



Accredited testing-laboratory

DAR registration number: DAT-P-176/94-D1

**Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97**

Recognized by the Federal Communications Commission

Anechoic chamber registration no.: 90462 (FCC)

Anechoic chamber registration no.: 3463C-1 (IC)

Certification ID: DE 0001

Accreditation ID: DE 0002

Accredited Bluetooth® Test Facility (BQTF)

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Test report no. : 1-0725-01-04/08
Type identification : TU-WHR1U
Applicant : Panasonic Corporation
FCC ID : ACJ-TUWHR1U
IC Certification No : 216A-TUWHR1U
Test standards : FCC CFR 47 Part 15.255
RSS-210 Issue 7



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1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 3.1.1. The CETECOM ICT Services GmbH 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 ICT Services GmbH.

Test laboratory manager:

2009-03-25	Karsten Gerald	
Date	Name	Signature

Technical responsibility for area of testing:

2009-03-25	Nicolas Stamber	
Date	Name	Signature



1.2 Testing laboratory

CETECOM ICT Services GmbH

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Fax: + 49 681 5 98 - 9075

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Internet: <http://www.cetecom-ict.de>

State of accreditation: The test laboratory (area of testing) is accredited according to
DIN EN ISO/IEC 17025
DAR registration number: DAT-P-176/94-D1

Accredited by: Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97

Testing location, if different from CETECOM ICT Services GmbH:

Name :
Street :
Town :
Country :
Phone :
Fax :

1.3 Details of applicant

Name:	Panasonic Corporation Visual Products and Display Devices Business Group
Street:	1-15 Matsuo-cho, Kadoma City
Town:	Osaka 571-8504
Country:	Japan
Telephone:	+81-6-6908-1551
Fax:	+81-6-6905-5983
Contact:	Mr. Masaya Koshimuta
E-mail:	-/-
Telephone:	+81-6-6905-5714

1.4 Application details

Date of receipt of order:	2008-10-24
Date of receipt of test item:	2009-01-22
Date of start test:	2009-01-22
Date of end test	2009-03-10
Persons(s) who have been present during the test:	-/-

2 Test standard/s

FCC 47 CFR Part 15.255	2008-07	Radio Frequency Devices, Subpart C - Intentional Radiators, Operation within the band 57 - 64 GHz
RSS-210	2007-06	Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

3 Technical tests

3.1 Details of manufacturer

Name:	Panasonic Corporation Visual Products and Display Devices Business Group
Street:	1-15 Matsuo-cho, Kadoma City
Town:	Osaka 571-8504
Country:	Japan

3.1.1 Test item

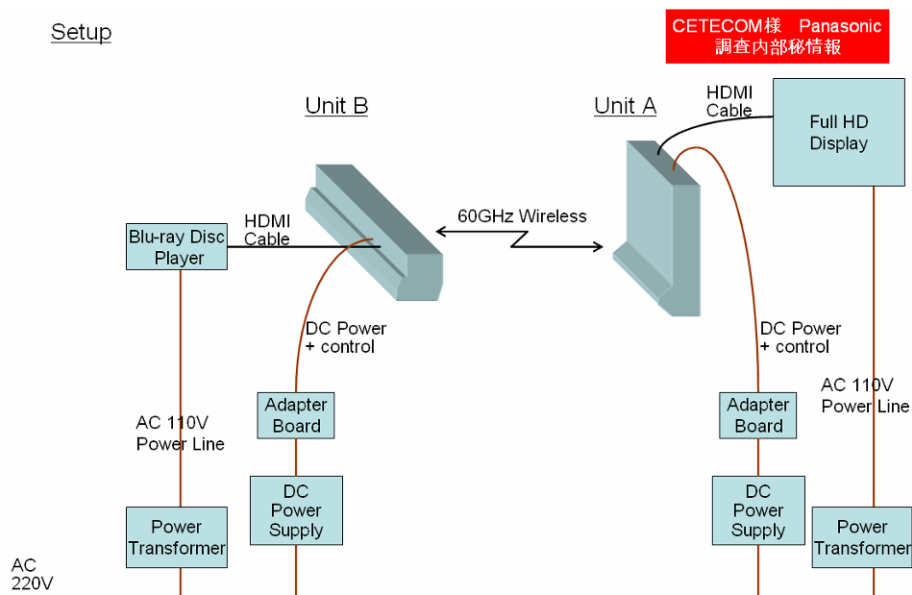
Kind of test item:	Wireless HDMI Transmission System
Type identification:	TU-WHR1U
Model number / serial number:	058
Frequency:	60.32 GHz, 60.48 GHz, 60.64 GHz
Type of Modulation:	OFDM
Number of channels:	3
Antenna :	integrated, non-replaceable patch antenna nominal antenna gain: 12 dBi
Power Supply:	12.0 Vdc via external AC/DC adaptor
Temperature Range:	-20 °C to +55 °C

FCC ID: ACJ-TUWHR1U
 IC: 216A-TUWHR1U

Remark:

The wireless HDMI Transmission System consists of two units: TU-WHR1U and TU-WHT1U (also called Unit A and Unit B). The present test report documents testing of TU-WHR1U (Unit A) only.

The tests of TU-WHT1U (Unit B) are documented in a separate test report.



