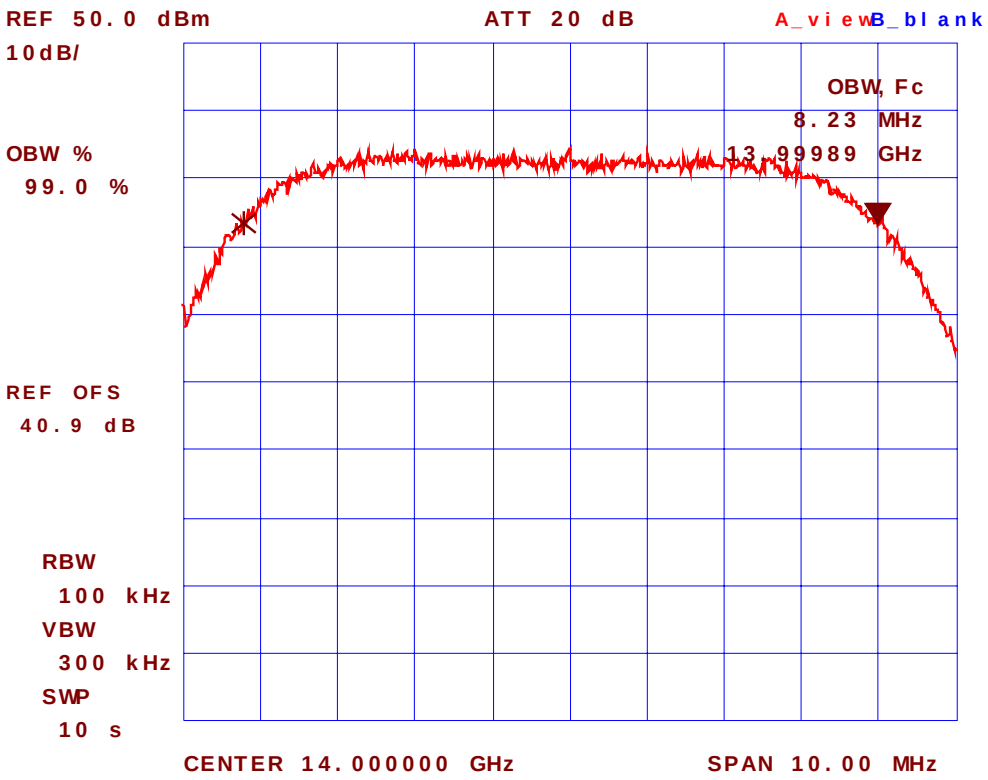


6.9.5. Test Data

6.9.5.1. 99% Occupied Bandwidth

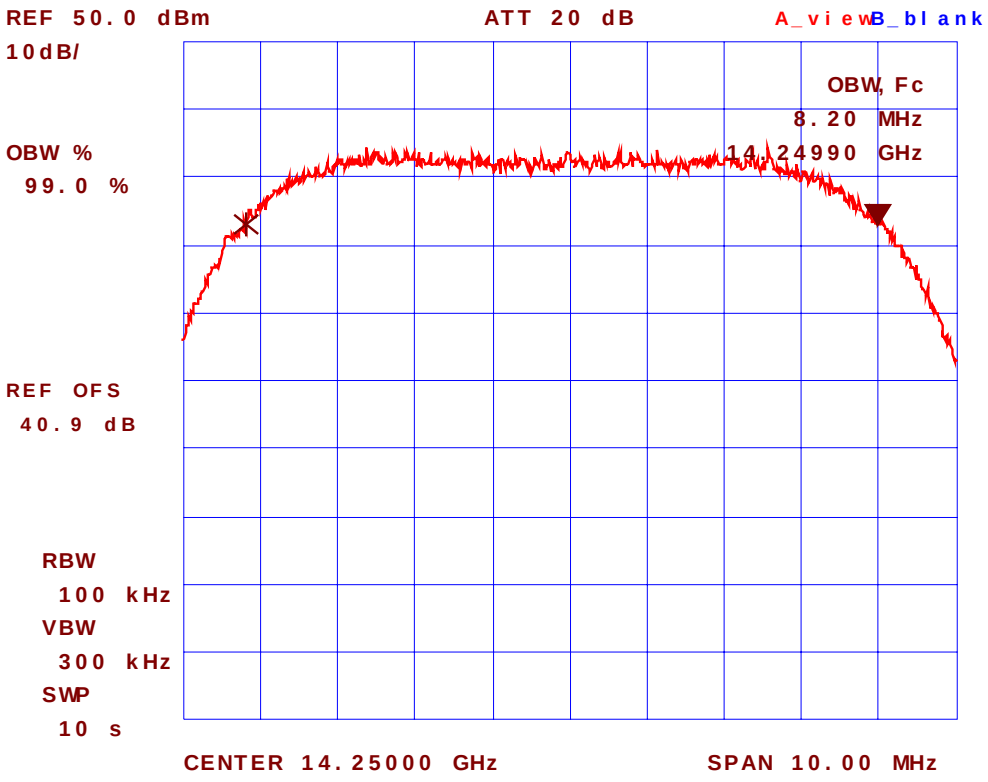
Frequency (GHz)	Measured 99% OBW (MHz)
14.00	8.23
14.25	8.20
14.50	8.23

Plot #7: Lowest Channel: 14 GHz, 99 % OBW

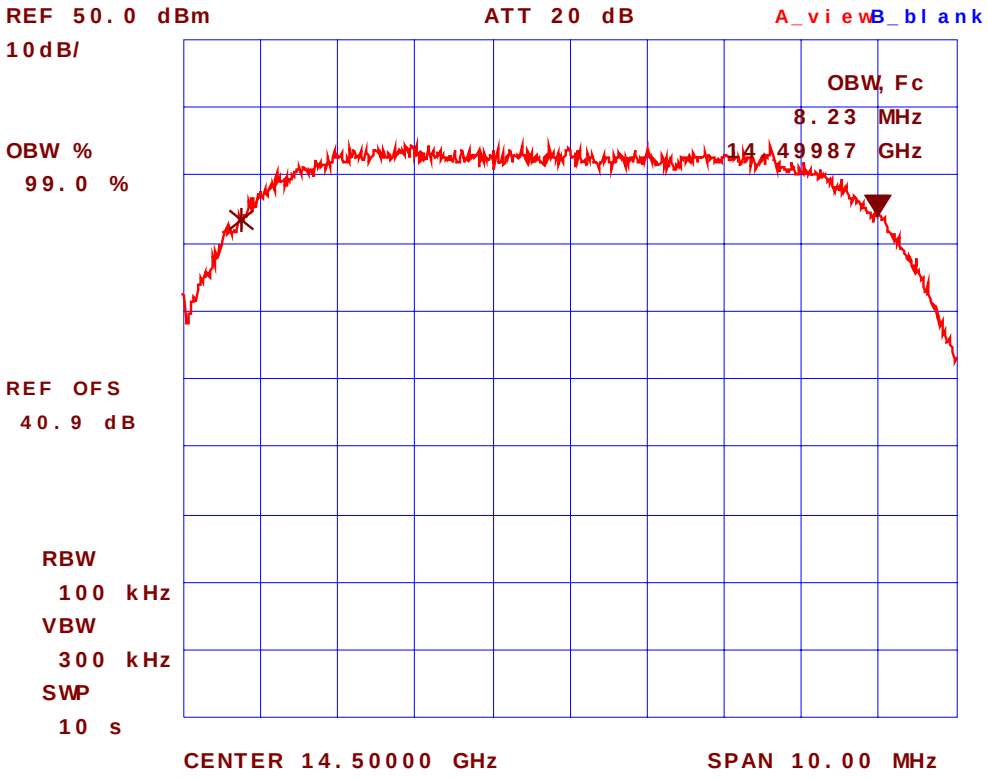


- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #8: Mid Channel: 14.25 GHz, 99 % OBW



Plot #9: Highest Channel: 14.5 GHz, 99 % OBW



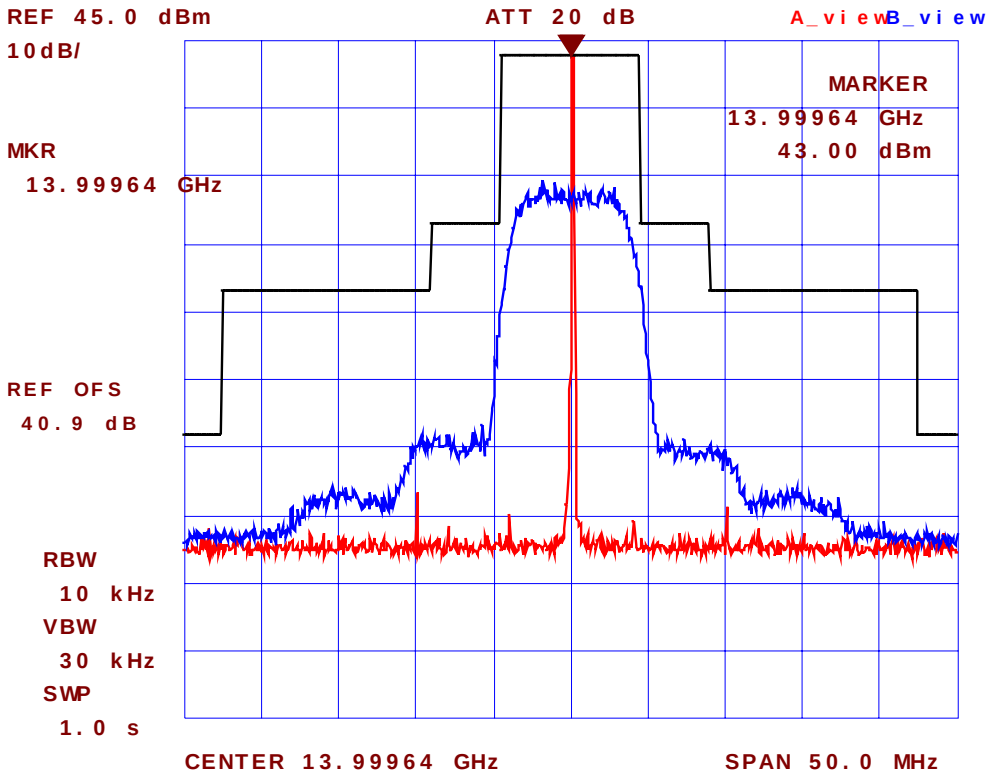
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

