



Nemko Test Report: 2014 263545 FCC PT101


Applicant: Fujitsu Network Communications, Inc.
Two Blue Hill Plaza
2nd Floor
Pearl River, NY 10965

**Equipment Under Test:
(E.U.T.)** GX4000

FCC Identifier: CFDGX4000

In Accordance With: **CFR 47, Part 101, Subpart C**
Fixed Microwave Services

Tested By: Nemko USA, Inc.
2210 Faraday Ave, Suite 150
Carlsbad, CA 92008

TESTED BY:  **DATE:** 28 July 2014
David Light, Senior Wireless Engineer

APPROVED BY:  **DATE:** 13 Aug 2014

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Section 1. Summary of Test Results

Manufacturer: Fujitsu Network Communications, Inc.

Model No.: GX4000*

Serial No.: DC version 130003
AC version 130007

Part numbers are as follows:	AC upper band unit	TA04011-B939
	AC lower band unit	TA04011-B938
	DC upper band unit	TA04011-B931
	DC lower band unit	TA04011-B930

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 101, Subpart C.

- | | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission | <input checked="" type="checkbox"/> | Production Unit |
| <input type="checkbox"/> | Class II Permissive Change | <input type="checkbox"/> | Pre-Production Unit |

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



NVLAP LAB CODE 200116-0

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This report applies only to the items tested.

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	101.113	55 dBW EIRP	Complies
Occupied Bandwidth	101.111	5000 MHz	Complies
Spurious Emissions at Antenna Terminals	101.111	-13 dBm/4 kHz	Complies
Field Strength of Spurious Emissions	101.111	-13 dBm ERP	Complies
Frequency Stability	101.107	101.107	NA

Footnotes:

- 1) This test does not apply to equipment operating in this band.

Section 2. General Equipment Specification

Supply Voltage Input:	120 Vac or -48 Vdc
Frequency Bands: TX	71000 to 76000 MHz and 81000 to 86000 MHz
Antenna Gain(dBi):	1' antenna = 43 dBi 2' antenna = 48 dBi
Output Impedance:	50 ohms
RF Output (Rated):	10 dBm

System Description

70/80 GHz point to point microwave radio.

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 101.113
TESTED BY: David Light	DATE: 21 July 2014

Test Results: Complies.

Measurement Data:

Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mW)
72903.000	10.3	10.7
82995.288	10.8	12.0

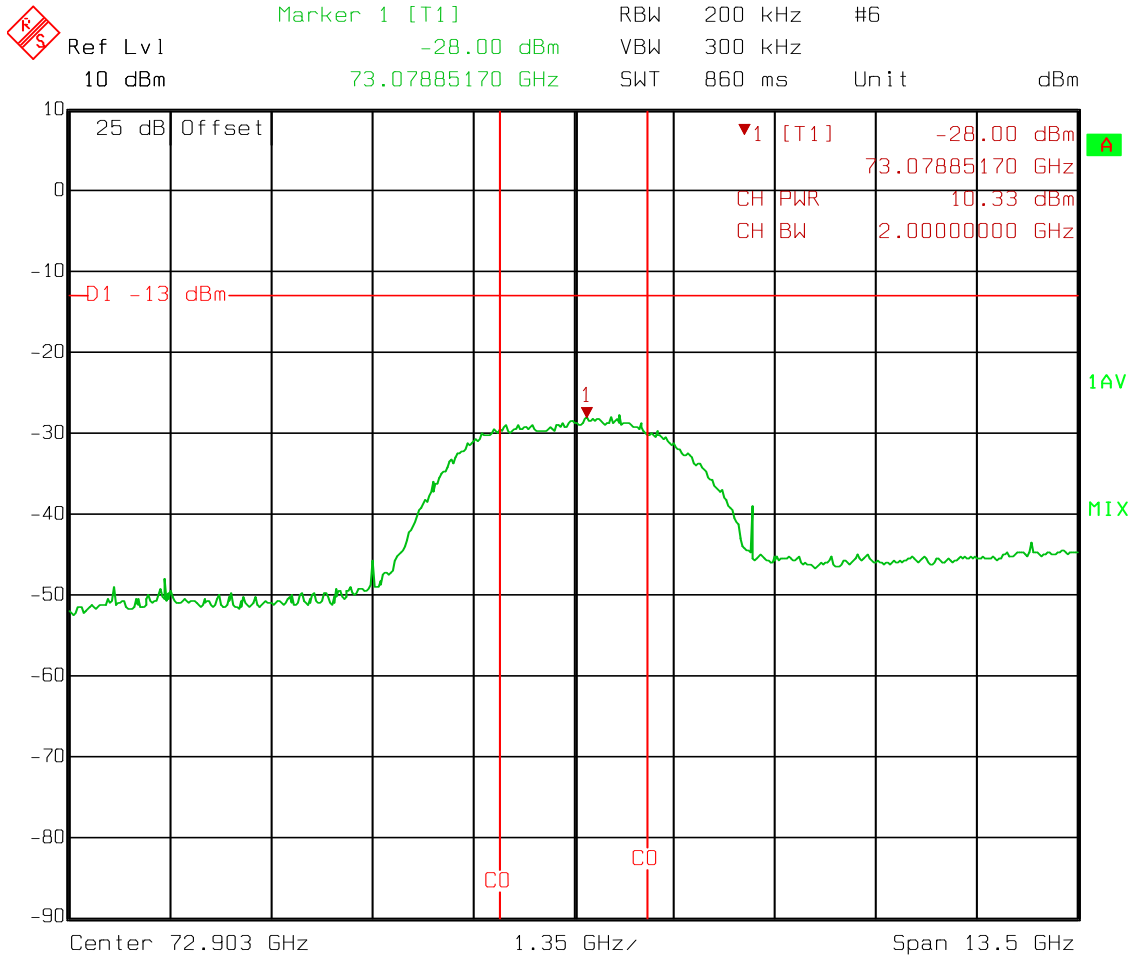
Equipment Used: 1036-FA001525

Measurement Uncertainty: +/- 1.7 dB

Temperature: 23 °C

Relative Humidity: 35 %

Test Data

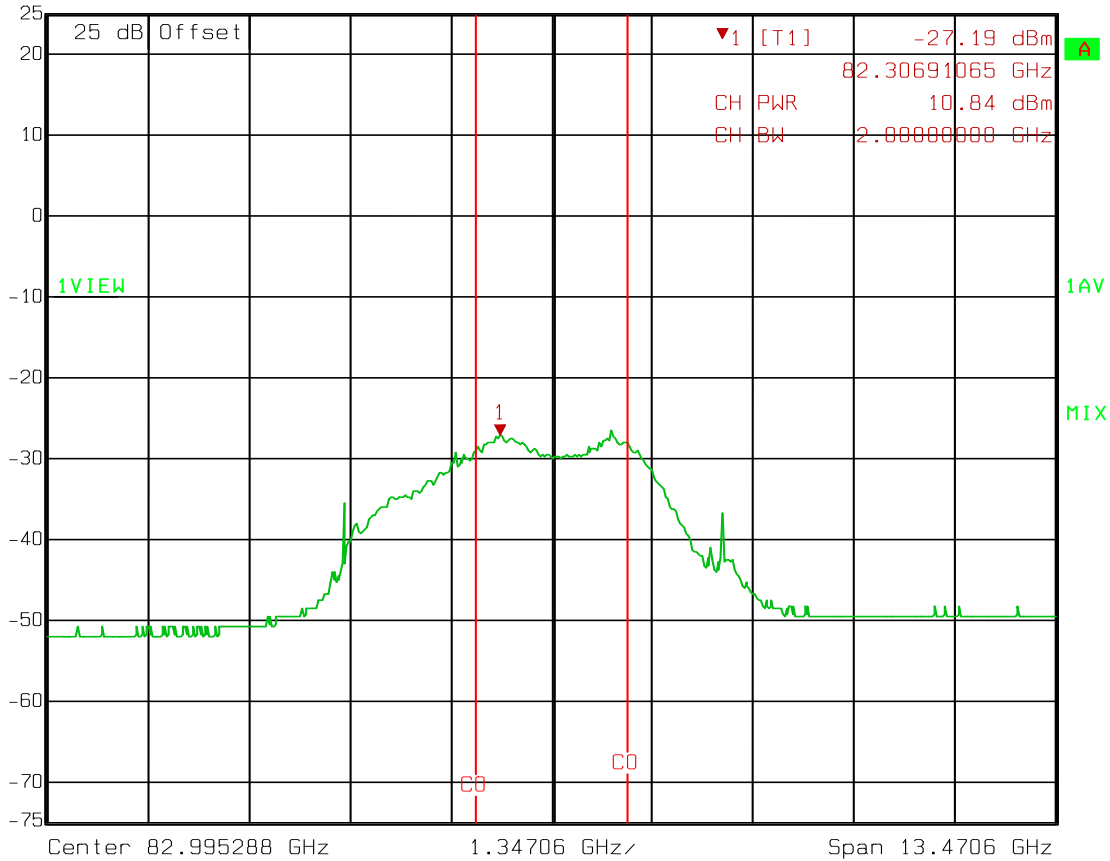


Date: 21.JUL.2014 14:09:05

Test Data



Marker 1 [T1] RBW 200 kHz #6
Ref Lvl -27.19 dBm VBW 300 kHz
25 dBm 82.30691065 GHz SWT 860 ms Unit dBm



Date: 21.JUL.2014 11:47:23

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 101.111
TESTED BY: David Light	DATE: 21 July 2014

Test Results: Complies.