3.1.2 EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
Op. 0	Normal mode	Normal temperature and power source conditions
Op. 1		low temperature, nominal power source conditions
Op. 2		high temperature, nominal power source conditions

*) EUT operating mode no. is used to simplify the test plan

3.1.3 Nominal conditions for testing

Description	Shortcut	Unit	Value
Nominal Temperature	T _{nom}	°C	23
Nominal Humidity	H _{nom}	%	45
Nominal Power Source	V _{nom}	Vac	110

Type of power source: 100 - 250 V AC adaptor to 12 V DC.

Extreme conditions are reported in chapter 5.8.

4 Summary of Measurement Results and list of all performed test cases

- No deviations from the technical specifications were ascertained
- There were deviations from the technical specifications ascertained

TC identifier	Description	Verdict	Date	Remark
RF-Testing	FCC CFR 47 Part 15.255 RSS-210, Annex 13	PASS	2009-03-25	-/-

Test Specification / Clause	Test Case	Pass	Fail	N/A	N/P	Results
§2.1049, §15.255 RSS-GEN 4.6	Occupied Bandwidth (99%) and 6 dB Bandwidth	X				max. 225 MHz / max. 95.0 MHz
§15.255 (b)(1) RSS-210 A13.2.2	Power Density	X				max. 1.98 nW/cm ²
§15.255 (c) RSS-210 A13.2.2	Spurious Emissions	X				complies
§15.255 (e) RSS-210 A13.2.3	Peak Transmitter Output Power	X				max. 0.14 mW
§15.255 (f) RSS-210 A13.2.5	Frequency Stability	X				max. -3.8 ppm
§15.255 (h) RSS-210 A13.2.6	Group Installations			X		
§15.255 (i) RSS-210 A13.2.7	Transmitter Self-Identification Transmission			X		
§15.207 RSS-GEN 7.2.2	AC Conducted Emission Limits	X				complies
FCC OET Bulletin 65	MPE Calculation	X				0.45 µW/cm ²

N/A: Not Applicable
N/P: Not Performed

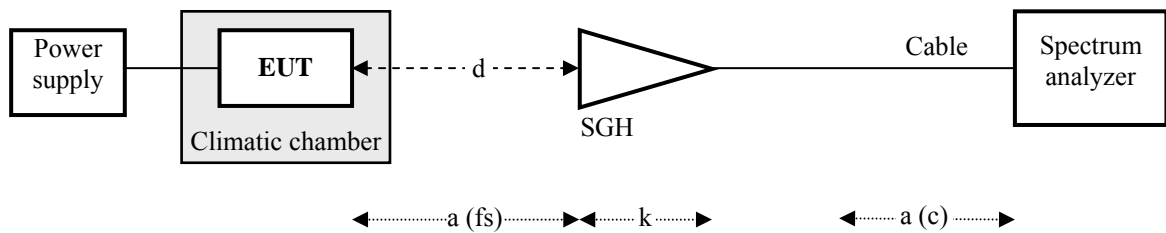
5 RF measurement testing

5.1 Description of test set-up

5.1.1 Radiated measurements

Field strength of spurious radiation in the frequency range 12 GHz to 40 GHz

Frequency stability of wanted signals

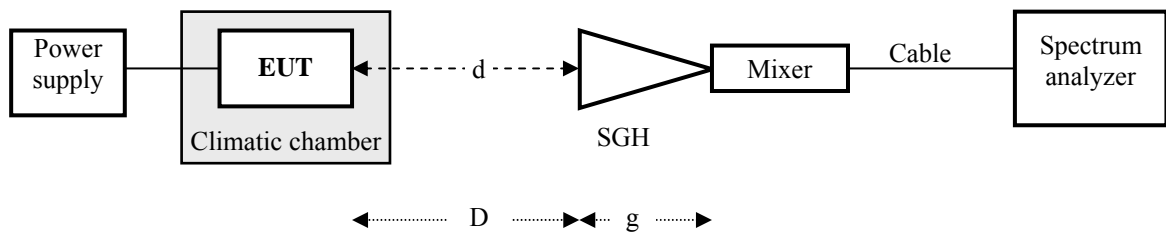


Frequency f [GHz]	Distance d [m]	Standard gain Horn ant. (SGH)	Dist. correction. dc (3m/Xm) [dB]	Antenna factor k [dB 1/m]	Cable loss a [dB]	Amplifier gain g(amp)[dB]
12 ... 18	0.5	narda 639	-15.6	34.0	3.1	35.0
18 ... 26	0.5	narda 638	-15.6	40.2	3.3	33.0
26 ... 40	0.5	narda V637	-15.6	44.0	4.2	19.0

Calculation: Field strength = Analyser reading + Cable loss + Antenna factor + Distance correction – Amp. gain

$$E_u = a + k + dc - g(amp)$$

Frequency stability and power density of wanted signal and spurious radiation in the frequency range 40 to 200 GHz



Frequency f [GHz]	Distance d [m]	Free space attenuation D [dB]	Antenna gain g [dBi] or antenna factor k [dB/m]	System Attenuation [dB]
40 ... 60	0.5	58.5 ... 62.0	20.0 (50 GHz)	40.0
50 ... 75	0.5	60.4 ... 63.9	25.3 (62.5 GHz)	36.8
60.48	0.5		k = 40.67	
60 ... 90	0.25	56.0 ... 59.5	25.7 (75 GHz)	32.1
90 ... 140	0.125	53.5 ... 57.4	25.5 (115 GHz)	30.1
140 ... 170	0.125	57.4 ... 59.0	22.0 (155 GHz)	36.2
170 ... 200	0.125	59.0 ... 60.5	20.0 (185 GHz)	39.7

A minimum test distance of 0.125 m was used for detecting of spurious radiations. 0.5 m was adjusted to measure the wanted signal levels in field strength or EIRP.