6.9.5.2. Emission Limitations

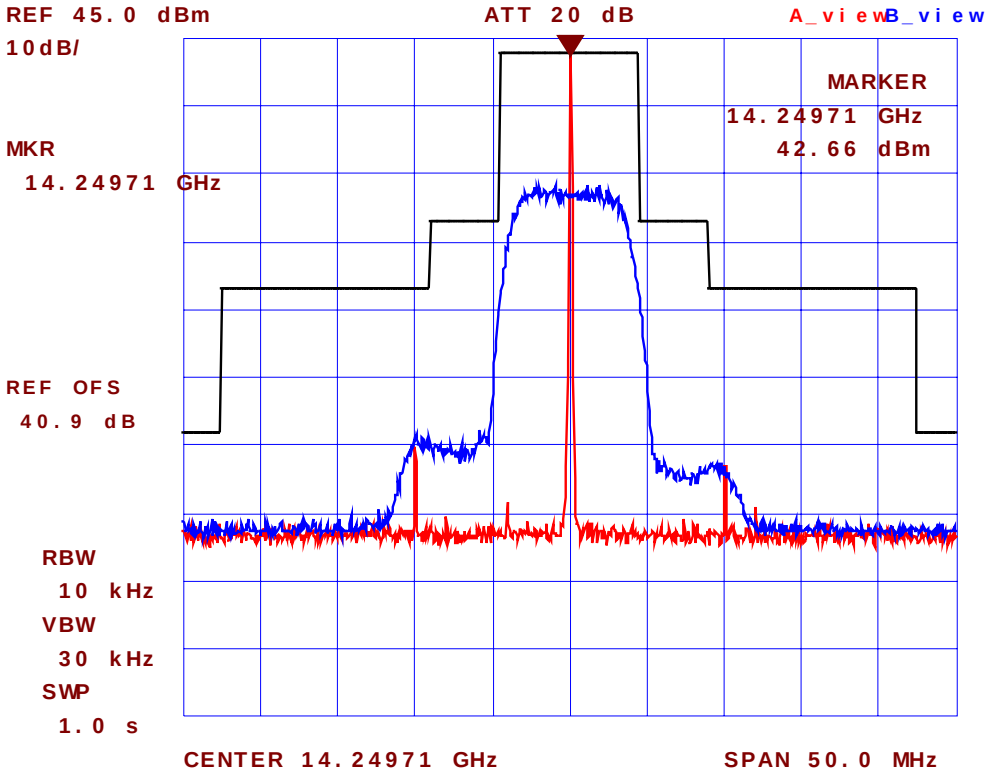
Remark: Since most of the spectrum analyzer has no capability of measurement in 4 kHz RBW, 10 kHz RBW is employed for measurement as the worst case. If the signal emission emissions were found to exceed the FCC Limit in 4 kHz, the additional measurements will be performed in 3 kHz RBW and the justification shall be made.

Conform. Please refer to Plot # 10 to 12 below for Details of measurements

Plot #10: Lowest Channel: 14 GHz, Emission Mask

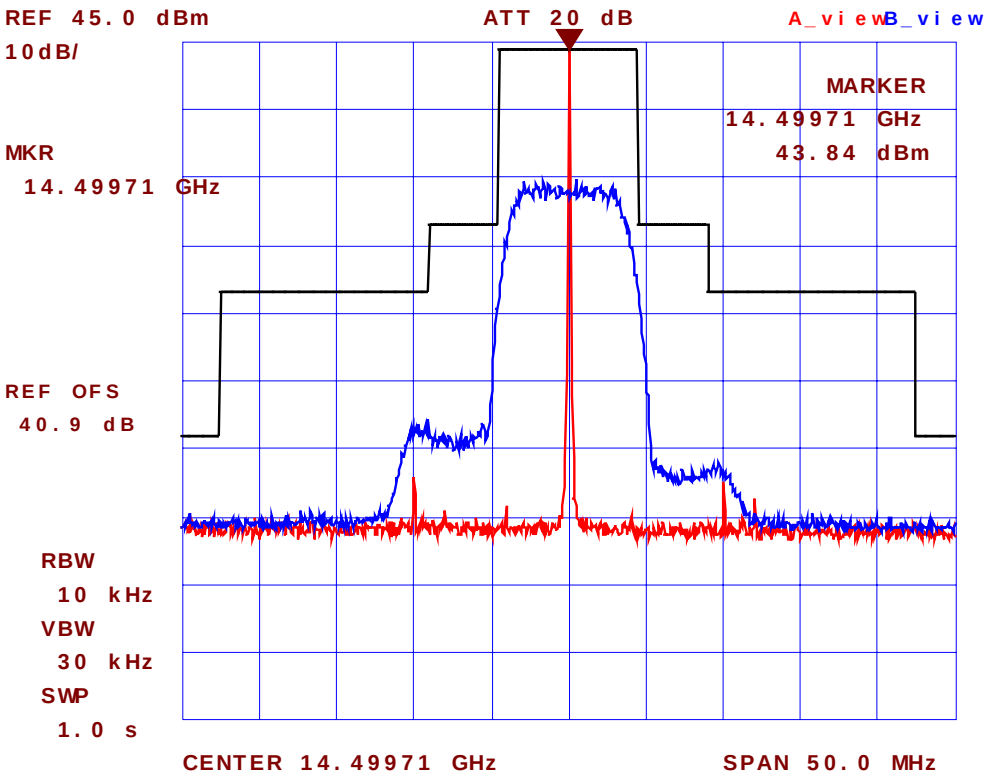


Plot #11: Mid Channel: 14.25 GHz, Emission Mask



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

Plot #12: Highest Channel: 14.5 GHz, Emission Mask



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

6.10. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 25.202(F)

6.10.1. Limits @ 25.202(f)

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

FCC Rules	Frequency Range	Attenuation Limit (dBc)
FCC 25.202(f)	FCC 25.202(f)	43 + 10* log(P in Watts)

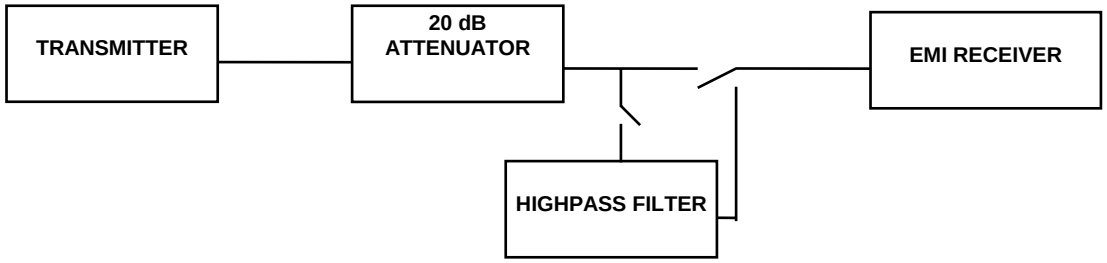
6.10.2. Method of Measurements

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

6.10.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3182	110401382	9 kHz to 40 GHz with external mixer to extend the upper frequency range - RMS, QP, Average & Peak Detectors.

6.10.4. Test Arrangement



6.10.5. Test Data

6.10.5.1. Near Lowest Frequency (14.00 GHz)

Fundamental Frequency: 14.00 GHz
Peak RF Output Power at antenna port: 40.5 dBm/MHz
Modulation: QPSK

FREQUENCY (GHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS (dBm/MHz)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
0.010 to 100	***	**	-49.1	***	PASS

- The emissions were scanned form 10 MHz to 100 GHz and no emissions less than 20 dB below the limits were found.
- Refer to Photos # 13 to 18 for detailed measurements

6.10.5.2. Near Lowest Frequency (14.25 GHz)

Fundamental Frequency: 14.25 GHz
Peak RF Output Power at antenna port: 40.2 dBm/MHz/MHz
Modulation: QPSK

FREQUENCY (GHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS (dBm/MHz)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
0.010 to 100	***	**	-49.1	***	PASS

- The emissions were scanned form 10 MHz to 100 GHz and all emissions less than 20 dB below the limits were recorded.
- Refer to Photos # 19 to 24 for detailed measurements

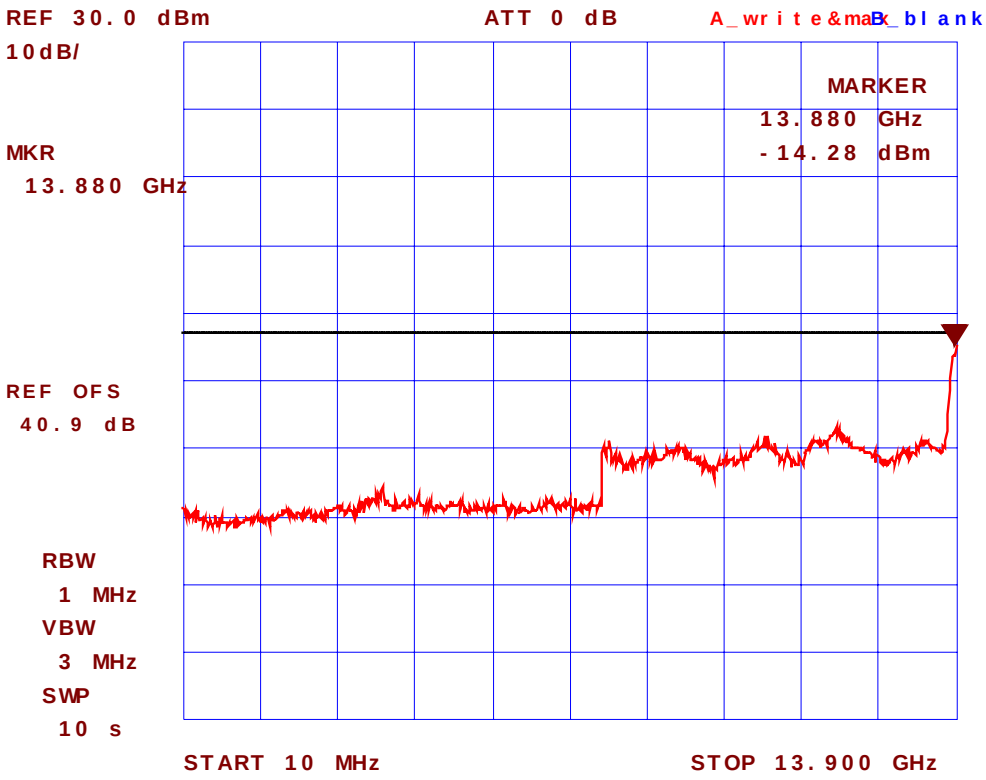
6.10.5.3. Near Lowest Frequency (14.50 GHz)

Fundamental Frequency: 14.50 GHz
Peak RF Output Power at antenna port: 40.8 dBm/MHz/MHz
Modulation: QPSK

FREQUENCY (GHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS (dBm.MHz)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
0.010 to 100	***	**	-49.1	***	PASS

