CETECOM Inc.

CETECOM Inc.

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FCC LISTED, REG. NO.: 101450
&
RECOGNIZED BY INDUSTRY CANADA
IC – 3925

Test report no.: 158FCC/2001
FCC Part 24 / RSS 133

CETECOM Inc.

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FCC ID: PBY6130202

Table of Contents

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM Inc. does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc.

TEST REPORT PREPARED BY:
EMC Engineer: Harpreet Sidhu

1.2 Testing laboratory

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1.3 Details of applicant

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1.4 Application details

Date of receipt of application : 2001-05-30
Date of receipt of test item : 2001-05-31
Date of test : 2001-05-31 & 2001-06-01

1.5 Test item

Manufacturer	:	**Applicant**
Name of EUT	:	GC75
Description	:	PC-Card Radio module for GSM 900/1800/1900
Type number	:	6130202-BV
FCC ID	:	PBY 6130202

Additional information

Frequency	:	GSM 900/1800/1900
Type of modulation	:	GMSK / TDMA (GSM)
Number of channels	:	298 (in PCS 1900)
Antenna	:	Tri-band 50 Ohm
Power supply	:	PC Card supply
Output power	:	1 Watt
EUT Temp. Tolerance	:	-30°C - +50°C
EUT Extreme Vol. Range	:	3.0VDC to 5.25VDC

1.6 Test standards

FCC Part 24 / RSS133 r1

2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

Technical responsibility for area of testing :

Date	Section	Name	Signature
2001-07-12	EMC& Radio	Lothar Schmidt	

2.2 Test report

TEST REPORT

Test report no.: 158FCC/2001
FCC ID: PBY6130202

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

PARAMETER TO BE MEASURED Paragraph PAGE

POWER OUTPUT SUBCLAUSE § 24.232

Summary:

This paragraph contains both average , peak output powers and EIRP measurements for the EUT.
In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Method of Measurements:

The EUT was set up for the max. output power with pseudo random data modulation.
The power was measured with R&S Spectrum Analyzer FSEM 30 (peak and average)
This measurements were done at 3 frequencies, 1850.2 MHz, 1880.0 MHz and 1909.8 MHz (bottom, middle and top of operational frequency range)

Limits:

Power Step	Nominal Peak Output Power (dBm)	Tolerance (dB)
0	+30	± 2

Power Measurements:

Conducted:

Frequency (MHz)	Power Step	Peak Output Power (dBm)	Average Output Power (dBm)
1850.2	0	29.25	19.94
1880.0	0	29.28	19.97
1909.8	0	29.10	19.79
Measurement uncertainty		±0.5 dB	

ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz

EIRP Measurements

Description: This is the test for the maximum radiated power from the EUT.
Rule Part 24.232(b) specifies that "Mobile/portable stations are limited to 2 watts e.i.r.p. peak power…" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."
Method of Measurement:
1. In an anechoic antenna test chamber, a half-wave dipole antenna for the frequency band of interest is placed at the reference center of the chamber. An RF Signal source for the frequency band of interest is connected to the dipole with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A known (measured) power (Pin) is applied to the input of the dipole, and the power received (Pr) at the chamber's probe antenna is recorded.
2. A "reference path loss" is established as Pin + 2.1 - Pr.
3. The EUT is substituted for the dipole at the reference center of the chamber. The EUT is put into CW test mode and a scan is performed to obtain the radiation pattern.
4. From the radiation pattern, the co-ordinates where the maximum antenna gain occurs is identified.
5. The EUT is then put into pulse mode at its maximum power level (Power Step 0).
6. "Gated mode" power measurements are performed with the receiving antenna placed at the coordinates determined in Step 3 to determine the output power as defined in FCC Rule 24.232 (b) and (c). The "reference path loss" from Step 1 is added to this result.
7. This value is EIRP since the measurement is calibrated using a half-wave dipole antenna of known gain (2.1 dBi) and known input power (Pin).
8. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.1dBi.

Limits:

Power Step	Burst Average EIRP (dBm)
0	<33

Power Measurements:

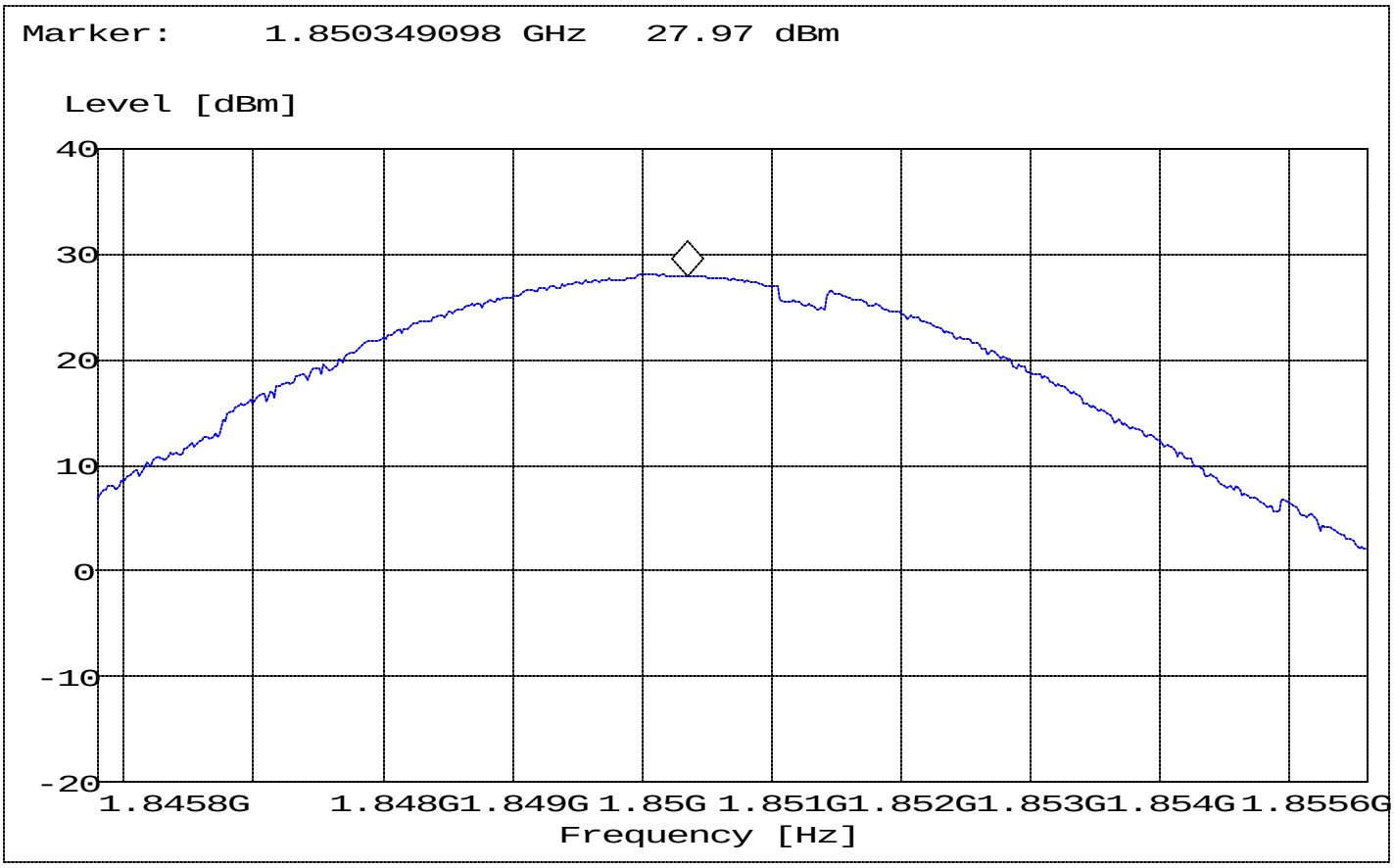
Plots are shown on next pages.

Radiated:

Frequency (MHz)	Power Step	BURST AVERAGE (dBm)		MODULATION AVERAGE (dBm)	
		EIRP	ERP	EIRP	ERP
1850.2	0	27.97	25.87	18.66	16.56
1880.0	0	26.92	24.82	17.61	15.51
1909.8	0	26.49	24.39	17.18	15.08
Measurement uncertainty		±0.5 dB			

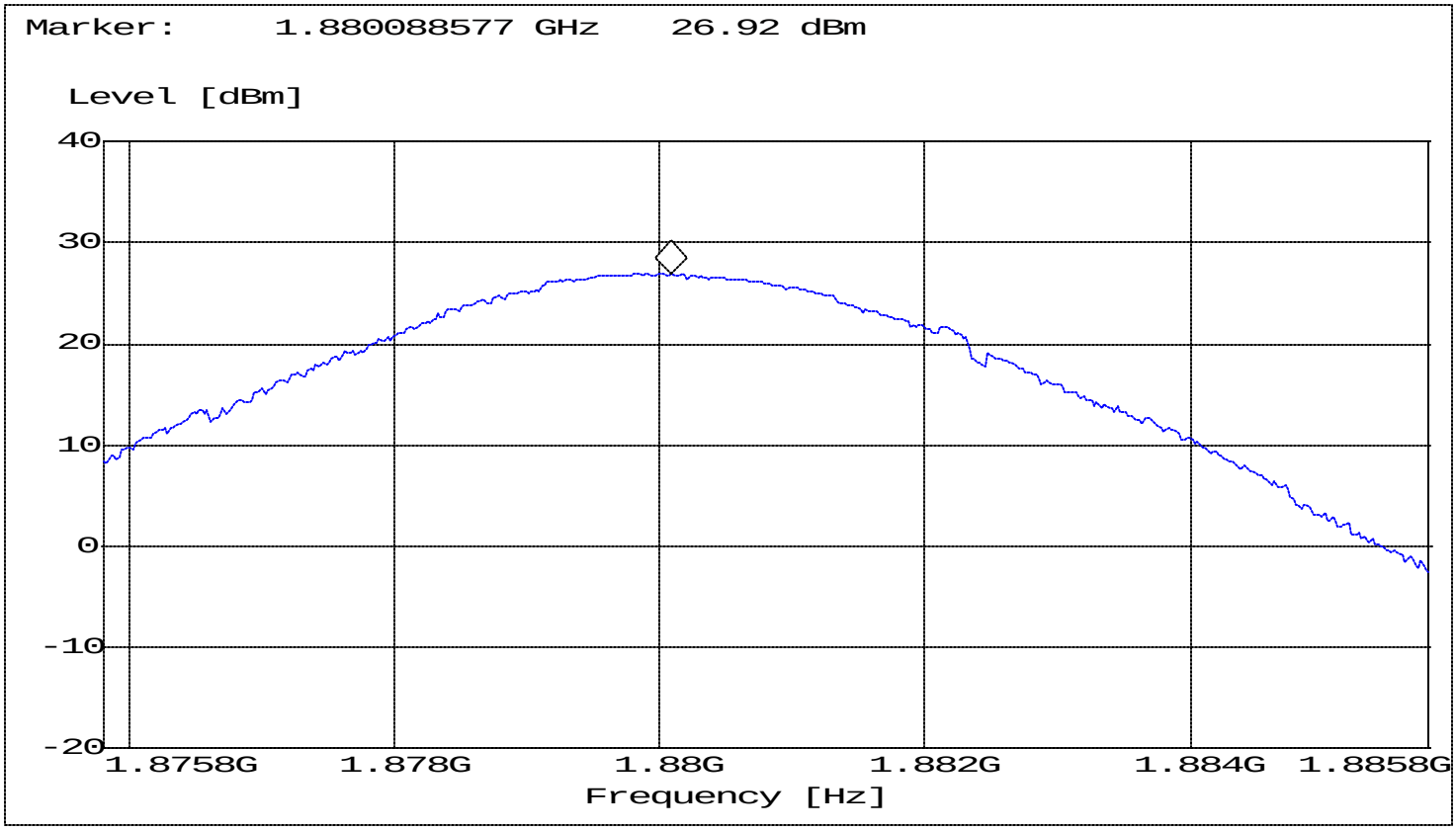
ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz

EIRP CHANNEL 512:



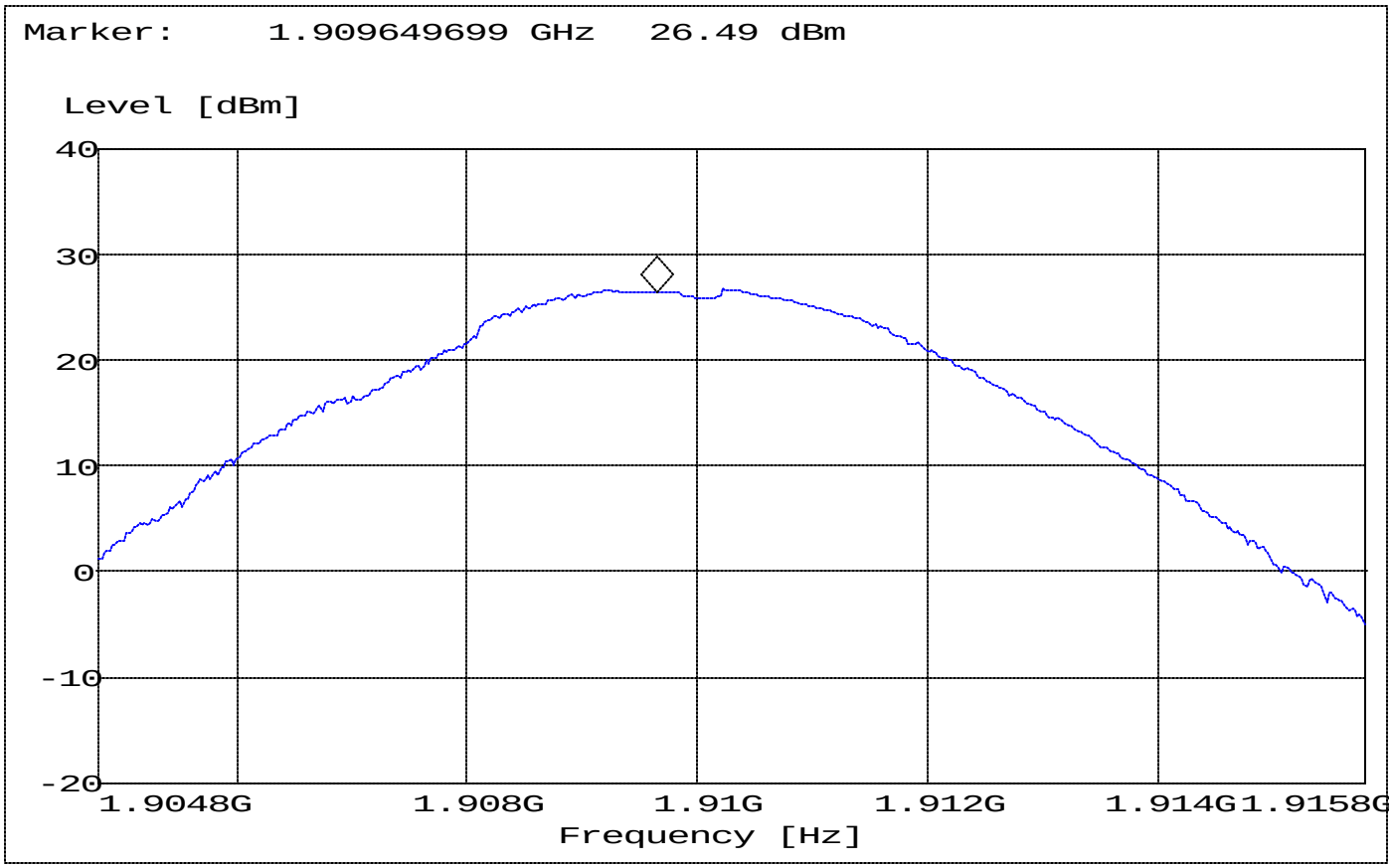
ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz

EIRP CHANNEL 661:



ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz

EIRP CHANNEL 810:



ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz

FREQUENCY STABILITY SUBCLAUSE § 24.235

Method of Measurement:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of a R&S CMD 55 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30 C.
3. With the EUT, powered via 3.6 Volts, connected to the CMD 55 and in a simulated call on channel 661 (center channel), measure the carrier frequency. These measurements should be made within 2 minutes of powering up the EUT, to prevent significant self warming.
4. Repeat the above measurements at 10 C increments from -30 C to +50 C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal 3.6 Volts. Vary supply voltage from minimum 3.0 Volts to maximum 5.3 Volts, in 0.2Volt increments remeasuring carrier frequency at each voltage. Pause at 3.6 Volts for 1 1/2 hours unpowered, to allow any self heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50 C.
7. With the EUT, powered via 3.6 Volts, connected to the CMD 55 and in a simulated call on channel 661 (center channel), measure the carrier frequency. These measurements should be made within 2 minutes of powering up the EUT, to prevent significant self warming.
8. Repeat the above measurements at 10 C increments from +50 C to -30 C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5 C during the measurement procedure.

Measurement Limit:

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment…," Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.0 VDC and 5.3 VDC, with a nominal voltage of 3.6 VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of –16.66 % and +47.22 %. For the purposes of measuring frequency stability these voltage limits are to be used.

AFC FREQ ERROR vs. VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
3.0	39	0.0207
3.2	22	0.0117
3.4	24	0.0127
3.6	28	0.0148
3.8	24	0.0127
4.0	25	0.0132
4.2	16	0.0085
4.4	22	0.0117
4.6	24	0.0127
4.8	23	0.0122
5.0	11	0.0058
5.2	16	0.0085
5.25	21	0.0111

AFC FREQ ERROR vs. TEMPERATURE

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	-147	-0.0781
-20	-141	-0.075
-10	-145	-0.0771
0	-87	-0.0462
+10	-26	-0.0138
+20	+34	+0.0180
+30	+29	+0.0154
+40	+36	+0.0191
+50	+17	+0.0090

EMISSIONS LIMITS §24.238

Measurement Procedure:

The following steps outline the procedure used to measure the radiated emissions from the EUT. The site is constructed in accordance with ANSI C63.4 – 1992 requirements and is recognised by the FCC to be in compliance for a 3 and a10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. This was rounded up to 20 GHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the USPCS band.