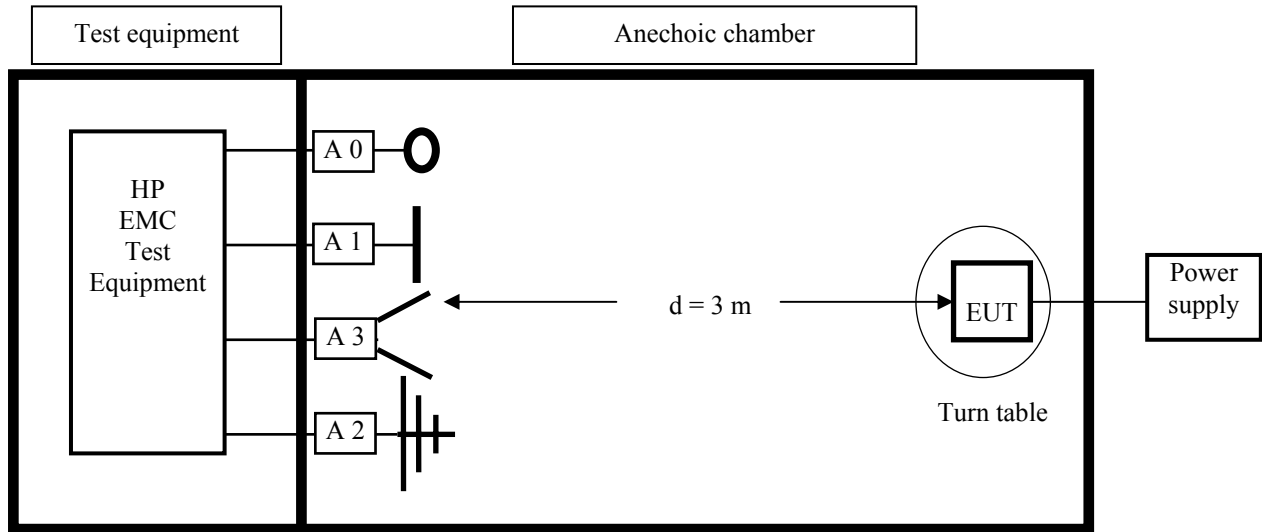
Calculation : Power density = $EIRP / (4\pi d^2) = EIRP / 1130973.4 \text{ cm}^2$ (for 3 m evaluation distance)

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Climatic box VUK 04/500	Heraeus Vötsch	32678	300000297	29.07.2008	24	27.07.2010
2	Spectrum Analyser 8565E	HP	3738A00773	300001665	08.01.2008	24	08.01.2010
3	Spectrum Analyser FSU 50	R&S	200012	300003443	05.06.2008	24	05.06.2010
4	Spectrum Analyzer 2782	Tektronix		300001665	28.08.2008	24	28.08.2010
5	Power Supply 6032A			300002115	15.05.2007		
6	SGH 12 ... 18 GHz	narda	01005	300000787	cyclic verification		
7	SGH 18 ... 27 GHz	narda	01005	300000487	cyclic verification		
8	SGH 27 ... 40 GHz	narda	82016	300000510	cyclic verification		
9	SGH 33 ... 50 GHz	Thomson		300000812	visual inspection		
10	Adapter WG/SMA	narda	64088	-/-	cyclic verification		
11	Adapter WG/SMA	flann	213	-/-	cyclic verification		
12	Adapter WG/SMA	HP	00231	-/-	cyclic verification		
13	SGH 50 ... 75GHz	Thomson	-/-	300000813	visual inspection		
14	Mixer 50 ... 75 GHz	HP	-/-	30000781m	07.08.2007	24	07.08.2009
15	SGH 75 ... 110 GHz	Thomson	-/-	30000798b	visual inspection		
16	Mixer 75 ... 110 GHz	HP	-/-	30000781c	07.08.2007	24	07.08.2009
17	SGH 110 ... 170 GHz	Flann	-/-	300001999	visual inspection		
18	Mixer 110 ... 170 GHz	Tektronix	B010186	300001685d	n.a.		
19	SGH 170 ... 325 GHz	Flann	-/-	300002000	visual inspection		
20	Mixer 170 ... 325 GHz	Tektronix	B010241	300001685j	n.a.		