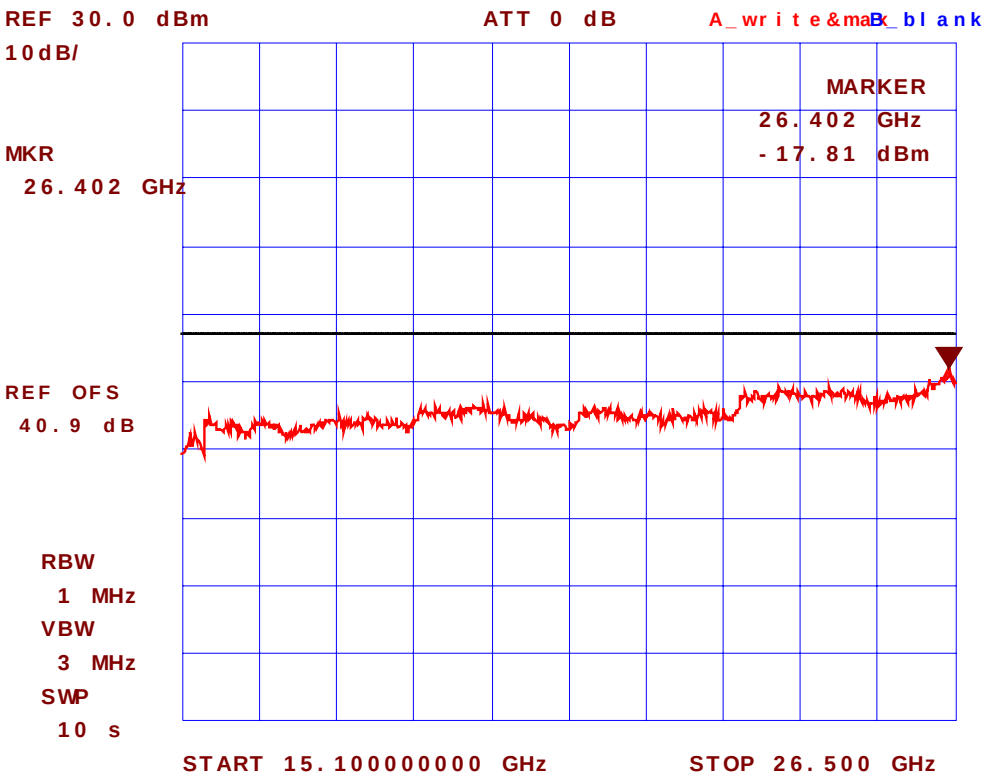
- The emissions were scanned form 10 MHz to 100 GHz and all emissions less than 20 dB below the limits were recorded.
- Refer to Photos # 25 to 30 for detailed measurements

Plot #13: Lowest Channel: 14 GHz, Spurious RF Conducted Emissions



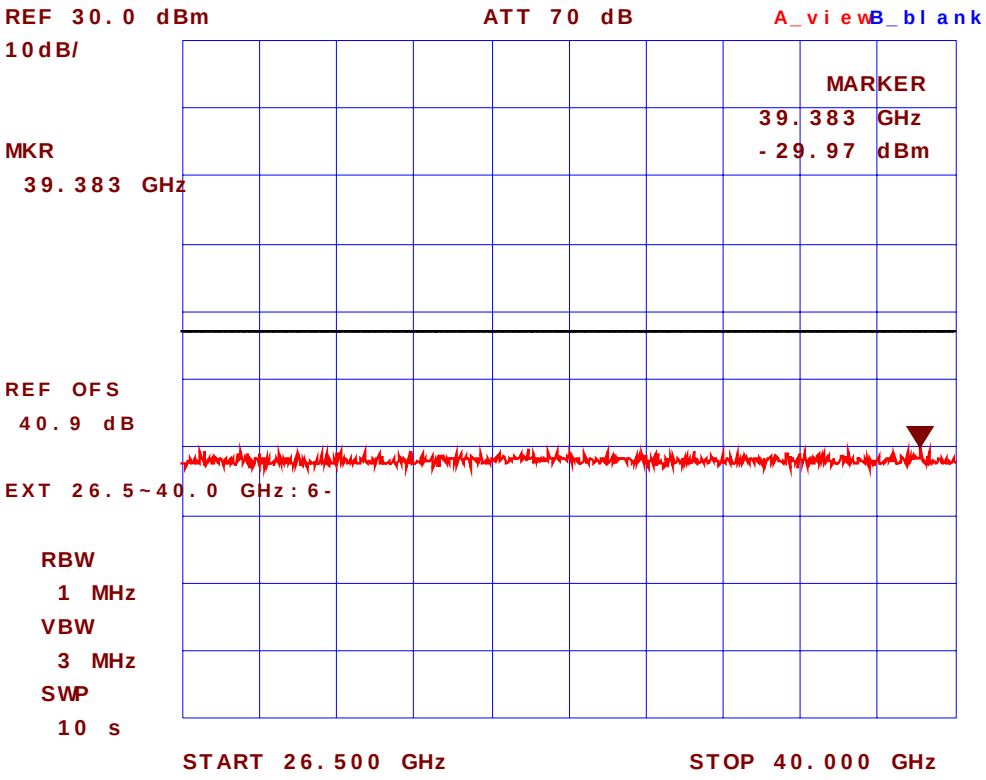
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #14: Lowest Channel: 14 GHz, Spurious RF Conducted Emissions

