ENGINEERING TEST REPORT

MDS ROR220 Data Transceiver
Model No.: MDS-ROR220
FCC ID: E5MDS-ROR220

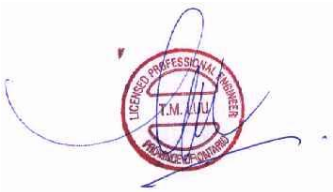
Applicant:

Microwave Data Systems
175 Science Parkway
Rochester, NY
USA, 14620-4261

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Parts 2 and 90 (Subparts I, T & K)

UltraTech's File No.: MIC-109FCC90

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: March 9, 2004	
Report Prepared by: Anca Dobre Issued Date: March 9, 2004	Tested by: Mr. Wayne Wu Test Dates: February 3 - 19, 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.*

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

EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	• Exhibit 1: Submittal Check List • 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	Radiated emissions test setup photos	OK
2	External Photos of EUT	External EUT photos	OK
3	Internal Photos of EUT	Internal EUT photos	OK
4	Cover Letters	• Letter from Ultratech for certification request • Letter from the applicant to appoint Ultratech to act as an agent • Letter from the applicant to request for confidentiality filing • Letter from the applicant to request for modular approval	OK
5	Attestation Statements	• Manufacturer's declaration for compliance with FCC clause 90.203(e)	OK
6	ID Label/Location Info	• ID label • Location of ID label	OK
7	Block Diagrams	Block diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List	Parts list	OK
10	Tune Up Info	Tune up information	OK
11	Operational Description	Theory of operation	OK
12	RF Exposure Info	See Section 6.6 of this test report for details	OK
13	Users Manual	Integration guide	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90 (Subparts I, T & K)
Title:	Telecommunication - Code of Federal Regulations, 47 CFR, Parts 2 and 90 (Subparts I, T & K)
Purpose of Test:	To obtain FCC Certification Authorization for Radio operating in the frequency bands 217-220 MHz (12.5kHz Channel Spacing, aggregated by 3 adjacent 5kHz OBW Channels).
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with TIA/EIA Standard TIA/EIA- 603 (01-Nov-2002) - Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

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	2001	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 16-1	1999	Specification for Radio Disturbance and Immunity measuring apparatus and methods
TIA/EIA 603, Edition B	01-Nov-2002	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Microwave Data Systems Inc.
Address:	175 Science Parkway Rochester, NY USA, 14620-4261
Contact Person:	Mr. Dennis McCarthy Phone #: 585-242-8440 Fax #: 585-241-5590 Email Address: dmccarthy@microwavedata.com

MANUFACTURER	
Name:	Microwave Data Systems Inc.
Address:	175 Science Parkway Rochester, NY USA, 14620-4261
Contact Person:	Mr. Dennis McCarthy Phone #: 585-242-8440 Fax #: 585-241-5590 Email Address: dmccarthy@microwavedata.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:	Microwave Data Systems
Product Name:	MDS ROR220 Data Transceiver
Model Name or Number:	MDS-ROR220
Serial Number:	Pre-production
Type of Equipment:	Licensed Non-Broadcast Station Transmitter
External Power Supply:	6 -12 VDC
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	Wireless data transceiver in an industrial environment.

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	• Base Station • Mobile
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	6–12 VDC
RF Output Power Rating:	2 Watts High and 0.5 Watts Low
Duty Cycle:	100% Maximum
Operating Frequency Range:	217-222 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	12.5 kHz, aggregated by 3 adjacent 5 kHz OBW channels.
Occupied Bandwidth (99%):	7.43 kHz for 12.5 kHz Channelisation with maximum 1.83 kHz frequency deviation.
Emission Designation*:	8K46F1D
Antenna Connector Type:	MCX

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

12.5 kHz Channel Spacing FM Digital Modulation:

$B_n = 2M + 2DK$

D = 1.83 kHz
M = 4.8/2
K = 1

$B_n = 2M + 2DK$
$= 2(4.8/2) + 2(1.83)(1)$
$= 8.46$ kHz

Emission designator: 8K46F1D

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	Antenna	1	MCX-type	N/A
2	Data Interface	1	16-pin dual–row header connector	Direct plug into motherboard from OEM user

3.5. ANCILLARY EQUIPMENT

Ancillary Equipment # 1	
Description:	MDS Interface Board
Brand name:	Microwave Data Systems
Model Name or Number:	Evaluation PCB 03-4051A01
Serial Number:	Test Sample
Cable Type:	Ribbon cable
Connected to EUT's Port:	Data

EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	12 VDC

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated at its maximum duty cycle of 100% and repeated continuously. The carrier was GMSK modulated, internal data source at 9.6 kb/s. The test frequencies were pre-set by the manufacturer at its maximum peak level and maximum frequency deviation (1.83 kHz peak)
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):	▪ 217-220 MHz ▪ 220-222 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	▪ 217 and 219.9875 MHz ▪ 220 and 222 MHz
Transmitter Wanted Output Test Signals:	
▪ RF Power Output (measured maximum output power):	2 Watts High and 0.5 Watt Low
▪ Normal Test Modulation:	GMSK
▪ Modulating signal source:	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, 24'(L) by 16'(W) by 8'(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 Section(s)	Test Requirements	Applicability (Yes/No)
90.205 (e)&(f) and 90.259(a)(4) & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
90.213 & 2.1055	Frequency Stability	Yes
2.1047(a)	Audio Frequency Response	Not applicable
90.210 & 2.1047(b)	Modulation Limiting	Yes
90.210 & 2.1049	Emission Limitation & Emission Mask	Yes
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
MDS ROR220 Data Transceiver, Model No.: MDS-ROR220 by **Microwave Data Systems** 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 upon 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 [§§ 2.1046 & 90.205(e) & (f) and 90.259(a)(4)]

6.5.1. LIMITS

§ 90.205: (E) 217-220 MHz. Limitations on power and antenna heights are specified in § 90.259.
(F) 220-222 MHz. Limitations on power and antenna heights are specified in § 90.729.

§ 90.259(a)(4):
In the 217-220 MHz band, the maximum transmitter output power is 2 watts. The maximum antenna height above average terrain (HAAT) is 152m (500 feet).

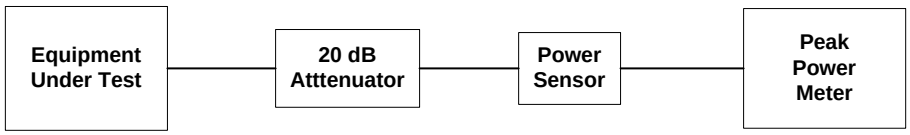
6.5.2. METHOD OF MEASUREMENTS

Refer to Exhibit 8, Section 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
Attenuator	Weinschel Corp	23-20-34	BH7876	DC – 18 GHz
Peak Power Meter	Hewlett Packard	8900D	2131A01044	100 MHz – 18 GHz, sensor dependent
Power Sensor	Hewlett Packard	84811A	2551A02902	100 MHz – 18 GHz

6.5.4. TEST ARRANGEMENT



6.5.5. TEST DATA

Duty Cycle: 100%.

Average-Peak Correction factor = 10*log (1) = 0 dB

Transmitter RF Power at the Antenna Port wrt. 12 VDC

Operating Band (MHz)	Fundamental Frequency (MHz)	Measured Peak Power (Watts)	Measured (Average) Power (Watts)	Power Limit (Watts)
High Power Level				
217-220	217	1.82	1.82	2
	219.9875	1.91	1.91	2
220-222	220	1.92	1.92	2
	222	1.91	1.91	2
Low Power Level				
217-220	217	0.54	0.54	2
	219.9875	0.56	0.56	2
220-222	220	0.56	0.56	2
	222	0.58	0.58	2

6.6. RF EXPOSURE REQUIRMENTS [§§ 1.1310 & 2.1091]

6.6.1. LIMITS

§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).

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

6.6.2. METHOD OF MEASUREMENTS

Refer to §§1.1310, 2.1091.

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

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

Calculation Method of RF Safety Distance:

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

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

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

- For portable transmitters (see §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 §1.1307(d).

6.6.3. TEST DATA

Frequency (MHz)	Measured Average RF Conducted (Watts)	Calculated Average EIRP (Watts)	*Laboratory's Recommended Minimum RF Safety Distance r (cm)	Manufacturer's Specified Minimum RF Safety Distance r (cm)
For 0-5 dBi Antenna Gain				
217 –222	1.92	6072	49	58
For 5-10 dBi Antenna Gain				
217 –222	1.92	19200	87	104
For 10-16.5 dBi Antenna Gain				
217 –222	1.92	85763	185	219

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

Sample calculation:

$S = 0.2\ mW/cm^2$, $EIRP = PG = (1920\ mW)(10(5/10)) = 6072\ mW$
$r = (EIRP/4\Pi S)^{1/2} = ((6072)/4\Pi(0.2))^{1/2} = 49\ cm$

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with IC Rules**
Minimum Calculated separation distance between antenna and persons required: See above table.	Manufacturer' instruction for separation distance between antenna and persons required: See above table.

6.7. FREQUENCY STABILITY [§§ 2.1055 & 90.213]

6.7.1. LIMITS

Please refer to CFR 47, Part 90, Subparts I, T & K, § 90.213 for specification details.

Frequency Range (MHz)	Fixed & Base Stations (ppm)			Mobile Stations (ppm)					
				> 2 W			≤ 2 W		
	6.25 kHz	12.5 kHz	25 kHz	6.25 kHz	12.5 kHz	25 kHz	6.25 kHz	12.5 kHz	25 kHz
216-220	1.0	1.0	1.0	--	--	--	1.0	1.0	1.0
220-222	0.1	0.1	0.1	1.5	1.5	1.5	1.5	1.5	1.5

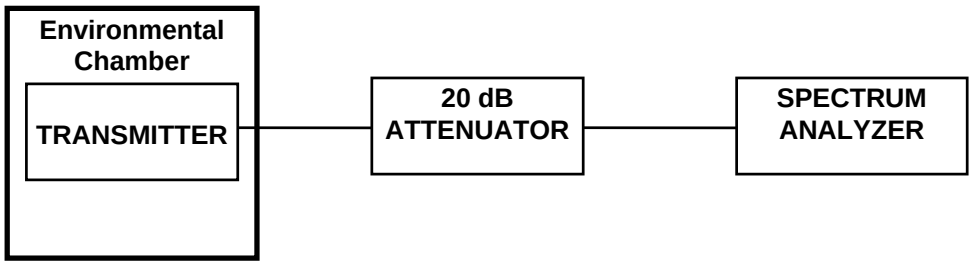
6.7.2. METHOD OF MEASUREMENTS

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

6.7.3. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
EMC Analyzer	Hewlett Packard	8953EM	3710A00237	9 kHz – 22 GHz
Attenuator	Weinschel Corp	23-20-34	BH7876	DC – 18 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40° to +60 ° C range

6.7.4. TEST ARRANJEMENT



6.7.5. TEST DATA

Product Name: **Model No.:**	MDS ROR220 Data transceiver MDS-ROR220
Center Frequency:	220 MHz
Full Power Level:	32.24 dBm
Frequency Tolerance Limit:	1.5 ppm
Max. Frequency Tolerance Measured:	-160 Hz
Input Voltage Rating:	12VDC

CENTER FREQUENCY & RF POWER OUTPUT VARIATION			
Ambient Temperature	**Supply Voltage (Nominal) 12 VDC**	**Supply Voltage (85% of Nominal) 10.2 VDC**	**Supply Voltage (115% of Nominal) 13.8 VDC**
(^{o}C)	**Hz**	**Hz**	**Hz**
-30	-160	N/A	N/A
-20	-149	N/A	N/A
-10	-111	N/A	N/A
0	103	N/A	N/A
+10	94	N/A	N/A
+20	17	-16	+21
+30	-30	N/A	N/A
+40	30	N/A	N/A
+50	+69	N/A	N/A

6.8. MODULATION LIMITING [§§ 2.1047(b) & 90.210]

6.8.1. LIMITS

Recommended frequency deviation characteristics is given below:

2.5 kHz for 12.5 KHz Channel Spacing

6.8.2. METHOD OF MEASUREMENT

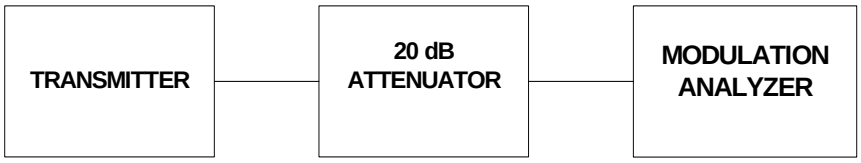
For Audio Transmitter: The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

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

6.8.3. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Modulation Analyzer	Hewlett Packard	8901B	3226A04606	150 kHz – 1300 MHz
Attenuator(s)	Weinschel Corp	23-20-34	BH7876	DC – 18 GHz

6.8.4. TEST ARRANGEMENT



6.8.5. TEST DATA

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

Channel Spacing Operations (kHz)	Data Baud Rate	Peak Deviation (kHz)	Maximum Limit (kHz)
12.5	9600	1.83	2.5

6.9. OCCUPIED BANDWIDTH & EMISSION MASK [§§ 2.1049, 90.208 & 90.210]

6.9.1. LIMITS

Please refer to 47 CFR 90.209 & 90.210.