The final open field emission test procedure is as follows:

a) The test item was placed on a 0. 8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.

b) The antenna output was terminated in a 50 ohm load.

c) A double ridged waveguide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.

d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and I MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters using the equation shown below:

$Pg = E^2 4\pi d^2 / 120\pi = E^2 d^2 /30$

where : P = power in watts

g = arithmetic gain of transmitting antenna over isotropic radiator.

E = maximum field strength in volts/meter

d = measurement distance in meter

Using a dipole gain of 1.67 or 2.2 dB and a test distance of 3 meters, this equation reduces to:

P(dBm) = E(dBuV/m) - 97.2dB

Measurement Limit:

Sec. 24.238 Emission Limits.

(a) On any frequency outside a licensee' s frequency block (e.g. A, D, B, etc.) within the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Measurement Results:
Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the USPCS band (1850.2 MHz, 1879.8 MHz and 1909.8 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the USPCS band into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

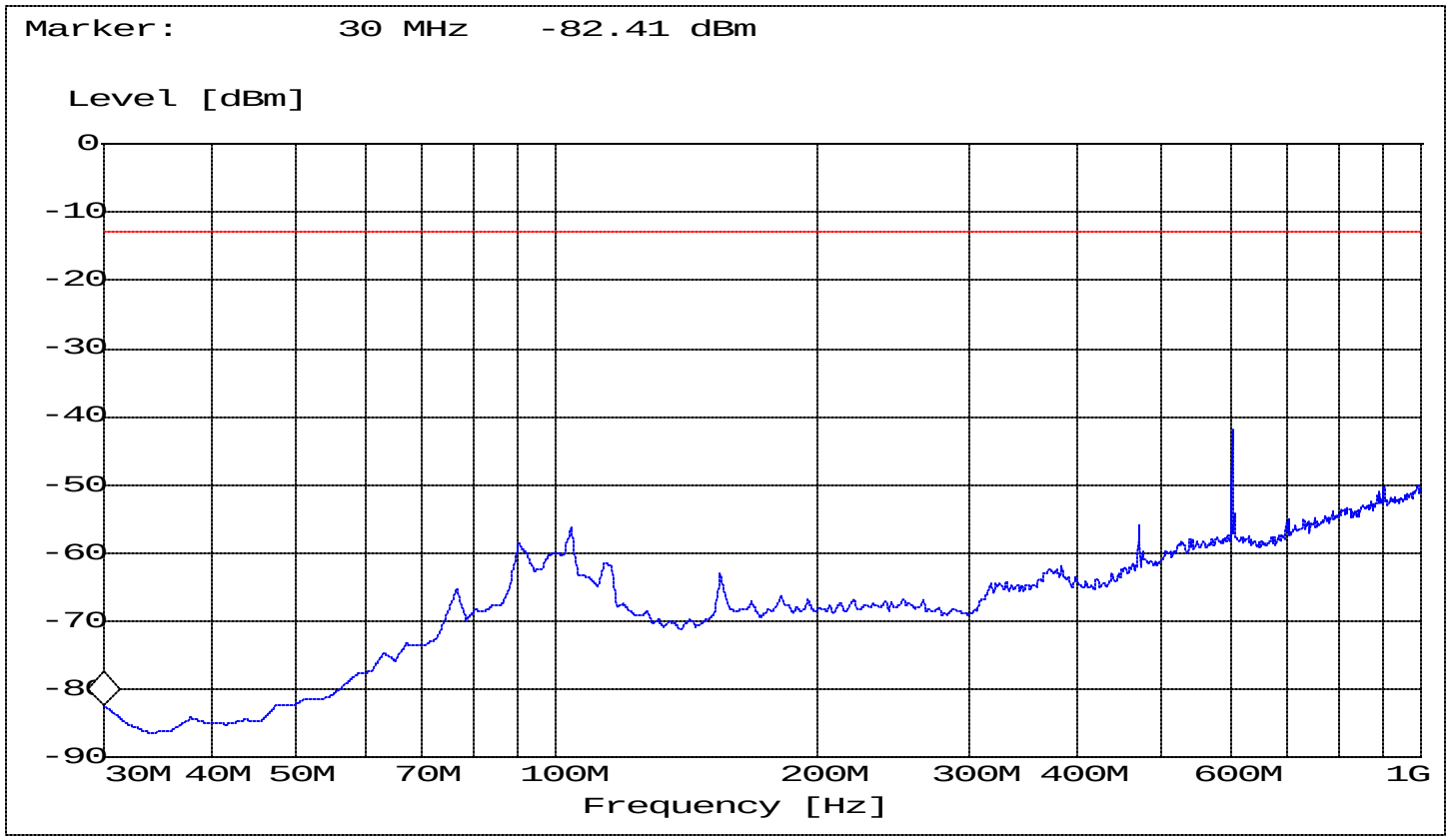
NOTE: The spurious emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 12.75 and 19.1 GHz very short cable connections to the antenna was used to minimize the noise level.

RESULTS OF OPEN FIELD RADIATED TEST FOR FCC-24:
The final open field radiated levels are presented on the next pages.

RADIATED SPURIOUS EMISSIONS

Channel 512 : 30MHz - 1GHz

Spurious emission limit –13dBm



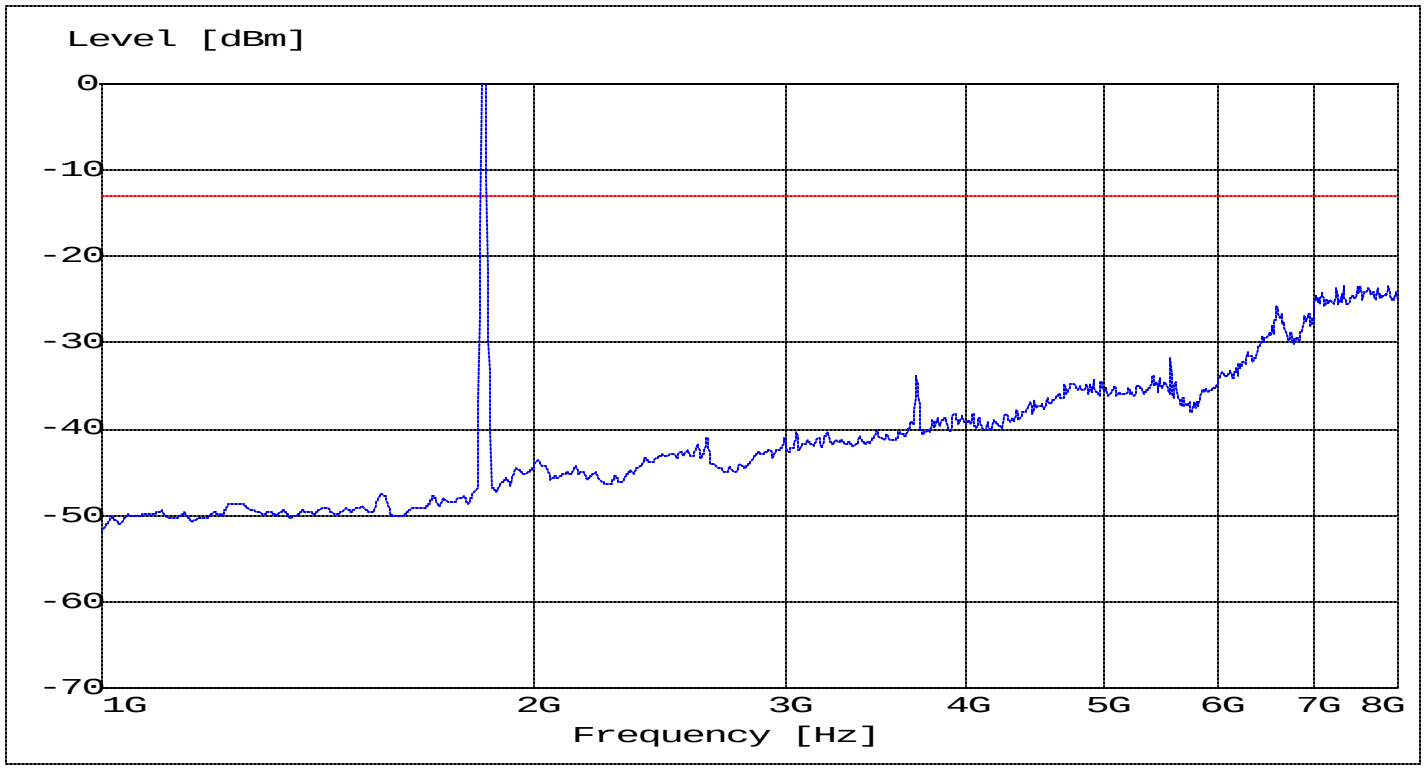
ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

RADIATED SPURIOUS EMISSIONS

Channel 512 : 1GHz – 8GHz

Spurious emission limit –13dBm

NOTE: peak above the limit line is the fundamental frequency.

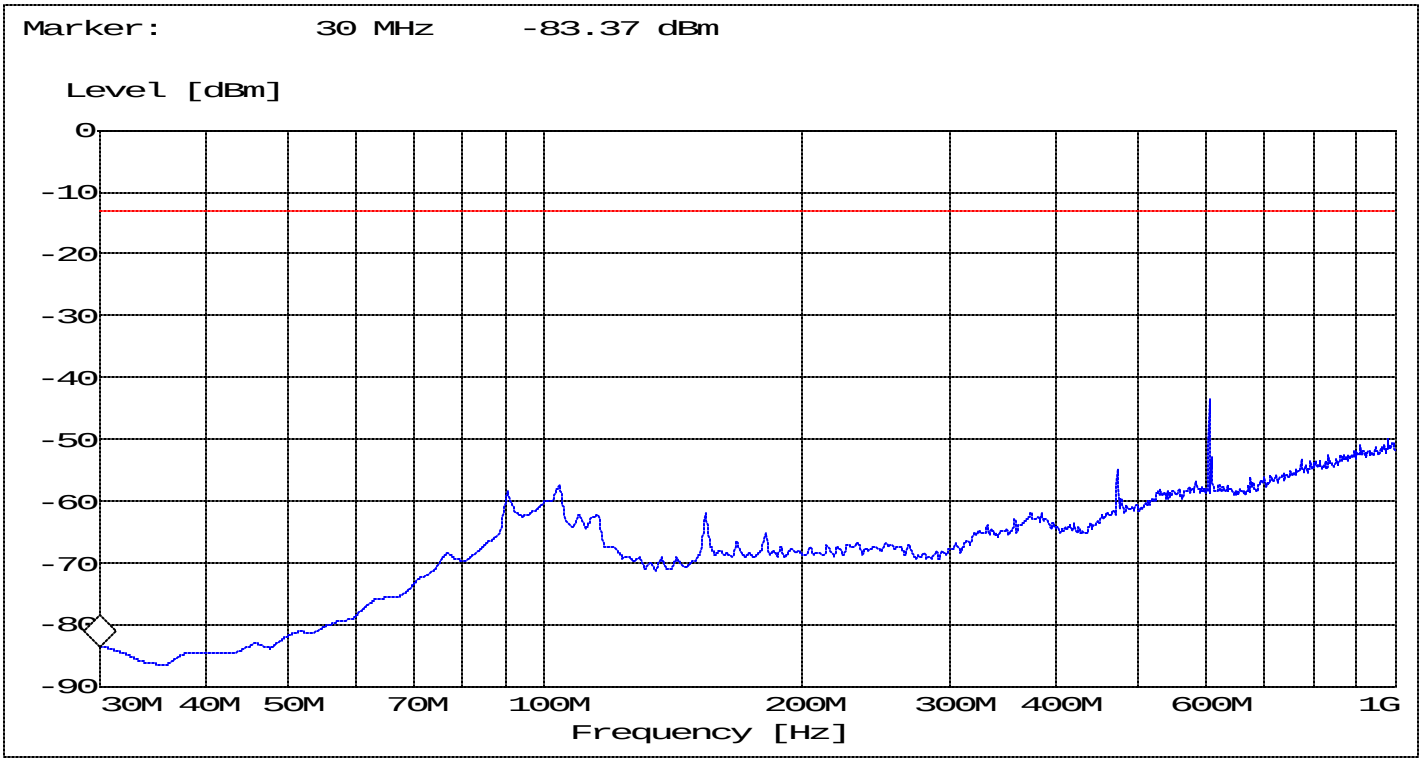


ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

RADIATED SPURIOUS EMISSIONS

Channel 661: 30MHz –1GHz

Spurious emission limit –13dBm



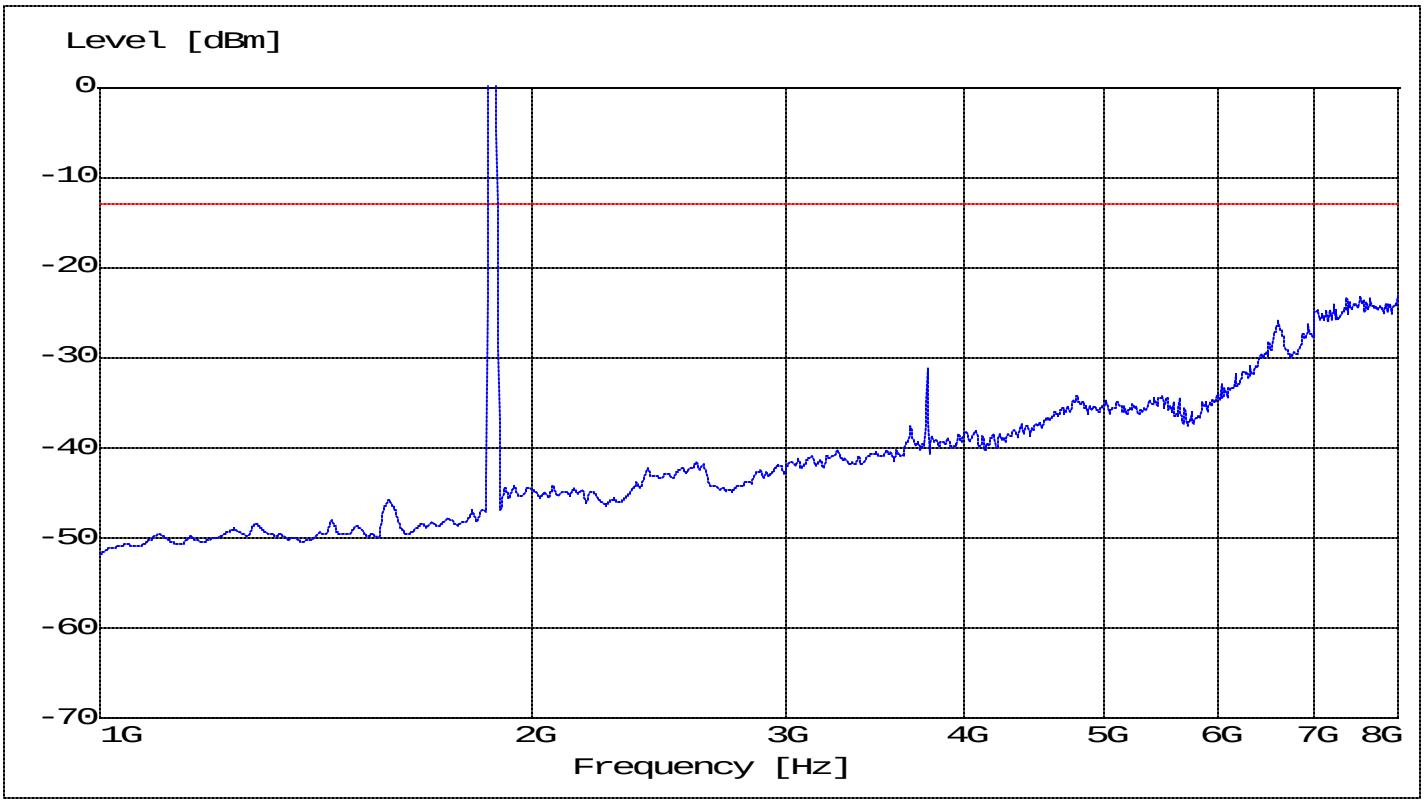
ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

RADIATED SPURIOUS EMISSIONS

Channel 661: 1GHz – 8GHz

Spurious emission limit –13dBm

NOTE: peak above the limit line is the fundamental frequency.