Measurement uncertainties

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±2.0 dB (up to 50 GHz)
eirp	±3.0 dB (above 50 GHz)

Field strength of spurious radiation in the frequency ranges 9 kHz to 30 MHz and 1 to 12 GHz
 Set-up for radiated measurements (FAC “Chamber C”)



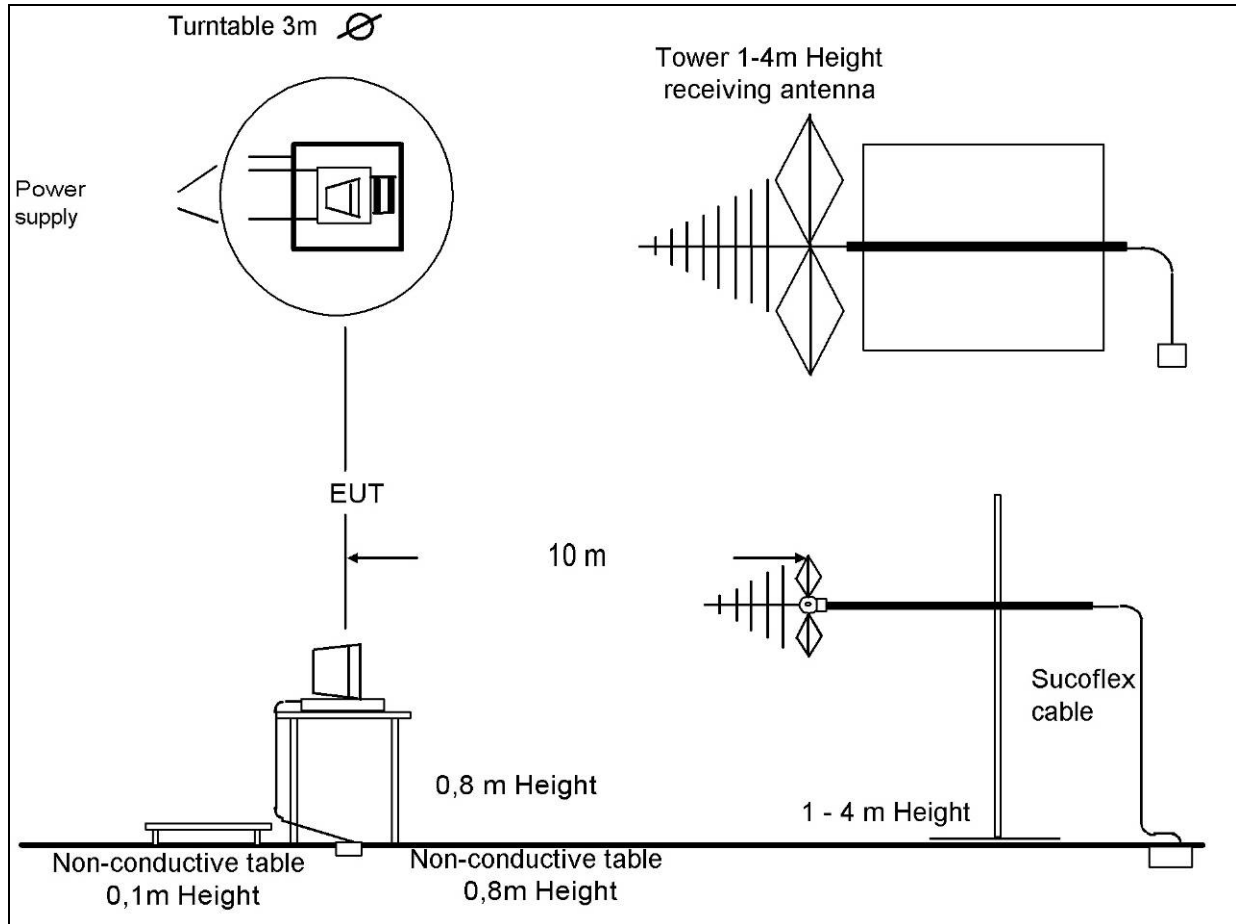
No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Anechoic chamber	MWB	87400/02	300000996	Monthly verification		
2	System-Rack 85900	HP I.V.	*	300000222	n.a.		
3	Measurement System 1						
4	Spektrum Analyzer 8566B	HP	3138A07614	300001207	13.12.2007	24	13.12.2009
5	Spektrum Analyzer Display 85662A	HP	3144A28627	300001208	13.12.2007	24	13.12.2009
6	Quasi-Peak-Adapter 85650A	HP	2811A01204	300002308	13.12.2007	24	13.12.2009
7	RF-Preselector 85685A	HP	2837A00778	300002448	13.12.2007	24	13.12.2009
8	PC Vectra VL	HP		300001688	n.a.		
9	Software EMI	HP		300000983	n.a.		
10	Measurement System 2						
11	FSP 30	R&S	100886	300003575	25.08.2008	24	25.08.2010
12	PC	F+W			n.a.		
13	TILE	TILE			n.a.		
14	Biconical antenna	EMCO	S/N: 860 942/003		Monthly verification (System cal.)		
15	Log. Period. Antenna 3146	EMCO	2130	300001603	Monthly verification (System cal.)		
16	Double Ridged Antenna HP 3115P	EMCO	3088	300001032	Monthly verification (System cal.)		
17	Active Loop Antenna 6502	EMCO	2210	300001015	Monthly verification (System cal.)		
18	Power Supply 6032A	HP	2818A03450	300001040	12.05.2007	36	12.05.2010
19	Busisolator	Kontron		300001056	n.a.		
20	Leitungsteiler 11850C	HP		300000997	Monthly verification (System cal.)		
21	Power attenuator 8325	Byrd	1530	300001595	Monthly verification (System cal.)		
22	Band reject filter WRCG1855/1910	Wainwright	7	300003350	Monthly verification (System cal.)		
23	Band reject filter WRCG2000/2483	Wainwright	11	300003351	Monthly verification (System cal.)		