Emissions shall be attenuated below the mean output power of the transmitter as specified in the following table:

Frequency Range (MHz)	Maximum Authorized BW (KHz)	Channel Spacing (KHz)	FCC Applicable Mask
220-222	5	4	Emission Mask F

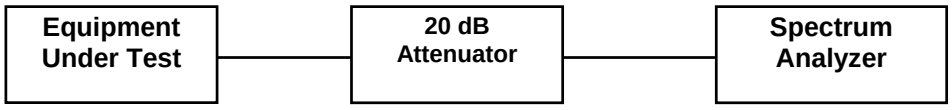
6.9.2. METHOD OF MEASUREMENT

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

6.9.3. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
EMC Analyzer	Hewlett Packard	8553EM	3710A00237	9 kHz – 22 GHz
Attenuator(s)	Weinschel Corp	23-20-34	BH7876	DC – 18 GHz

6.9.4. TEST ARRANGEMENT



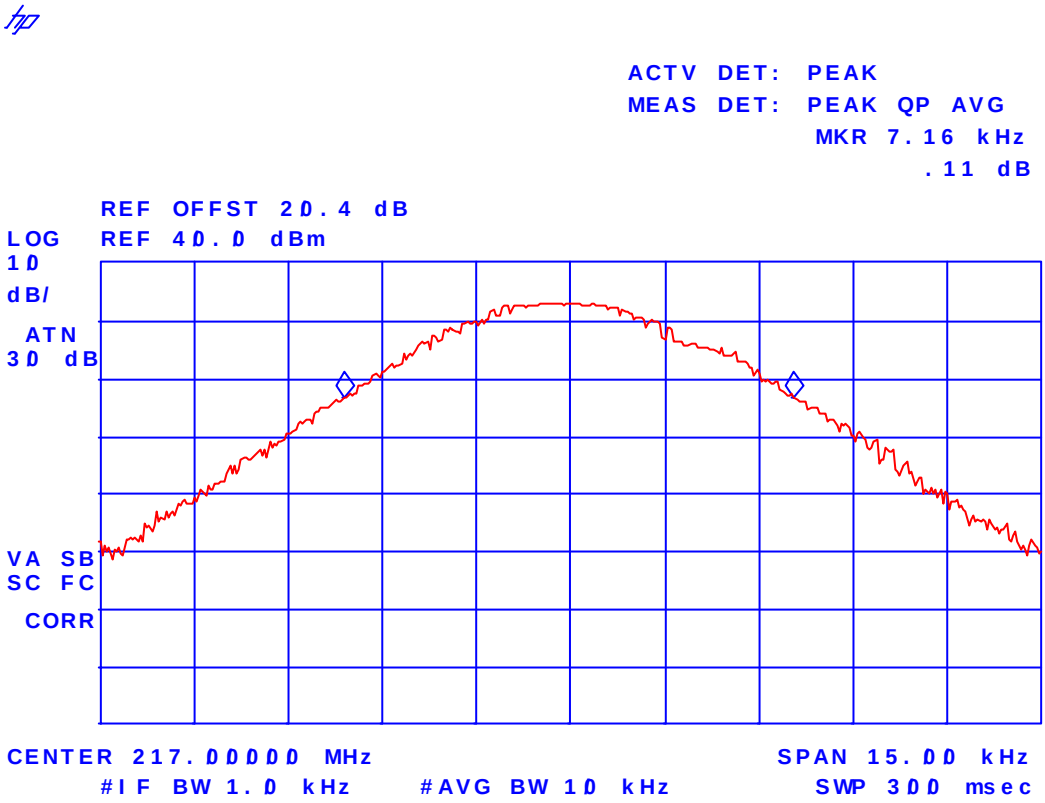
6.9.5. TEST DATA

6.9.5.1. 99% OCCUPIED BANDWIDTH FOR 12.5 kHz CHANNELISATION

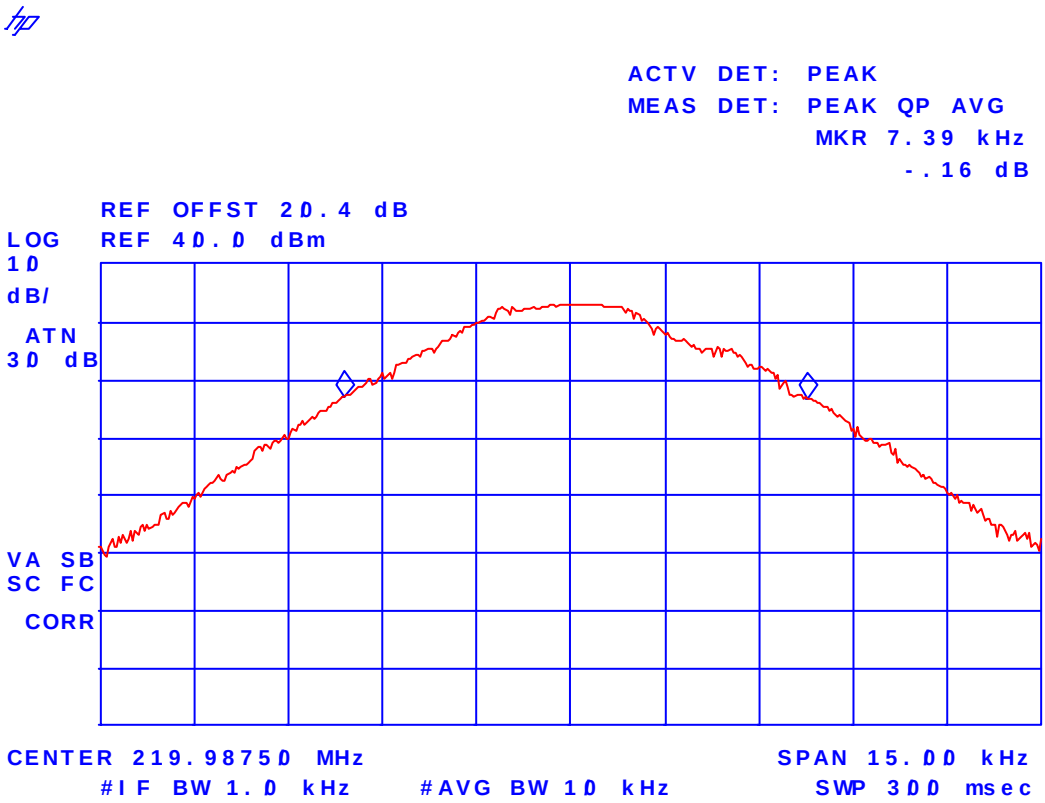
FCC Permitted Band (MHz)	Frequency (MHz)	Channel Spacing (kHz)	Measured 99% OBW (kHz)
217 - 220	217	12.5	7.16
	219.9875	12.5	7.39
220 - 222	220	12.5	7.35
	222	12.5	7.43

Please refer to Plots # 1 to 4 for detailed measurements.

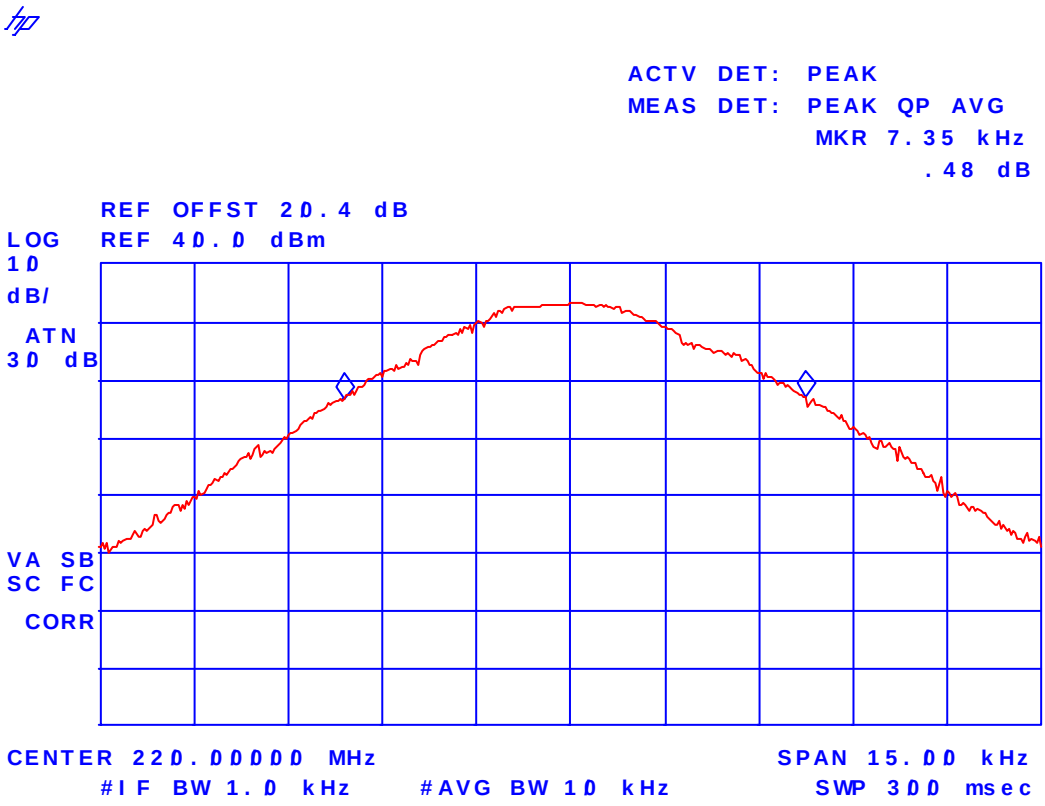
Plot # 1: 99% Occupied Bandwidth @ 217 MHz
12.5 kHz Channel Spacing, Freq. Dev. = 1.83 kHz max, Power = 2 W