Measurement Data: See attached plots

Equipment Used: 1036-FA001525

Measurement Uncertainty: +/- 1.7 dB

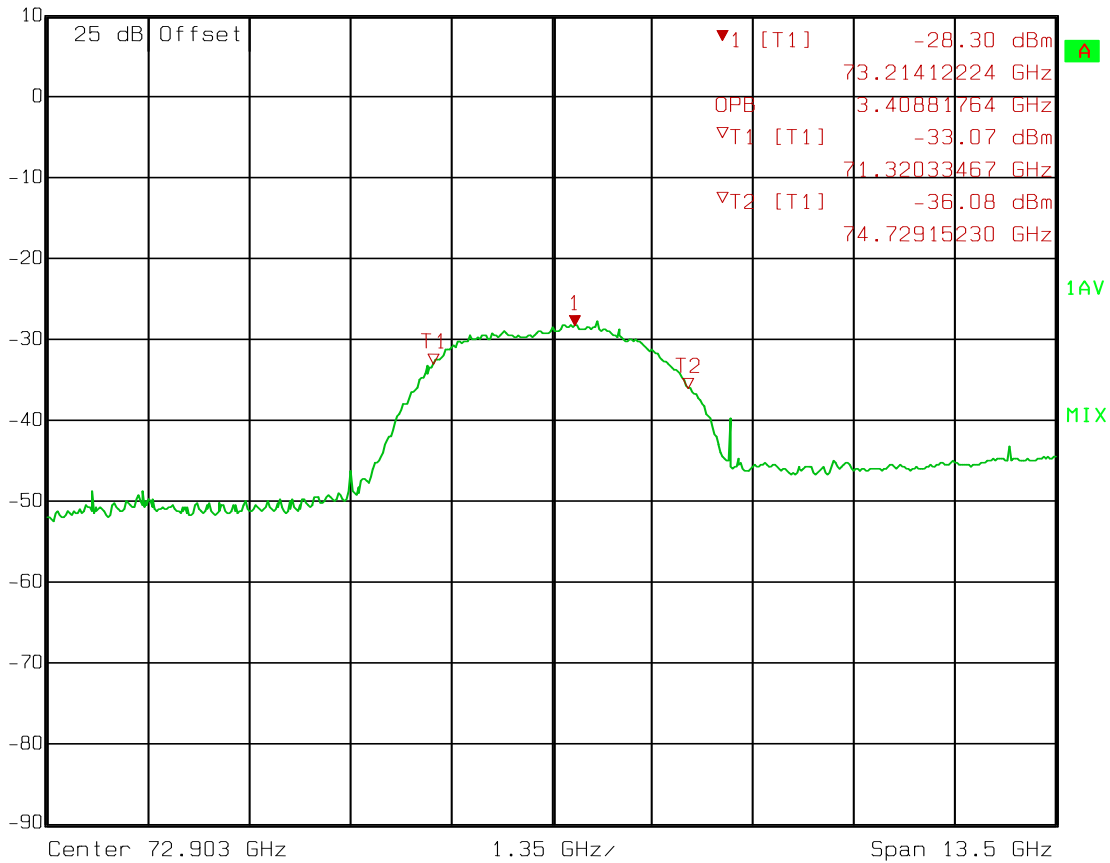
Temperature: 23 °C

Relative Humidity: 35 %

Test Data



Marker 1 [T1] RBW 200 kHz #6
 Ref Lvl -28.30 dBm VBW 300 kHz
 10 dBm 73.21412224 GHz SWT 860 ms Unit dBm

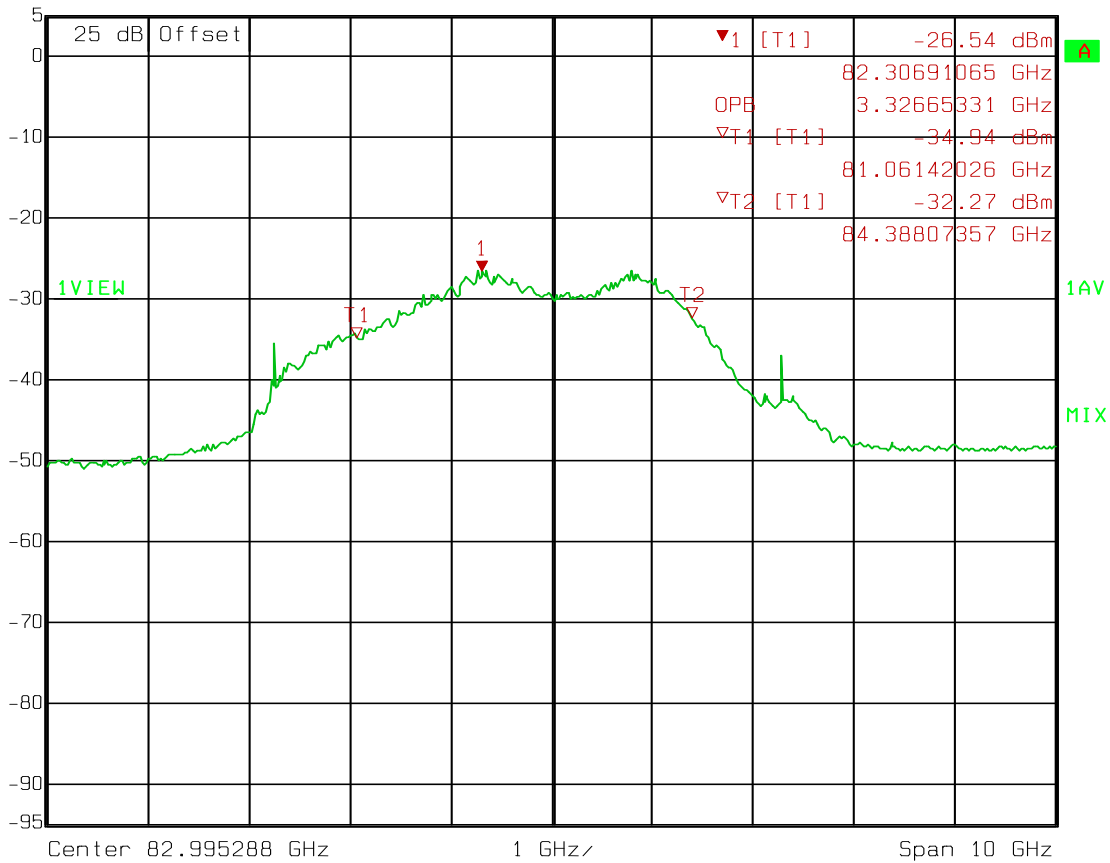


Date: 21.JUL.2014 14:10:19

Test Data



Marker 1 [T1] RBW 200 kHz #6
 Ref Lvl -26.54 dBm VBW 300 kHz
 5 dBm 82.30691065 GHz SWT 640 ms Unit dBm



Date: 21.JUL.2014 11:50:07

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions at Antenna	PARA. NO.: 101.111(a)(2)(v)
TESTED BY: David Light	DATE: 21 July 2014

Test Results: Complies.