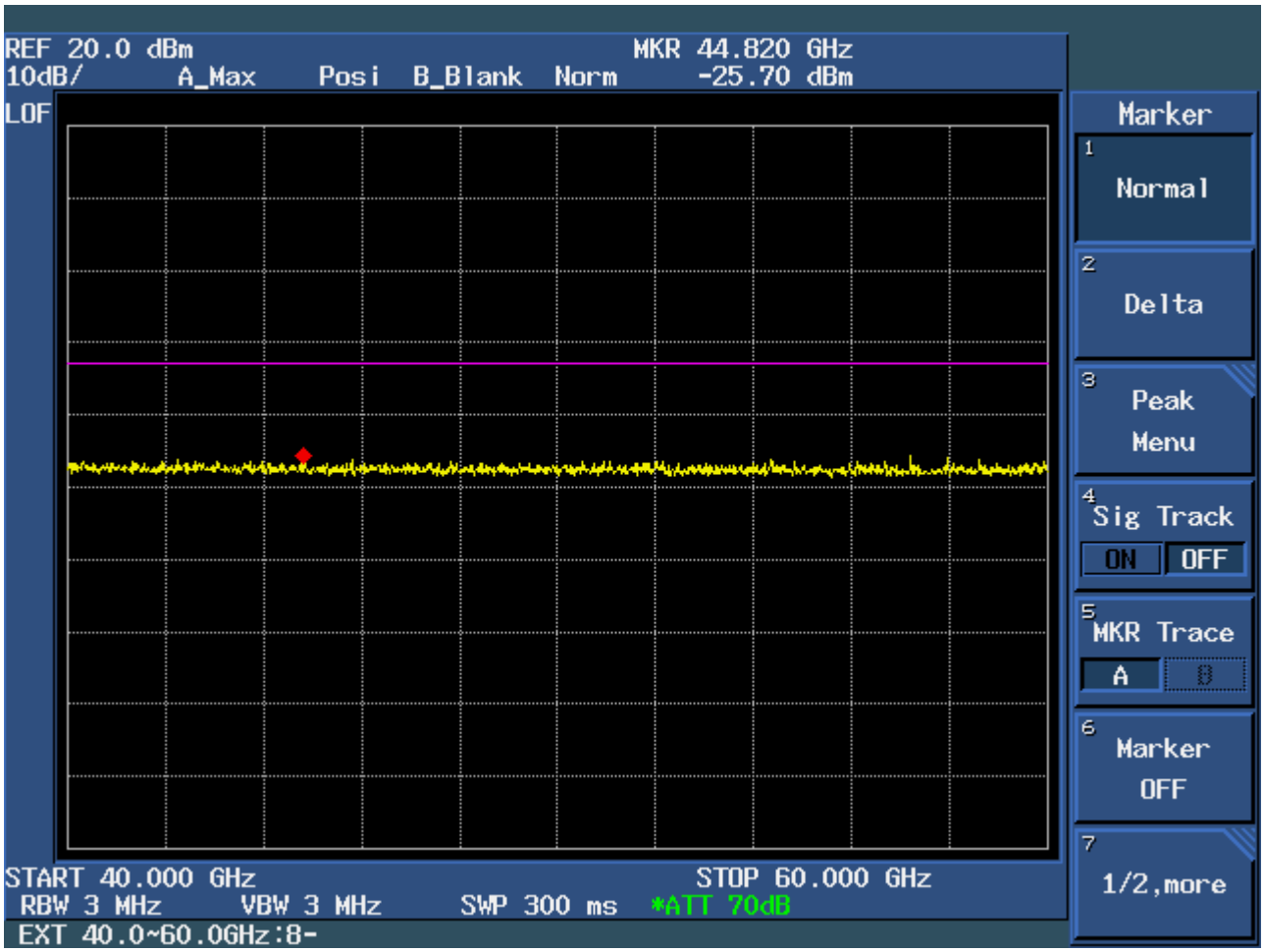


- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

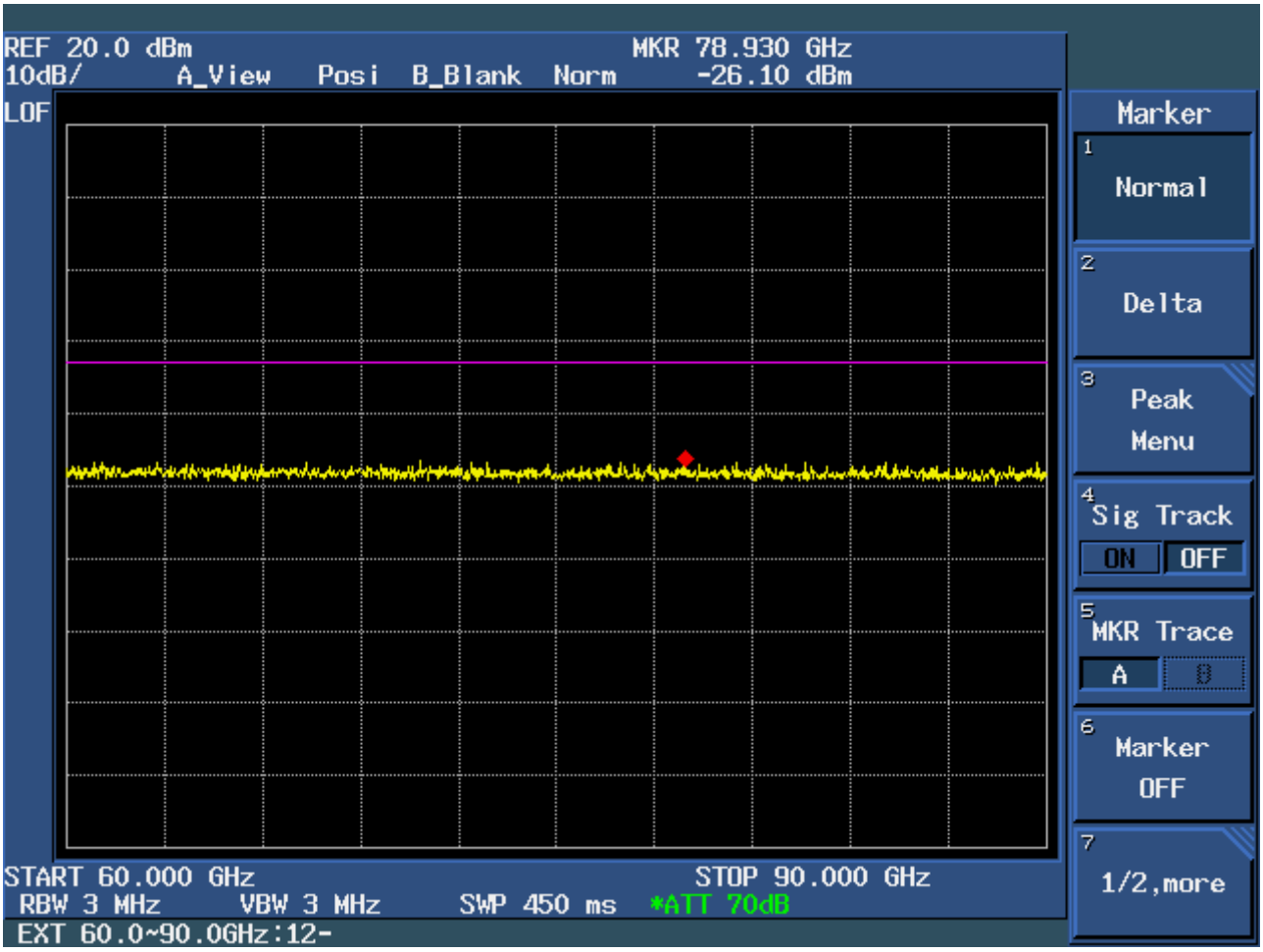
Plot #15: Lowest Channel: 14 GHz, Spurious RF Conducted Emissions



Plot #16: Lowest Channel: 14 GHz, Spurious RF Conducted Emissions

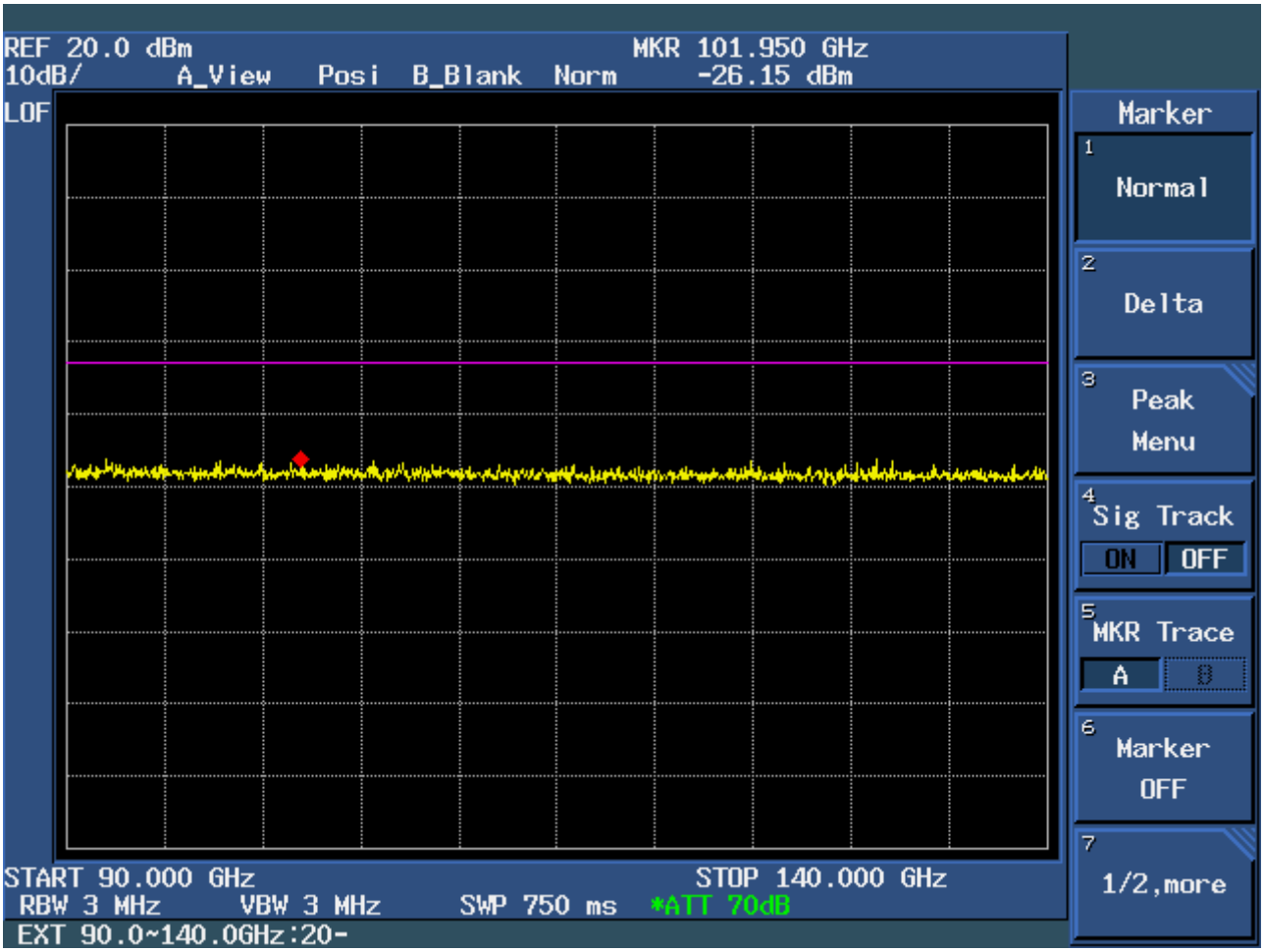


Plot #17: Lowest Channel: 14 GHz, Spurious RF Conducted Emissions

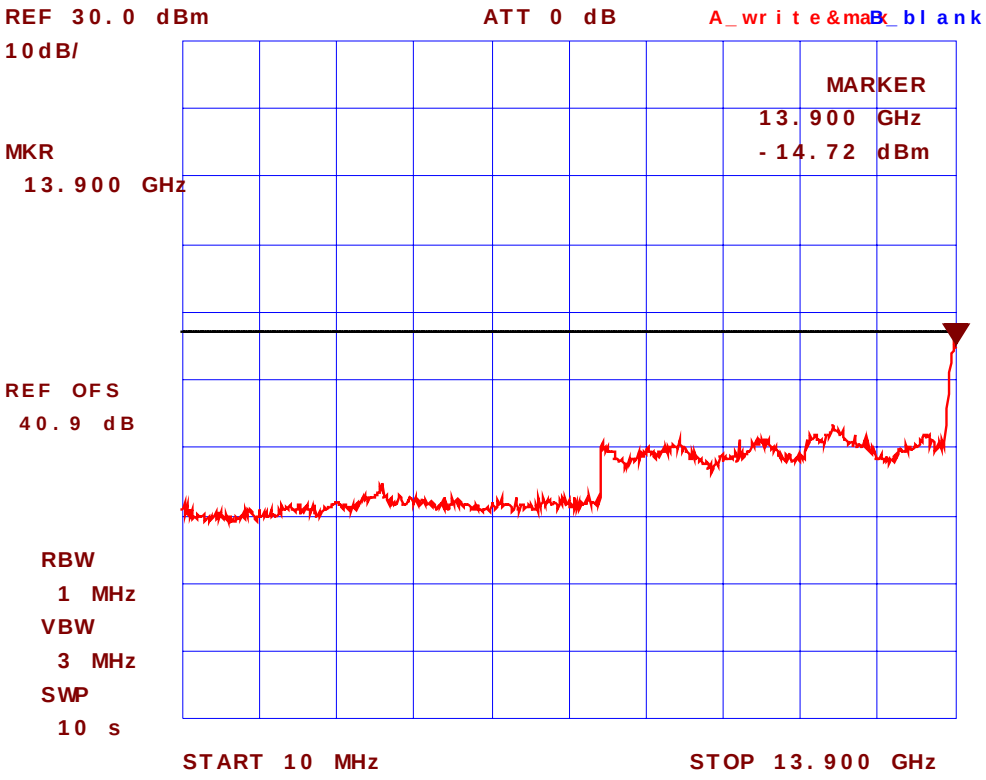


- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot # 18: Lowest Channel: 14 GHz, Spurious RF Conducted Emissions