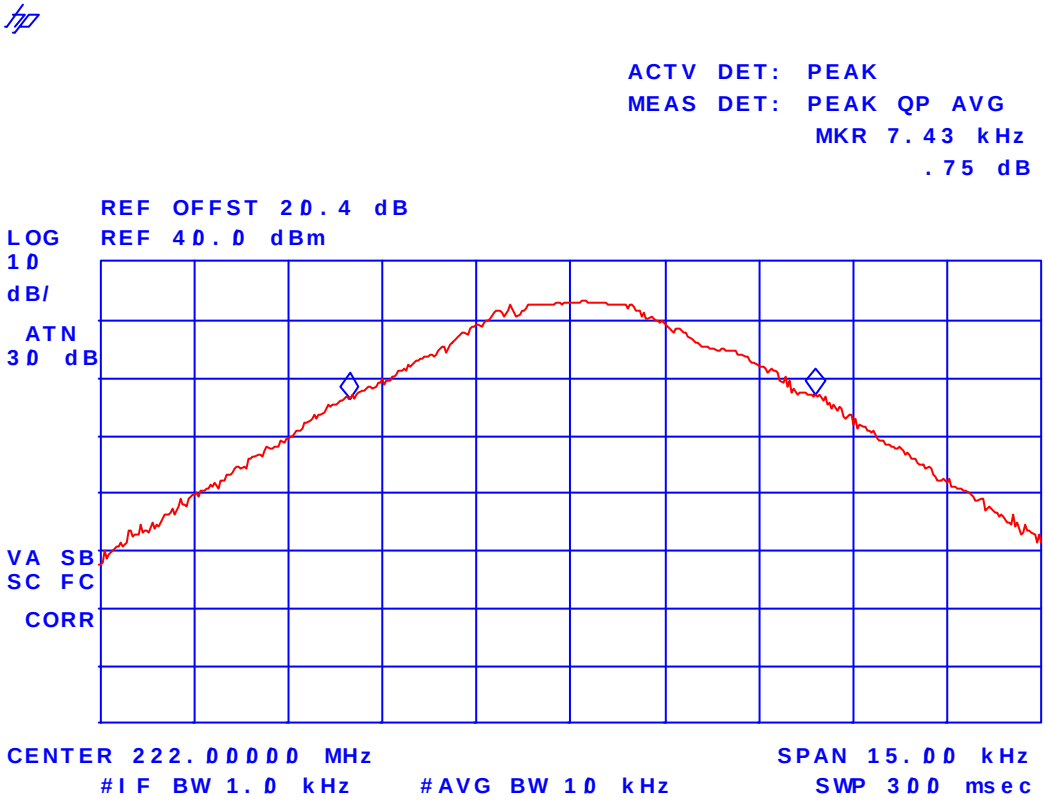
Plot # 2: 99% Occupied Bandwidth @ 219.9875 MHz
12.5 kHz Channel Spacing, Freq. Dev. = 1.83 kHz max, Power = 2W



Plot # 3: 99% Occupied Bandwidth @ 220 MHz
12.5 kHz Channel Spacing, Freq. Dev. = 1.83 kHz max, Power = 2 W



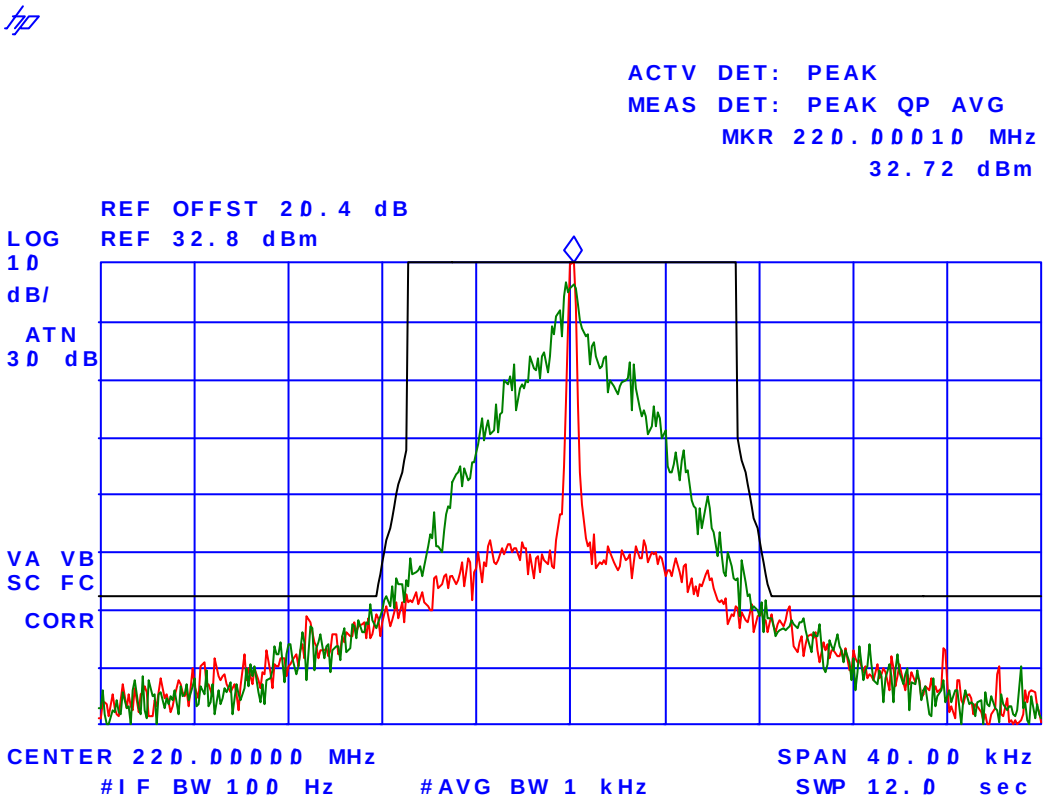
Plot # 4: **99% Occupied Bandwidth @ 222 MHz**
12.5 kHz Channel Spacing, Freq. Dev. = 1.83 kHz max, Power = 2 W



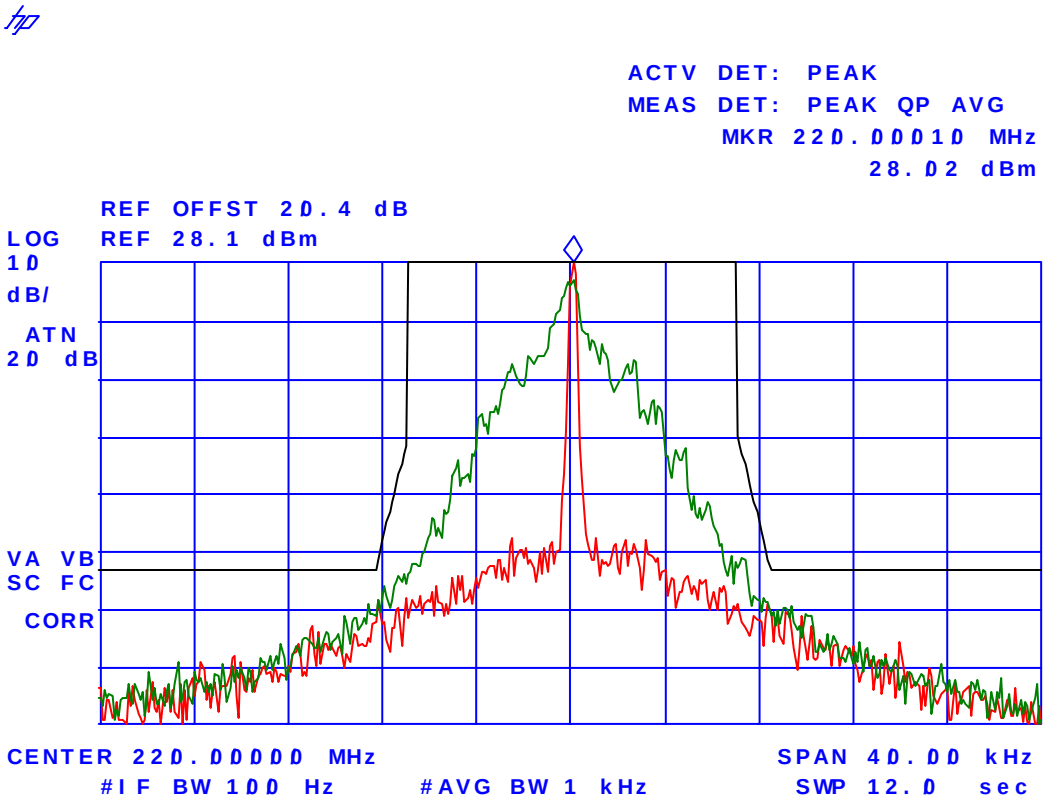
6.9.5.2. EMISSION MASK

Conform. Please refer to Plot # 5 to 8 for details of measurements.

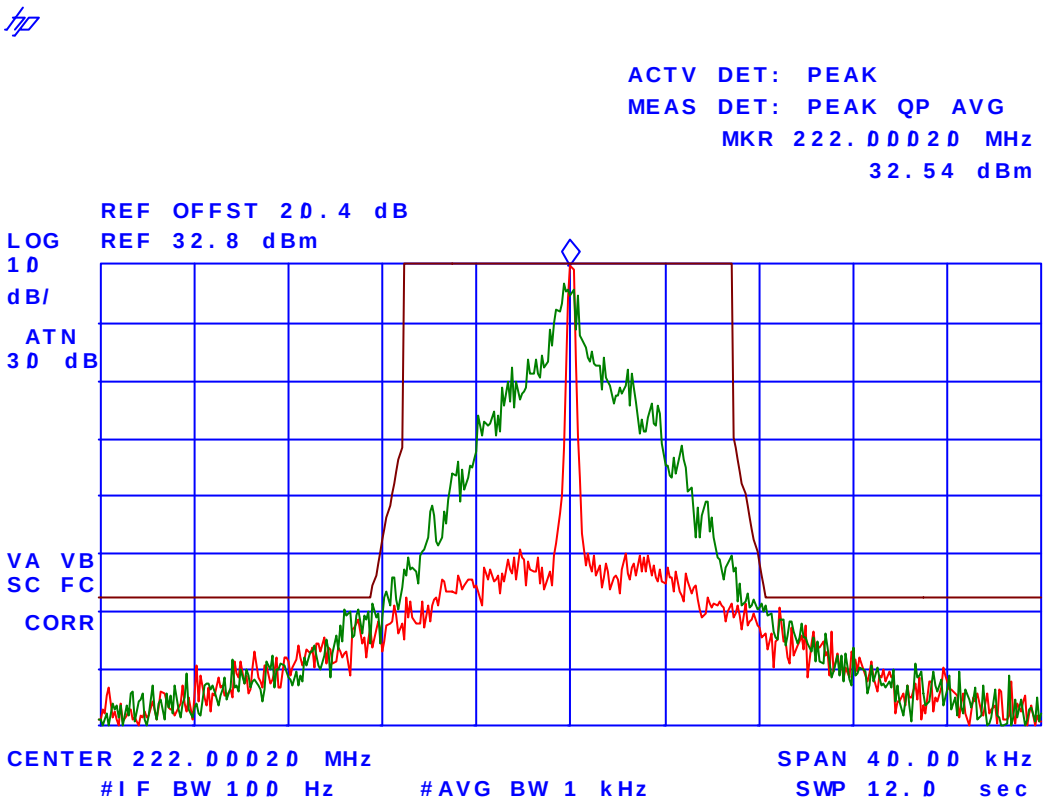
Plot # 5: Emission Mask F @ 220 MHz
12.5 kHz Channel Spacing, Freq. Dev. = 1.83 kHz, Power = 2 W



Plot # 6: **Emission Mask F @ 220 MHz**
12.5 kHz Channel Spacing, Freq. Dev. = 1.83 kHz, P = 0.5 W