Measurement Data: See attached plots

Equipment Used: 1036-FA001525-FA001526-FDA001524-FA002322

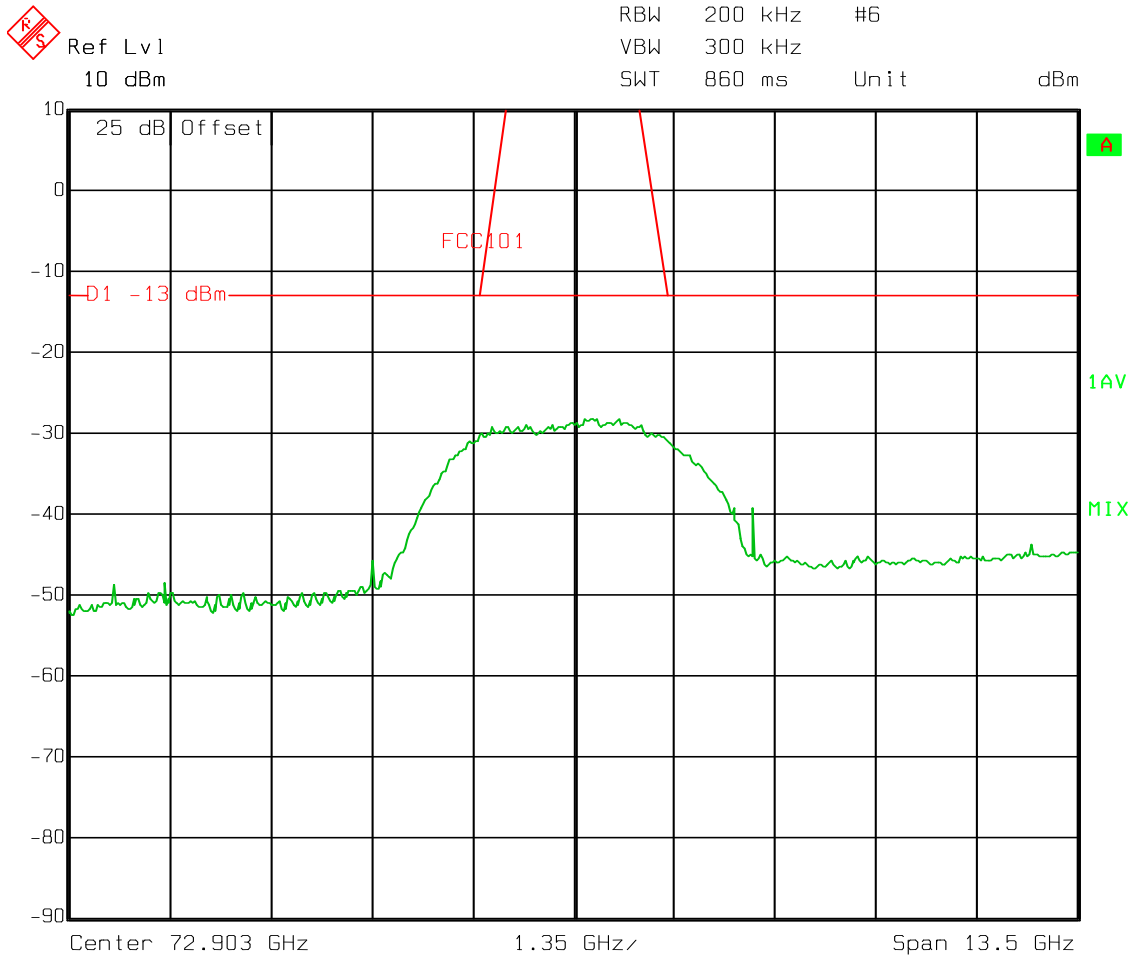
Measurement Uncertainty: +/- 1.7 dB

Temperature: 23 °C

Relative Humidity: 35 %

Test Data

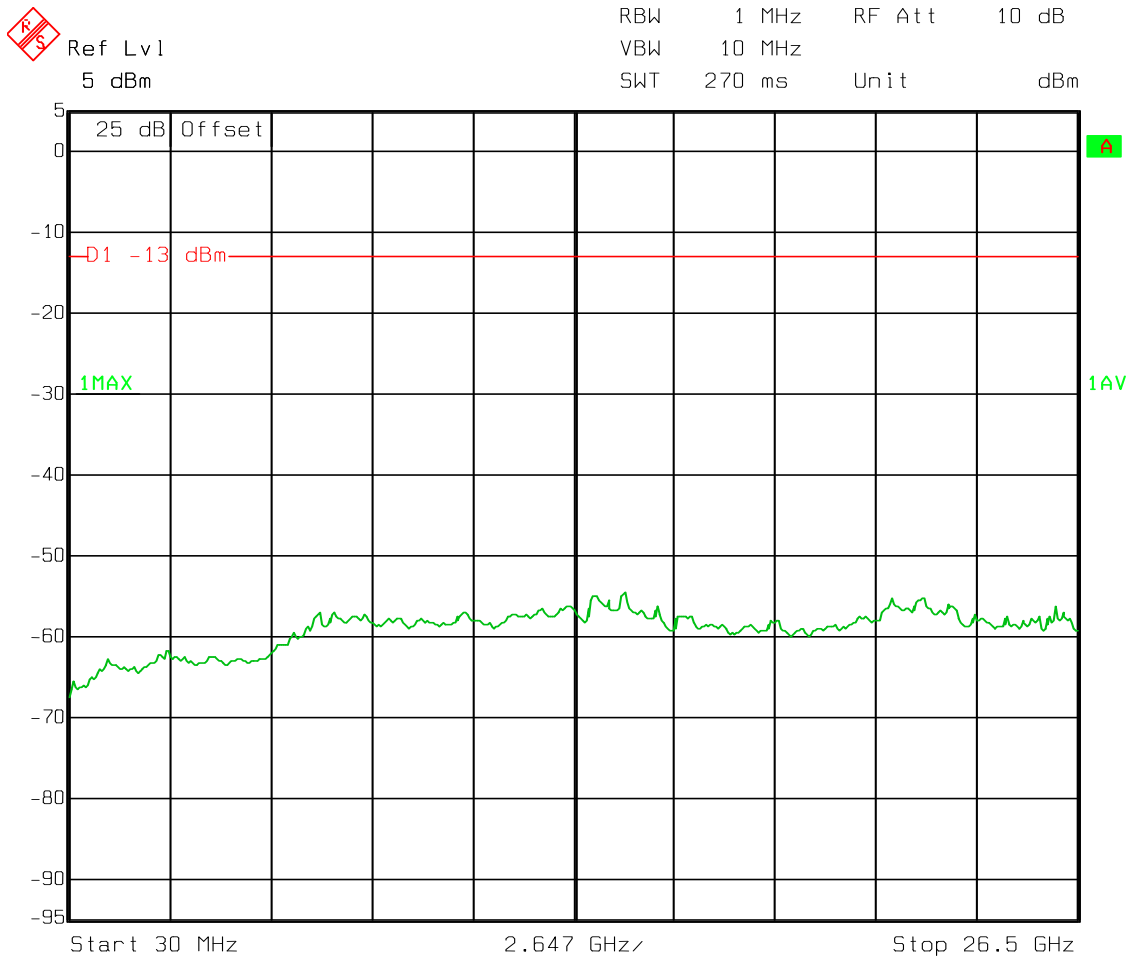
70 GHz Unit



Date: 21.JUL.2014 14:12:12

Test Data