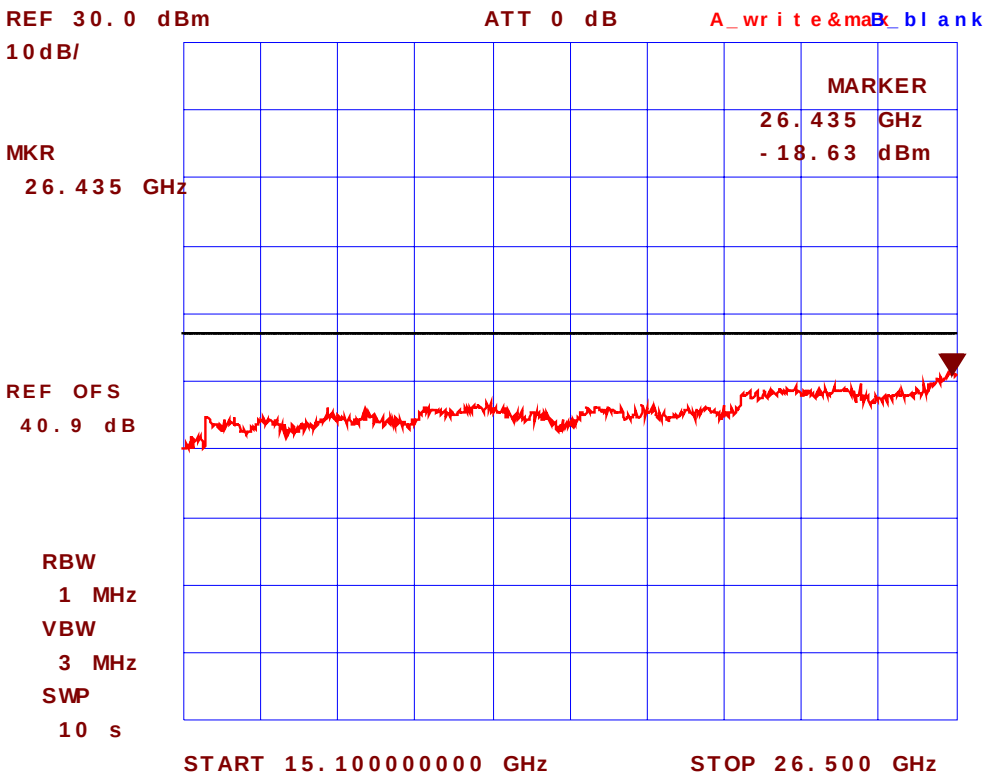


Plot #19: Mid Channel: 14.25 GHz, Spurious RF Conducted Emissions



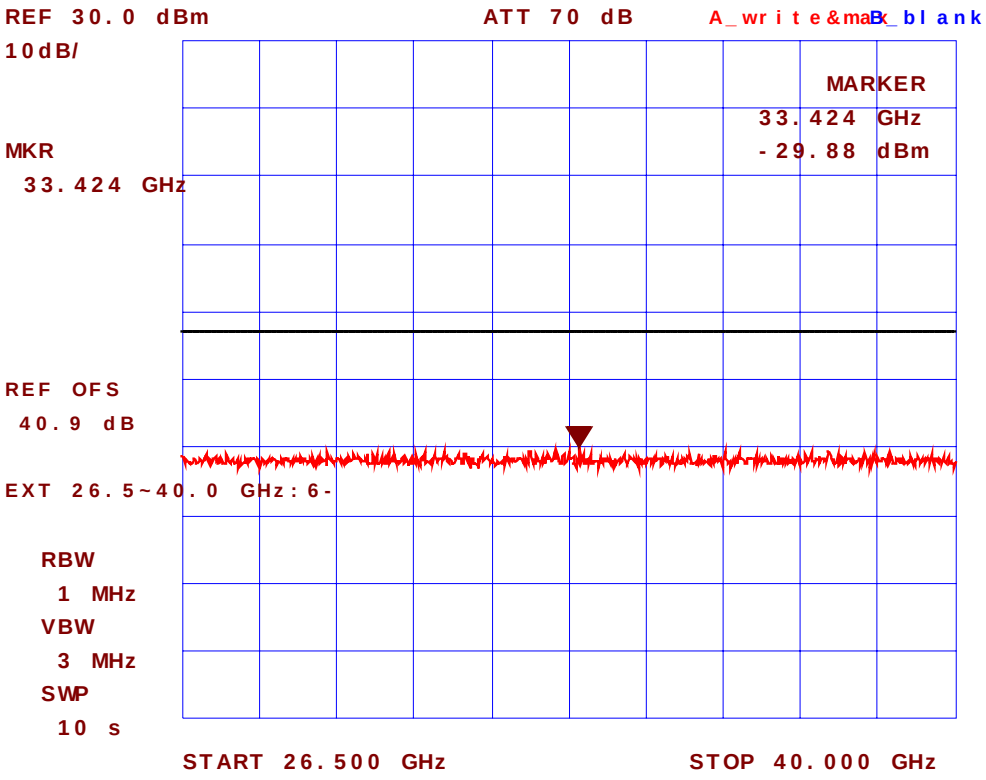
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #20: Mid Channel: 14.25 GHz, Spurious RF Conducted Emissions



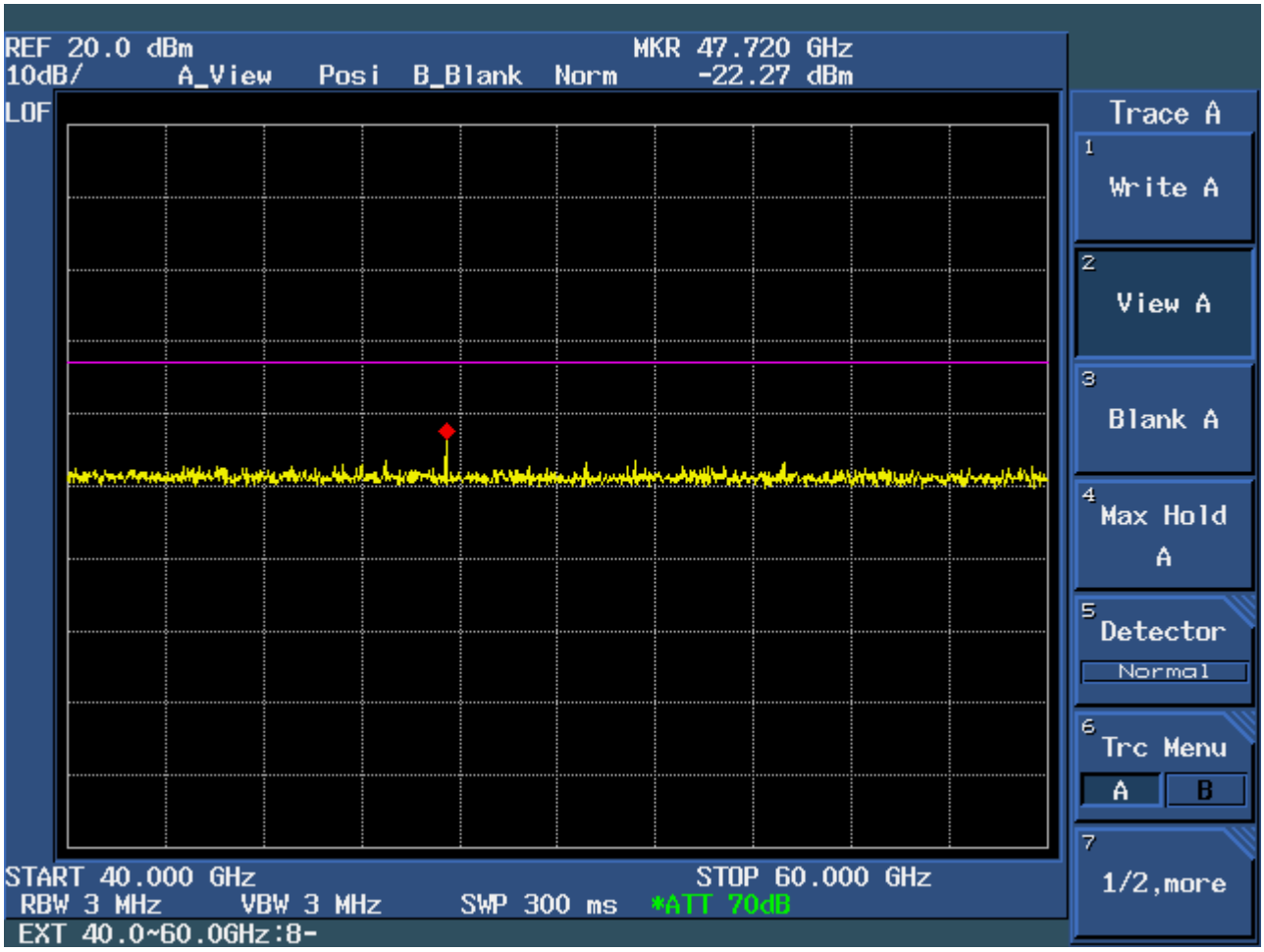
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #21: Mid Channel: 14.25 GHz, Spurious RF Conducted Emissions



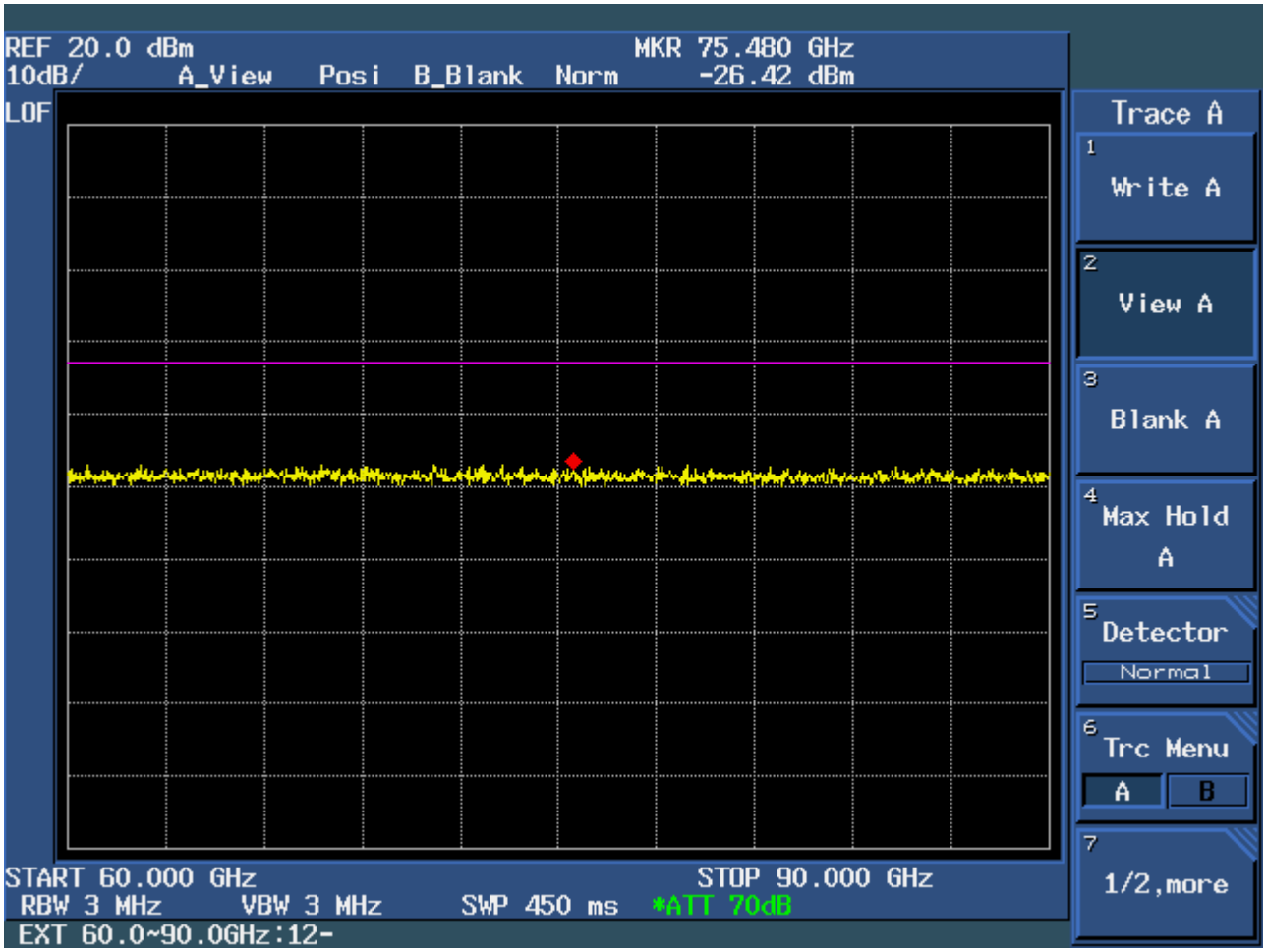
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #22: Mid Channel: 14.25 GHz, Spurious RF Conducted Emissions