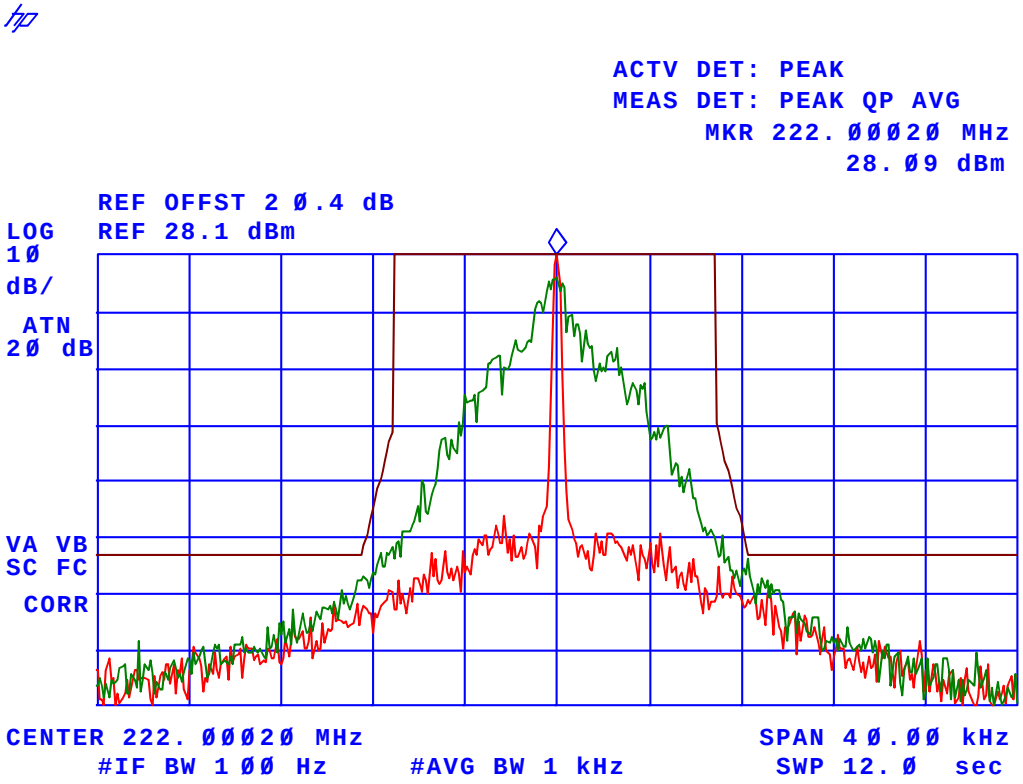


Plot # 7: **Emission Mask F @ 222 MHz**
12.5 kHz Channel Spacing, Freq. Dev. = 1.83 kHz, P = 2 W



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

Plot # 8: **Emission Mask F @ 222 MHz**
12.5 kHz Channel Spacing, Freq. Dev. = 1.85 kHz, P = 0.5 W



6.10. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§ 90.210]

6.10.1. LIMITS

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

FCC Rules	Frequency Range	Attenuation Limit (dBc)
90.210(f) – Data	10 MHz to Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	55+10*log(P) or -25 dBm or 65 dBc whichever is less

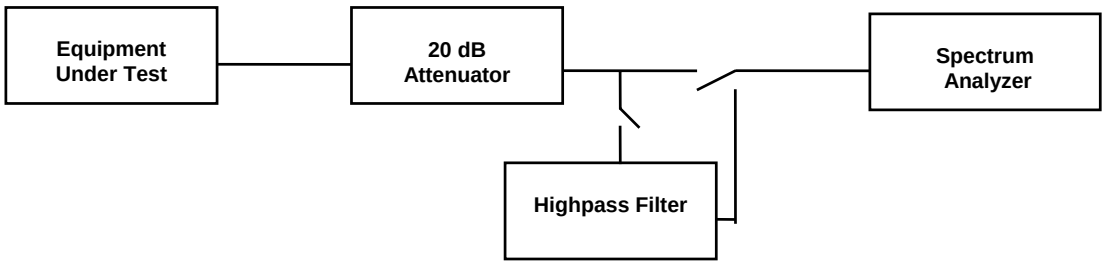
6.10.2. METHOD OF MEASUREMENTS

Refer to Exhibit 8, Section 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	HP	8953EM	3710A00237	9 kHz – 22 GHz
Attenuator(s)	Weinschel Corp	23-20-34	BH7876	DC – 18 GHz
High Pass Filter	Mini-Circuits	SHP-600	--	Cut-off Frequency at 560 MHz

6.10.4. TEST ARRANGEMENT



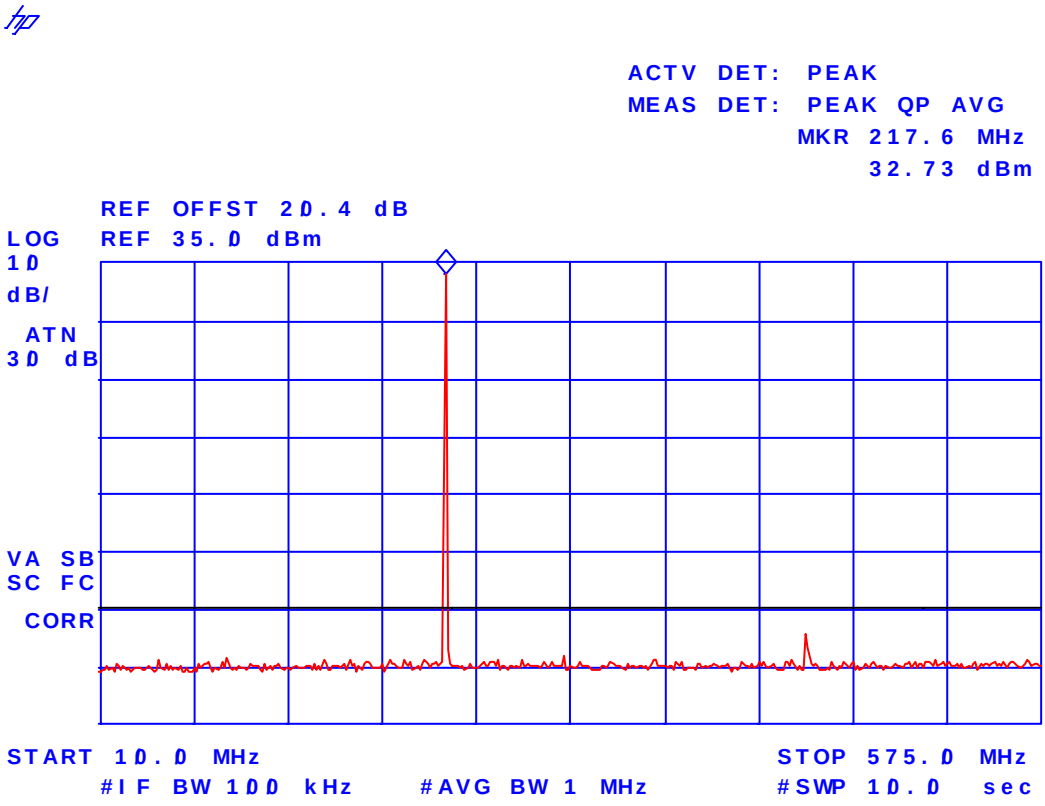
6.10.5. TEST DATA

6.10.5.1. Near Lowest Frequency in 217-220 MHz Band (217 MHz)

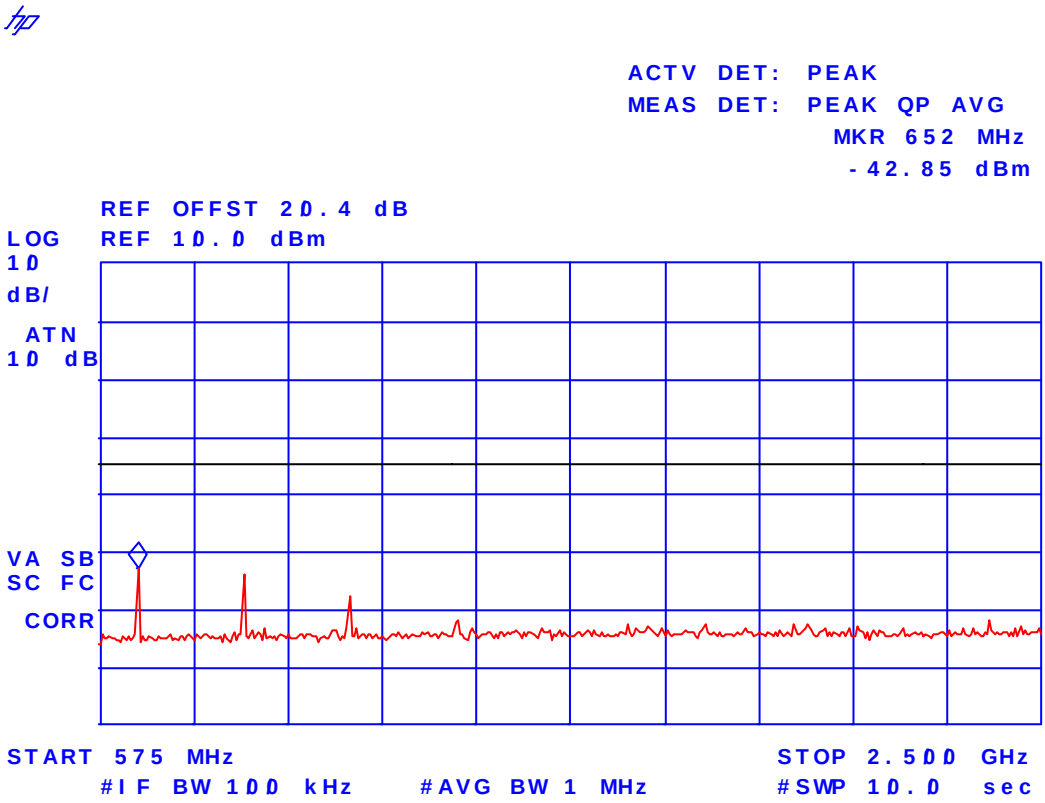
Fundamental Frequency:	217 MHZ
RF Output Power:	2 W or 33 dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
FCC Limit:	55 + 10*log(2) = 58.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
433.8	-29.48	-62.48	-58.0	-4.5	Pass
652	-42.85	-75.85	-58.0	-17.9	Pass
869	-44.02	-77.02	-58.0	-19.0	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 9 and 10 for detailed measurements.					