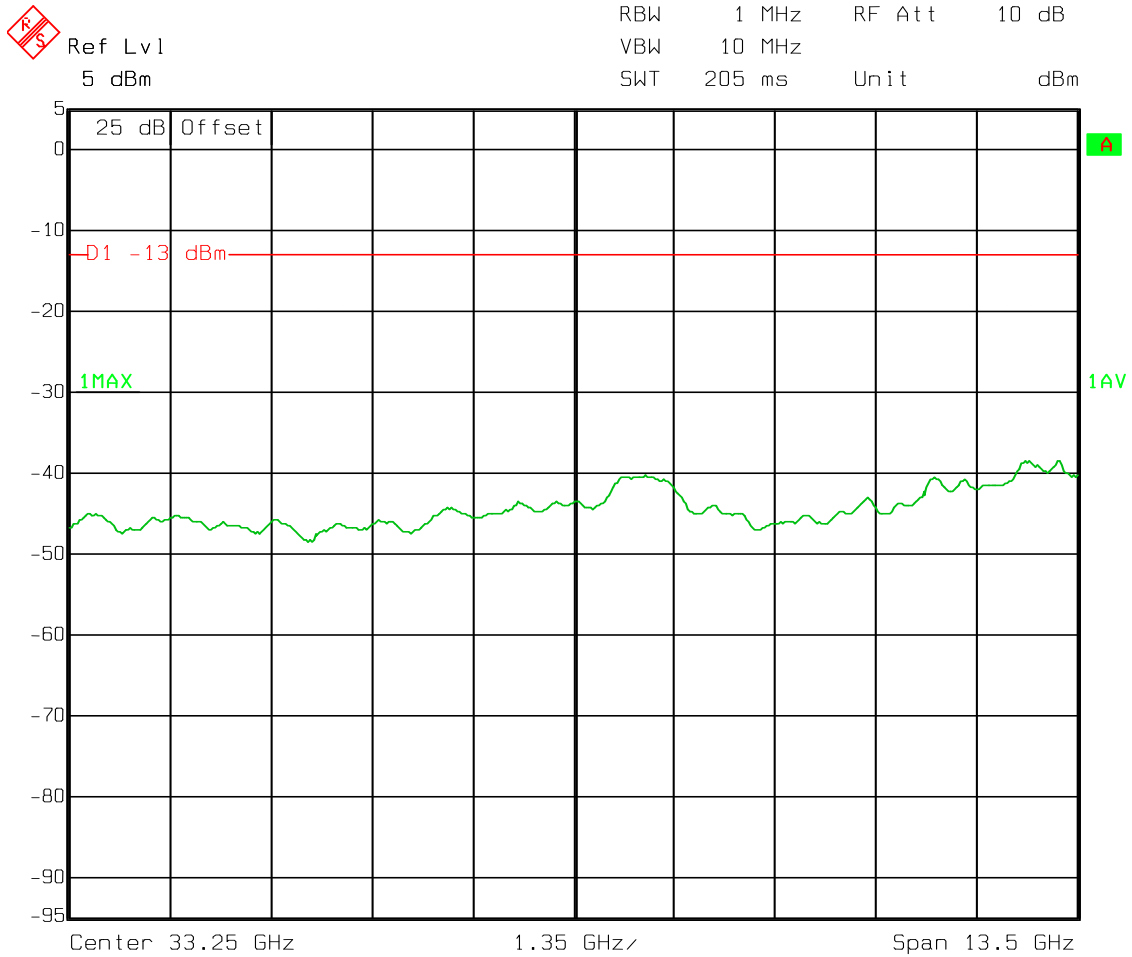
70 GHz Unit



Date: 21.JUL.2014 14:32:15

Test Data

70 GHz Unit



Date: 21.JUL.2014 14:31:36

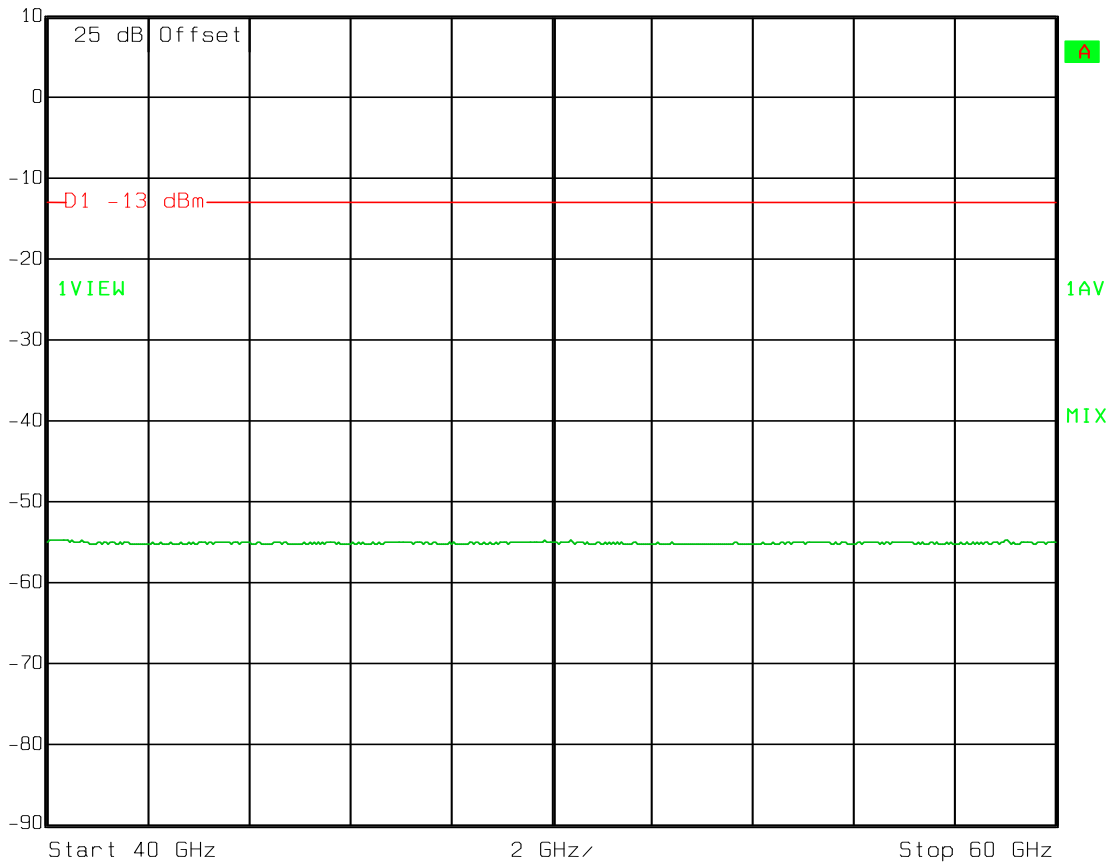
Test Data

70 GHz Unit



Ref Lvl
10 dBm

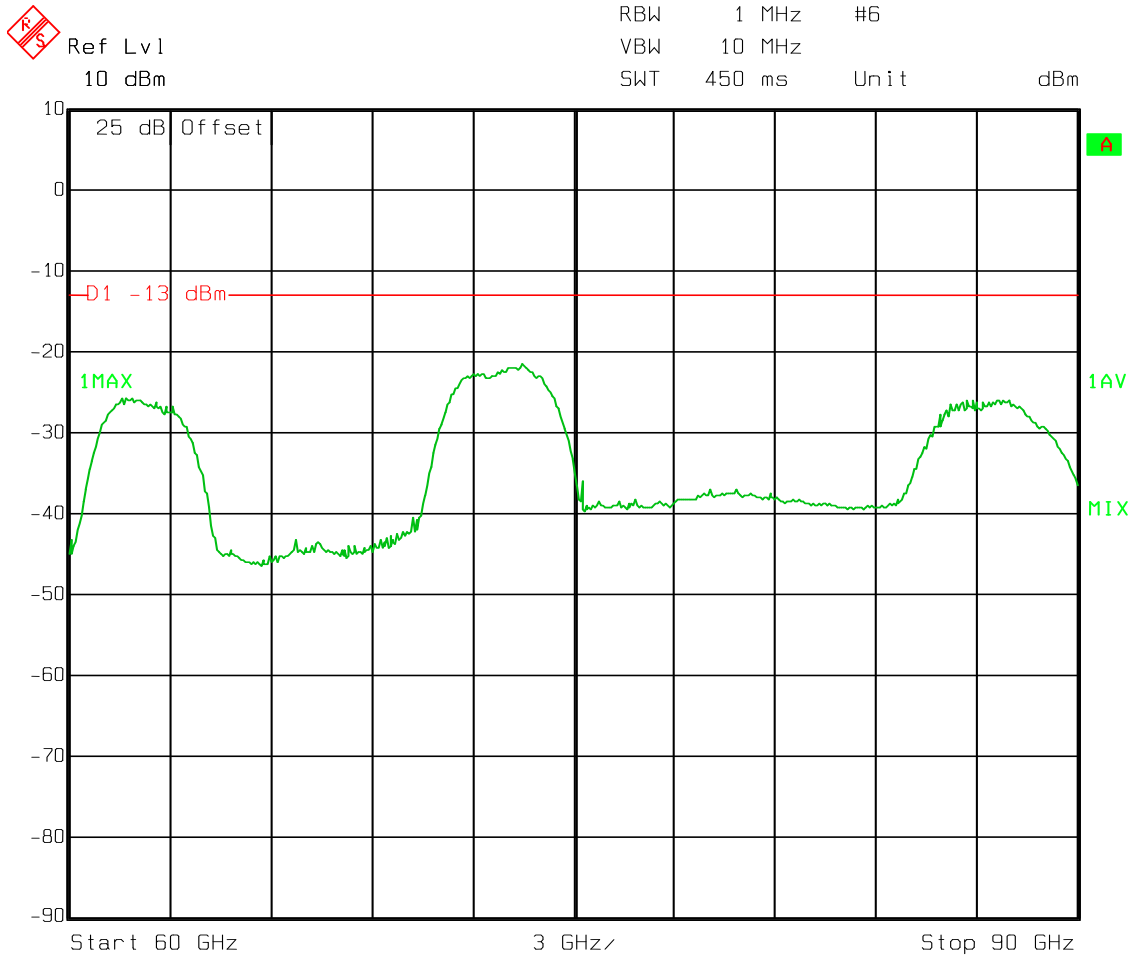
RBW 1 MHz #4 CVL 25.0dB
VBW 10 MHz
SWT 300 ms Unit dBm