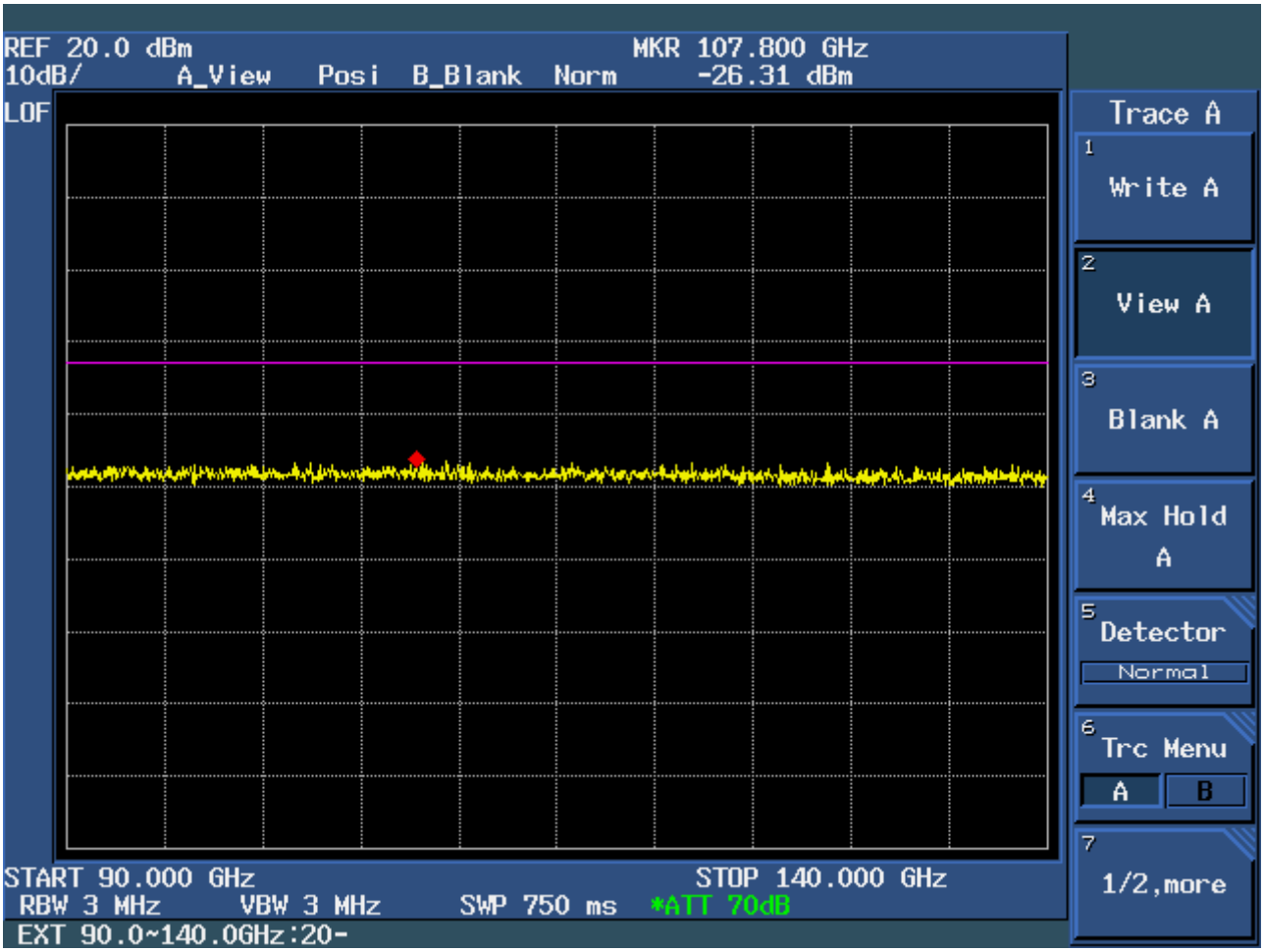


- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

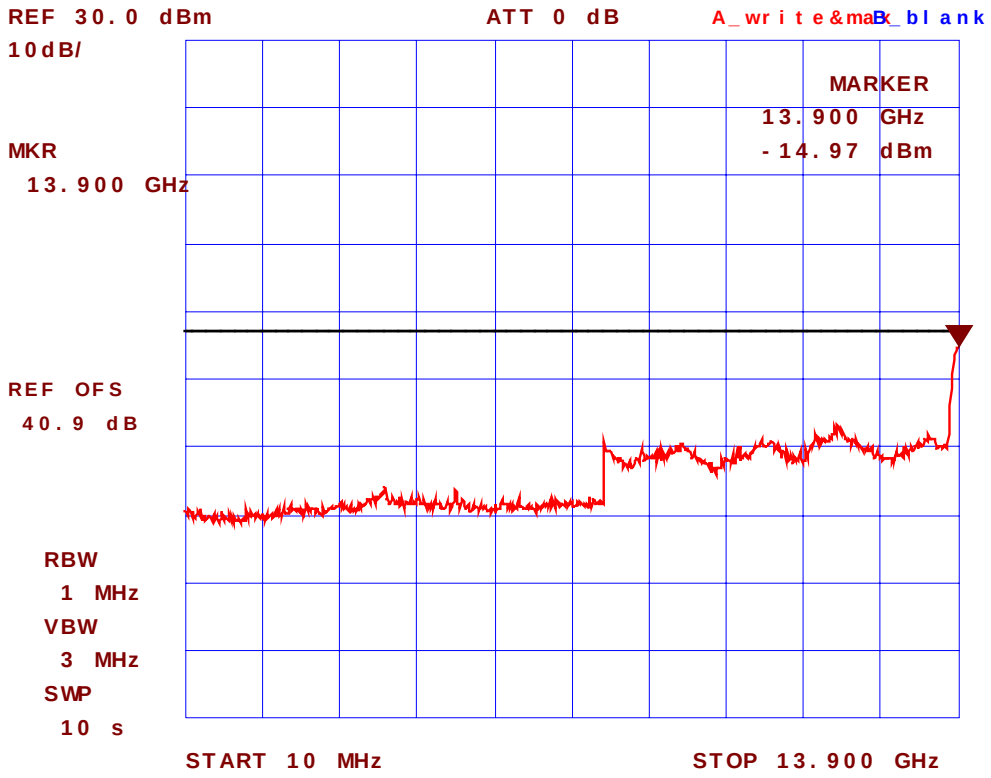
Plot #23: Mid Channel: 14.25 GHz, Spurious RF Conducted Emissions