Plot # 9: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 217 MHz, RF Output Power: 2 Watts



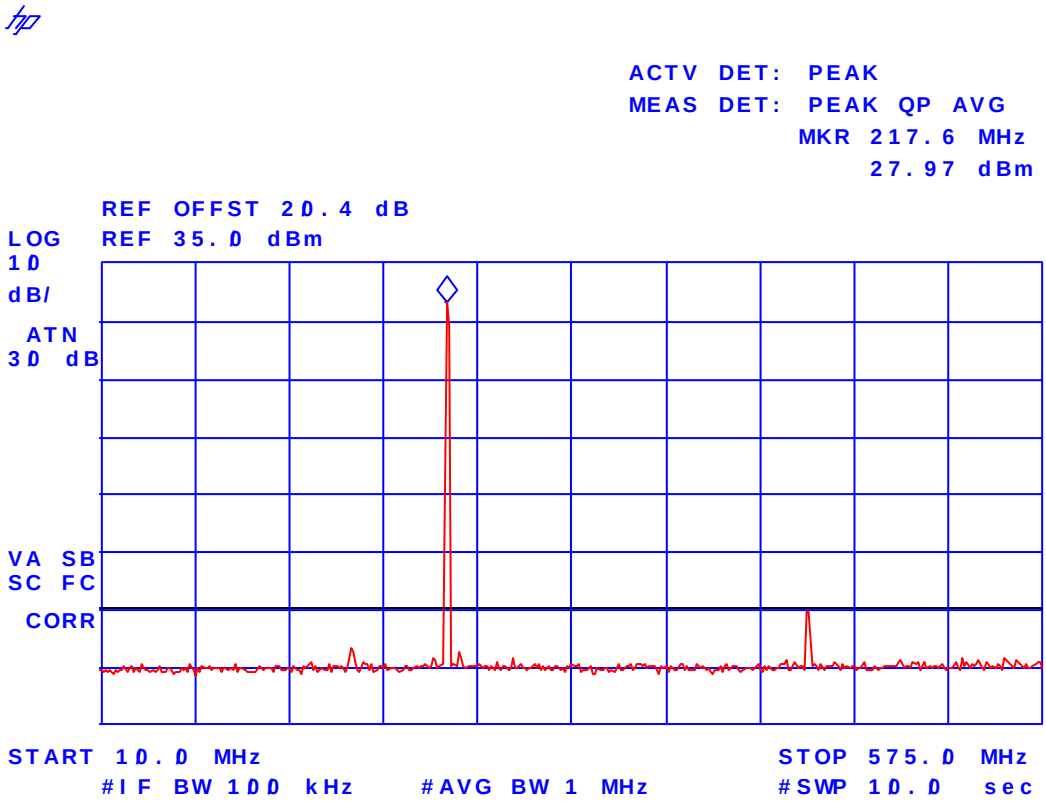
Plot # 10: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 217 MHz, RF Output Power: 2 Watts



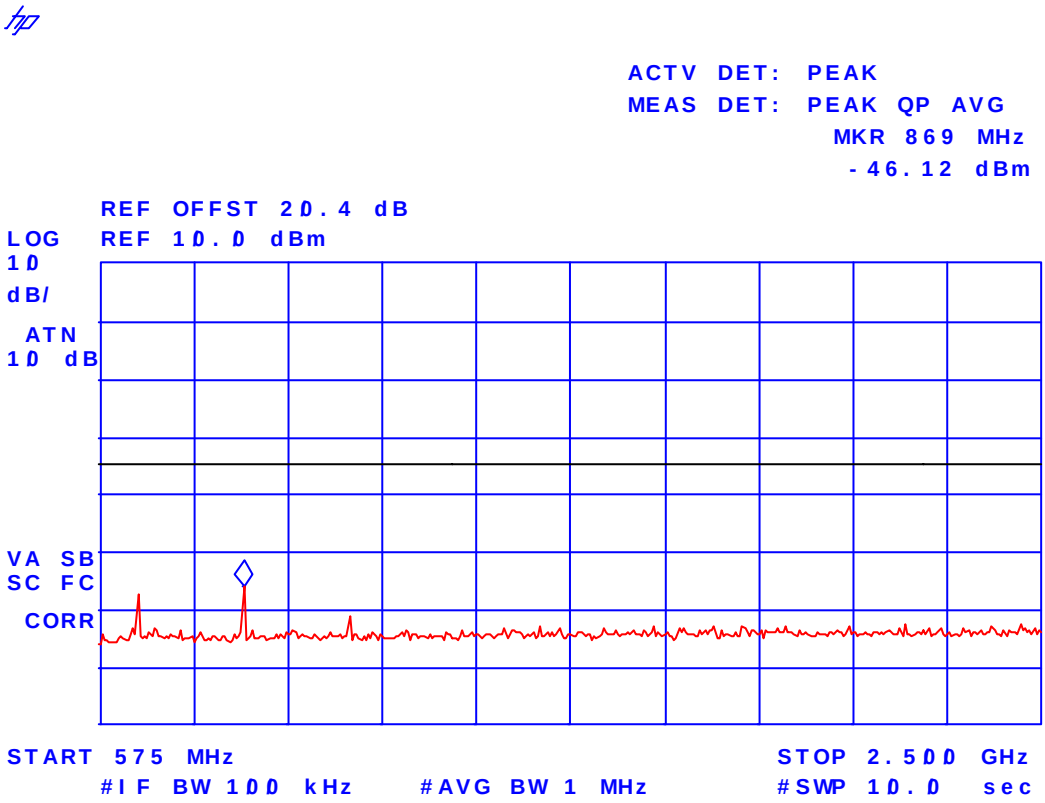
Fundamental Frequency:	217 MHz
RF Output Power:	0.5 W or 27 dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
FCC Limit:	55 + 10*log(0.5) = 52.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
433.8	-25.37	-52.37	-52.0	-0.4	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 11 and 12 for detailed measurements.					

Plot # 11: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 217 MHz, RF Output Power: 0.5 Watts



Plot # 12: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 217 MHz, RF Output Power: 0.5 Watts

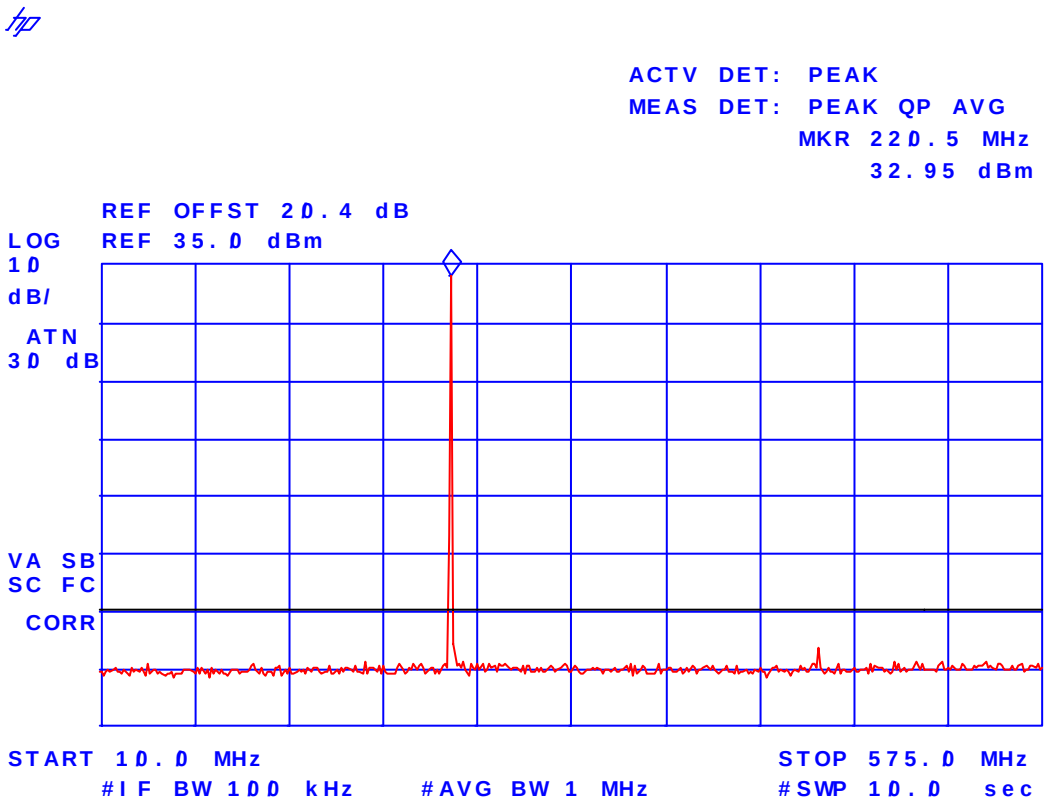


6.10.5.2. NEAR HIGHEST FREQUENCY IN 217-220 MHz BAND (219.9875 MHz)

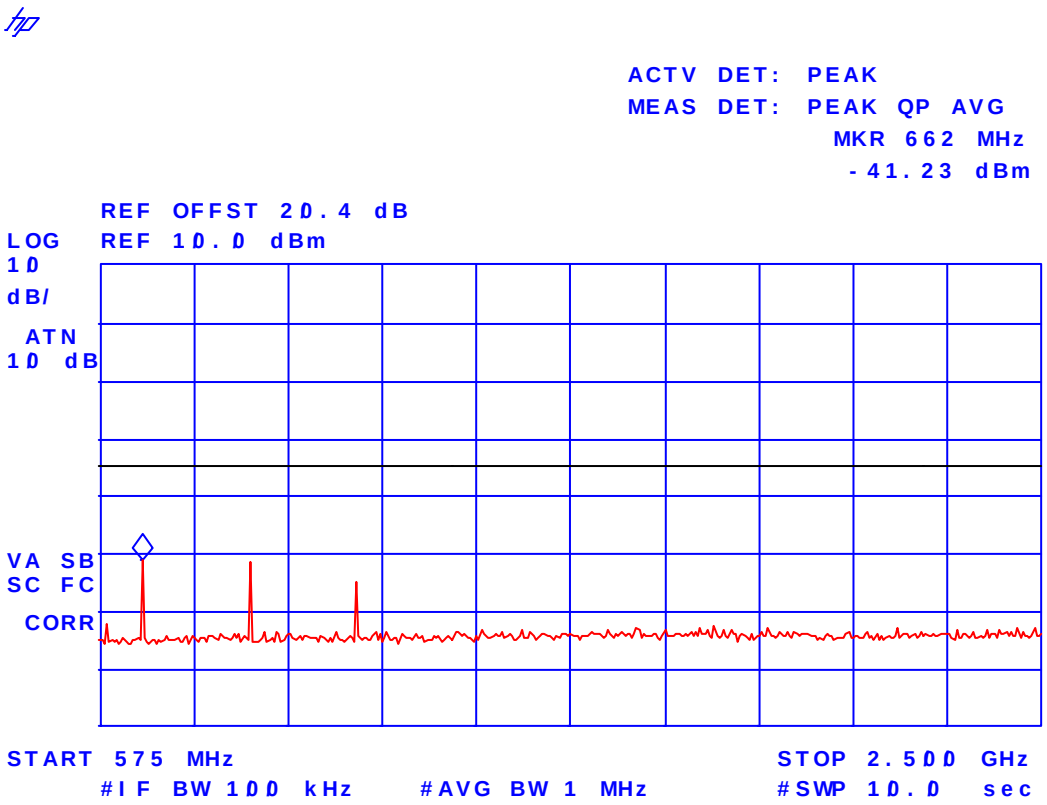
Fundamental Frequency:	219.9875 MHz
RF Output Power:	2 Watts or 33 dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
FCC Limit:	55+10*log(2) = 58.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
440.8	-31.32	-64.32	-58.0	-6.3	Pass
622.0	-41.23	-74.23	-58.0	-16.2	Pass
883.0	-41.34	-74.34	-58.0	-16.3	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 13 and 14 for detailed measurements.					