Date: 21.JUL.2014 14:29:07

Test Data

70 GHz Unit



Date: 21.JUL.2014 14:18:03

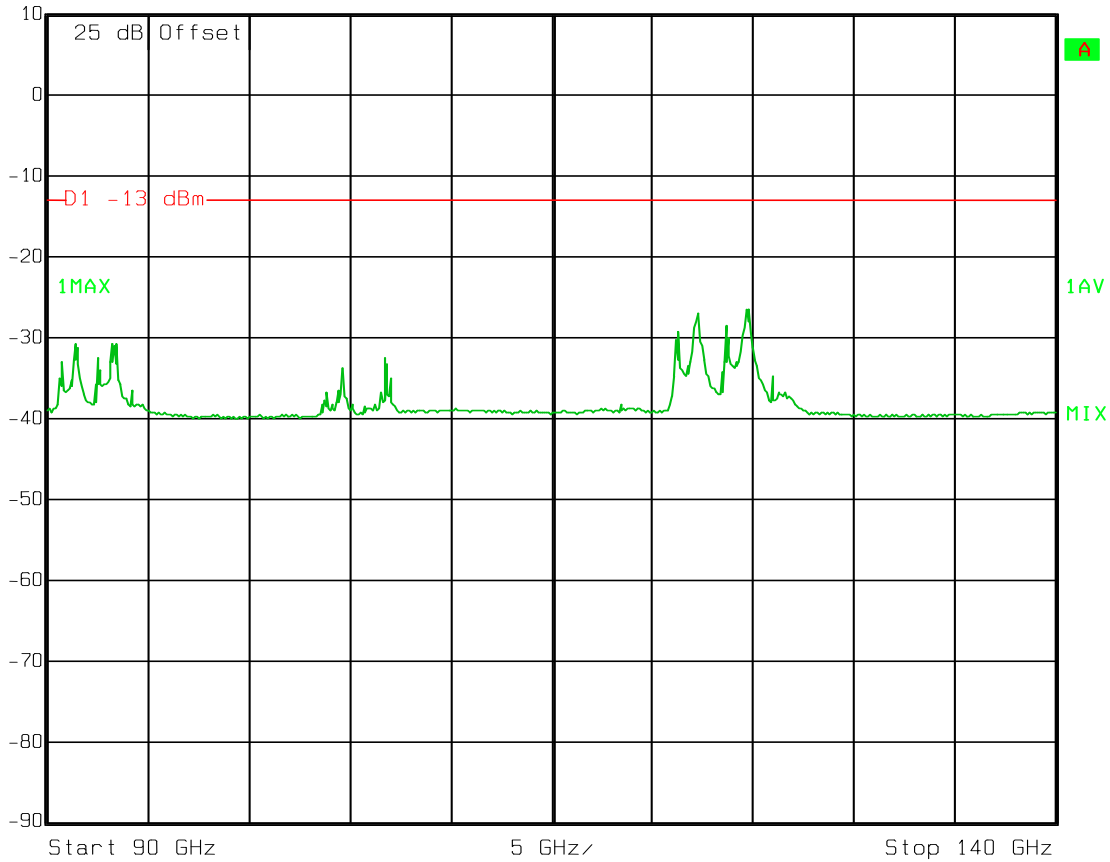
Test Data

70 GHz Unit



Ref Lvl
10 dBm

RBW 1 MHz #10 CVL 40.0dB
VBW 10 MHz
SWT 760 ms Unit dBm



Date: 21.JUL.2014 14:16:29

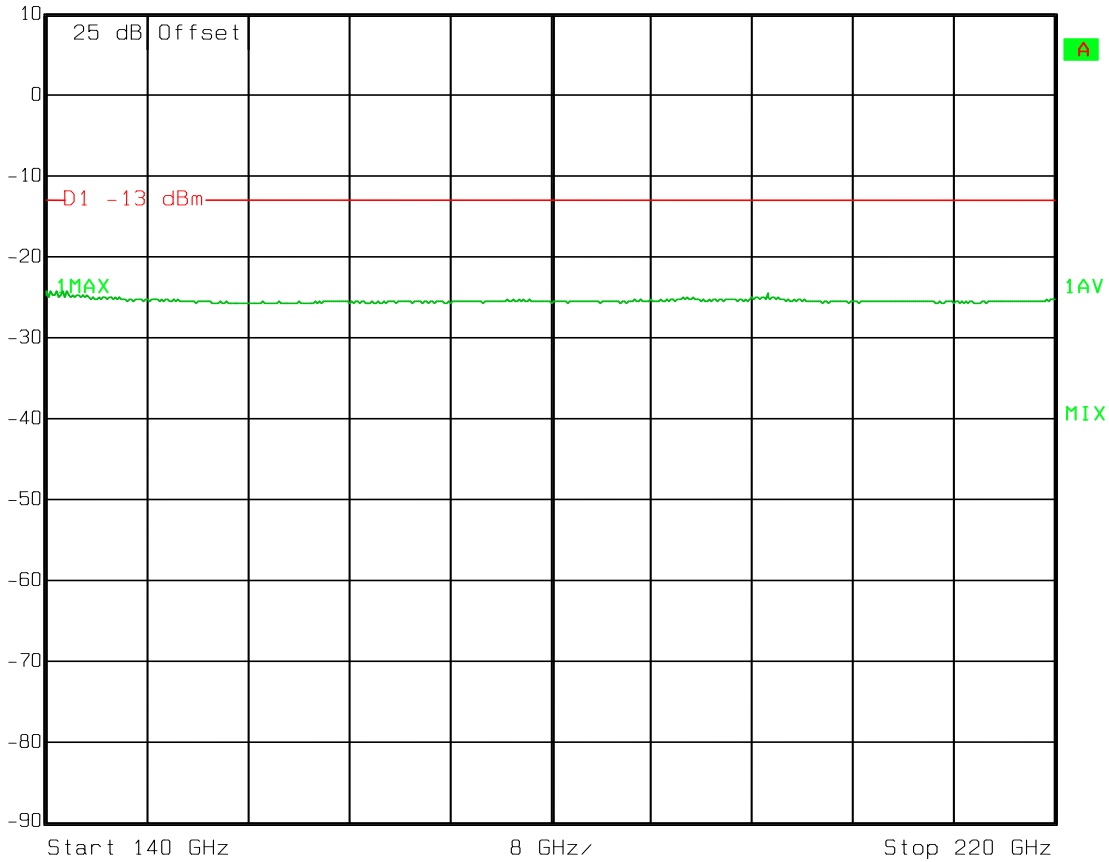
Test Data

70 GHz Unit



Ref Lvl
10 dBm

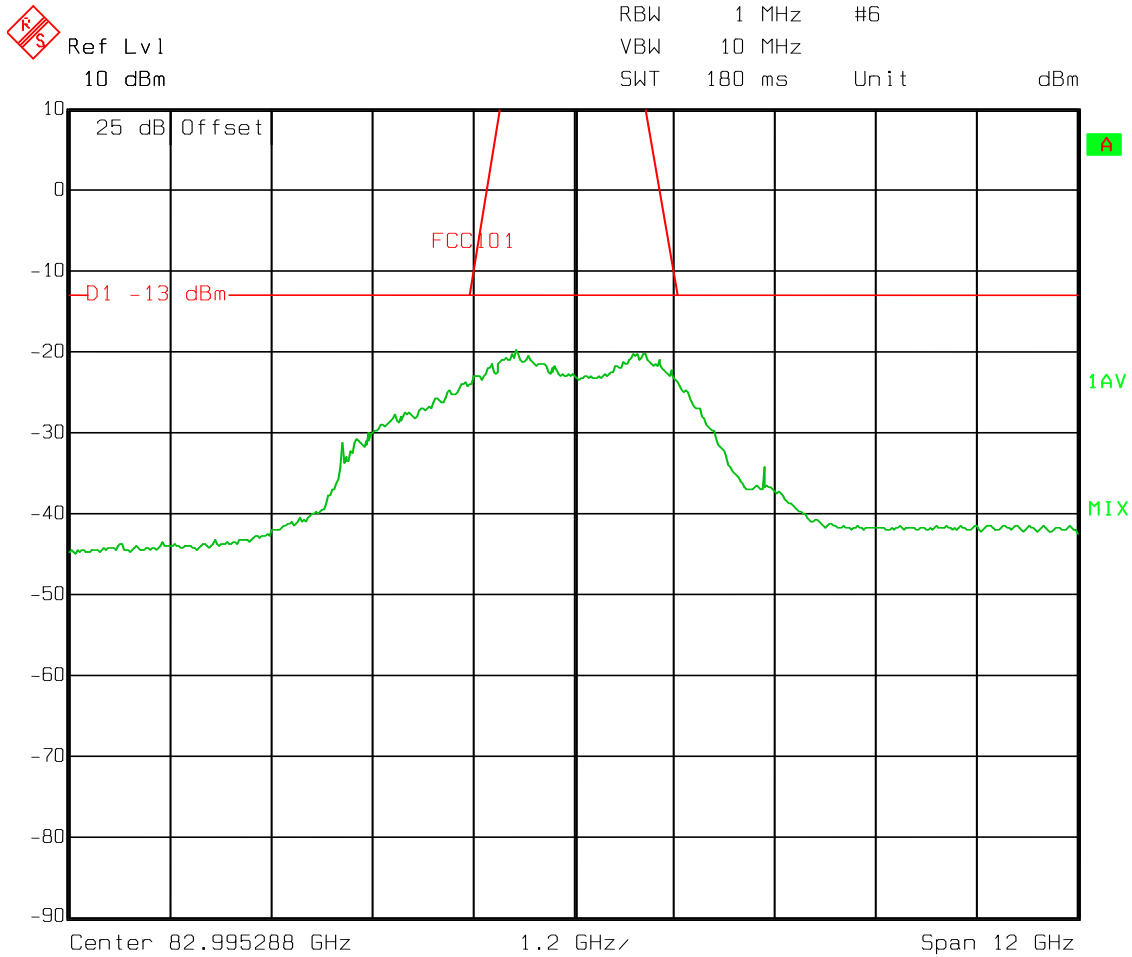
RBW 1 MHz #16 CVL 55.0dB
VBW 10 MHz
SWT 1.2 s Unit dBm