Plot #24: Mid Channel: 14.25 GHz, Spurious RF Conducted Emissions

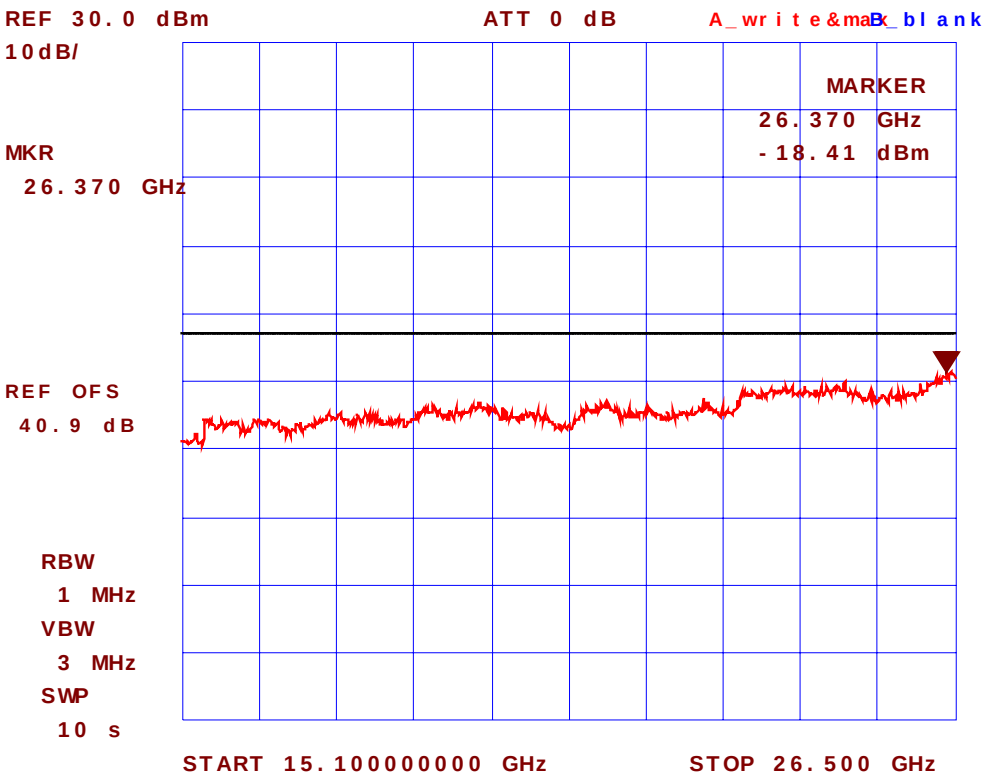


Plot #25: Highest Channel: 14.5 GHz, Spurious RF Conducted Emissions



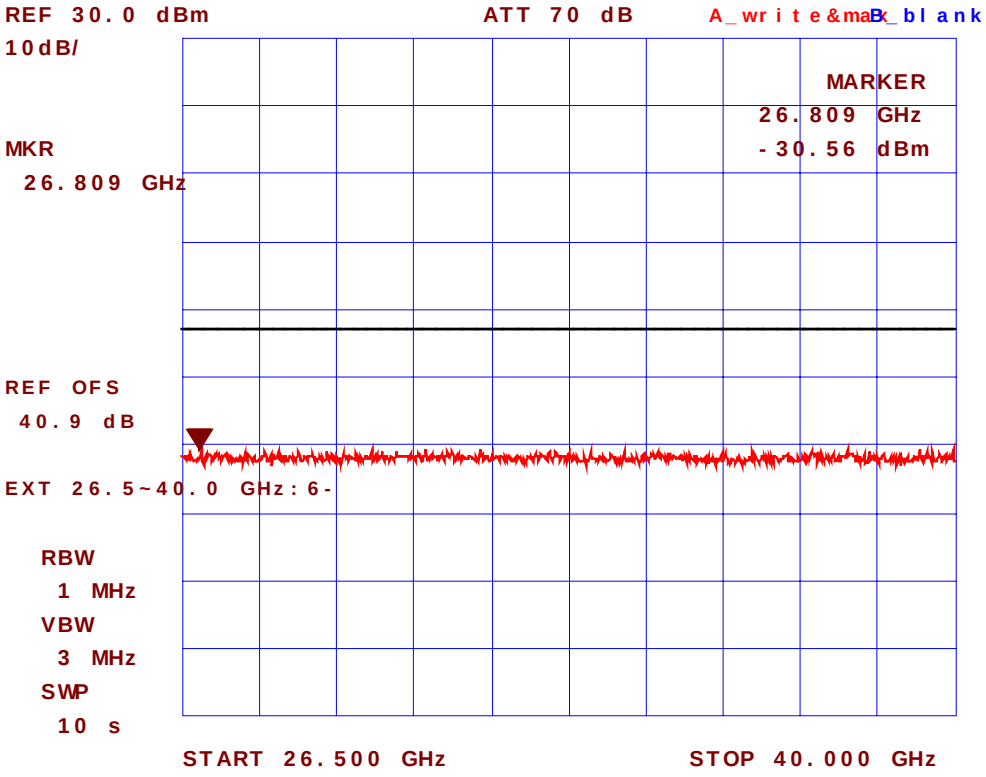
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #26: Highest Channel: 14.5 GHz, Spurious RF Conducted Emissions



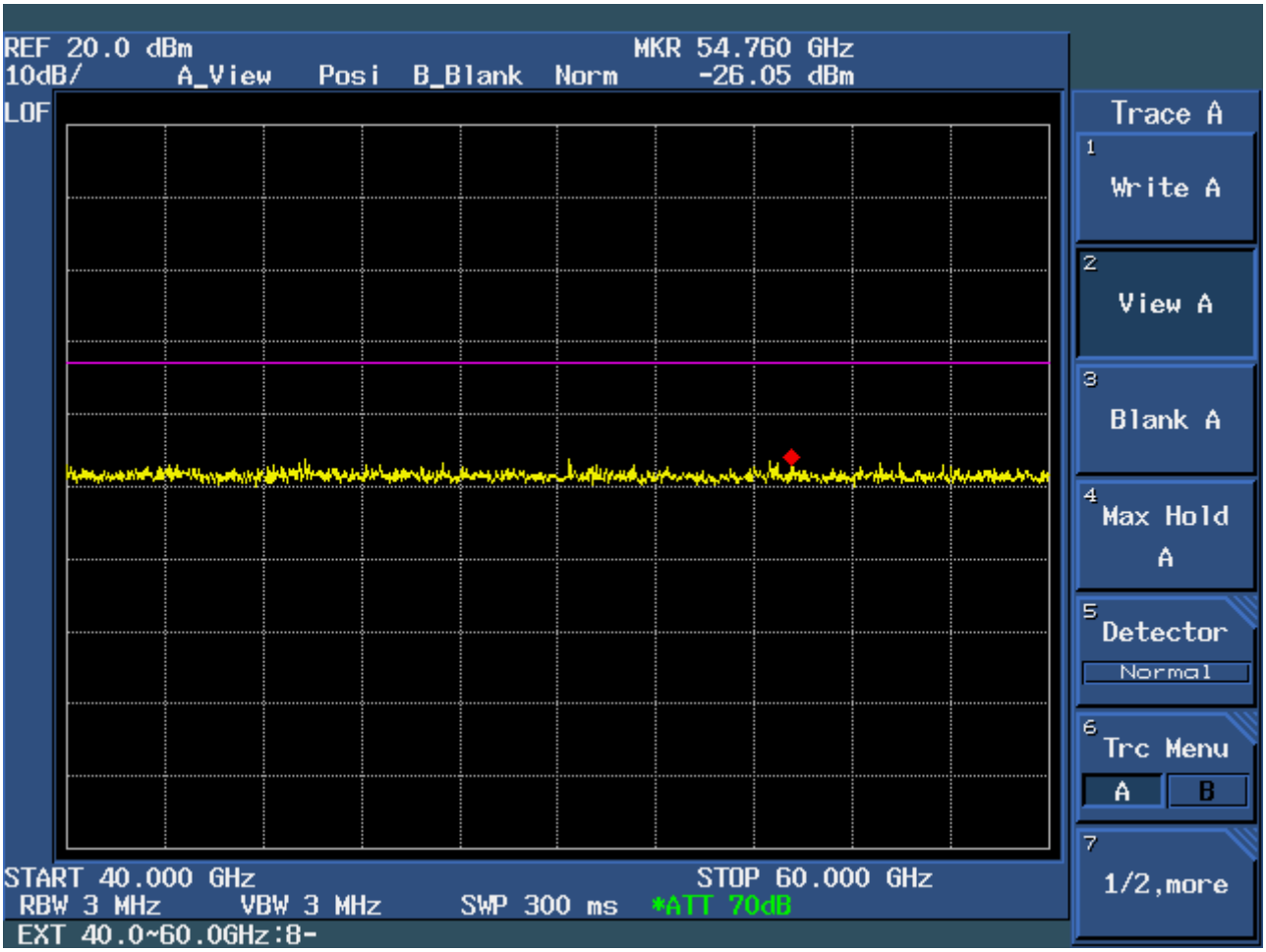
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #27: Highest Channel: 14.5 GHz, Spurious RF Conducted Emissions



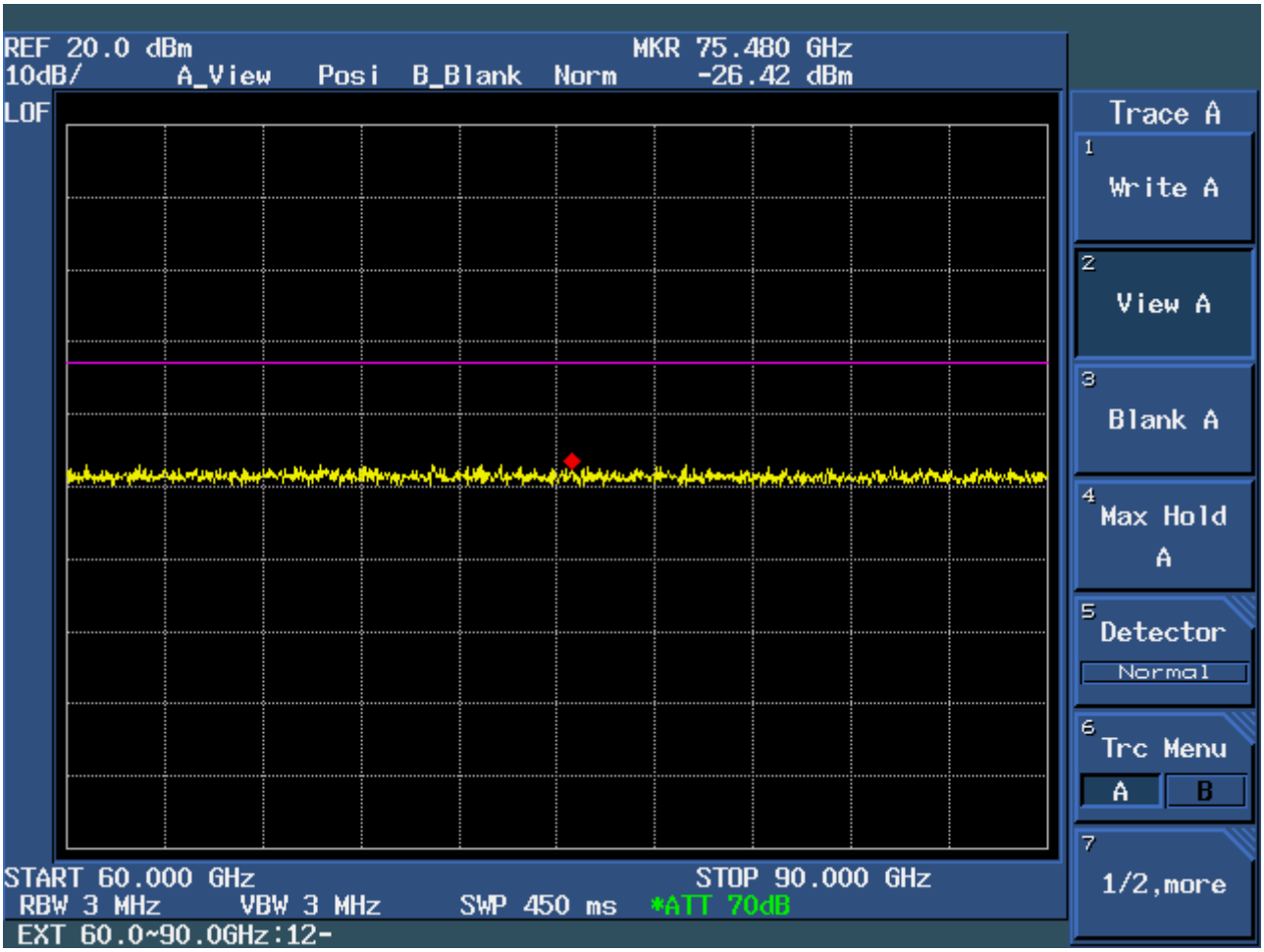
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #28: Highest Channel: 14.5 GHz, Spurious RF Conducted Emissions