Measurement uncertainties

Test Parameter	Measurement uncertainty
Input power (DC)	±0.1 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
RF-power	±2.0 dB

Field strength of spurious radiation in the frequency ranges 30 to 1000 MHz

Set-up for radiated measurements at test distances 3m and 10m (SAC "Chamber F")



No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Control Computer	F+W	FW0502032	300003303	-/-	-/-	-/-
2	Trilog Antenna VULB 9163	Schwarzbeck	9163-295	300003787	30.04.2008	24	30.04.2010
3	Amplifier - 0518C-138	Veritech Microwave Inc.	-/-	-/-	-/-	-/-	-/-
4	Switch - 3488A	HP		300000368	-/-	-/-	-/-
5	EMI Test receiver - ESCI	R&S	100083	300003312	09.01.2009	24	31.01.2011
6	Turntable Controller - 1061 3M	EMCO	1218	300000661	-/-	-/-	-/-
7	Tower Controller 1051 Controller	EMCO	1262	300000625	-/-	-/-	-/-
8	Tower - 1051	EMCO	1262	300000625	-/-	-/-	-/-
10	Ultra Notch-Filter Rejected band Ch. 62	WRCD	9	-/-	-/-	-/-	-/-

Measurement uncertainties:

The uncertainty of the measurement equipment fulfils CISPR 16 and the related European and international standards. The semi anechoic chamber fulfils the requirements of CISPR 16-1 (ANSI C63.4) for a test volume of 1.5m Ø.

Remarks on methods of measurements

1. General

The device under test is positioned on a non-conductive fixture and can be rotated and tilted relative to the measurement antenna.

The measurements of radiated emissions in the frequency range from 30 MHz to 1 GHz are performed in vertical and horizontal plane in a semi-anechoic chamber, compliant to CISPR 16-1 for test distances of 3m and 10m. The EUT is positioned on a non-conductive support at a height of 0.80 m above the conductive ground plane covering the whole chamber. The measuring antennas can be moved over a height range from 1.0 m to 4.0 m in order to detect the maximum field strength emitted from the EUT. These antennas are compliant with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5.

Radiated emissions measurements in the frequency ranges from 9 kHz to 30 MHz and 1 GHz to 18 GHz are carried out in a fully-anechoic chamber, compliant to CISPR 16-1, providing test distances up to 5 m. EUT and receiving antennas are positioned 1.5 m above the tips of the absorbers.

Measurements between 18 GHz and 200 GHz are performed in certain test laboratory environments, where analyzers up to 50 GHz, without using external mixers, and harmonic mixer modules and standard gain horns are available up to 320 GHz.

The measurement distances between EUT and receiving antennas are indicated in the test set-ups for the various frequency ranges. For each measurement, the antenna was moved by hand in a defined distance around the EUT until the maximum field strength is received for both polarizations planes.

The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths (RBW) over various frequency ranges are set according to requirement ANSI C63-4-2003 clause 4.2.

Test equipment and ancillaries used for tests

Calibrations occur according to the EN/ISO/IEC 17025 standard. Calibrations are performed by an external accredited calibration laboratory. Additional to these calibrations, the laboratory performs comparison measurements with other calibrated systems and regular chamber inspections. All used devices are connected to an external 10 MHz reference.

2. Measurements of the EIRP and power density (PD) at fundamental frequency

The measurements are conducted according to FCC rules and, if appropriate to the guideline "Millimeter Wave Test Procedure" with a spectrum analyser (SA), harmonic mixer covering appropriate frequency range and a rectangular standard gain horn antenna (SGH) with matching wave guide dimensions. The conversion loss of the external mixer is taken into account in the SA power level reading automatically.

The radiated power measurements are performed with resolution bandwidth filter (RBW) of 1.0 MHz and a video filter of 1 MHz. Tests are repeated with different RBW, e.g. 2.0 MHz and Video bandwidth filter (VBW) 3.0 MHz in order to evaluate whether a calculated bandwidth correction may be performed.

The evaluation distance for fundamental power measurement is 3.0 m. If the far field condition is met, a smaller test distance (e.g. 1 m) is used and compliance with the 3 m requirement is proved by corresponding calculation. The SA level scale is set to the dimension dBm. With the appropriate antenna aperture area the power density can be calculated from the equation:

$$\begin{matrix} \text{Power Density} & = & \text{EIRP} & / & \text{Antenna aperture area} & [\text{mW}/\text{cm}^2] \\ \text{pd} & = & \text{eirp} & - & \text{a} & [\text{dB}(\text{mW}/\text{cm}^2)] \end{matrix}$$

Field strength measurements in 3m distance are performed in the case of too large far field distances ($R=2*L^2/\lambda$, R = far field distance in meters, L = largest dimension of either measuring horn or transmitting EUT antenna).