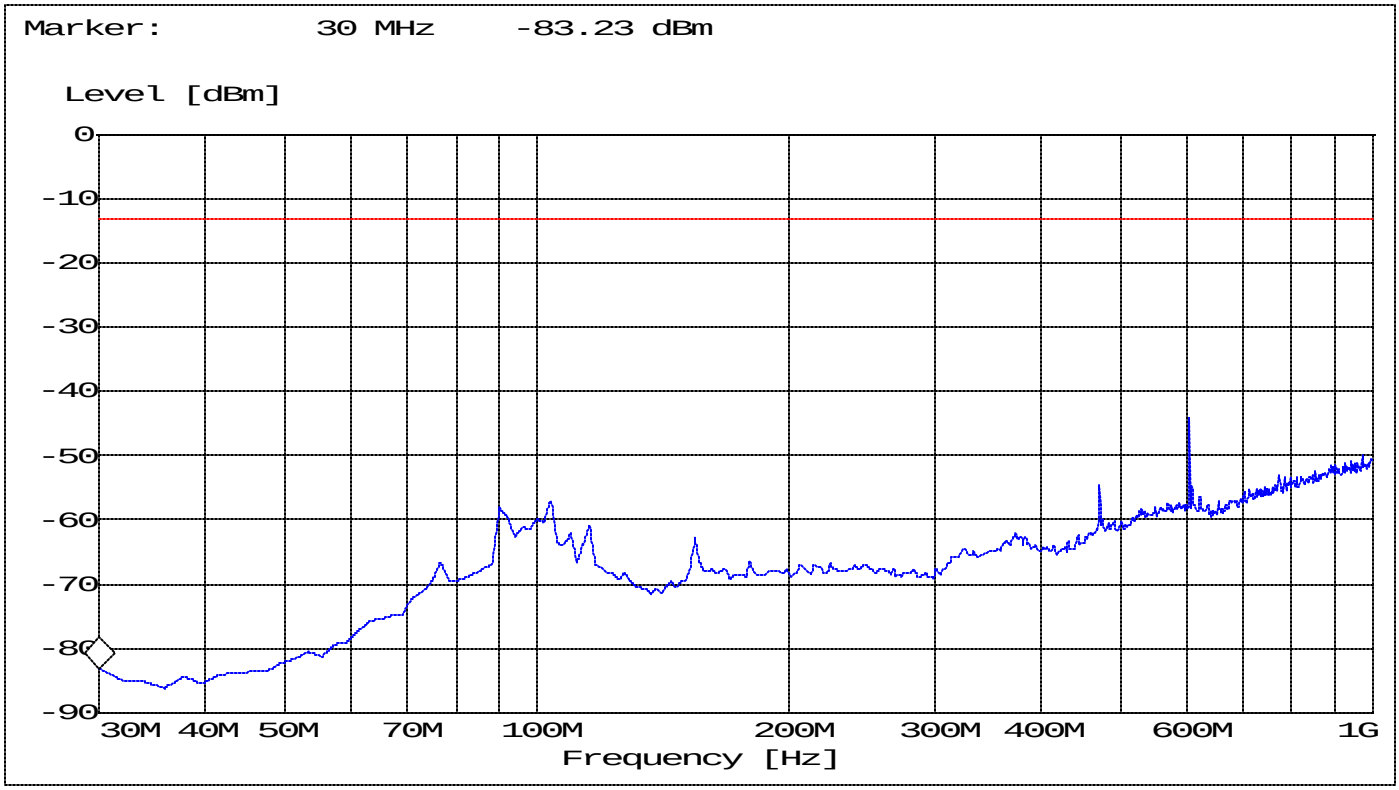


ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

RADIATED SPURIOUS EMISSIONS

Channel 810: 30MHz –1GHz

Spurious emission limit –13dBm



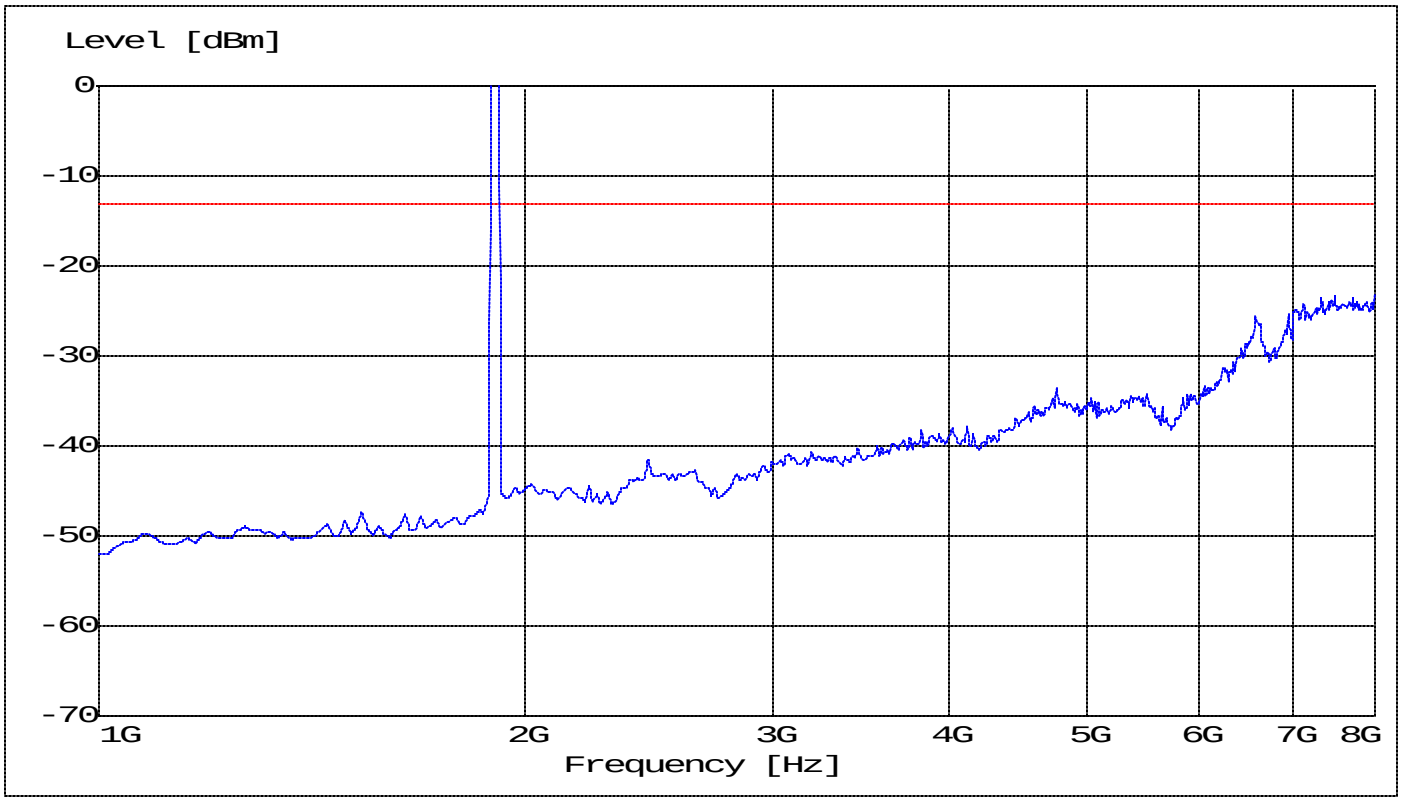
ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

RADIATED SPURIOUS EMISSIONS

Channel 810: 1GHz – 8GHz

Spurious emission limit –13dBm

NOTE: peak above the limit line is the fundamental frequency.



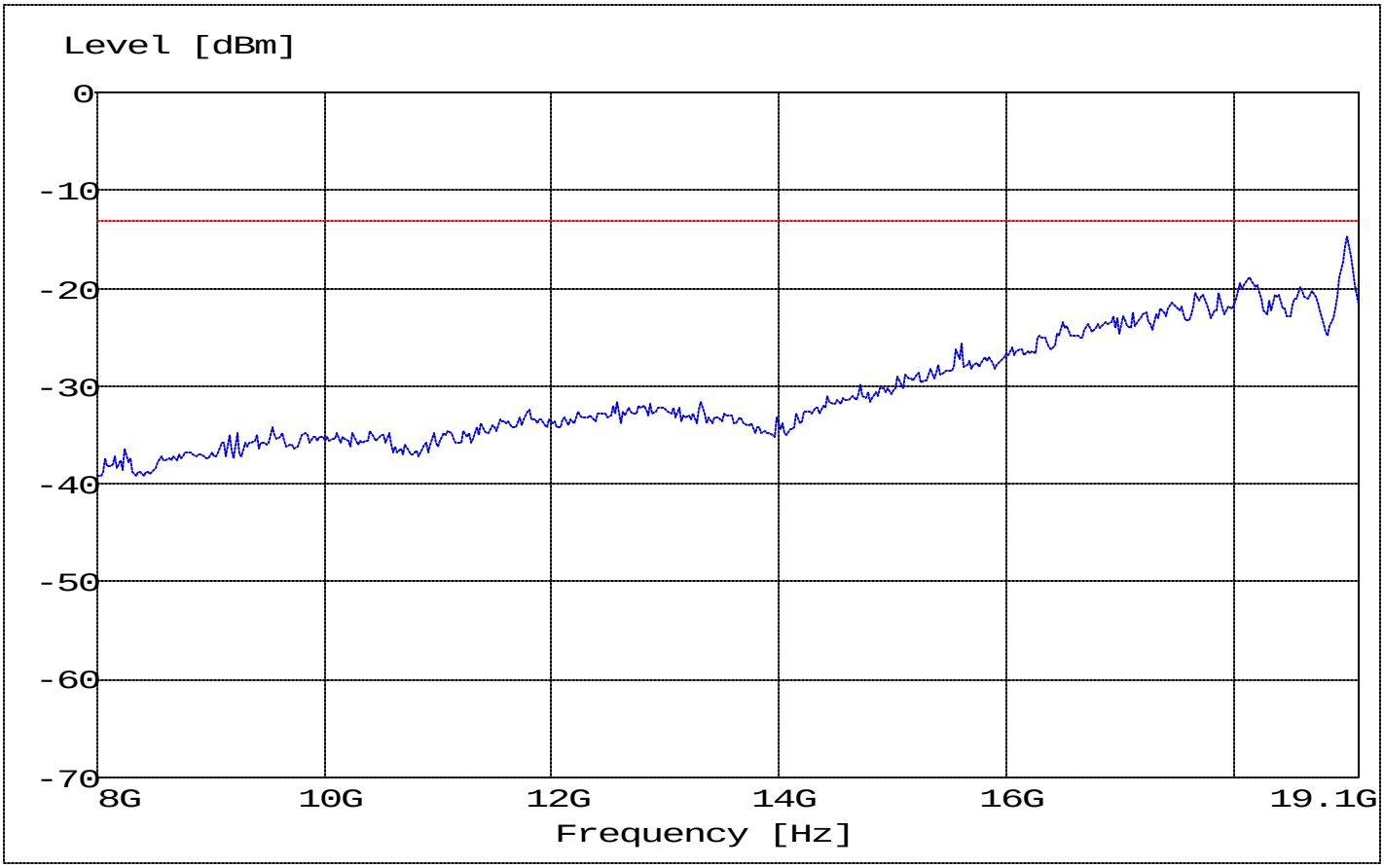
ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

RADIATED SPURIOUS EMISSIONS

Channel 661: 8GHz – 19.1GHz

Spurious emission limit –13dBm

(NOTE: This plot is valid for all three channels)