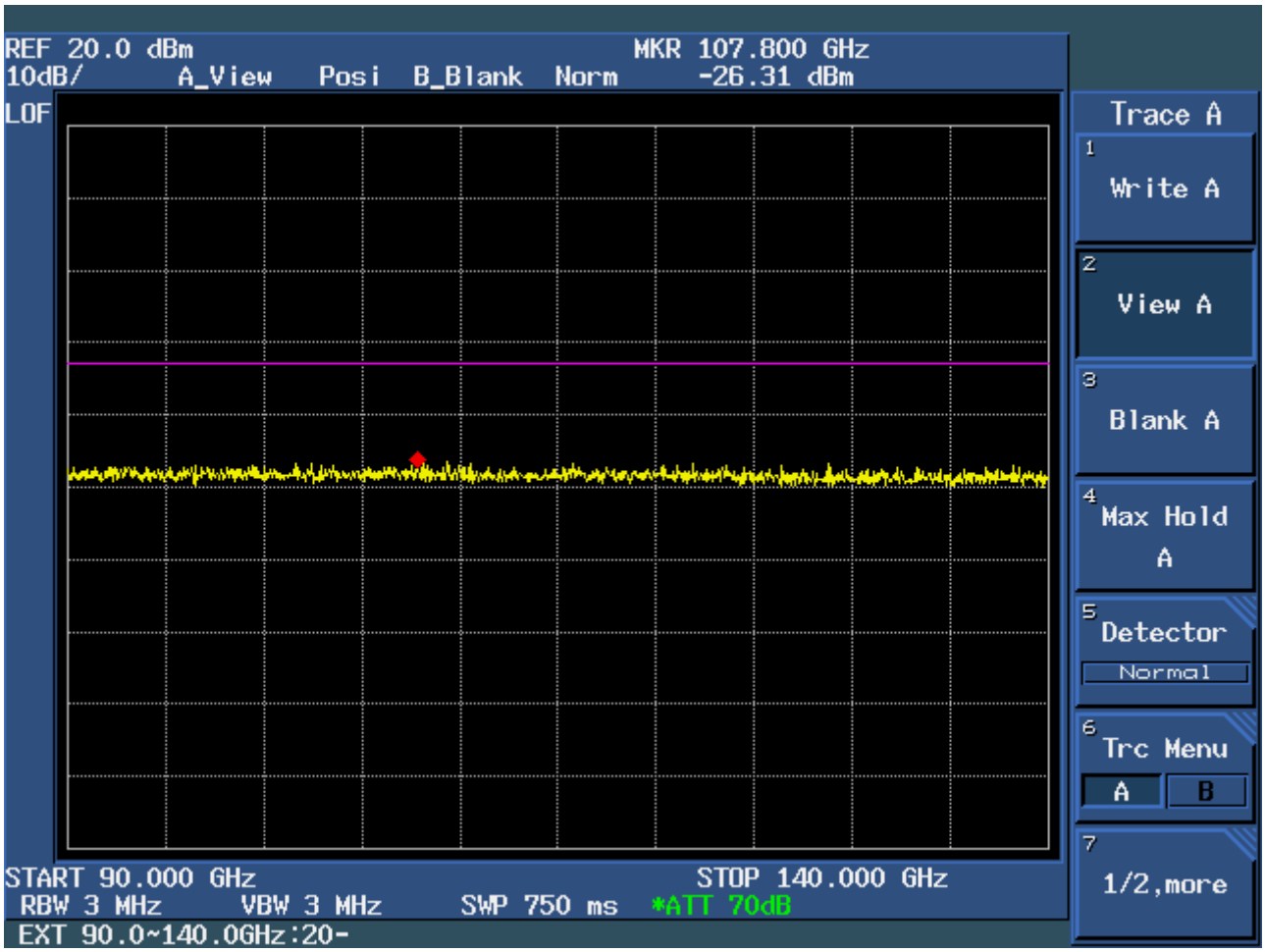


- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Plot #29: Highest Channel: 14.5 GHz, Spurious RF Conducted Emissions



Plot #30: Highest Channel: 14.5 GHz, Spurious RF Conducted Emissions



6.11. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 25.202(F)

6.11.1. Limits @ FCC 25.202(f)

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

FCC Rules	Frequency Range	Attenuation Limit (dBc)
FCC 25.202(f)	FCC 25.202(f)	43 + 10* log(P in Watts)

6.11.2. Method of Measurements

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

6.11.3. 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
Mixer/Antenna Kit	Radar Systems Technology	M19H/A	…	40 –60 GHz
Mixer/Antenna Kit	Radar Systems Technology	M12H/A	…	60 –90 GHz
Mixer/Antenna Kit	Radar Systems Technology	M10H/A	…	75 –110 GHz

6.11.4. Test Setup

Please refer to Photo # 1 to 3 in Annex 1 for detailed of test setup.

6.11.5. Test Data

6.11.5.1. Near Lowest Frequency (14.00 GHz)

Fundamental Frequency: 14.00 GHz
Peak EIRP: 82.5 dBm/MHz
Modulation: QPSK

FREQUENCY (GHz)	E-FIELD @3m (dBuV/m)/MHz	EIRP measured by Substitution Method (dBm)/MHz	(dBc)	EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
0.01 – 100	**	**	**	PEAK	V/H	-95.5	**	PASS
The emissions were scanned form 10 MHz to 100 GHz and no emissions less than 20 dB below the limits were found.								

6.11.5.2. Near Lowest Frequency (14.25 GHz)

Fundamental Frequency: 14.25 GHz
Peak EIRP: 82.2 dBm/MHz
Modulation: QPSK

FREQUENCY (GHz)	E-FIELD @3m (dBuV/m)/MHz	EIRP measured by Substitution Method (dBm)/MHz	(dBc)	EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
0.01 – 100	**	**	**	PEAK	V/H	-95.2	**	PASS
The emissions were scanned form 10 MHz to 100 GHz and no emissions less than 20 dB below the limits were found.								

6.11.5.3. Near Lowest Frequency (14.50 GHz)

Fundamental Frequency: 14.50 GHz
Peak EIRP: 82.8 dBm/MHz
Modulation: QPSK

FREQUENCY (GHz)	E-FIELD @3m (dBuV/m)/MHz	EIRP measured by Substitution Method (dBm)/MHz	(dBc)	EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
0.01 – 100	**	**	**	PEAK	V/H	-95.8	**	PASS
The emissions were scanned form 10 MHz to 100 GHz and no emissions less than 20 dB below the limits were found.								

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 intEIRPolation	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 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

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

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

EXHIBIT 8. MEASUREMENT METHODS

8.1. 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.

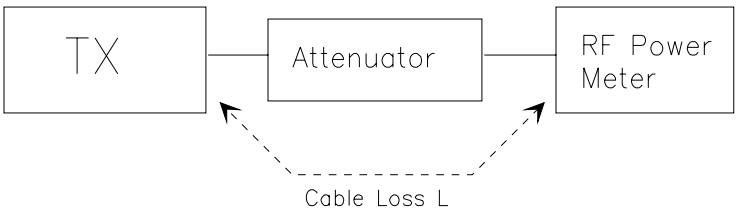
Step 2: Calculation of Average EIRP. See Figure 1

- 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 form 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 (EIRP & 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 form 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 form 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 EIRP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- DIPOLE antenna for frequency form 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(e) Mount the transmitting antenna at 1.5 meter high form the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- DIPOLE antenna for frequency form 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 form 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 form 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 form the transmitter was obtained in the test receiver.
(n) Record the power level read form the Average Power Meter and calculate the EIRP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
EIRP = 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 form the signal generator
P2: Power measured at attenuator A input
P3: Power reading on the Average Power Meter
EIRP: EIRP 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

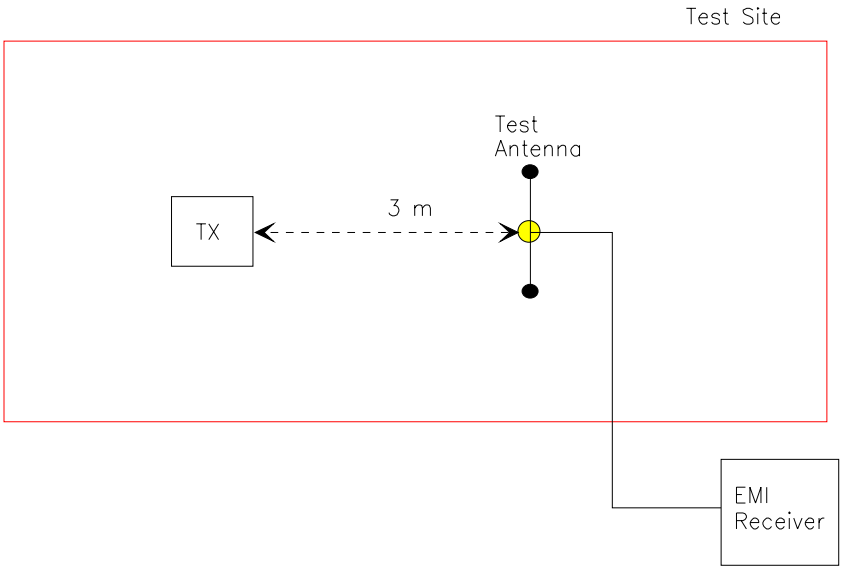
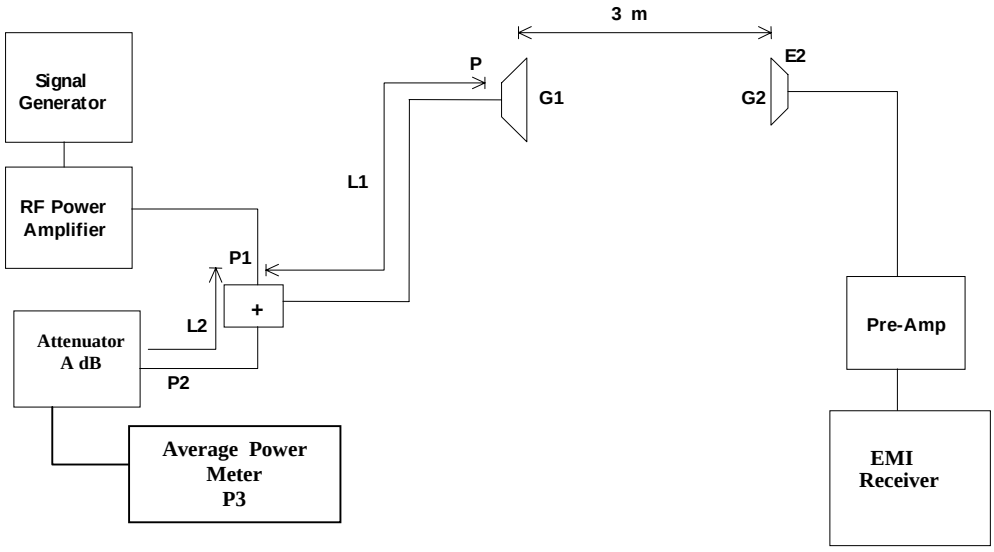


Figure 3



8.3. FREQUENCY TOLERANCE

Refer to FCC @ 2.1055.

(a) The Frequency Tolerance shall be measured with variation of ambient temperature as follows: Form -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 Tolerance supply shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage form 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 Tolerance 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

For measuring the Emission Limitation, the Resolution bandwidth is set to 1% of the 99% OBW and the VBW shall be greater than the RBW.

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 $\geq$ 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 form 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 equivaLeonardt 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.