Plot # 13: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 219.9875 MHz, RF Output Power: 2 Watts



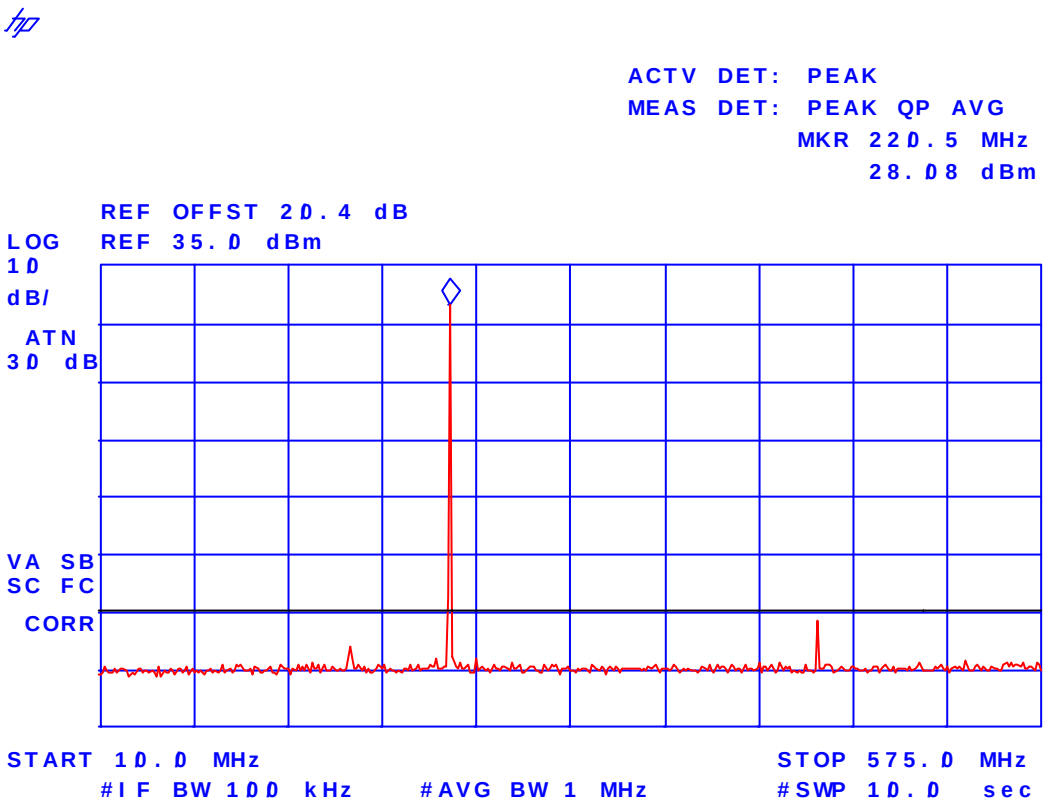
Plot # 14: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 219.9875 MHz, RF Output Power: 2 Watts



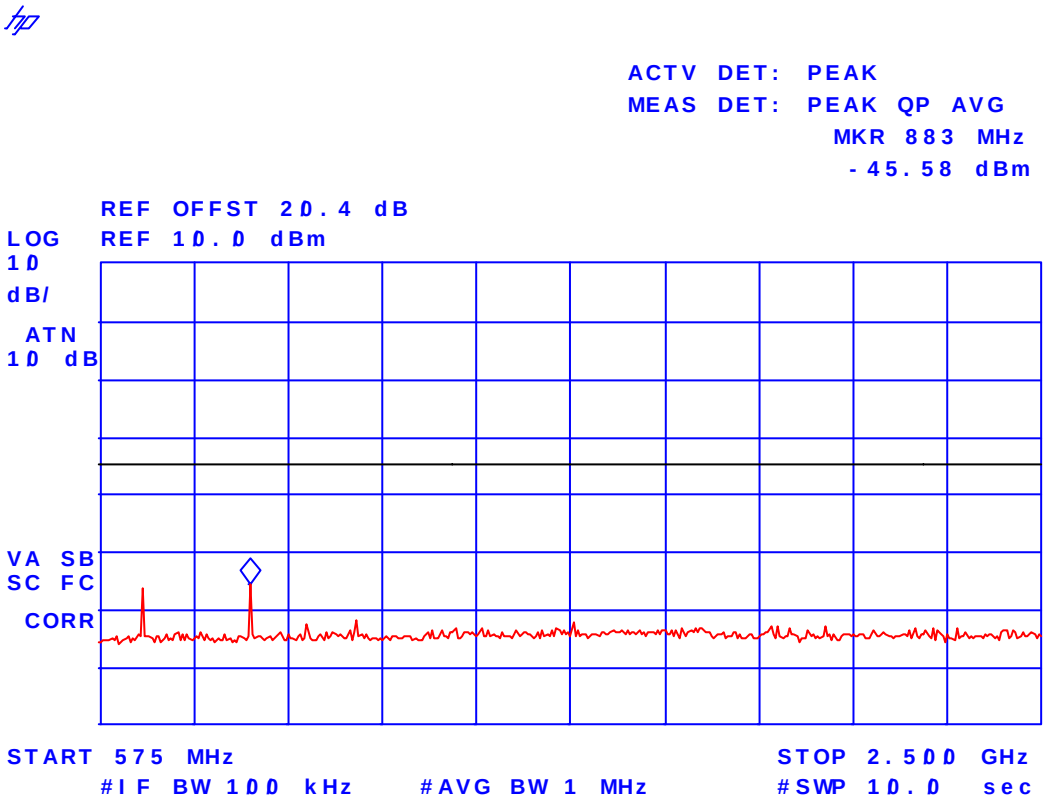
Fundamental Frequency:	219.9875 MHz
RF Output Power:	0.5 Watts or 27 dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
FCC Limit:	55+10*log(0.5) = 52.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
440.8	-26.47	-53.47	-52.0	-1.5	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 15 and 16 for detailed measurements.					

Plot # 15: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 219.9875 MHz, RF Output Power: 0.5 Watts



Plot # 16: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 219.9875 MHz, RF Output Power: 0.5 Watts

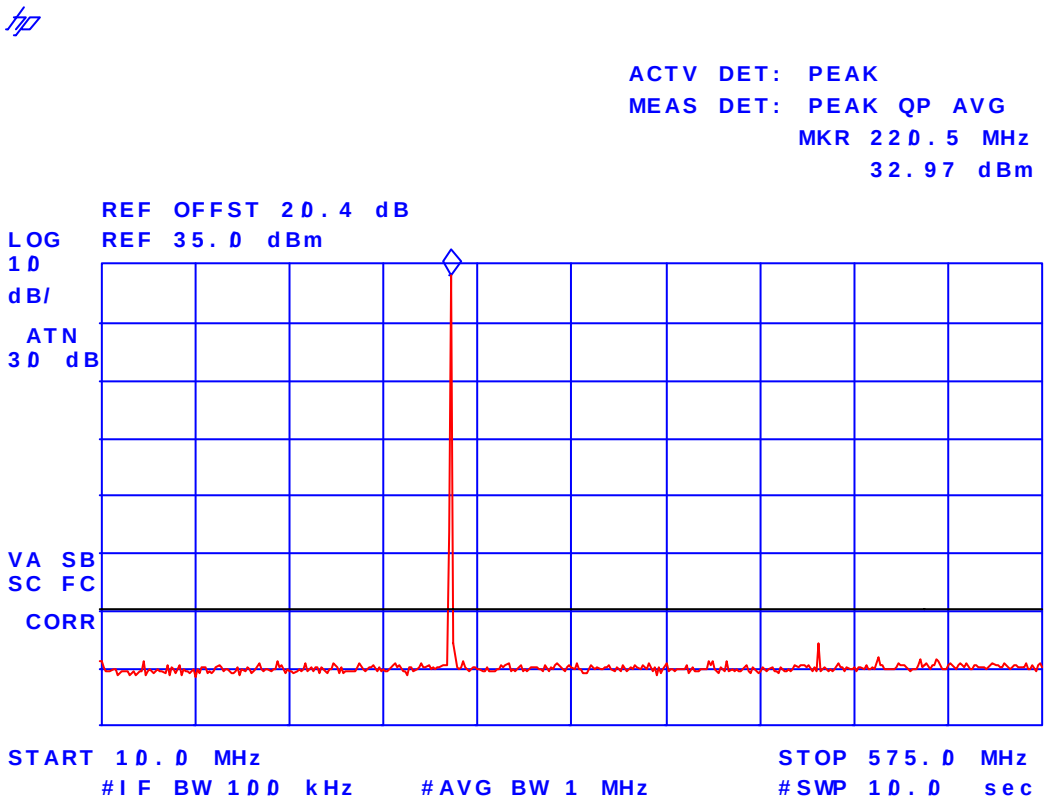


6.10.5.3. NEAR LOWEST FREQUENCY IN 220-222 MHz BAND (220 MHz)

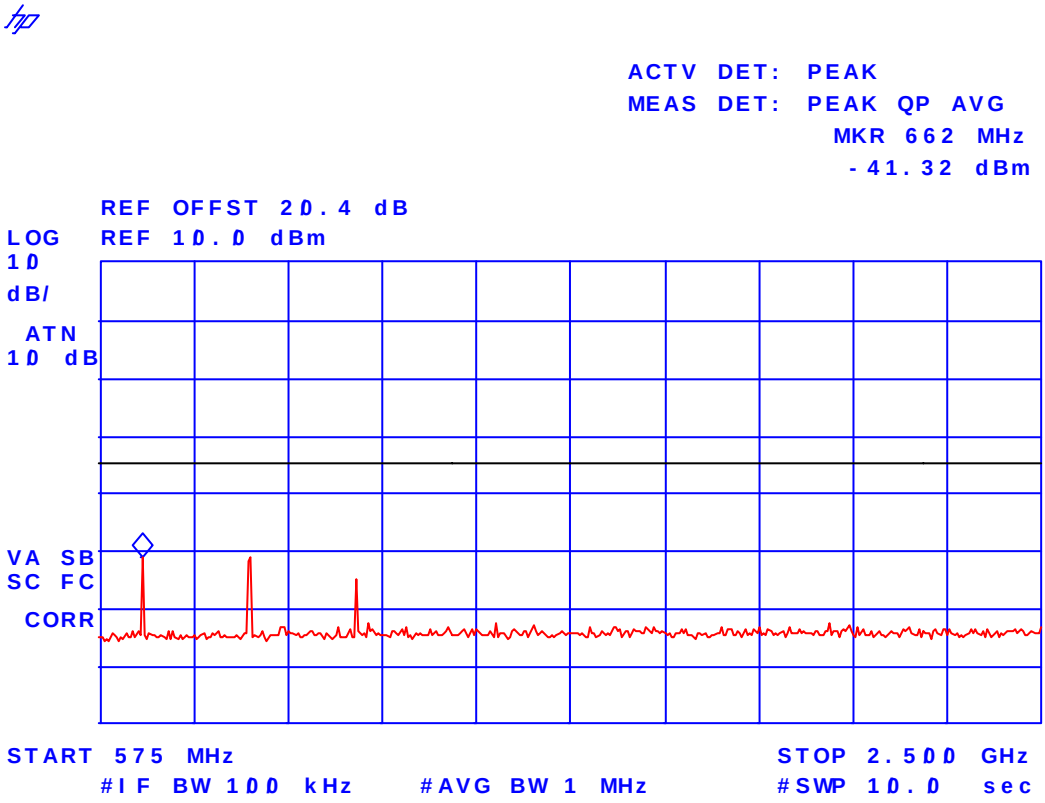
Fundamental Frequency:	220 MHz
RF Output Power:	2 Watts or 33 dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
Limit:	55+10*log(2) = 58.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
440.8	-30.90	-63.90	-58.0	-5.9	Pass
662	-41.32	-74.32	-58.0	-16.3	Pass
883	-41.34	-74.34	-58.0	-16.3	Pass
1100	-44.99	-77.99	-58.0	-20.0	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 17 and 18 for detailed measurements.					