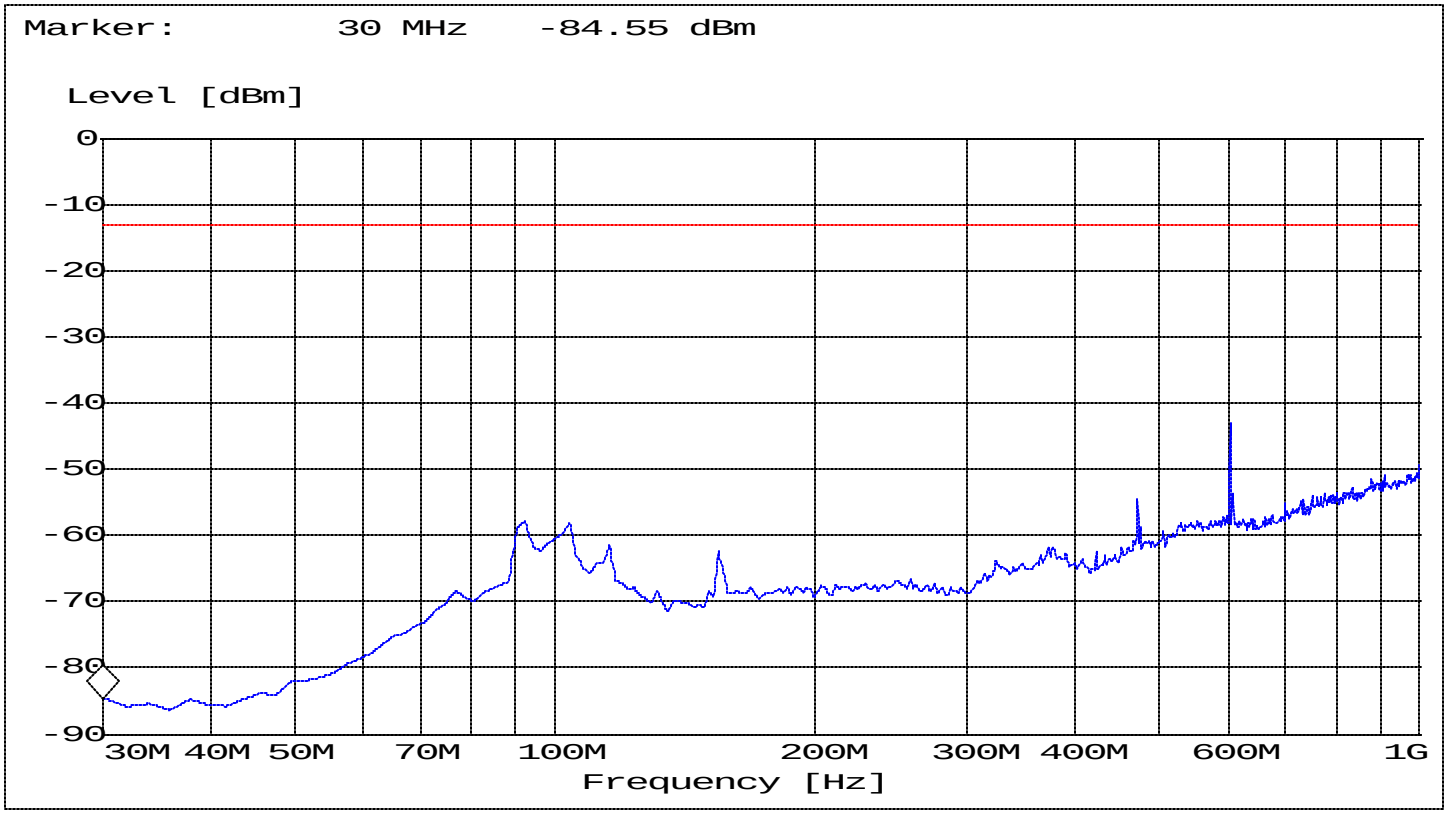


ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

RADIATED SPURIOUS EMISSIONS

EUT in Idle Mode: 30MHz – 1GHz

Spurious emission limit –13dBm

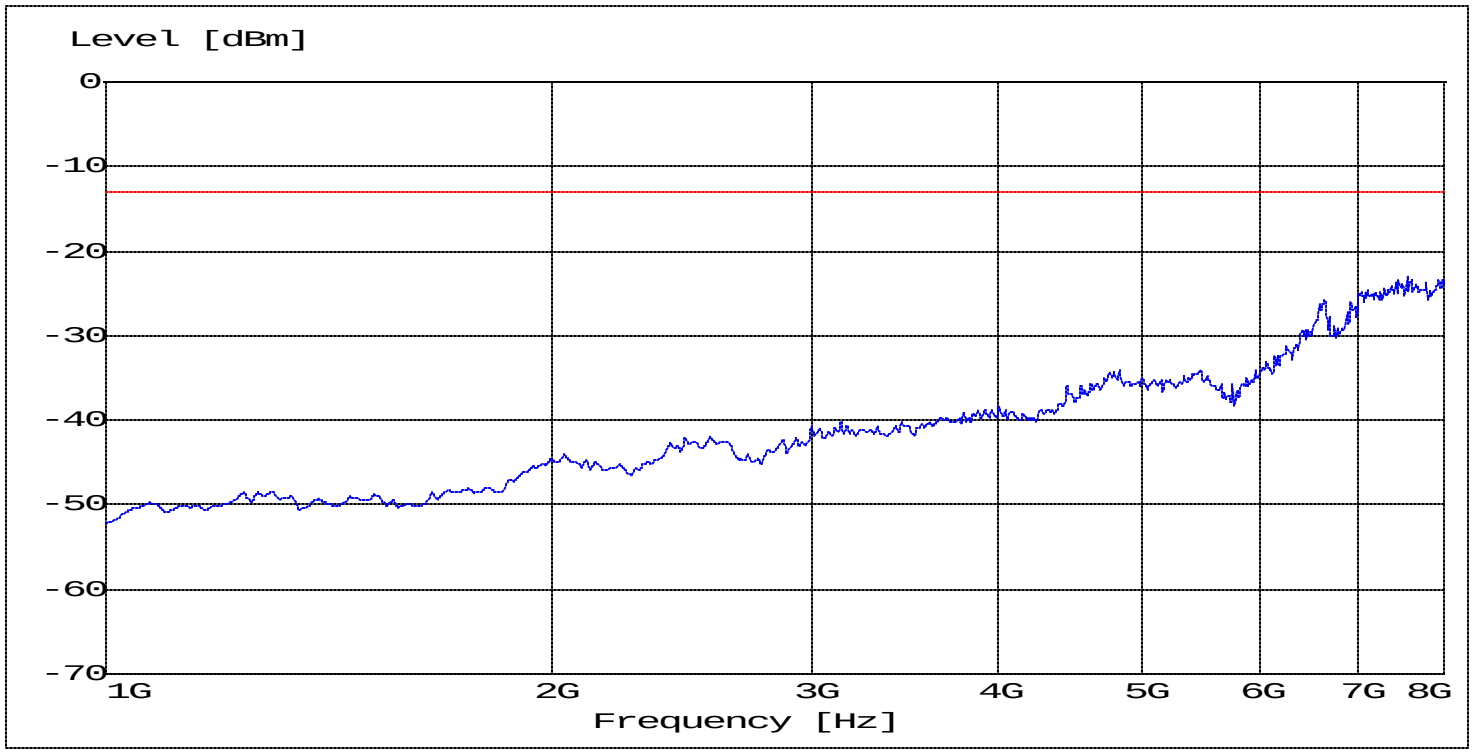


ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

RADIATED SPURIOUS EMISSIONS

EUT in Idle Mode: 1GHz – 8GHz

Spurious emission limit –13dBm

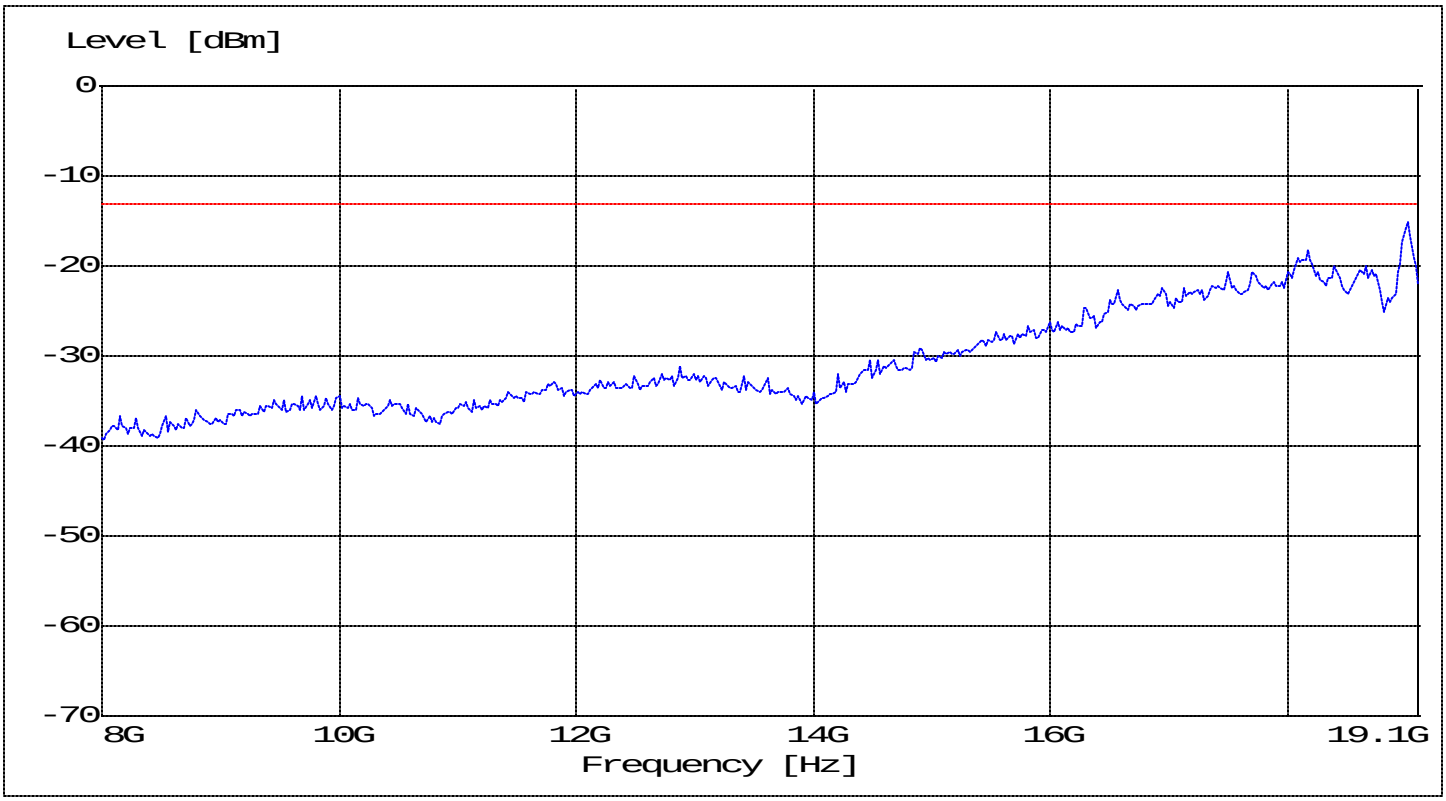


ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

RADIATED SPURIOUS EMISSIONS

EUT in Idle Mode: 8GHz – 19.1GHz

Spurious emission limit –13dBm

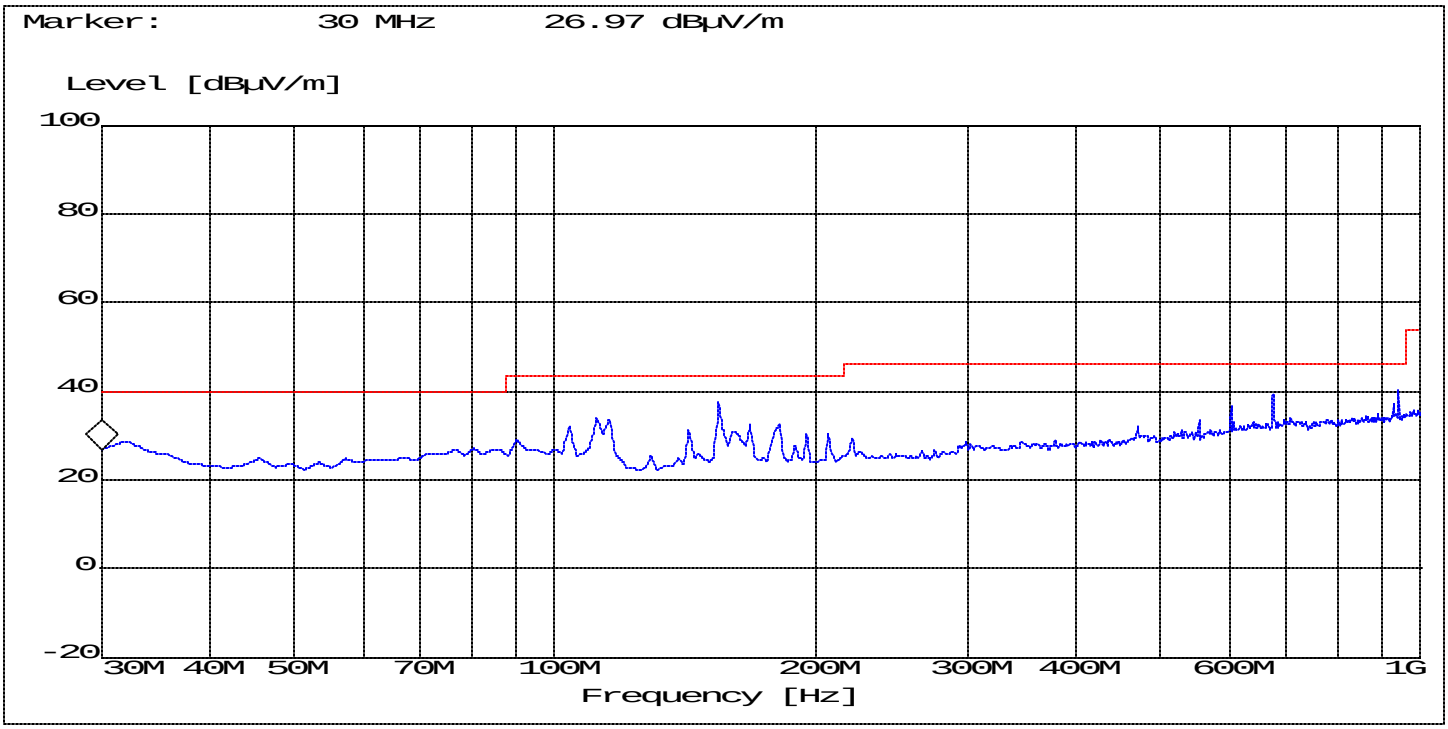


ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

RECEIVER SPURIOUS EMISSIONS
EUT in Idle Mode: 30MHz – 1GHz

NOTE: The spurious emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 18GHz and 20 GHz very short cable connections to the antenna was used to minimize the noise level.

ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

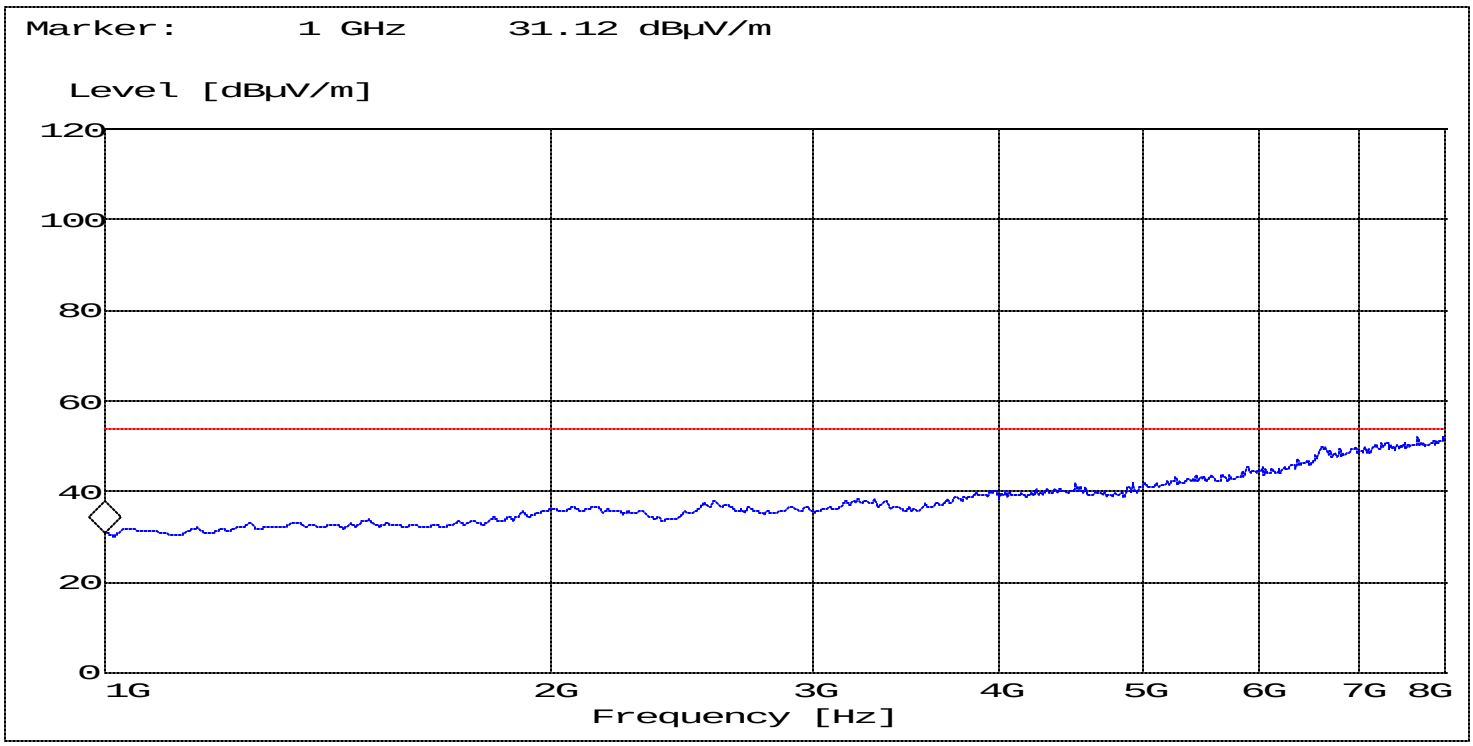


Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

RECEIVER SPURIOUS EMISSIONS: 1GHz – 8GHz

ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

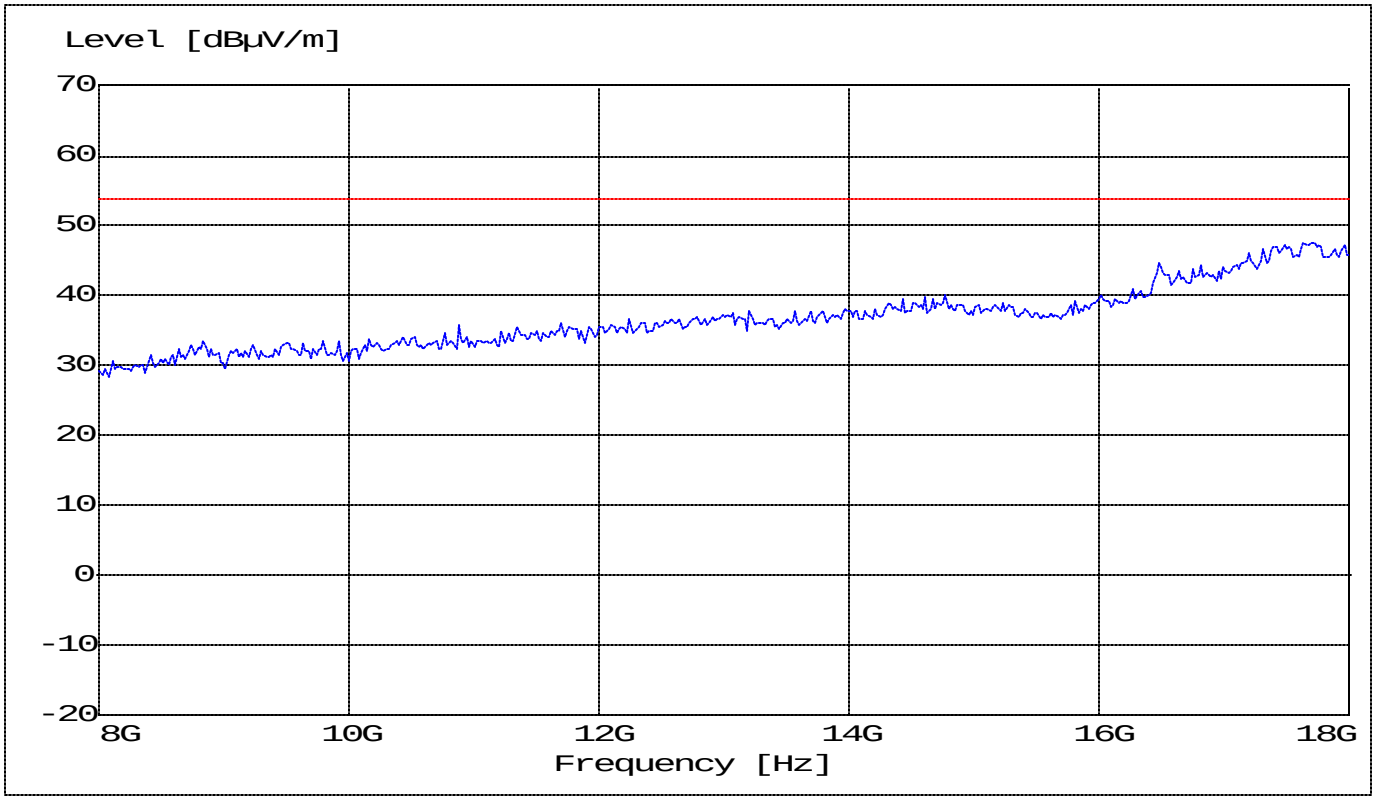


Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

RECEIVER SPURIOUS EMISSIONS: 8GHz – 18GHz

ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

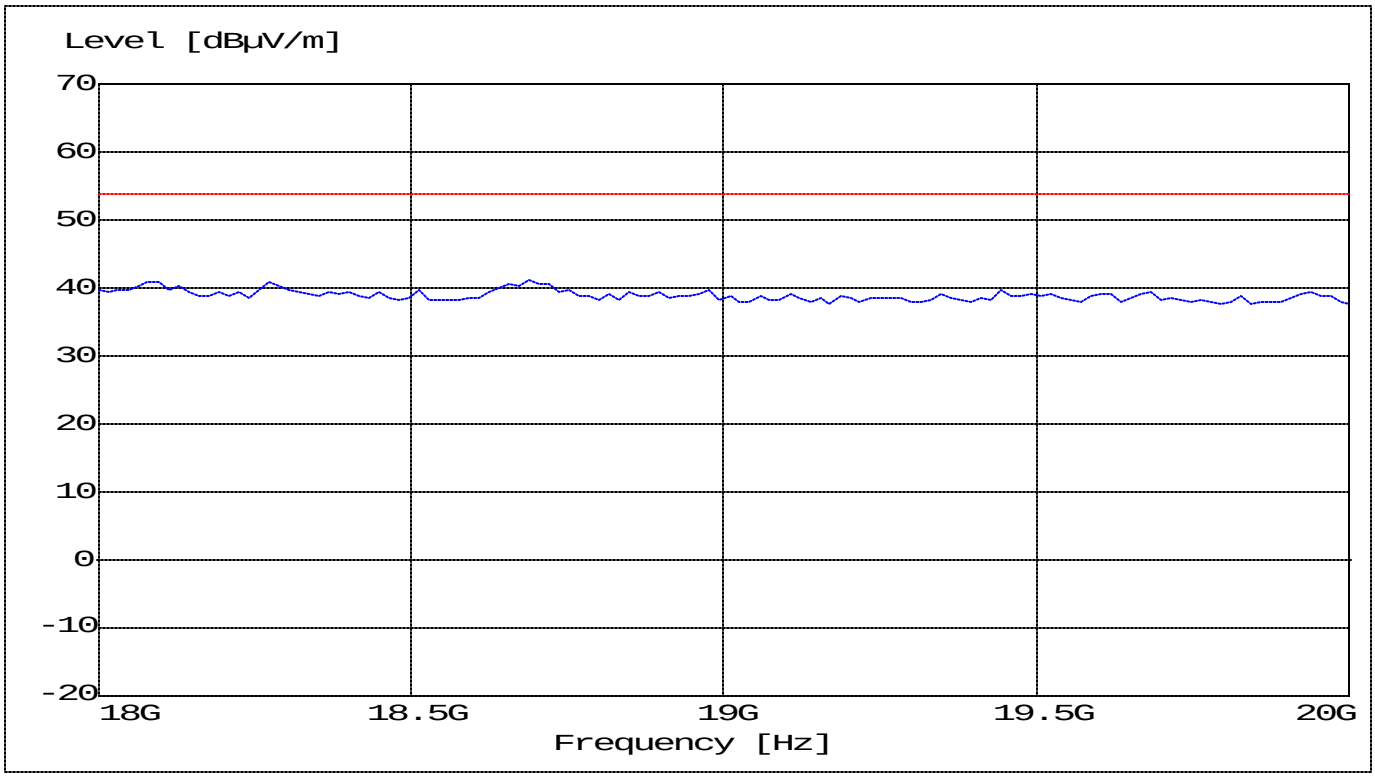


Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

RECEIVER SPURIOUS EMISSIONS: 18GHz – 20GHz

ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz



Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

CONDUCTED SPURIOUS EMISSIONS

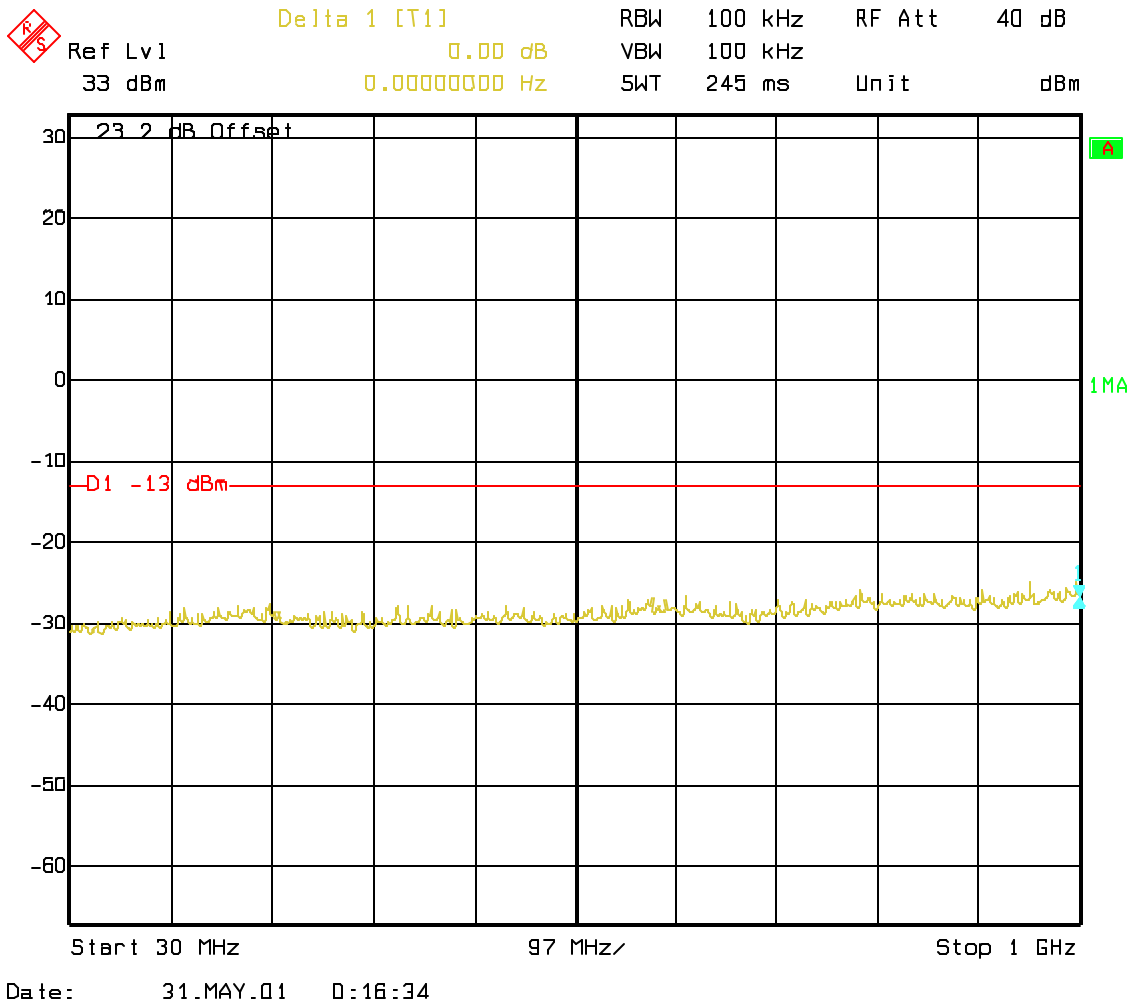
Measurement Procedure:
The following steps outline the procedure used to measure the conducted emissions from the EUT.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency.
For the equipment under test, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
USPCS Transmitter
Channel Frequency
512 1850.2 MHz
661 1880.0 MHz
810 1909.8 MHz

Measurement Limit:
Sec. 24.238 Emission Limits.
(a) On any frequency outside frequency band of the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

CONDUCTED SPURIOUS EMISSIONS

Channel 512: 30MHz – 1GHz

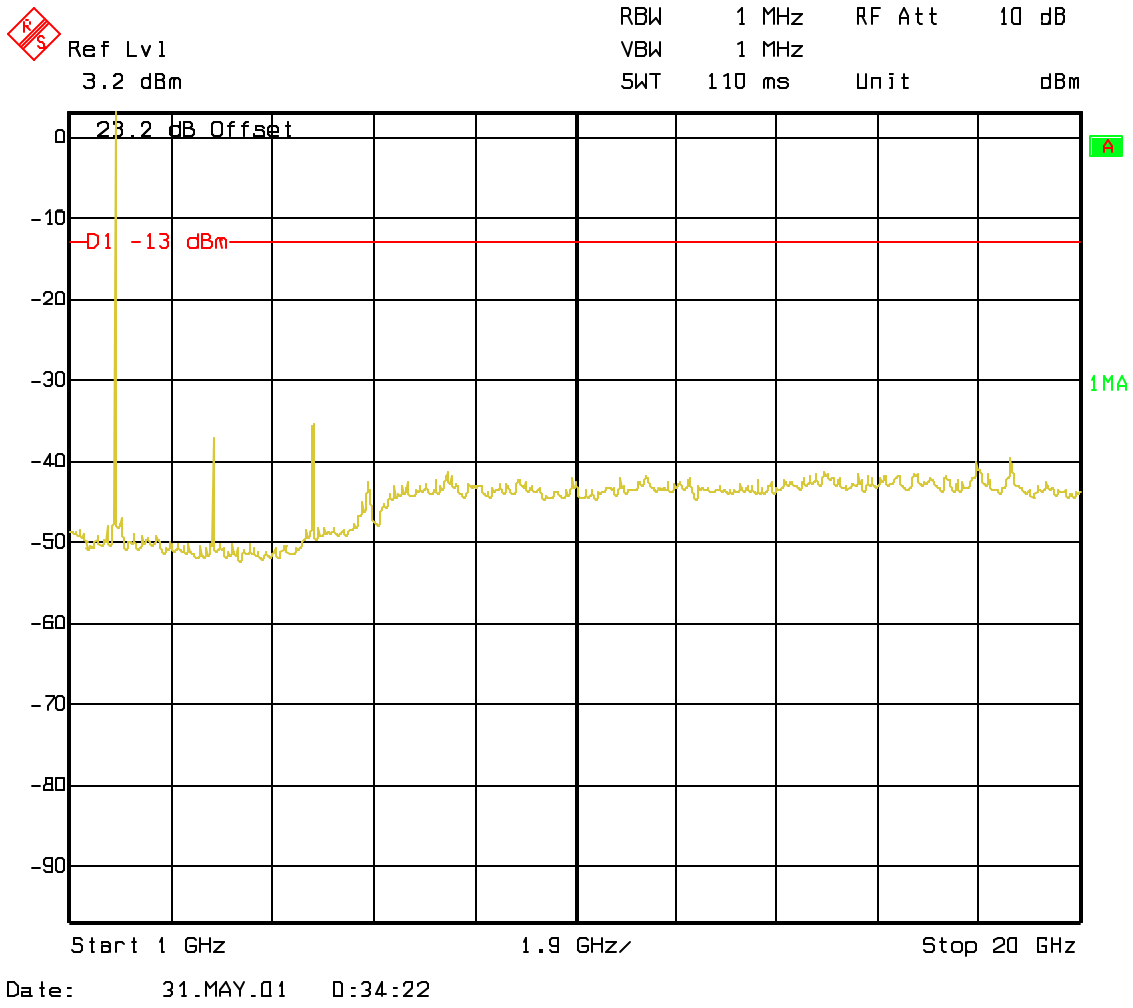
Spurious emission limit –13dBm



ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

CONDUCTED SPURIOUS EMISSIONS
Channel 512: 1GHz – 20GHz
Spurious emission limit –13dBm

NOTE: peak above the limit line is the fundamental frequency.

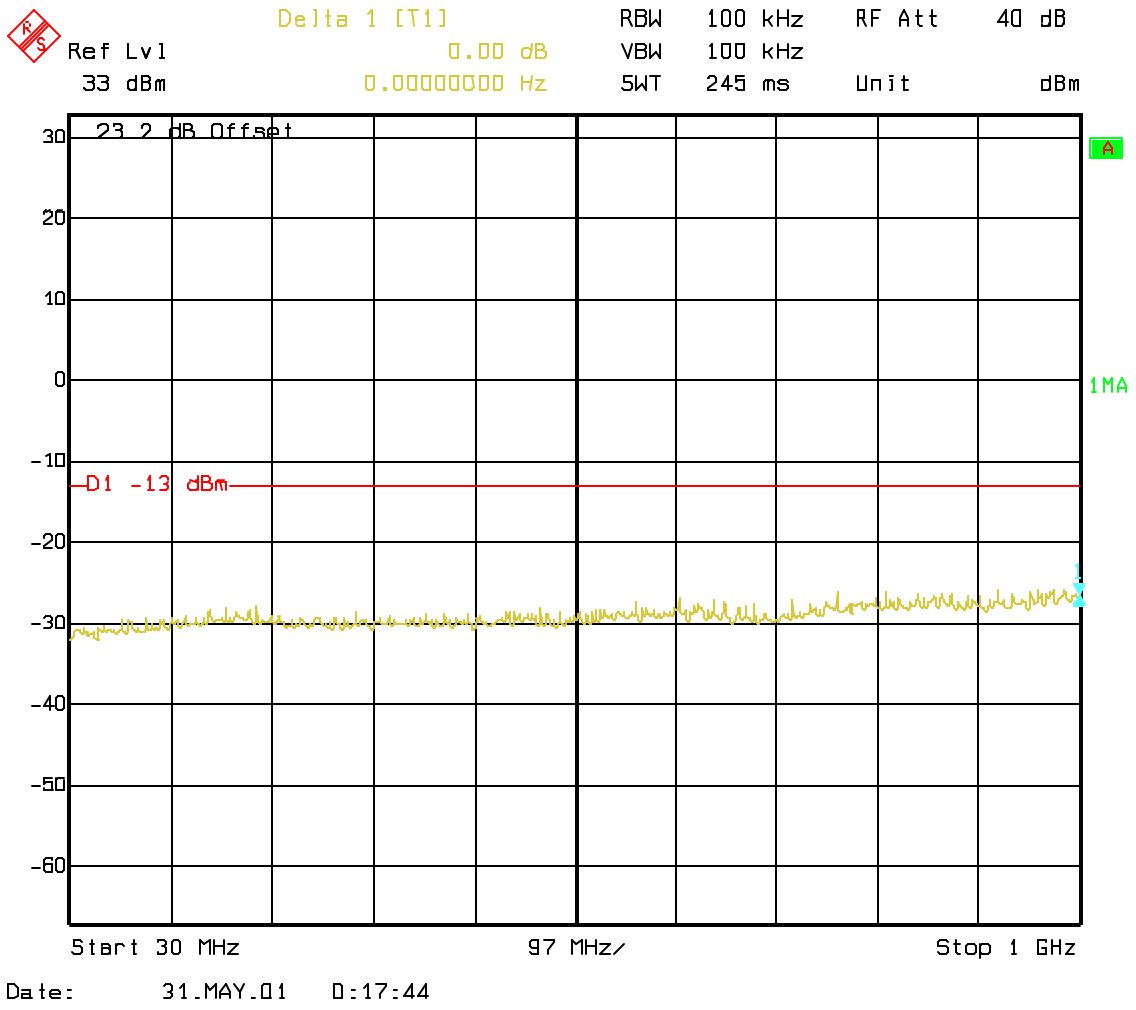


ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

CONDUCTED SPURIOUS EMISSIONS

Channel 661: 30MHz – 1GHz

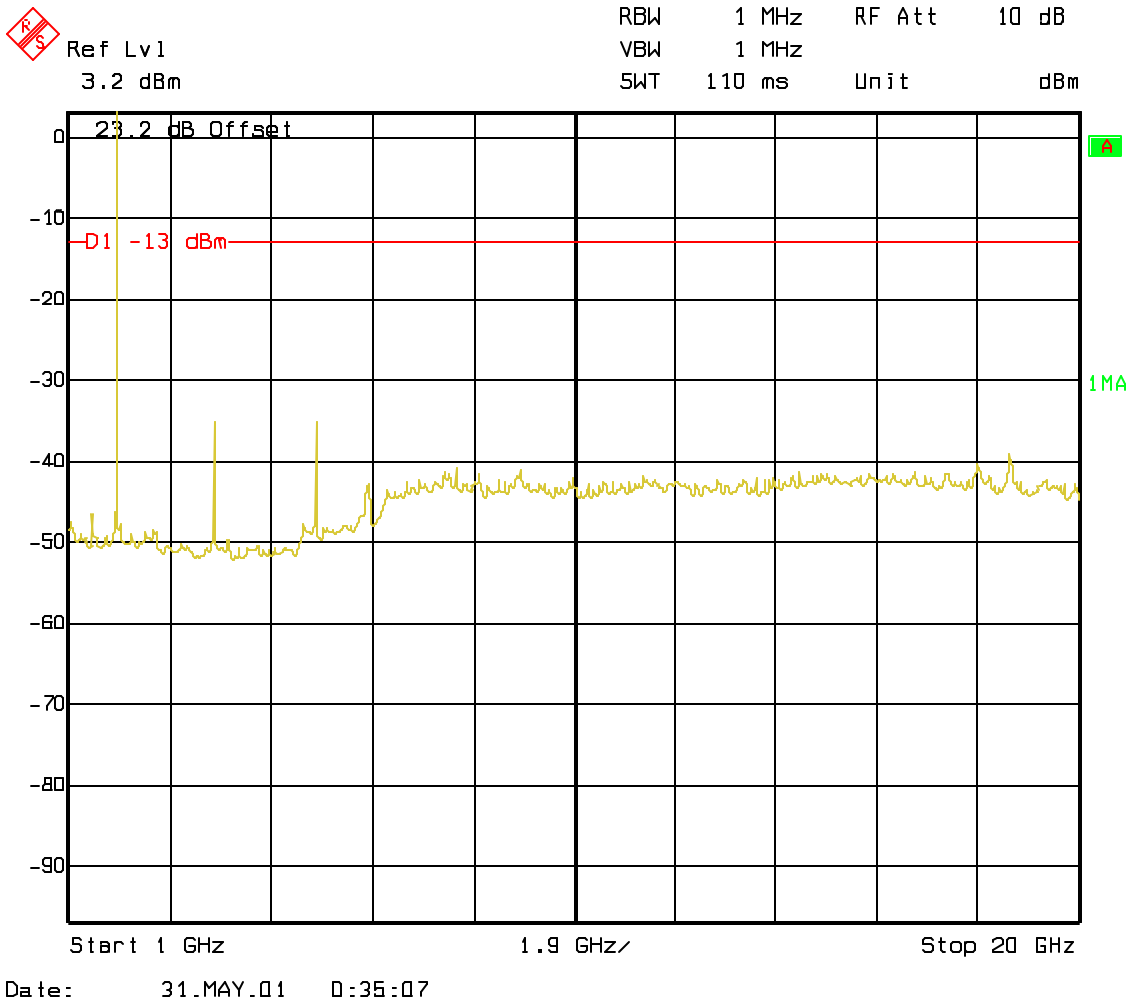
Spurious emission limit –13dBm



ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

CONDUCTED SPURIOUS EMISSIONS
Channel 661: 1GHz – 20GHz
Spurious emission limit –13dBm

NOTE: peak above the limit line is the fundamental frequency.