3. Measurements of frequency stability

The frequency stability of the EUT under normal and extreme test conditions is normally measured in (unmodulated) CW-mode (if available).

For extreme test conditions the EUT is placed in a climatic chamber where the front door is made of stable polystyrene. The EUT can radiate through the front door without any additional path losses. The climatic chamber together with the EUT is cooled down to -20 °C for at least 1 hour. Then frequency stability measurement is carried out with power supply set to nominal value.

The climatic chamber together with the EUT is warmed up in 10° steps and in a rate of +1°C/minute. After reaching the next temperature step the temperature is kept for a certain time to be stabilized also within the EUT. The frequency stability measurement is done. These temperature steps are repeated until +50 °C is reached.

Frequency measurements are performed under extreme temperature / normal power supply voltage and under normal temperature / extreme power supply voltages.

4. Measurements of field strength and power density at spurious frequencies

Spurious frequencies are produced by transmitter and receiver when the EUT is active.

According to FCC requirements 15.209 and 15.255, spurious emissions have to be investigated as maximum field strength values in the frequency range from 9 kHz to 40 GHz, and as maximum power density in the frequency range above 40 GHz up to 200 GHz. Where possible, the measurement distance shall be 3 m.

In the low frequency range (9 kHz to 30 MHz), the receiving antenna is an active loop antenna which is positioned at 3 m distance in a shielded, anechoic chamber. In case of required measuring distances greater than 3 m, a distance correction factor is used to calculate the received field strength.

Spurious field strength measurements in the frequency range 1 to 12 GHz are carried out in shielded semi-anechoic test chambers. The measurement distance is 3 m.

In the frequency range 12 to 200 GHz, spurious field strength measurements are performed in a certain test laboratory environments with rectangular SGHs.

In the frequency range 40 to 200 GHz, spurious frequencies are measured as power densities. The EUT is operating with its specified modulation. The RBW and VBW are set to such a value that spurious power levels are clearly readable above the noise level of spectrum analyzer. The measurement distance chosen depends on the frequency range, EUT antenna size, test antenna size and test system noise floor for proper detecting spurious emission signals.

5. Measurements of maximum safe level for radiated power density

According to FCC § 1.1307, § 1.1310, § 2.1091 and § 2.1093 measurements are carried out in order to evaluate the impact of human exposure to RF radiation. For this test the EUT is in normal operation mode.

If there is a safety distance given in the manufacturer's document this distance is used for the calculation. The limit of maximum permissible exposure (MPE) for uncontrolled environment is: 1.0 mW/cm². See FCC § 1.1310.

5.2 Referenced Documents

none

5.3 Additional comments

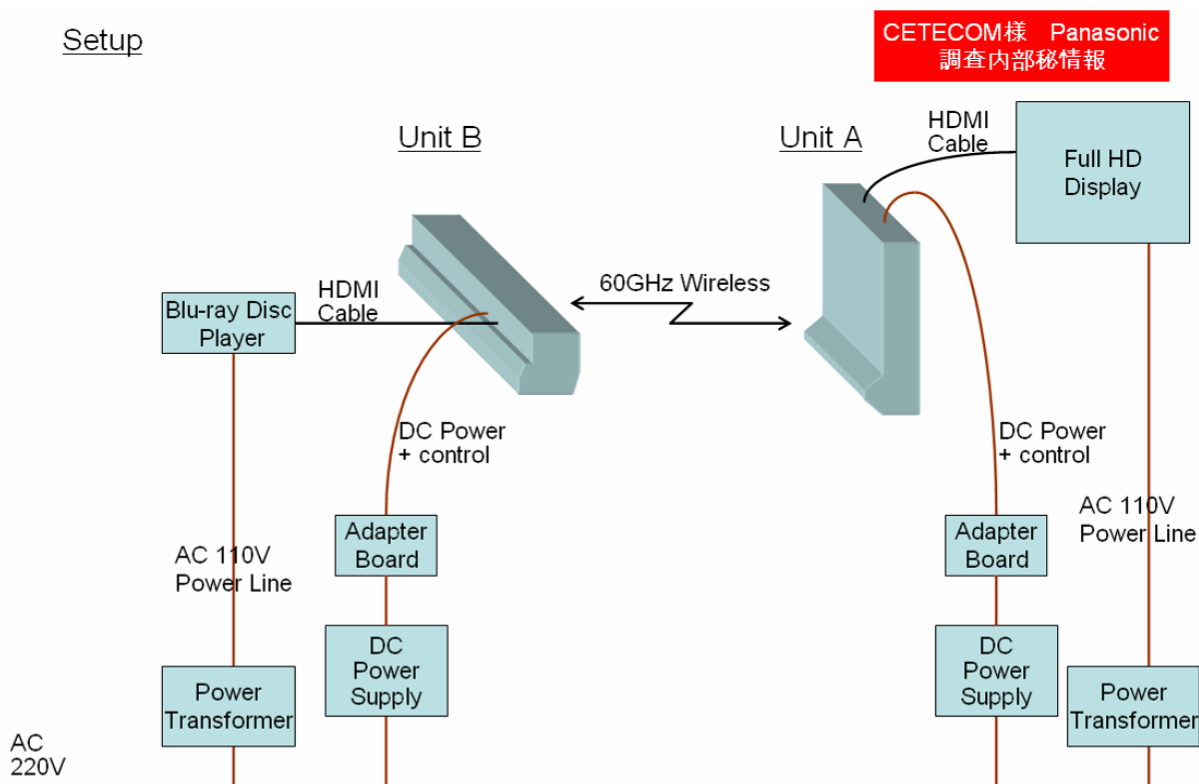
FCC Inquiry (Tracking Number 813083)