Plot # 17: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 220 MHz, RF Output Power: 2 Watts



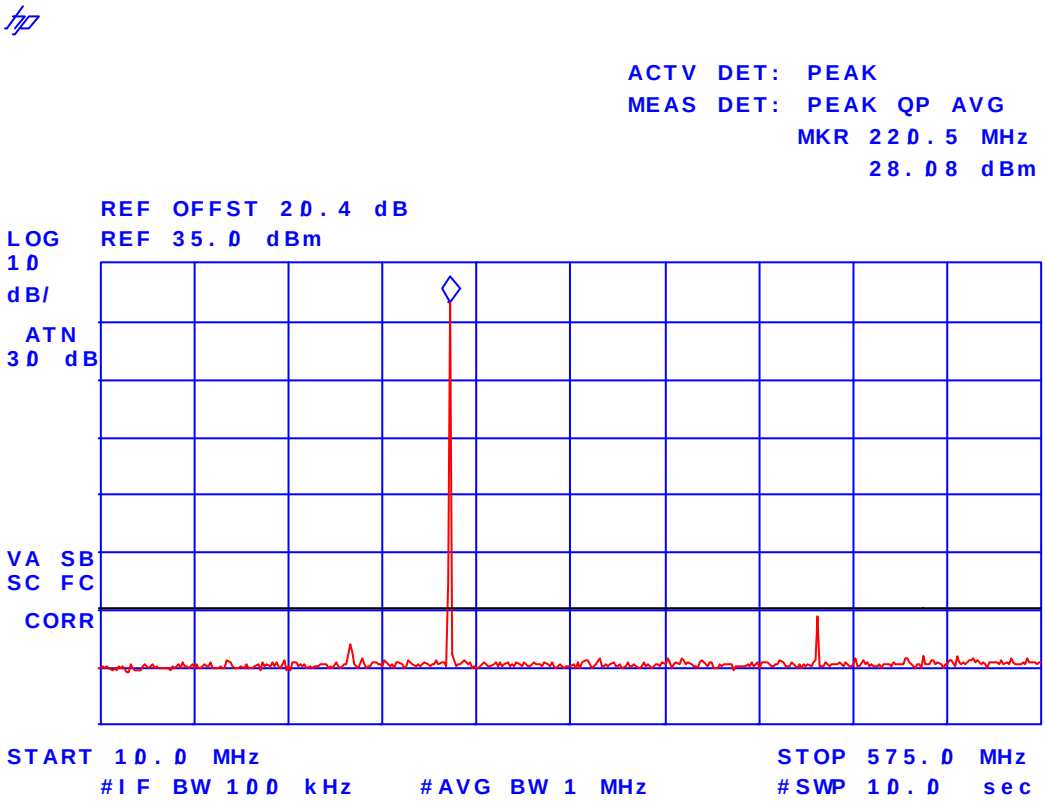
Plot # 18: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 220 MHz, RF Output Power: 2 Watts



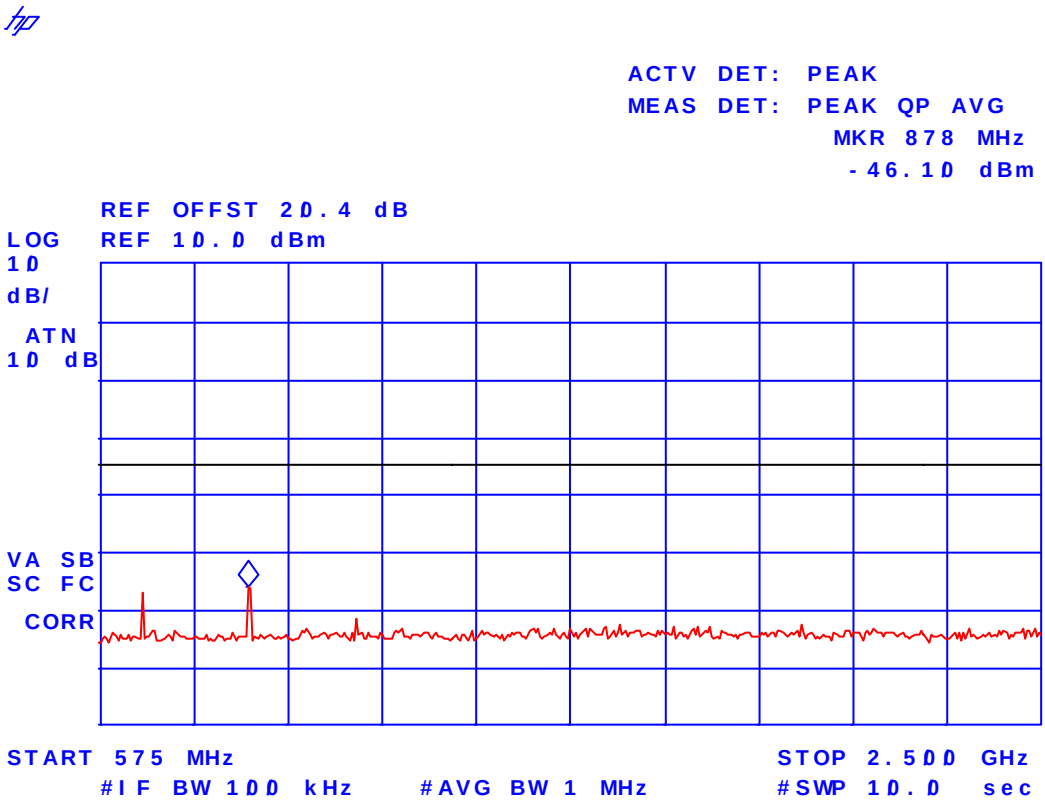
Fundamental Frequency:	220 MHz
RF Output Power:	0.5 Watts or 27 dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
Limit:	55+10*log(0.5) = 52.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
440.8	-26.14	-53.14	-52.0	-1.1	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 19 and 20 for detailed measurements.					

Plot # 19: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 220 MHz, RF Output Power: 0.5 Watts



Plot # 20: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 220 MHz, RF Output Power: 0.5 Watts

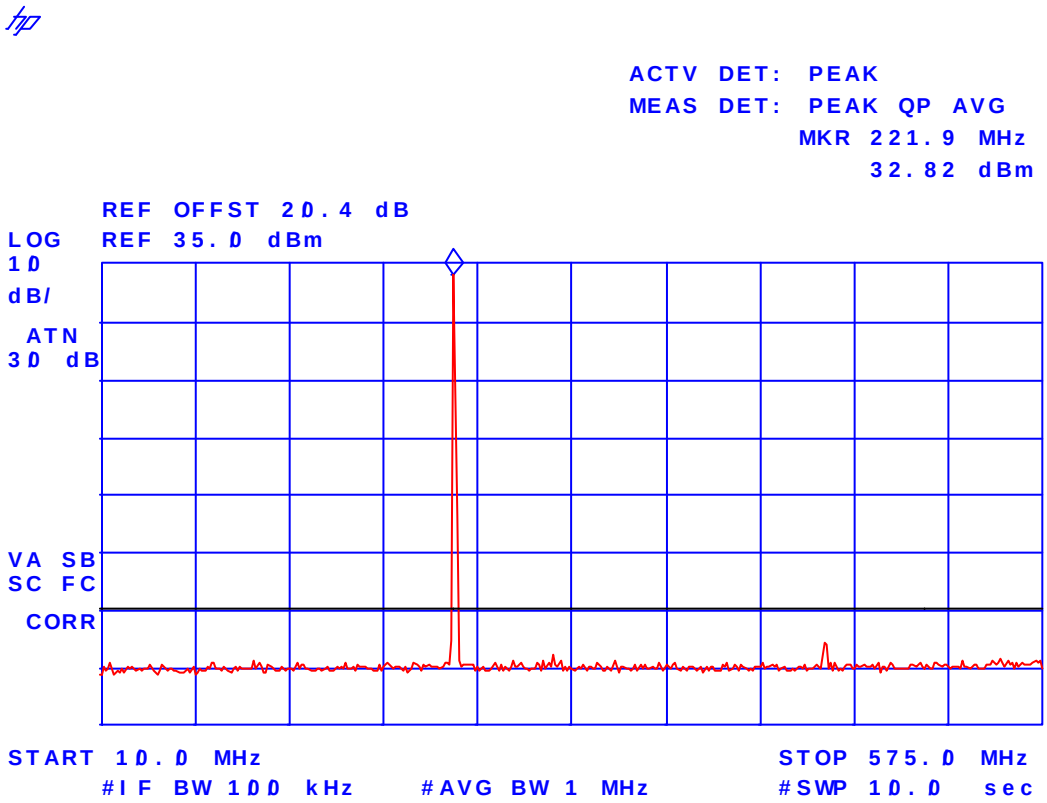


6.10.5.4. NEAR HIGHEST FREQUENCY IN 220-222 MHz BAND (222 MHz)

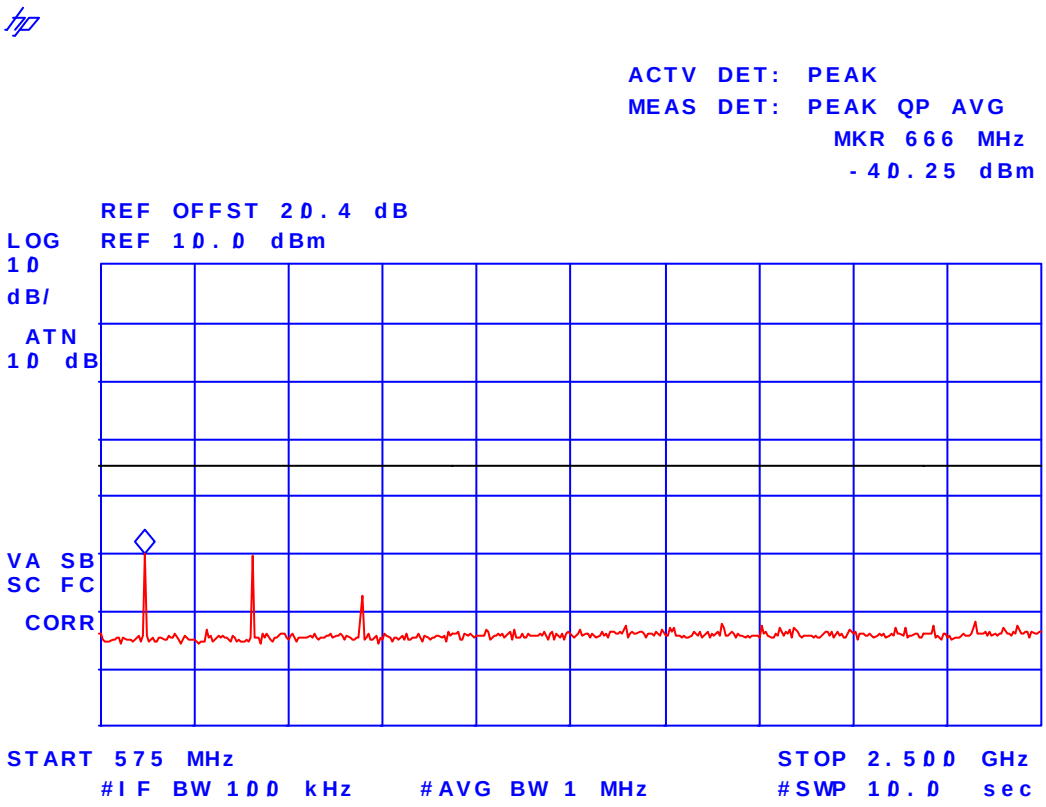
Fundamental Frequency:	222 MHz
RF Output Power:	2 Watts or 33 dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
Limit:	55+10*log(2) = 58.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
444.6	-30.75	-63.75	58.0	-5.8	Pass
666	-40.25	-73.25	58.0	-15.3	Pass
888	-40.35	-73.35	58.0	-15.4	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 21 and 22 for detailed measurements.					