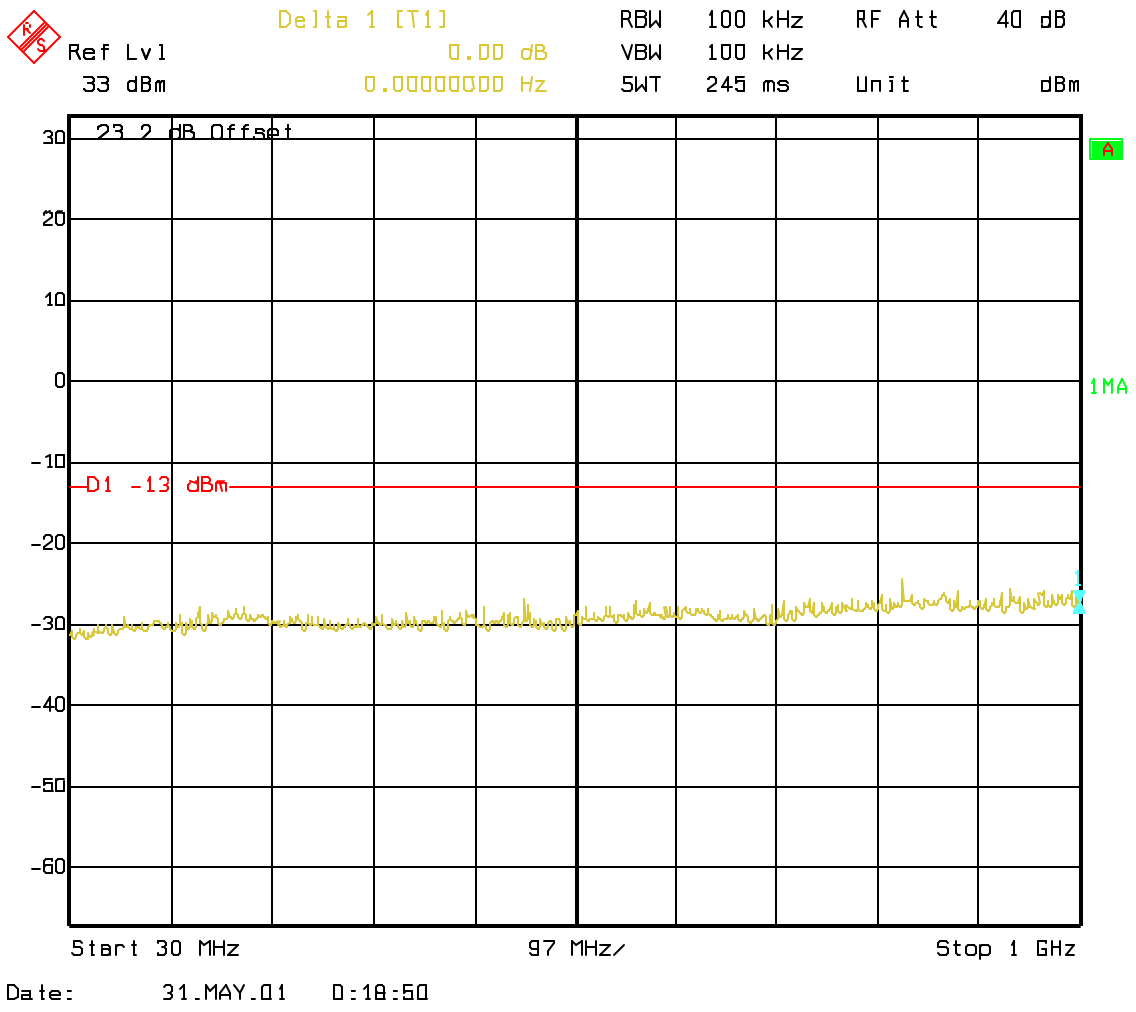


ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

CONDUCTED SPURIOUS EMISSIONS

Channel 810: 30MHz – 1GHz

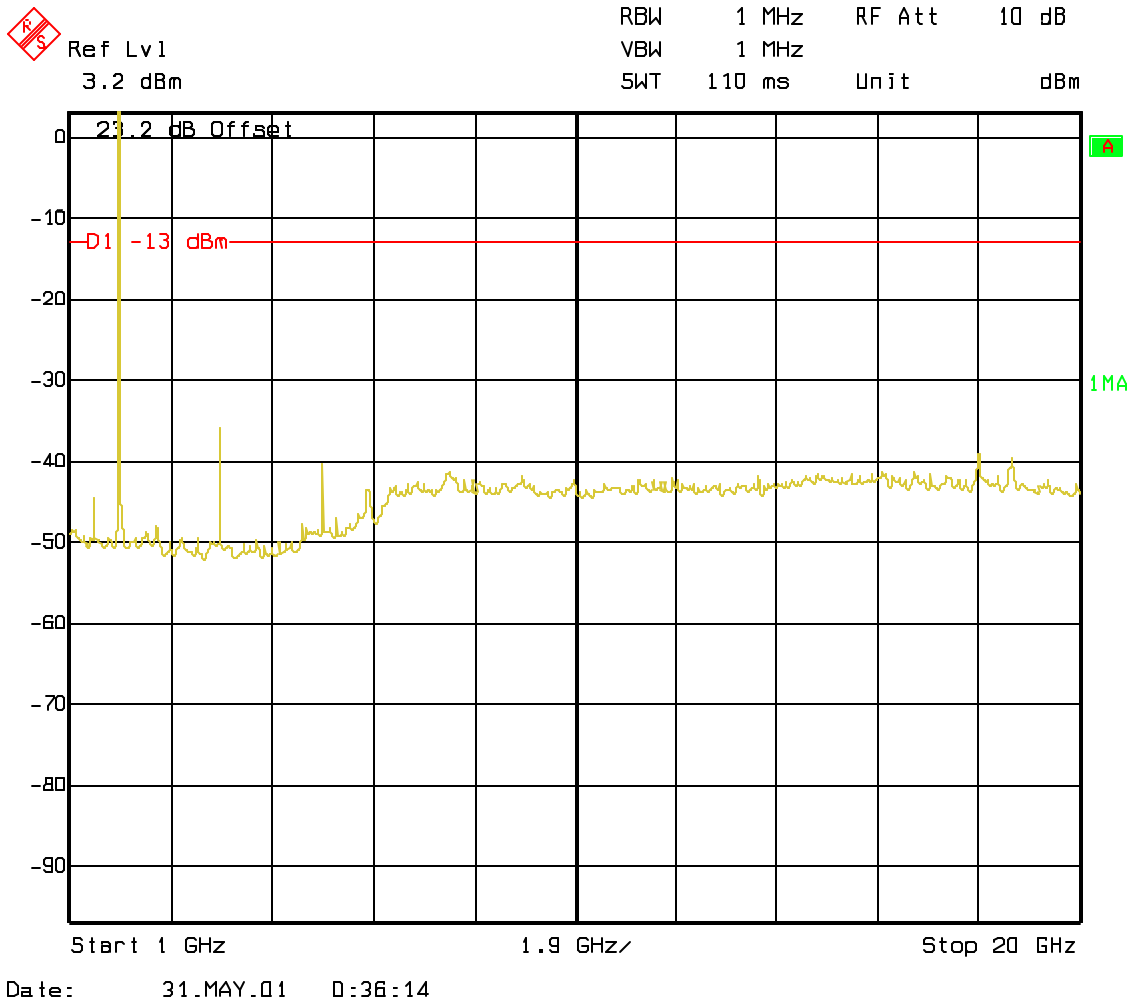
Spurious emission limit –13dBm



ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

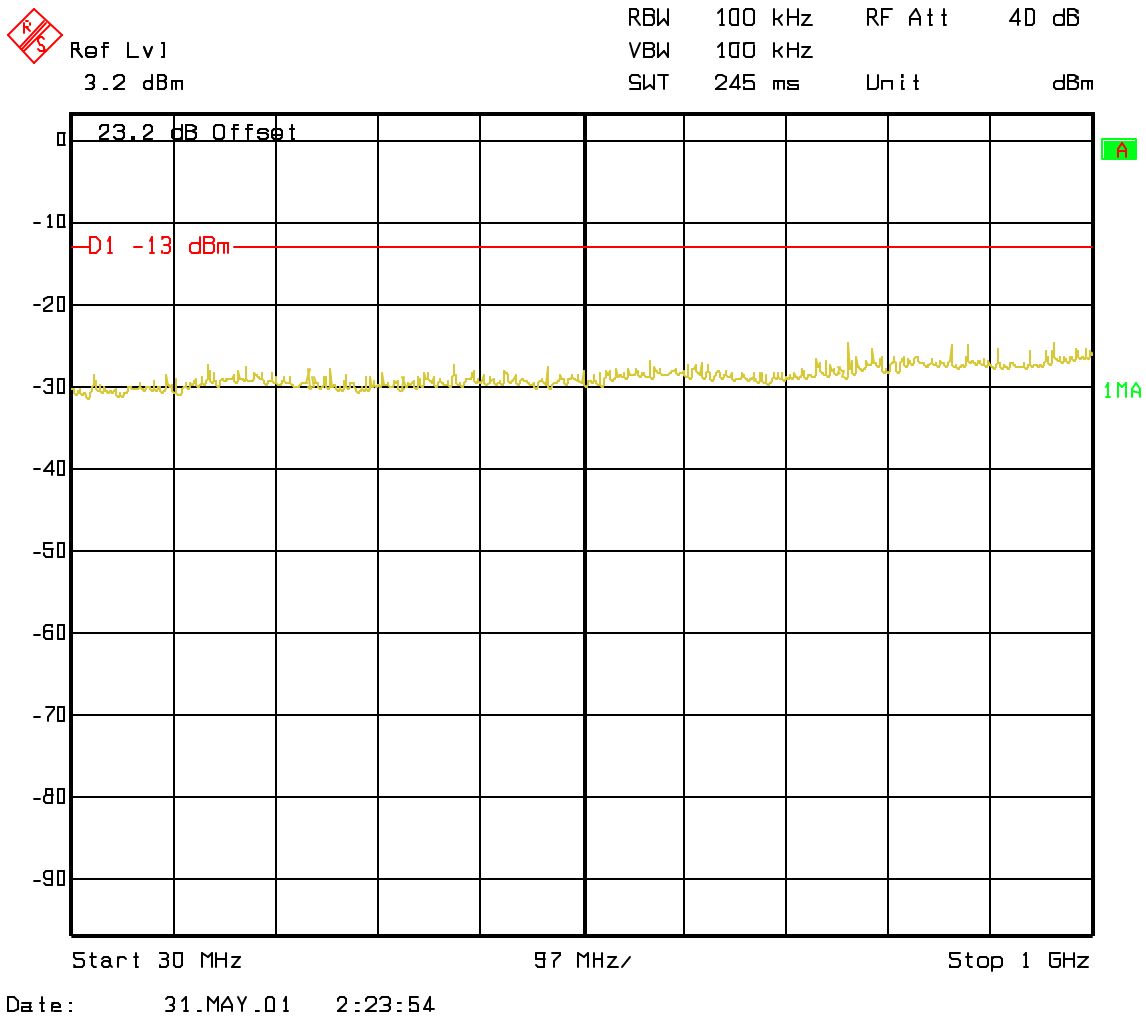
CONDUCTED SPURIOUS EMISSIONS
Channel 810: 1GHz – 20GHz
Spurious emission limit –13dBm

NOTE: peak above the limit line is the fundamental frequency.



ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

CONDUCTED SPURIOUS EMISSIONS
EUT in Idle Mode: 30MHz – 1GHz
Spurious emission limit –13dBm