Date: 21.JUL.2014 14:22:15

Test Data

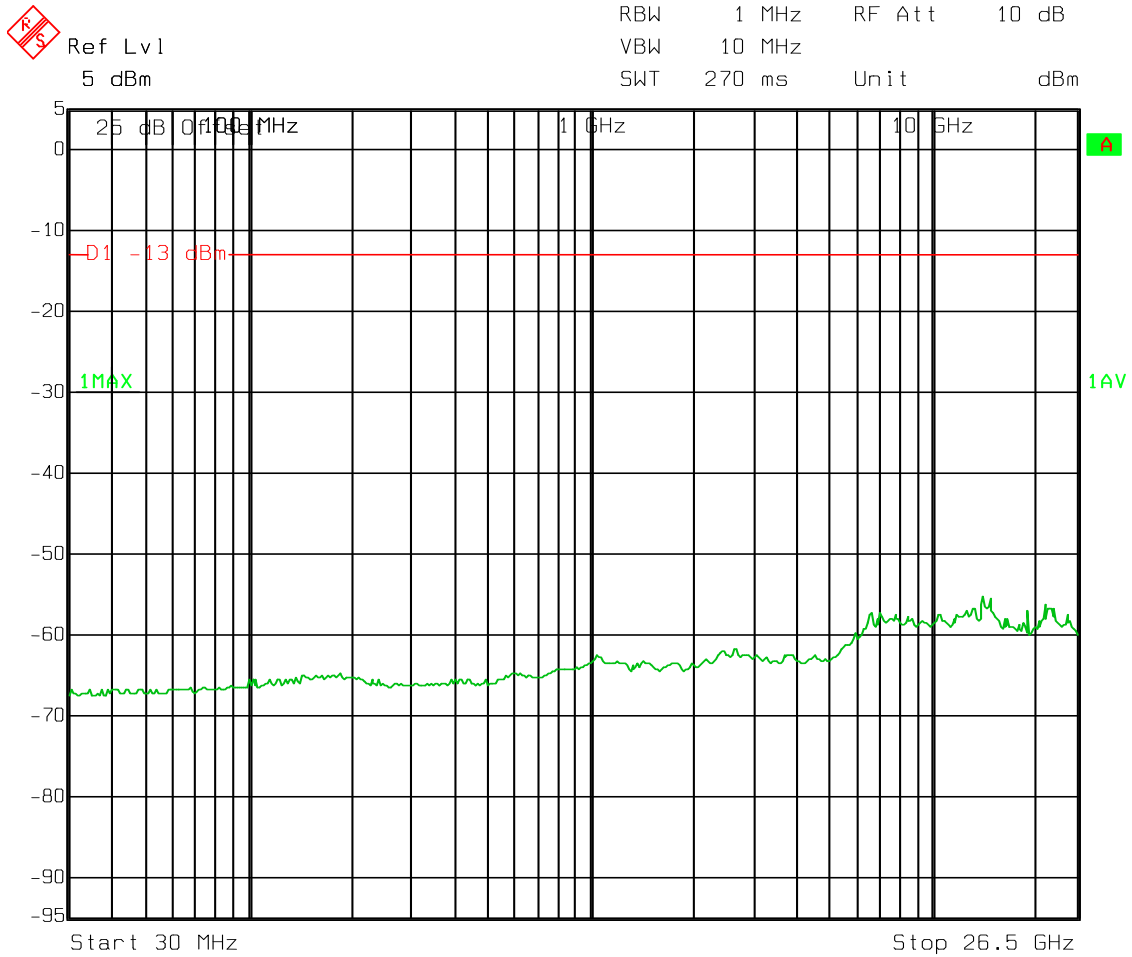
80 GHz Unit



Date: 21.JUL.2014 12:40:54

Test Data

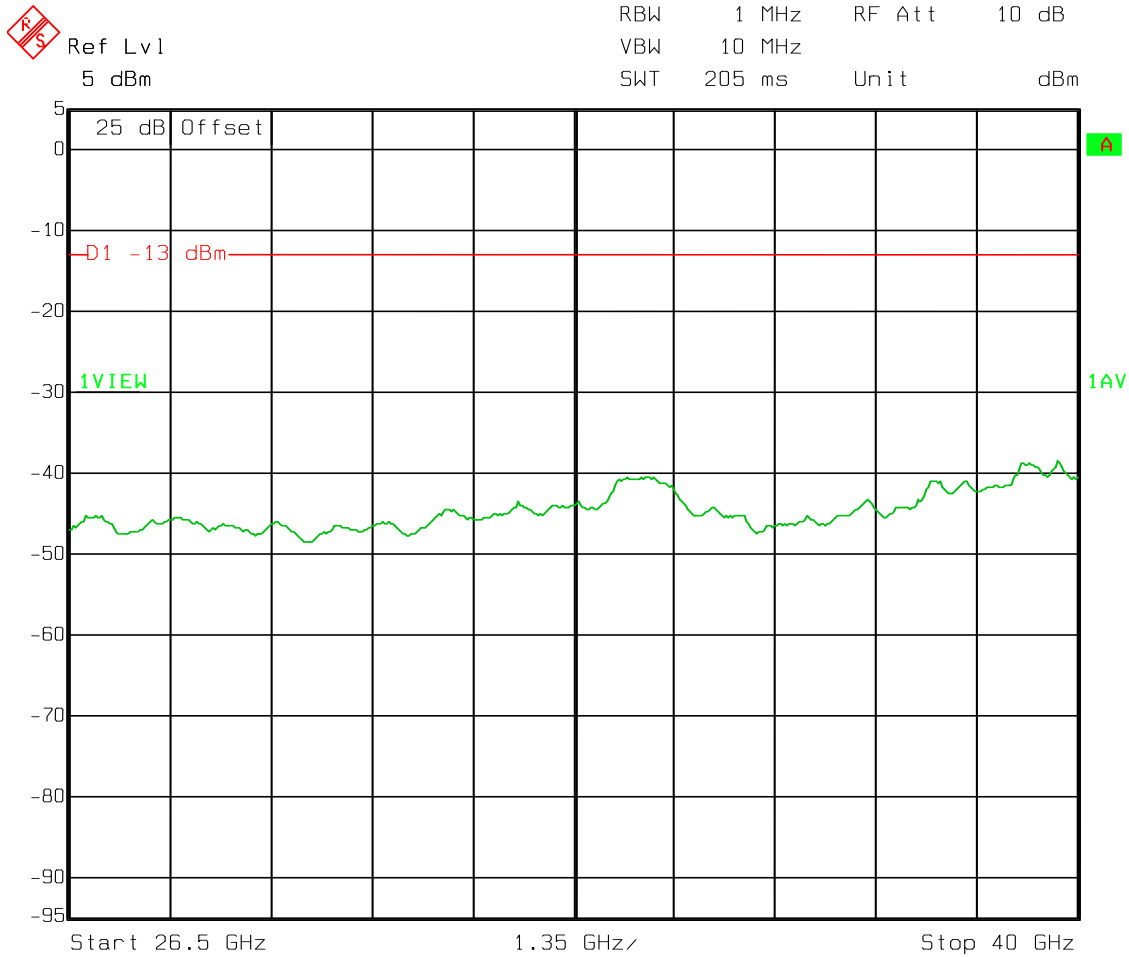
80 GHz Unit



Date: 21.JUL.2014 13:38:27

Test Data

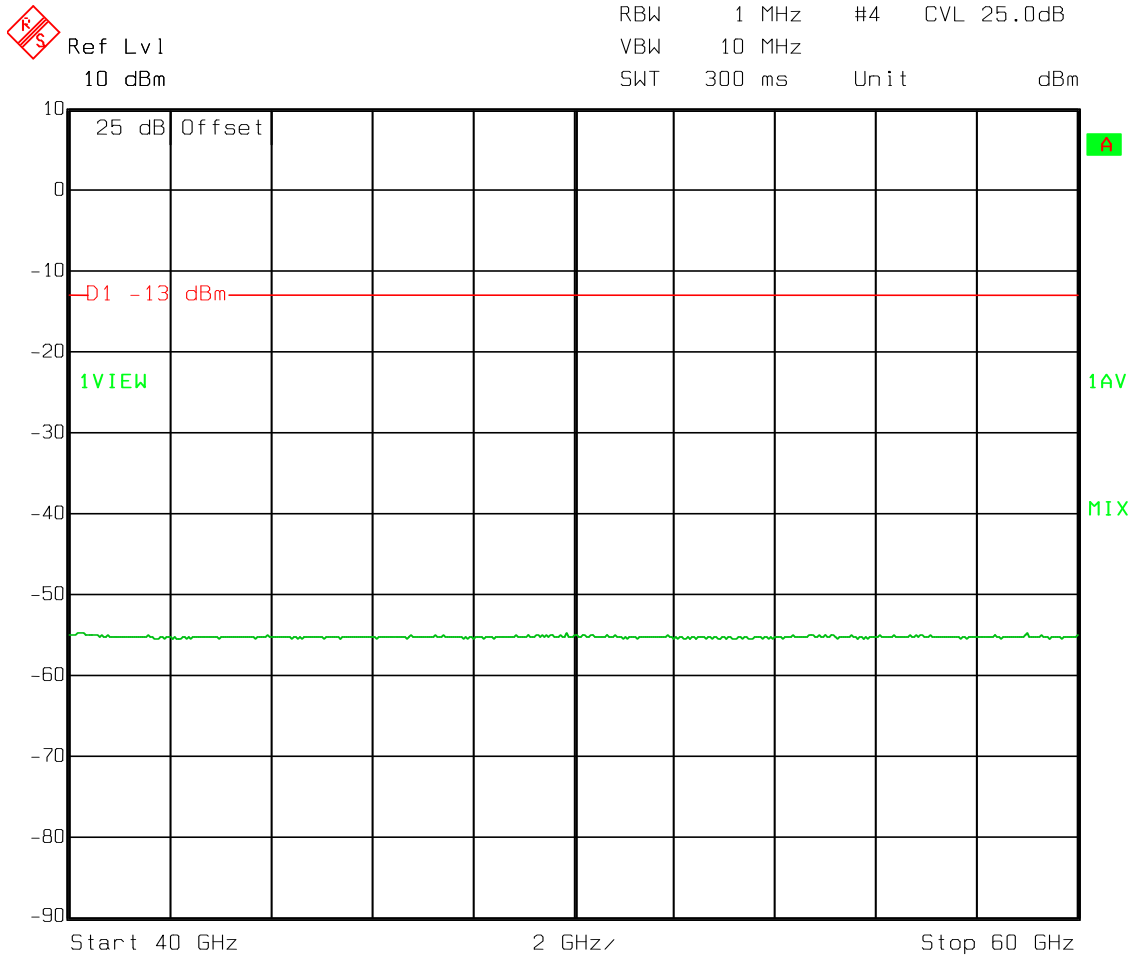
80 GHz Unit



Date: 21.JUL.2014 13:23:17

Test Data

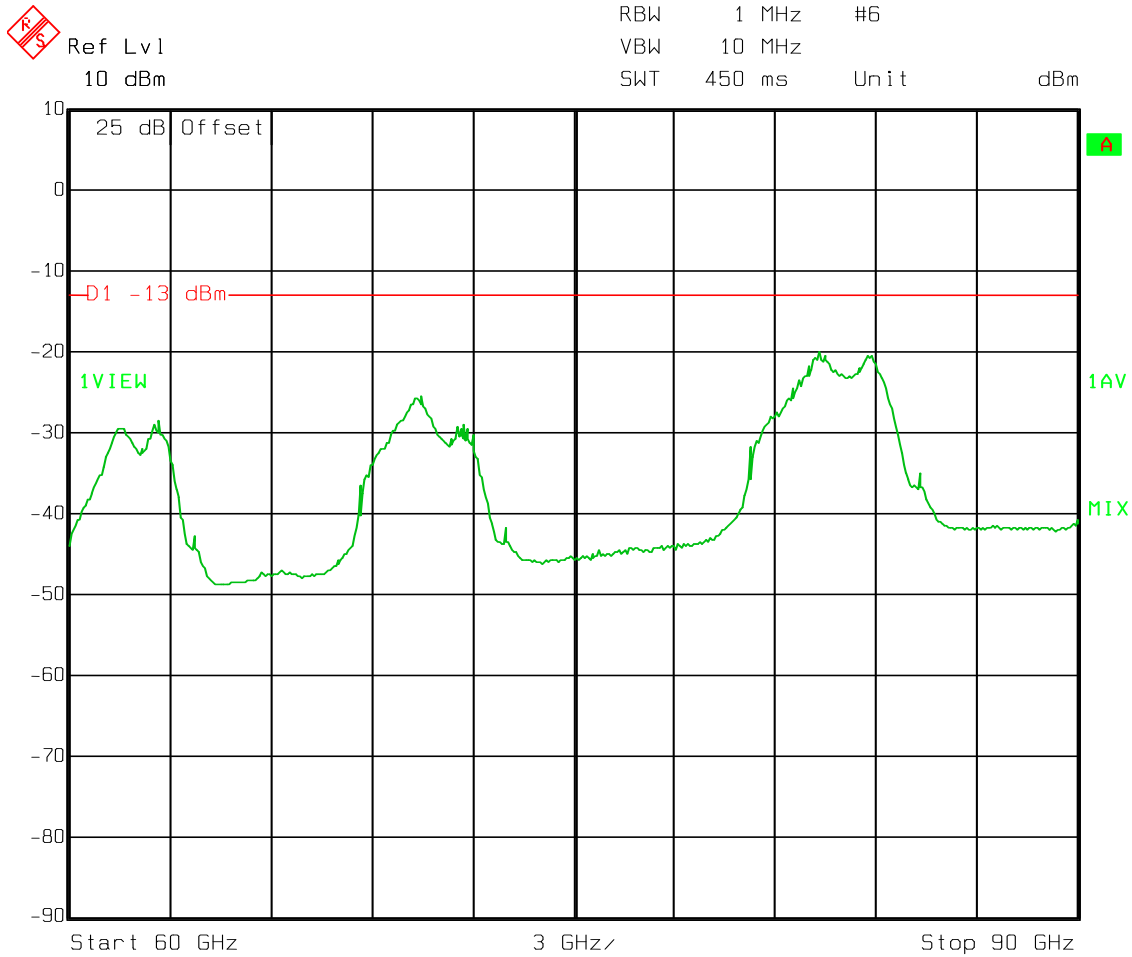
80 GHz Unit



Date: 21.JUL.2014 13:21:46

Test Data

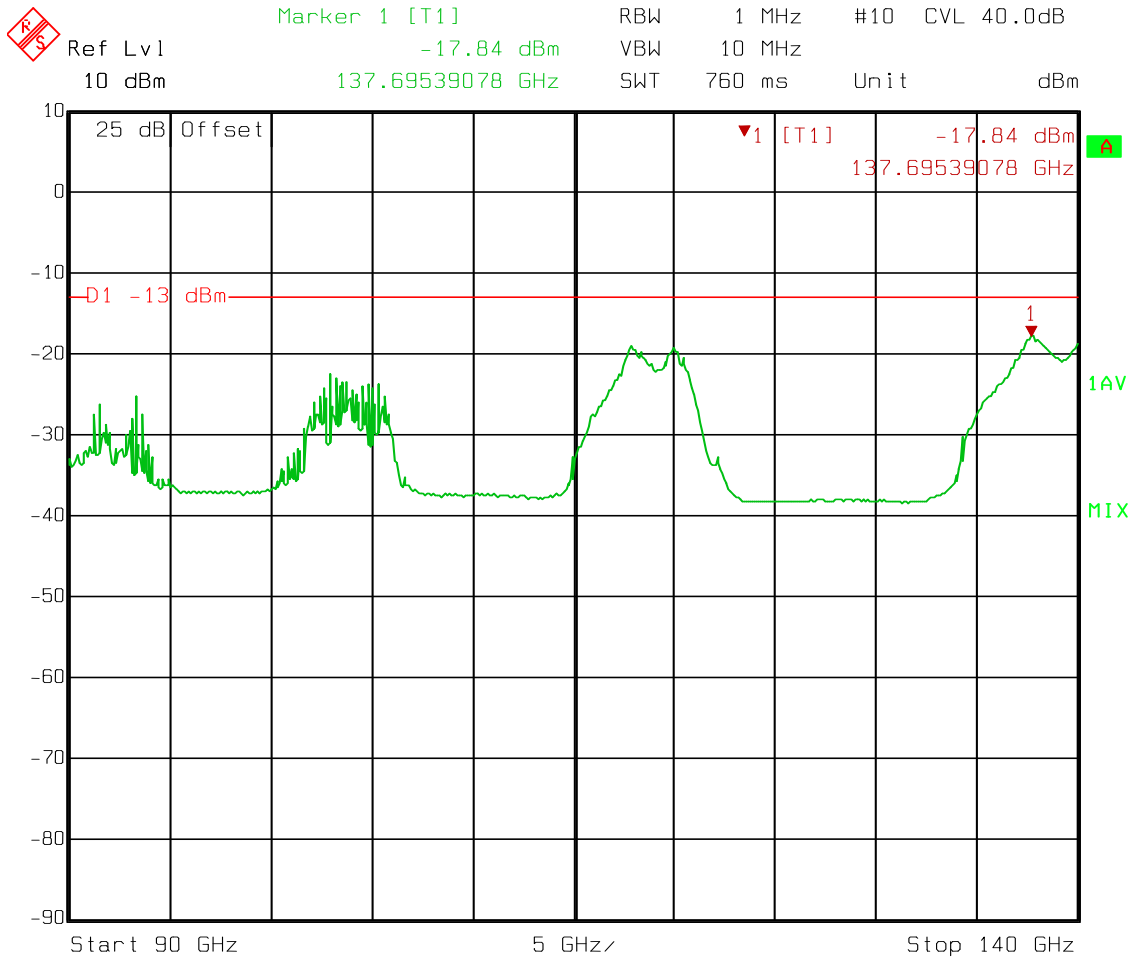
80 GHz Unit



Date: 21.JUL.2014 12:42:57

Test Data

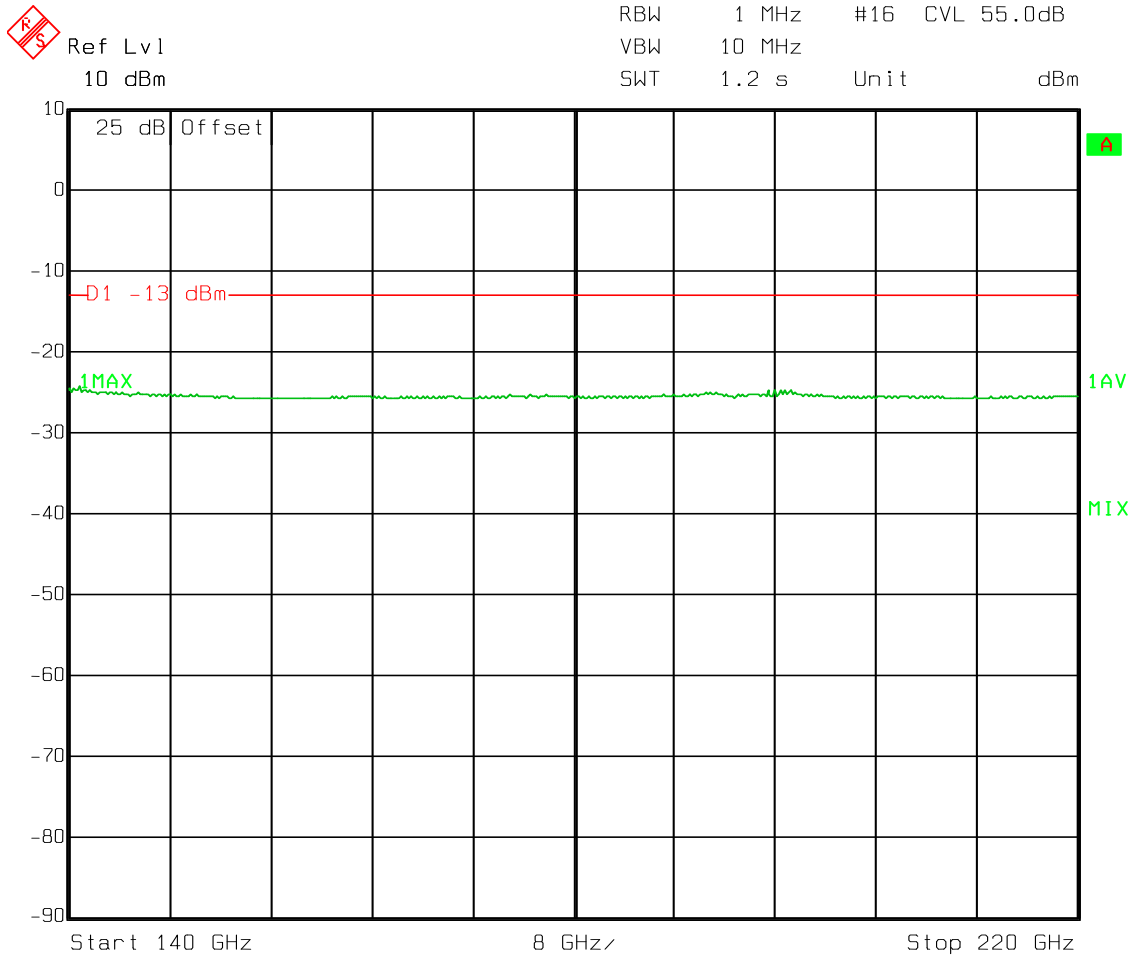
80 GHz Unit



Date: 21.JUL.2014 12:49:55

Test Data

80 GHz Unit



Date: 21.JUL.2014 12:53:45

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 101.111(a)(2)(v)
TESTED BY: David Light	DATE: 21 July 2014

Test Results: Complies.

Measurement Data: There were no emissions detected above the noise floor which was at least 20 dB below the specification limit of -13 dBm.

Equipment Used: 1036-FA001525-FA001526-FDA001524-FA002322-529-1016-1480-901

Measurement Uncertainty: +/- 1.7 dB

Temperature: 23 °C

Relative Humidity: 35 %

Section 7. Test Equipment List

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
529	Antenna, DRWG	EMCO	3115	2505	31-Oct-2012	31-Oct-2014
901	Preamplifier	Sonoma	310 N	130607	21-Nov-2013	21-Nov-2014
1016	Preamplifier	Hewlett Packard	8449A	2749A00159	20-Aug-2013	20-Aug-2014
1036	Spectrum Analyzer	Rohde & Schwartz	FSEK30	830844/006	15-Jul-2013	15-Jul-2015
1480	Antenna, Bilog	Schaffner-Chase	CBL6111C	2572	02-Apr-2014	02-Apr-2015
FA001526	Mixer/Horn antenna	OML/Millitech	WR-05	G91220-1	Verify before use	NA
FA001525	Mixer/Horn antenna	OML/Millitech	WR-08	F19220-1	Verify before use	NA
FA001524	Mixer/Horn antenna	OML/Millitech	WR-12	E91220-1	Verify before use	NA
FA002322	Mixer/Horn antenna	OML/Millitech	WR-19	110317-1	Verify before use	NA