Dear FCC Experts, We have a device which falls under Part 15.255 Operation within the band 57-64 GHz. The device is a HDMI transmitter: One part is connected to the HDMI interface of a BlueRay/DVD-Player, the counterpart is connected to the HDMI interface of a TV. Transmission is done on 60.48 GHz (center frequency). The device's antenna is a patch antenna array with a beam steering function. The antenna can change the main beam direction e.g. if someone is standing in the line-of-sight between the two units to minimize disturbance of the transmission.

Test proposal: Based on the Millimeter Wave Test Procedure I would propose to setup both devices line-of-sight in a certain distance to make sure to have proper operation. Spectrum analyzer is placed apart from this line-of-sight. During the measurements the mixer is moved carefully by hand in a fixed distance to the transmitting device on a grid like on a chess board within the line-of-sight and completely around the unit. That means nothing except the mixer itself and my hand is within this line-of-sight to minimize disturbance between the two 60 GHz devices. Doing so, I think it should be possible to measure the maximum field strength / EIRP of the carrier and spurious levels even with activated beam steering functionality. Do you agree to this procedure? Best regards Karsten Gerald

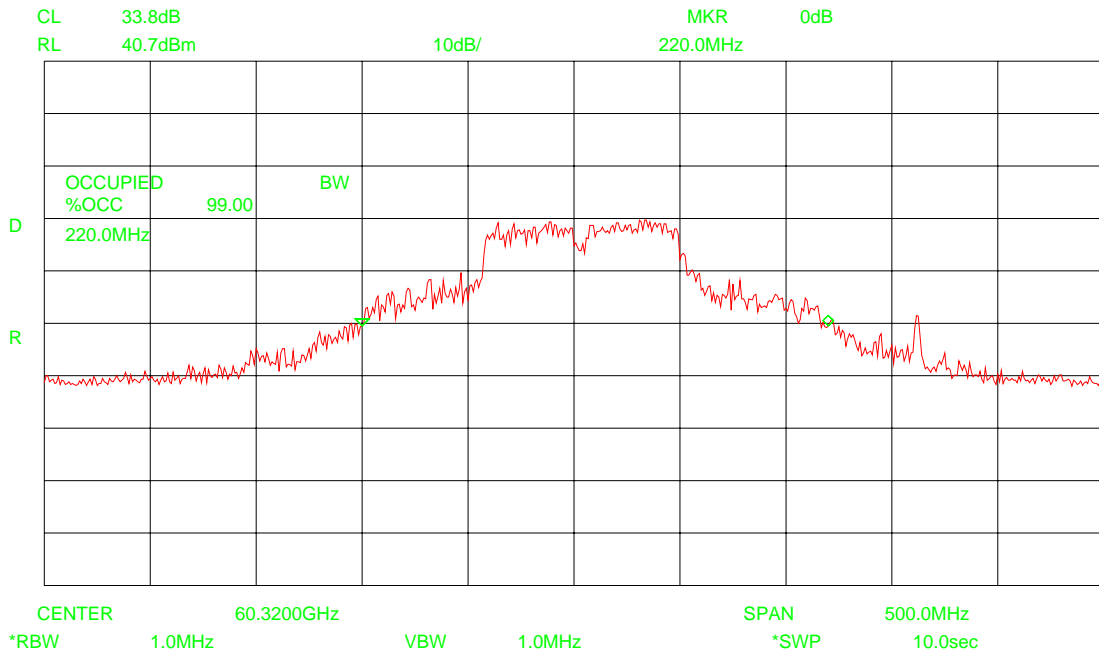
Response:

We agree with the proposed test procedure.