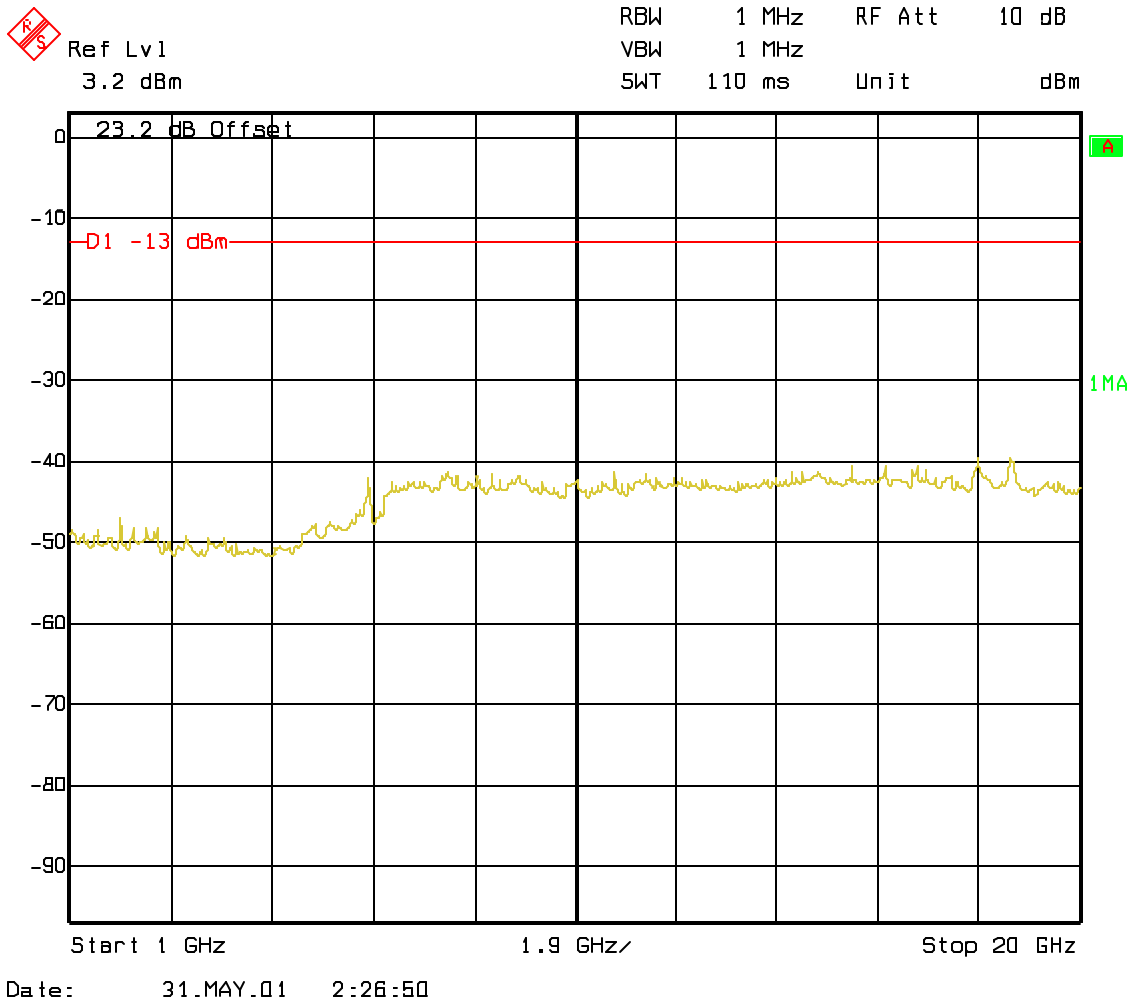


ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz

CONDUCTED SPURIOUS EMISSIONS

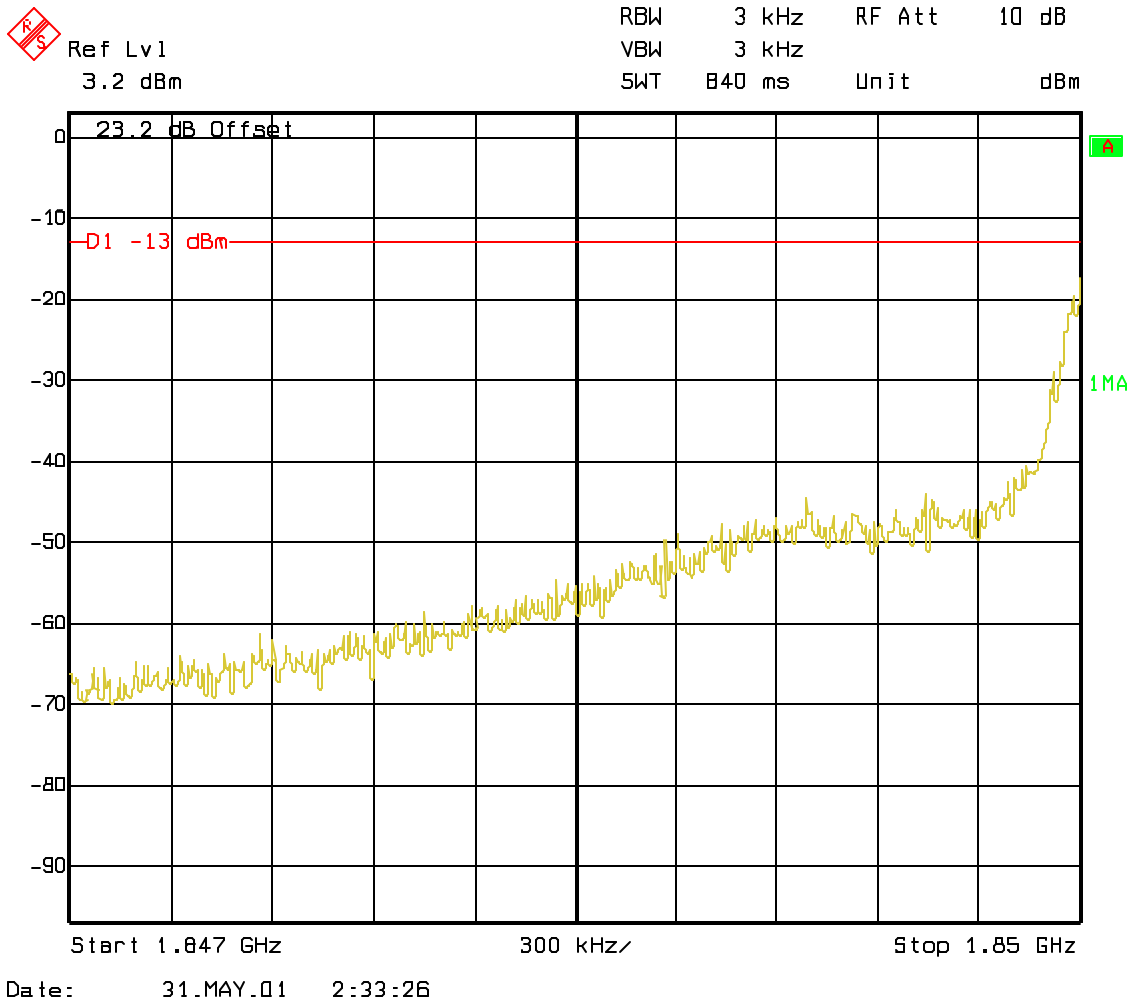
EUT in Idle Mode: 1GHz – 20GHz

Spurious emission limit –13dBm



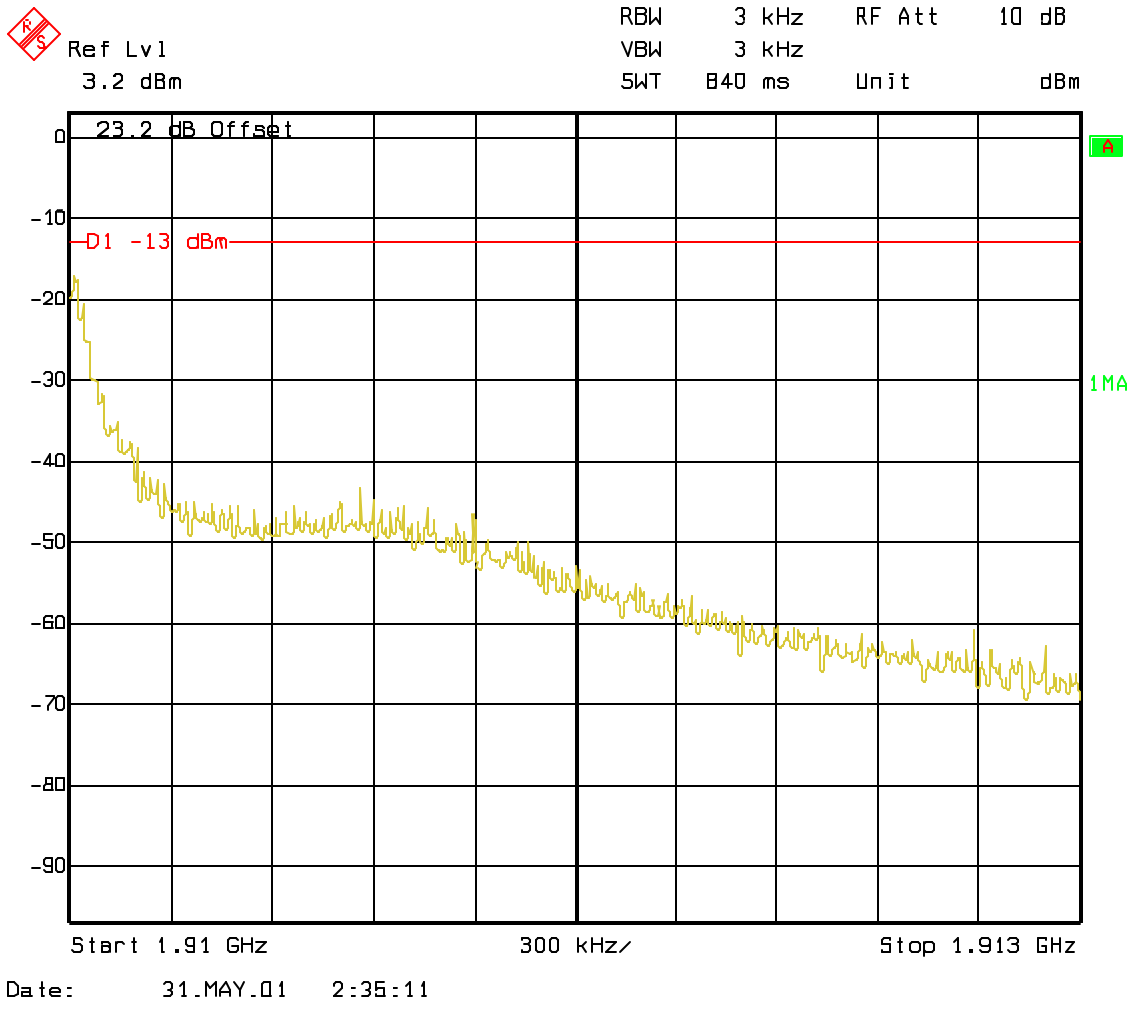
ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz

Lower Band Edge:
(Conducted)



ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

Higher Band Edge:
(Conducted)



ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

OCCUPIED BANDWIDTH §2.989

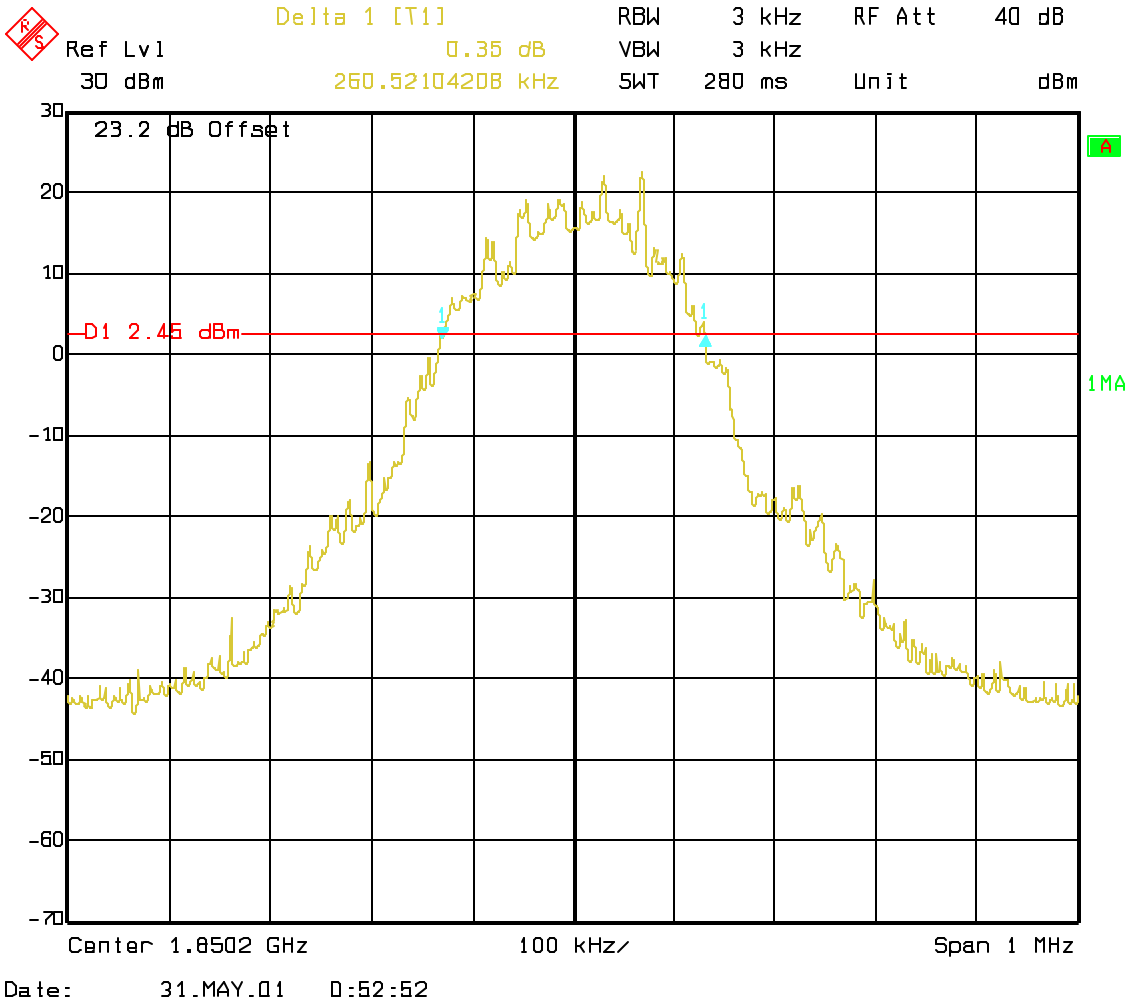
Occupied Bandwidth Results

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the USPCS frequency band. Table 8.2 below lists the measured 99% power and -26dBC occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Frequency	99% Occupied Bandwidth	-26 dBc Bandwidth
1850.2 MHz	260.5 KHz	298.5 KHz
1880.0 MHz	258.5 KHz	294.5 KHz
1909.2 MHz	258.5 KHz	298.5 KHz

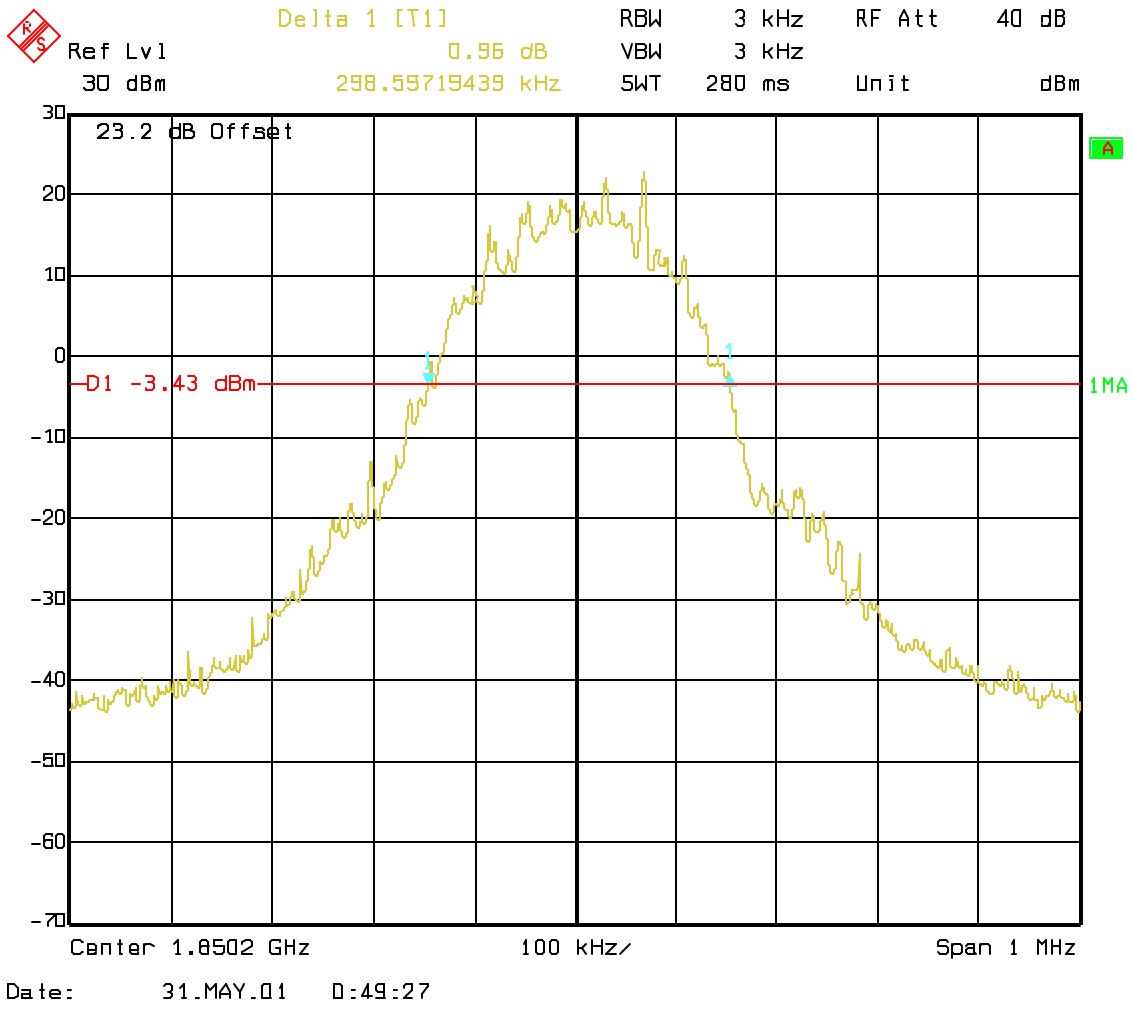
Part 24.238 (a) requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 290 kHz, this equates to a resolution bandwidth of at least 2.96 kHz. For this testing, a resolution bandwidth 3.0 kHz was used.

Channel 512
99% Occupied Bandwidth



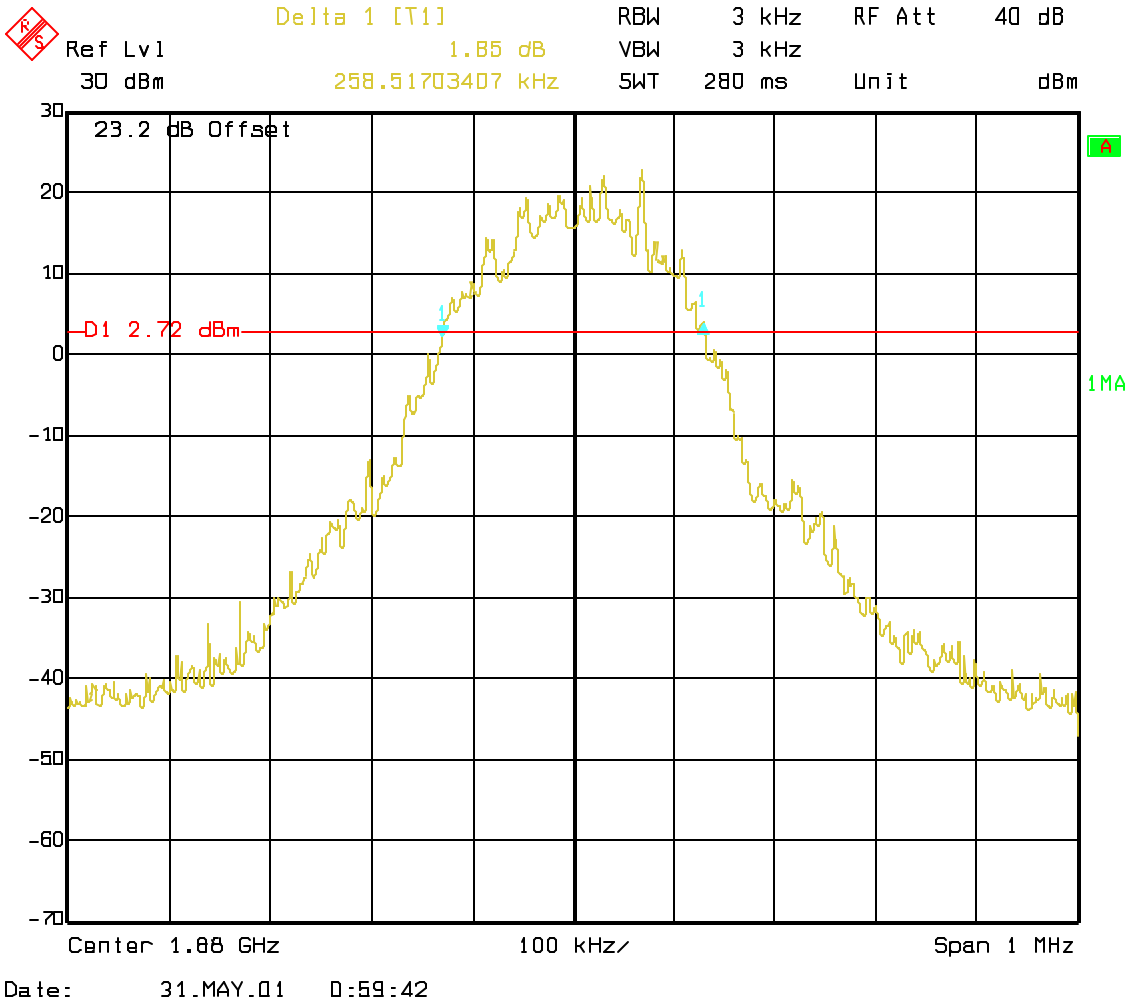
ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

Channel 512
-26 dBc Bandwidth



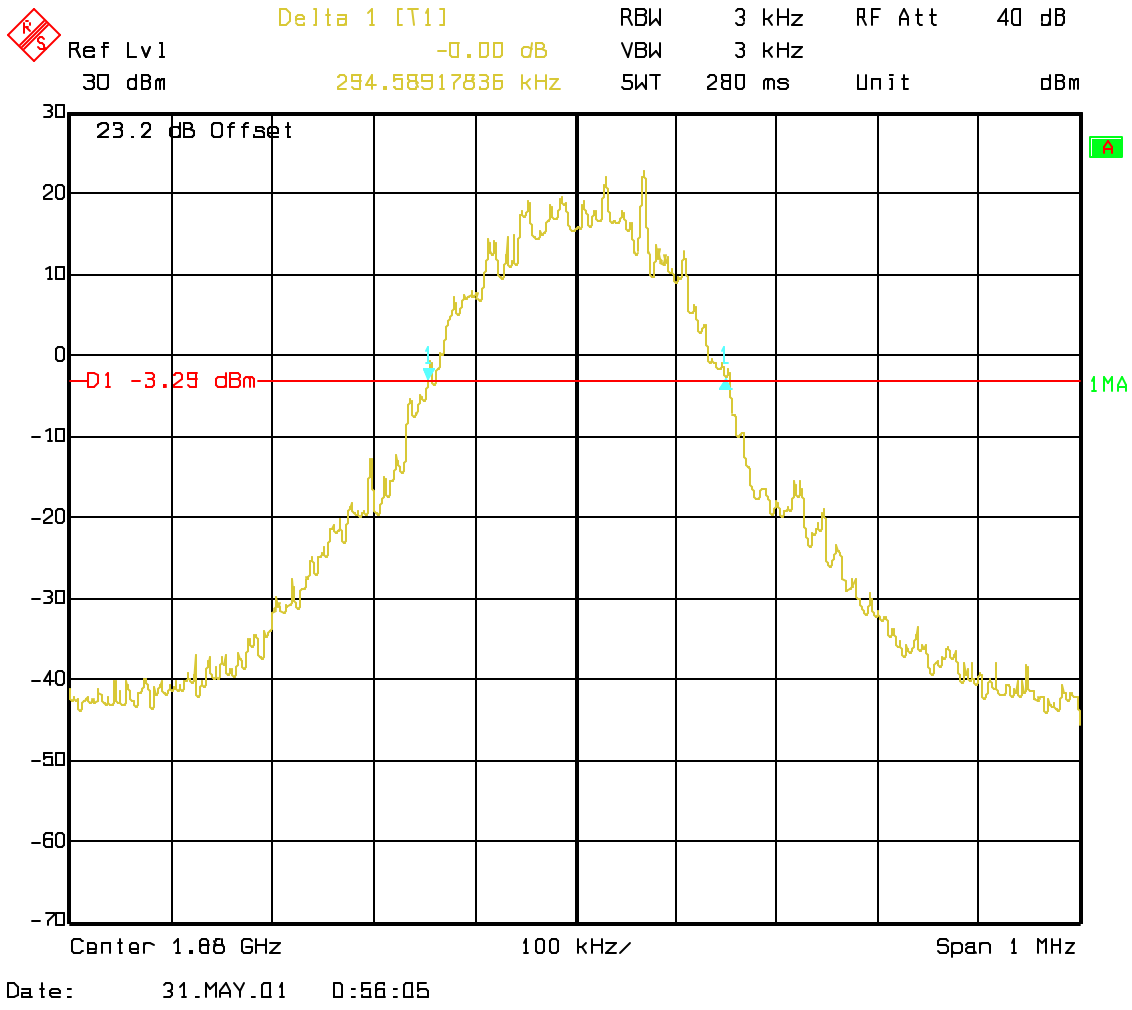
ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