Nemko USA, Inc.

CFR 47, PART 101, SUBPART C

FIXED MICROWAVE SERVICES

EQUIPMENT: **GX4000**

REPORT NO.: **2014 263545 FCC PT101**

Annex A - Test Details

NAME OF TEST: RF Power Output	PARA. NO.: 101.113
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Minimum Standard: **§101.113 Transmitter power limitations.**

(a) On any authorized frequency, the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified below. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of this station. Further, the output power of a transmitter on any authorized frequency in this service may not exceed the following:

Frequency band (MHz)	Maximum allowable EIRP ^{1 2}	
	Fixed ^{1 2} (dBW)	Mobile (dBW)
928.0-929.0(2)	+17	
932.0-932.5(2)	+17	
932.5-935.0	+40	
941.0-941.5(2)	+30	+14
941.5-944.0	+40	
952.0-960.0(2)	+40	+14
1,850-1,990	+45	
2,110-2,150	+45	
2,150-2,180 ³	+45	
2,180-2,200	+45	
2,450-2,500	+45	
2,500-2,686		
2,686-2,690	+45	
3,700-4,200	+55	
5,925-6,425	+55	
6,425-6,525		+35
6,525-6,875	+55	

Frequency band (MHz)	Maximum allowable EIRP ^{1 2}	
	Fixed ^{1 2} (dBW)	Mobile (dBW)
6,875-7,125	+55	
10,550 to 10,600 ⁵	+55	
10,600 to 10,680 ⁵	+40	
10,700-11,700	+55	
12,200-12,700 ¹¹	+50	
12,700-13,200 ⁴	+50	
13,200-13,250 ⁴	+55	
14,200-14,400 ¹²	+45	
17,700-18,600	+55	
18,600-18,800 ⁶	+35	
18,800-19,700	⁵ +55	
21,200-23,600 ¹⁰	+55	
24,250-25,250	⁵ +55	
27,500-28,350 ⁹	+55	
29,100-29,250	(7)	
31,000 to 31,075 ^{8 9}	30 dBW/MHz	30 dBW/MHz
31,075 to 31,225 ^{8 9}	30 dBW/MHz	30 dBW/MHz
31,225 to 31,300 ^{8 9}	30 dBW/MHz	30 dBW/MHz
38,600-40,000	+55	
71,000-76,000 ¹³	+55	+55
81,000-86,000 ¹³	+55	+55
92,000-95,000	+55	+55

Method Of Measurement:

Detachable Antenna:

The average channel power at antenna terminals is measured using a spectrum analyzer with channel power measurement function.