Plot # 21: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 222 MHz, RF Output Power: 2 Watts



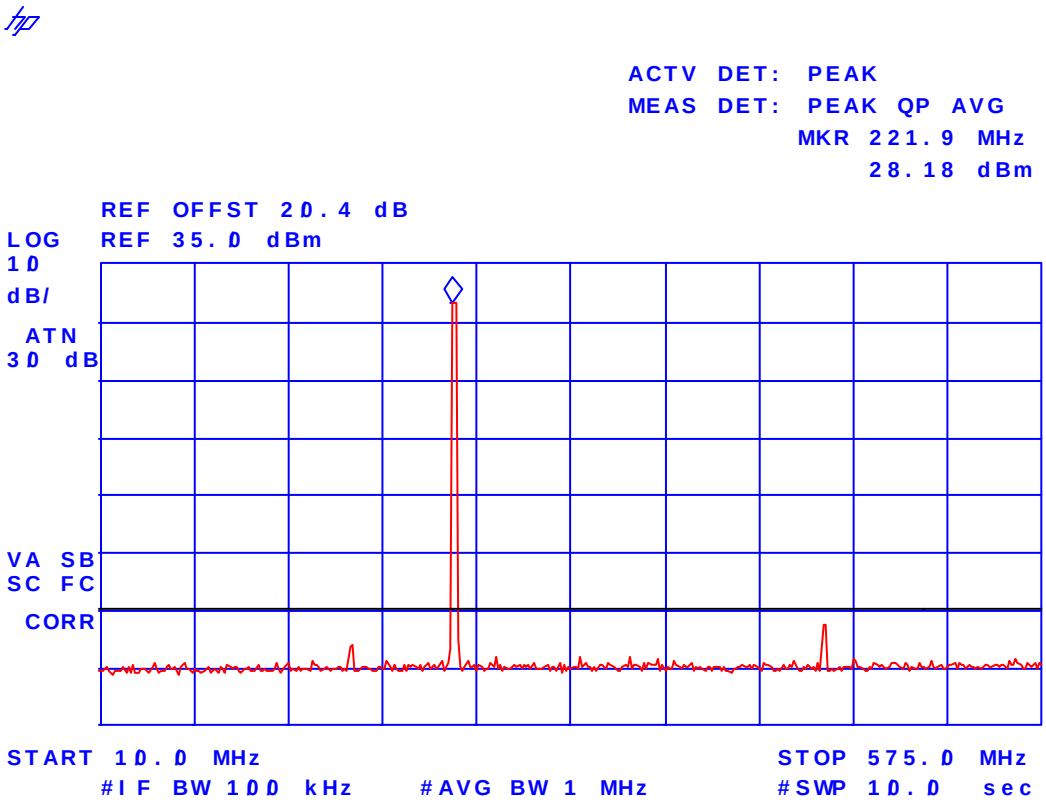
Plot # 22: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 222 MHz, RF Output Power: 2 Watts



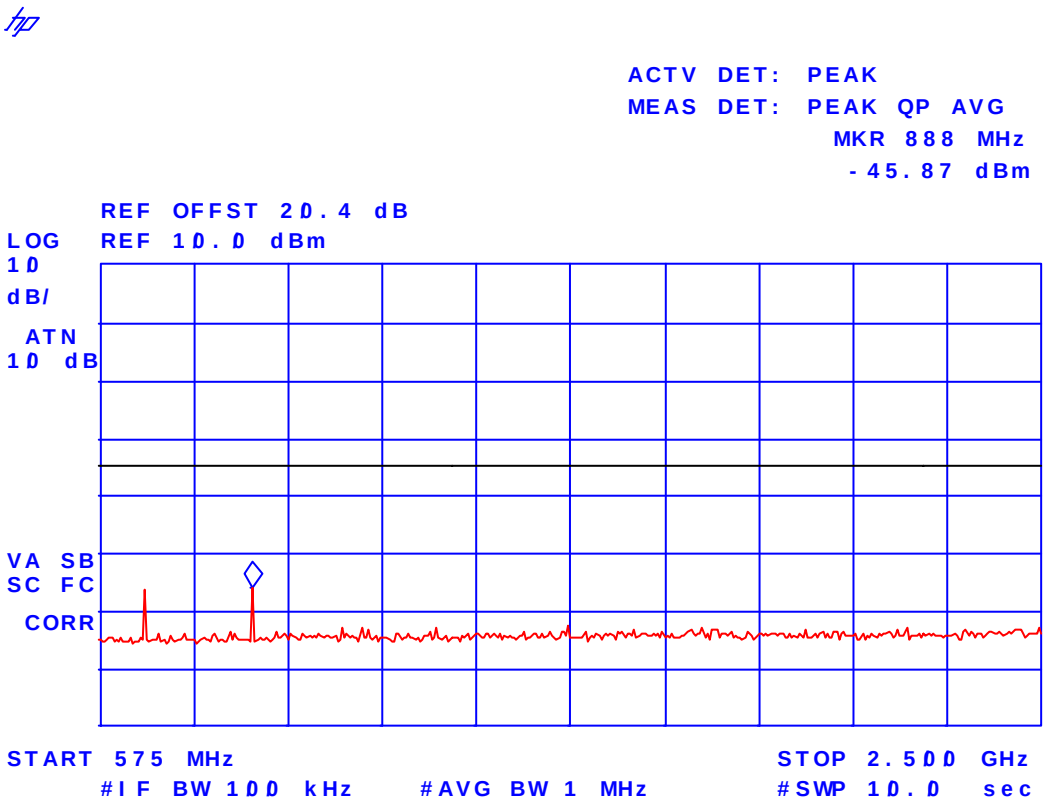
Fundamental Frequency:	222 MHz
RF Output Power:	0.5 Watts or 27dBm
Modulation:	FM modulation with 9.6 kb/s internal random data source
Limit:	55+10*log(0.5) = 52.0 dBc
Test Frequency Range:	10 MHz to 2.5 GHz

Frequency (MHz)	Transmitter Conducted Antenna Emissions		Limit (dBc)	Margin (dB)	Pass/ Fail
	(dBm)	(dBc)			
444.6	-27.70	-54.70	52.0	-2.7	Pass
All other spurious emissions are more than 20dB below the limit; refer to Plots # 23 and 24 for detailed measurements.					

Plot # 23: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 222 MHz, RF Output Power: 0.5 Watts



Plot # 24: Transmitter RF Conducted Emissions at the Antenna Port
Tx Frequency: 222 MHz, RF Output Power: 0.5 Watts



6.11. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 90.210]

6.11.1. LIMITS

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

FCC Rules	Frequency Range	Attenuation Limit (dBc)
90.210(f) – Data	10 MHz to Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	55+10*log (P) or -25 dBm or 65 dBc whichever is less

6.11.2. 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 = Pc 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)

6.11.3. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rhode & Schwarz	FSEK20/B4/B21	834157/005	9kHz – 40 GHz
RF Amplifier	Com-Power	PA-102		1 MHz to 1 GHz, 30 dB gain nominal
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

6.11.4. TEST DATA

Remarks:

- Test frequency range: 30 – 2500 MHz
- The radiated emissions were performed with high power setting (2 Watts) at 3 meters distance to represents the worst-case test configuration.

6.11.4.1. Near Lowest Frequency in 217-220 MHz Band (217 MHz)

All spurious emissions and harmonics were more than 20 dB below the permissible limit.

6.11.4.2. Near Highest Frequency in 217-220 MHz Band (219.9875 MHz)

All spurious emissions and harmonics were more than 20 dB below the permissible limit.

6.11.4.3. Near Lowest Frequency in 220-222 MHz Band (220 MHz)

All spurious emissions and harmonics were more than 20 dB below the permissible limit.

6.11.4.4. Near Highest Frequency in 220-222 MHz Band (222 MHz)

All spurious emissions and harmonics were more than 20 dB below the permissible limit.

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 Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

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

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

EXHIBIT 8. MEASUREMENT METHODS

8.1. 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.

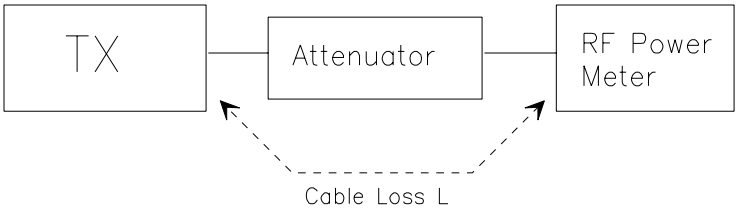
Step 2: Calculation of Average EIRP. See Figure 1

- 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.



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

8.2.1. MAXIMIZING RF EMISSION LEVEL (E-FIELD)

(a) The measurements were 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

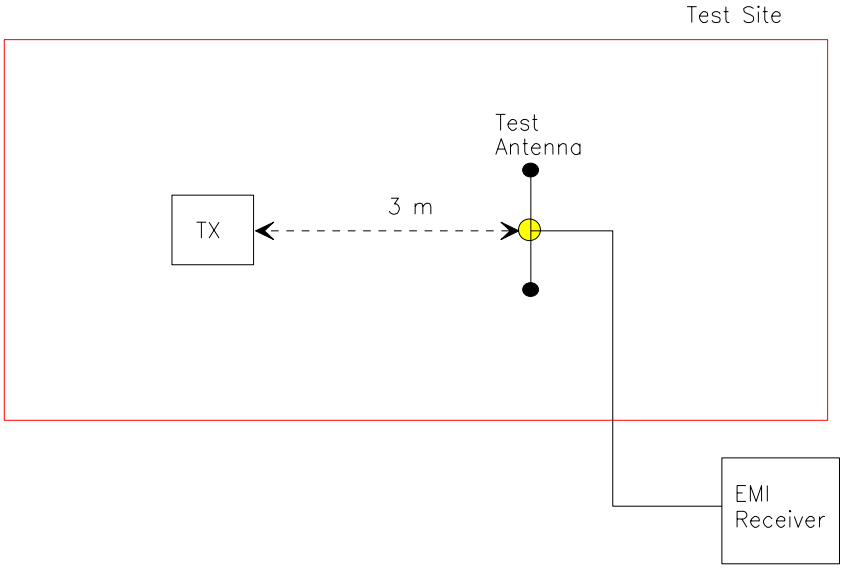
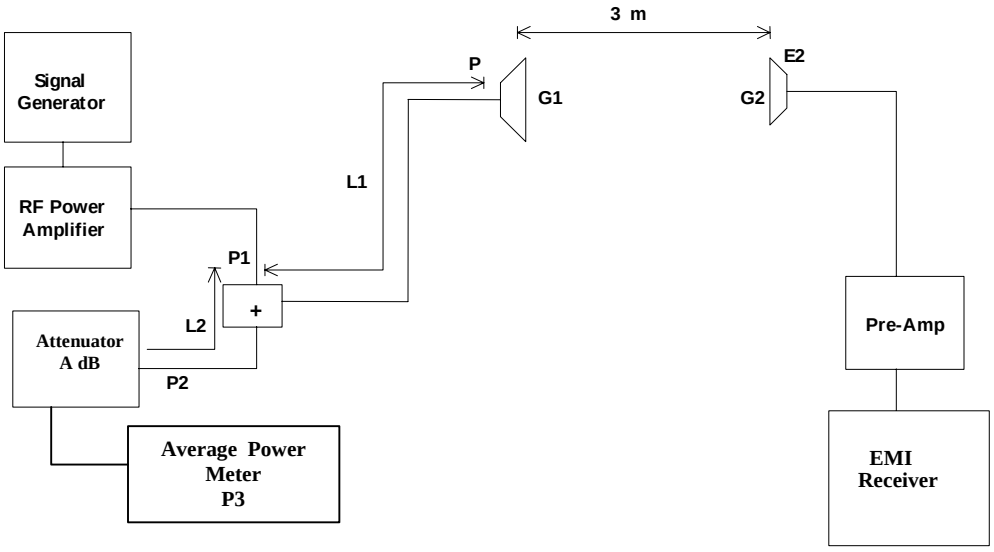


Figure 3



8.3. FREQUENCY STABILITY

Refer to § 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 MASK

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

Digital Modulation Through a Data Input Port § 2.1049(h): Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

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

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

47 CFR § 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 that are attenuated more than 20 dB below the permissible value need not to be reported.

47 CFR § 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 that are attenuated more than 20 dB below the permissible value need not to be specified.