Channel 661
99% Occupied Bandwidth



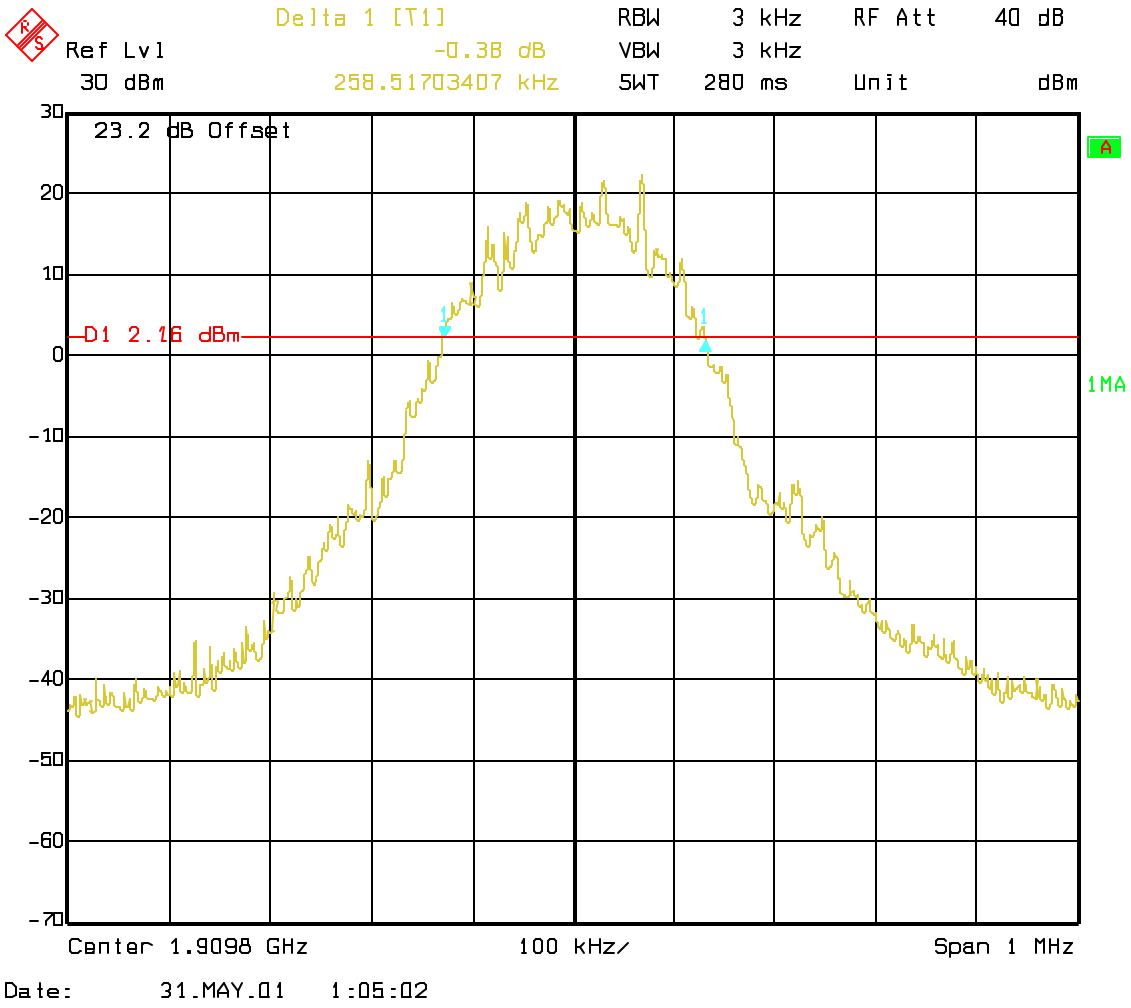
ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

Channel 661
-26 dBc Bandwidth



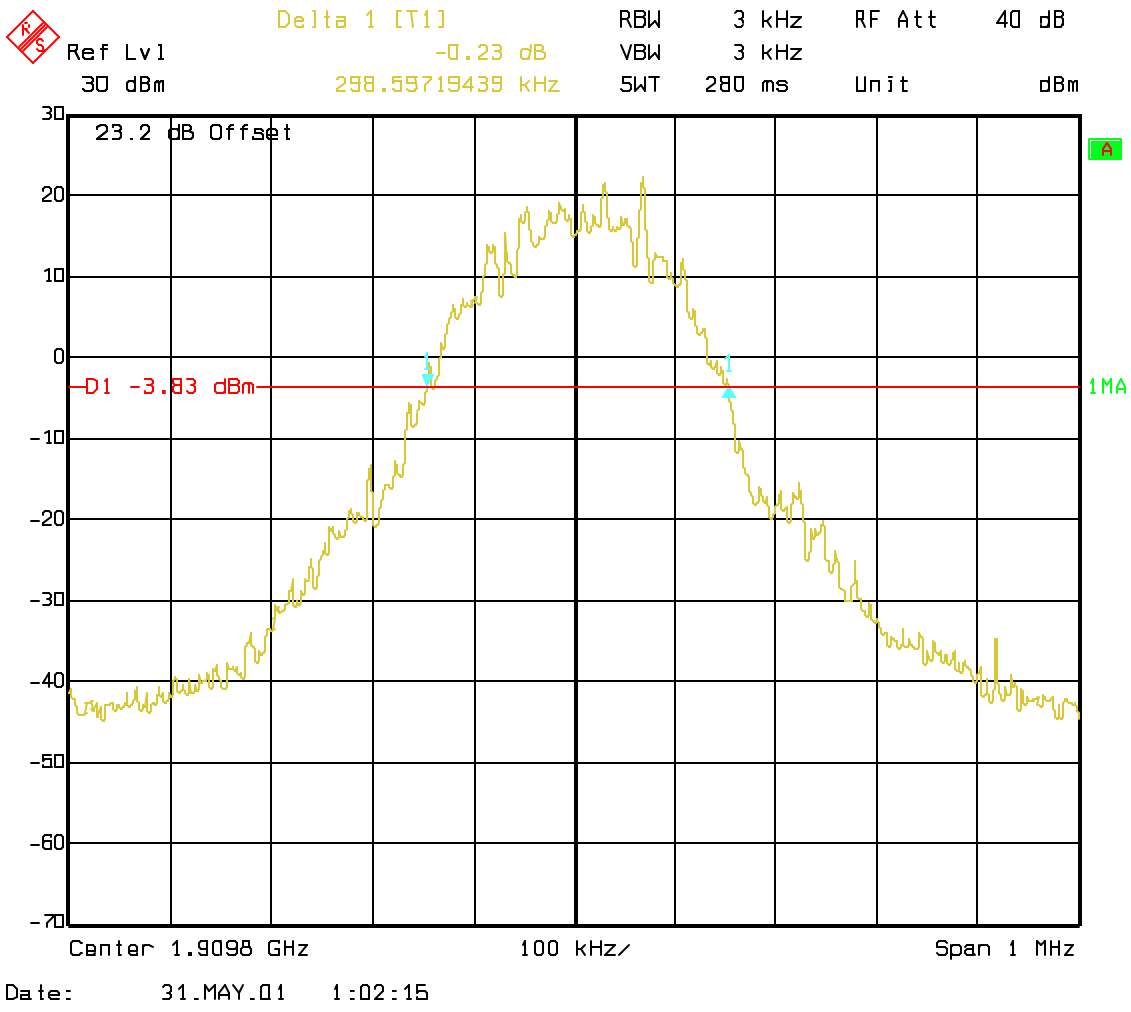
ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

Channel 810
99% Occupied Bandwidth



ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

Channel 810
-26 dBc Bandwidth

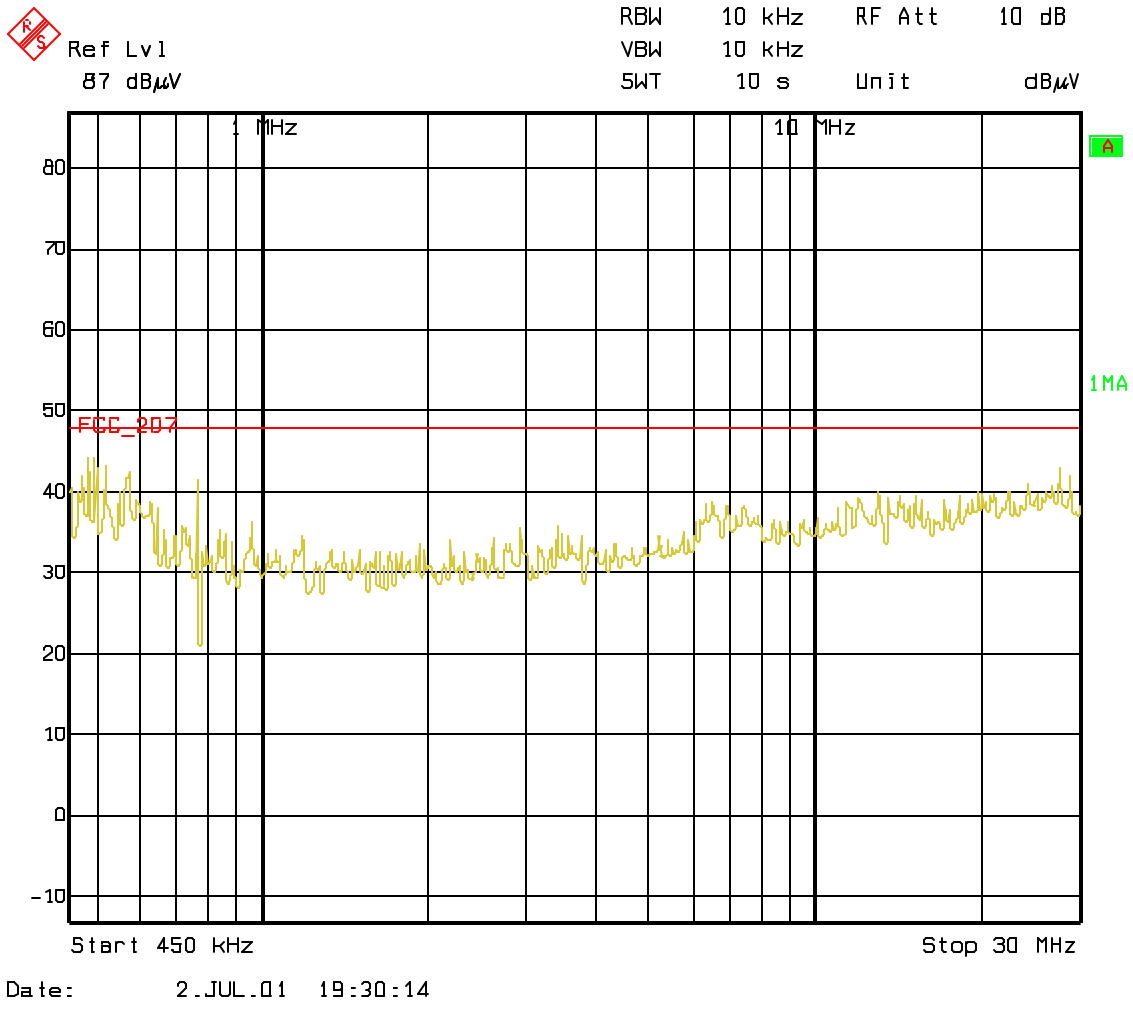


ANALYZER SETTINGS: RBW = 3KHz VBW = 3KHz

CONDUCTED EMISSIONS § 15.107/207

Measured with AC/DC power adapter plugged in LISN

Phase: Line



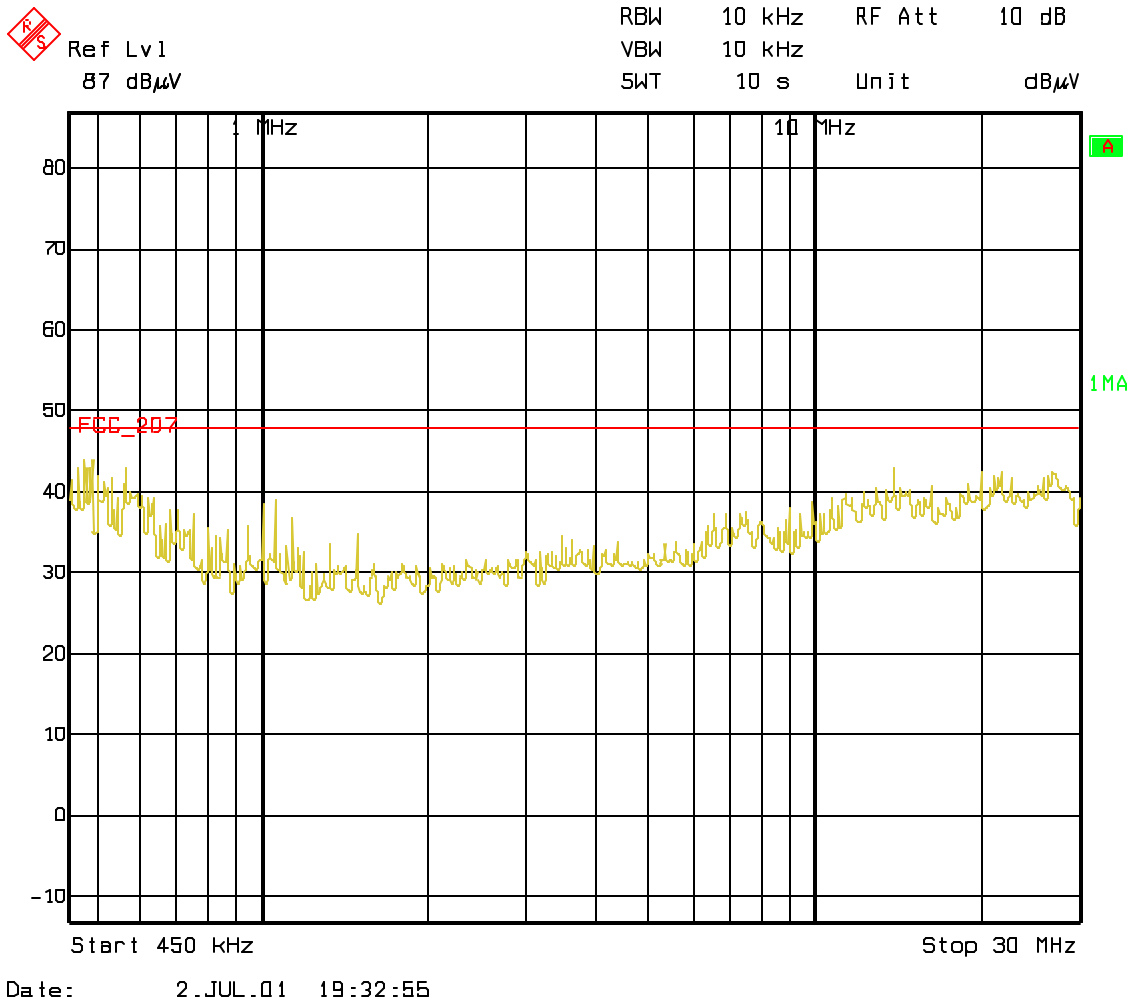
Technical specification: 15.107 / 15.207 (Revised as of October 1, 1991)

Limit

0.45 to 30 MHz	250 µV / 47.96dBµV

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

Phase: Neutral



Technical specification : 15.107 / 15.207 (Revised as of October 1, 1991)

Limit

0.45 to 30 MHz	250 µV / 47.96 dBµV

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/010
02	Signal Generator	SMY02	Rohde & Schwarz	836878/011
03	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
04	Power Amlifier	250W1000	Amplifier Research	300031
05	Biconilog Antenna	3141	EMCO	0005-1186
06	Horn Antenna	SAS-200/571	AH Systems	325
07	Power Splitter	11667B	Hewlett Packard	645348
08	Climatic Chamber	VT4004	Votch	G1115
09	Pre-Amplifier	JS4-00102600	Miteq	00616
10	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807