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 101.109
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Minimum Standard:

101.109 Bandwidth.

(a) Each authorization issued pursuant to these rules will show, as the emission designator, a symbol representing the class of emission which must be prefixed by a number specifying the necessary bandwidth. This figure does not necessarily indicate the bandwidth actually occupied by the emission at any instant. In those cases where part 2 of this chapter does not provide a formula for the computation of the necessary bandwidth, the occupied bandwidth may be used in the emission designator.

(b) Stations in this service will be authorized any type of emission, method of modulation, and transmission characteristic, consistent with efficient use of the spectrum and good engineering practice, except that Type B, damped-wave emission will not be authorized.

(c) The maximum bandwidth which will be authorized per frequency assigned is set out in the table that follows. Regardless of the maximum authorized bandwidth specified for each frequency band, the Commission reserves the right to issue a license for less than the maximum bandwidth if it appears that a lesser bandwidth would be sufficient to support an applicant's intended communications.

Frequency band (MHz)	Maximum authorized bandwidth
928 to 929	25 kHz ^{1 5 6}
932 to 932.5, 941 to 941.5	12.5 kHz ^{1 5 6}
932.5 to 935, 941.5 to 944	200 kHz ¹
952 to 960	200 KHz ^{1 5 6}
1,850 to 1,990	10 MHz ¹
2,110 to 2,130	3.5 MHz
2,130 to 2,150	800 or 1600 KHz ¹
2,150 to 2,160	10 MHz
2,160 to 2,180	3.5 MHz
2,180 to 2,200	800 or 1600 KHz ¹
2,450 to 2,483.5	625 KHz ²
Frequency band (MHz)	Maximum authorized bandwidth
2,483.5 to 2,500	800 KHz

3,700 to 4,200	20 MHz
5,925 to 6,425	¹ 60
6,425 to 6,525	25 MHz
6,525 to 6,875	30 MHz. ¹
6,875 to 7,125	25 MHz ¹
10,550 to 10,680	5 MHz ¹
10,700 to 11,700	¹ 80
12,200 to 12,700 ⁸	500 megahertz
12,700 to 13,150	50 MHz
13,200 to 13,250	25 MHz
17,700 to 18,140	220 MHz ¹
18,140 to 18,142	2 MHz
18,142 to 18,580	6 MHz
18,580 to 18,820	20 MHz ¹
18,820 to 18,920	10 MHz
18,920 to 19,160	20 MHz ¹
19,160 to 19,260	10 MHz
19,260 to 19,700	220 MHz ¹
21,200 to 23,600	50 MHz ^{1 4}
24,250 to 25,250	40 MHz ⁷
27,500 to 28,350	850 MHz
29,100 to 29,250	150 MHz
31,000 to 31,075	75 MHz
31,075 to 31,225	150 MHz
31,225 to 31,300	75 MHz
38,600 to 40,000	50 MHz ⁷
71,000 to 76,000	5000 MHz
81,000 to 86,000	5000 MHz
92,000 to 95,000	(³)

Method of Measurement:

The measurement is made using 99% bandwidth function on spectrum analyzer.

**NAME OF TEST: Spurious Emission at Antenna
Terminals**

PARA. NO.: 101.111

Minimum Standard: (ii) For operating frequencies above 15 GHz, in any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 11 decibels:

$A = 11 + 0.4(P-50) + 10 \text{ Log}_{10} B.$ (Attenuation greater than 56 decibels or to an absolute power of less than -13 dBm/1MHz is not required.)

(iii) In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \text{ Log}_{10}$ (the mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation. The authorized bandwidth includes the nominal radio frequency bandwidth of an individual transmitter/modulator in block-assigned bands. Equipment licensed prior to April 1, 2005 shall only be required to meet this standard in any 4 kHz band.

Method Of Measurement:

Spectrum analyzer settings:

RBW: 5 kHz or 10 kHz

VBW: \geq RBW

Sweep: Auto

To demonstrate compliance in any 4 kHz bandwidth, the RBW is set to the next higher setting and the emission limit is increased by a factor of $10 \text{ Log}(RBW/4)$. For example, if a setting of 5 kHz is used for the measurement, the emission limit is increased by 0.969 dB.

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 101.111
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Minimum Standard: (ii) For operating frequencies above 15 GHz, in any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 11 decibels:

$A = 11 + 0.4(P-50) + 10 \text{ Log}_{10} B$. (Attenuation greater than 56 decibels or to an absolute power of less than $-13 \text{ dBm}/1\text{MHz}$ is not required.)

(iii) In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \text{ Log}_{10}$ (the mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation. The authorized bandwidth includes the nominal radio frequency bandwidth of an individual transmitter/modulator in block-assigned bands. Equipment licensed prior to April 1, 2005 shall only be required to meet this standard in any 4 kHz band.

Method Of Measurement:

The EUT is placed on a turntable at a distance of 3 meters. For emissions above 1 GHz a closer distance may be used. The emission level of spurious emissions is measured and the turntable orientation and receive antenna height are adjusted to obtain maximum emission level. The EUT is then replaced with a reference antenna of known gain and fed with a signal source. The level of the signal source is adjusted to repeat the measured emission level. The ERP is the resulting reference antenna input level after correction for the reference antenna gain with respect to a dipole antenna.

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
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Minimum Standard: (a) The carrier frequency of each transmitter authorized in these services must be maintained within the following percentage of the reference frequency except as otherwise provided in paragraph (b) of this section or in the applicable subpart of this part (unless otherwise specified in the instrument of station authorization the reference frequency will be deemed to be the assigned frequency):

Frequency (MHz)	Frequency tolerance (percent)
928 to 929 ⁵	0.0005
932 to 932.5	0.00015
932.5 to 935	0.00025
941 to 941.5	0.00015
941.5 to 944	0.00025
952 to 960 ⁵	0.0005
1,850 to 1,990	0.002
2,110 to 2,200	0.001
2,450 to 2,500 ¹	0.001
3,700 to 4,200 ¹	0.005
5,925 to 6,875 ¹	0.005
6,875 to 7,125 ¹	0.005
10,550 to 11,700 ^{1 2}	0.005
11,700 to 12,200 ¹	0.005
12,200 to 13,250 ⁴	0.005
14,200 to 14,400	0.03
17,700 to 18,820 ³	0.003
18,820 to 18,920 ³	0.001
928 to 929 ⁵	0.0005
18,920 to 19,700 ³	0.003
19,700 to 27,500 ^{4 7}	0.001
27,500 to 28,350	0.001

Frequency (MHz)	Frequency tolerance (percent)
29,100 to 29,250	0.001
31,000 to 31,300 ⁶	0.001
31,300 to 40,000 ⁴	0.03
71,000 to 76,000 ⁸	
81,000 to 86,000 ⁸	
92,000 to 95,000 ⁸	

¹Applicable only to common carrier LTTS stations. Tolerance for 2450-2500 MHz is 0.005%. Beginning Aug. 9, 1975, this tolerance will govern the marketing of LTTS equipment and the issuance of all such authorizations for new radio equipment. Until that date new equipment may be authorized with a frequency tolerance of .03% in the frequency range 2,200 to 10,500 MHz and .05% in the range 10,500 MHz to 12,200 MHz, and equipment so authorized may continue to be used for its life provided that it does not cause interference to the operation of any other licensee. Beginning March 1, 2005, new LTTS operators will not be licensed and existing LTTS licensees will not be renewed in the 11.7-12.2 GHz band.

²See subpart G of this part for the stability requirements for transmitters used in the Digital Electronic Message Service.

³Existing type accepted equipment with a frequency tolerance of $\pm 0.03\%$ may be marketed until December 1, 1988. Equipment installed and operated prior to December 1, 1988 may continue to operate after that date with a minimum frequency tolerance of $\pm 0.03\%$. However, the replacement of equipment requires that the current tolerance be met.

⁴Applicable to private operational fixed point-to-point microwave and stations providing MVDDS.

⁵For private operational fixed point-to-point microwave systems, with a channel greater than or equal to 50 KHz bandwidth, $\pm 0.0005\%$; for multiple address master stations, regardless of bandwidth, $\pm 0.00015\%$; for multiple address remote stations with 12.5 KHz bandwidths, $\pm 0.00015\%$; for multiple address remote stations with channels greater than 12.5 KHz bandwidth, $\pm 0.0005\%$.

⁶For stations authorized prior to March 11, 1997, transmitter tolerance shall not exceed 0.03%.

⁷The frequency tolerance for stations authorized on or before April 1, 2005 is 0.03%. Existing licensees and pending applicants on that date may continue to operate after that date with a frequency tolerance of 0.03%, provided that it does not cause harmful interference to the operation of any other licensee. For analog systems, if the channel

bandwidth is greater than 30 MHz up to 50 MHz, the frequency tolerance standard will be 0.03%; if the channel bandwidth is 30 MHz or less, then the frequency tolerance standard will be 0.003%. This analog standard is conditional provided that harmful interference is not caused to digital stations operating within the 0.001% tolerance standards. If harmful interference is caused to stations operating with the more stringent standard, the onus shall be on the operators with the less stringent parameters to develop an engineering solution to the problem. For exceptions, see §101.147 and §101.507.

⁸Equipment authorized to be operated in the 71,000-76,000 MHz, 81,000-86,000 MHz, 92,000-94,000 MHz and 94,100-95,000 MHz bands is exempt from the frequency tolerance requirement noted in the table of paragraph (a) of this section.

(b) Heterodyne microwave radio systems may be authorized at a somewhat less restrictive frequency tolerance (up to .01 percent) to compensate for frequency shift caused by numerous repeaters between base band signal insertion. Where such relaxation is sought, applicant must provide all calculations and indicate the desired tolerance over each path. In such instances the radio transmitters and receivers used must individually be capable of complying with the tolerance specified in paragraph (a) of this section. Heterodyne operation is restricted to channel bandwidth of 10 MHz or greater.

(c) As an additional requirement in any band where the Commission makes assignments according to a specified channel plan, provisions must be made to prevent the emission included within the occupied bandwidth from radiating outside the assigned channel at a level greater than that specified in §101.111.

Method Of Measurement:

Frequency Stability With Voltage Variation

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.