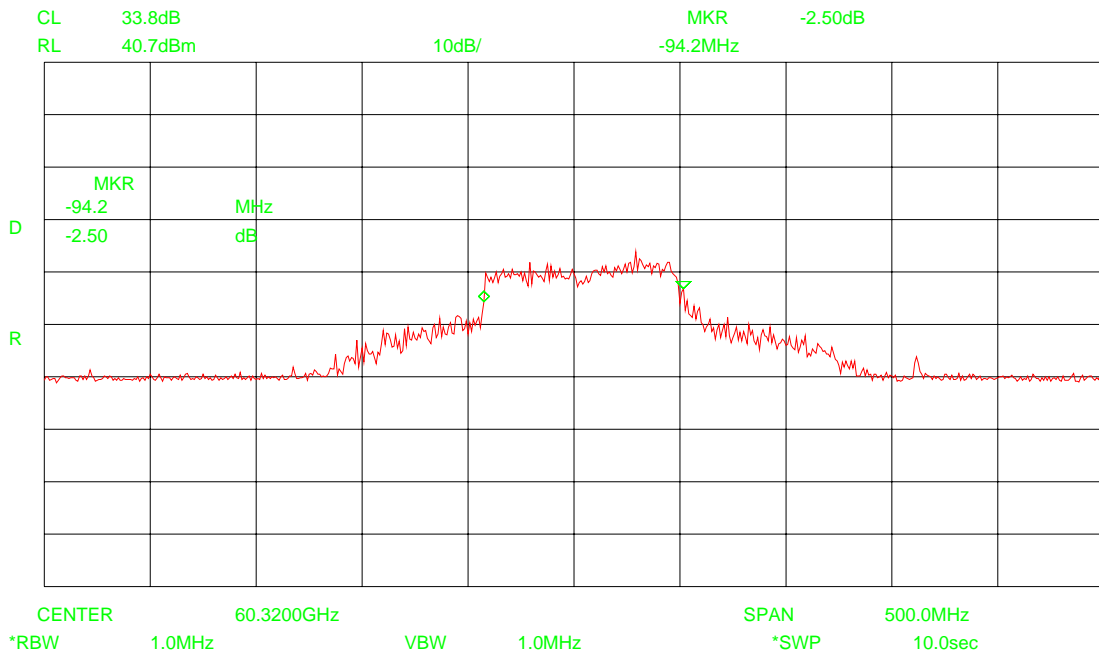


5.4 Occupied Bandwidth (99%) and 6 dB Bandwidth §2.1049 / RSS-GEN 4.6

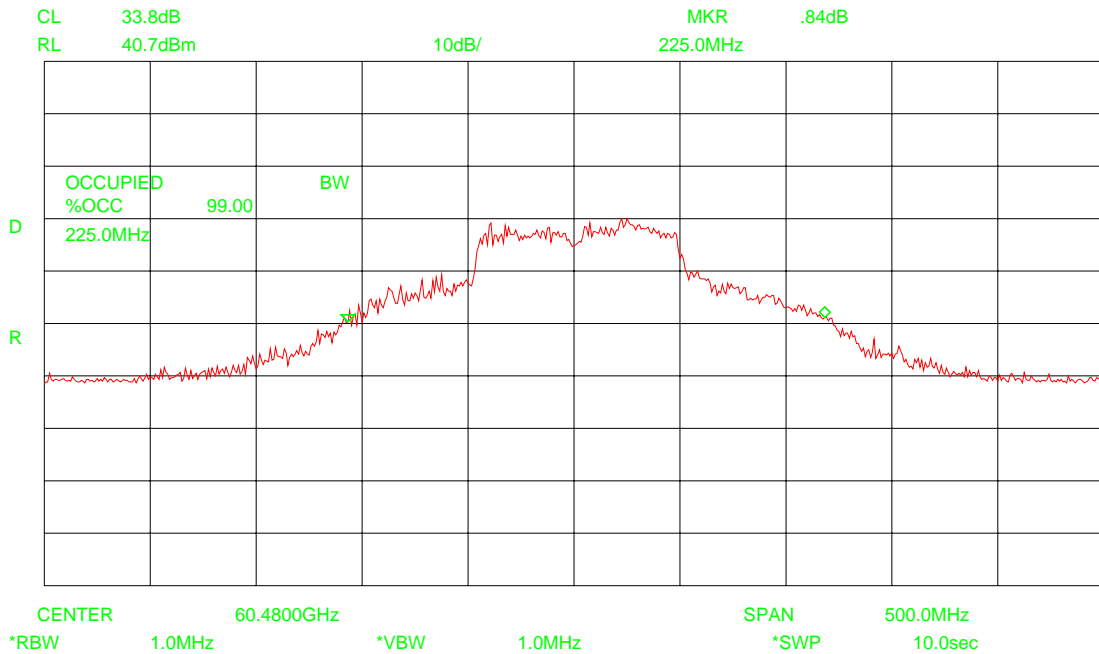
Plot 1: Occupied bandwidth (99%) (Channel 1, 60.32 GHz):



Plot 2: 6 dB bandwidth (Channel 1, 60.32 GHz):



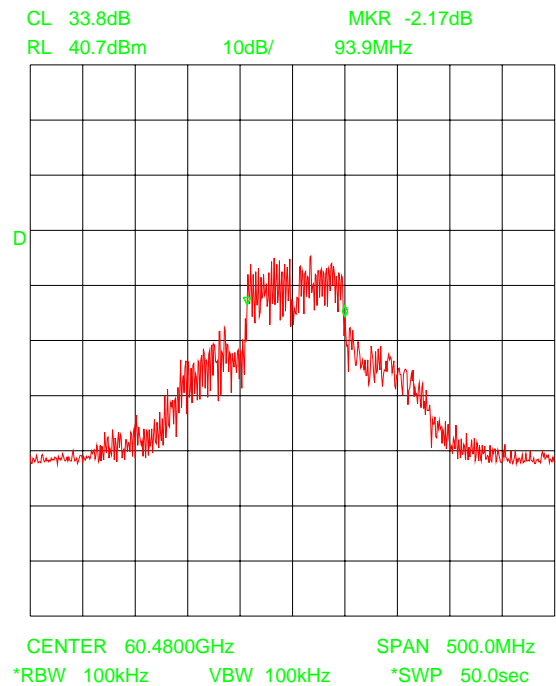
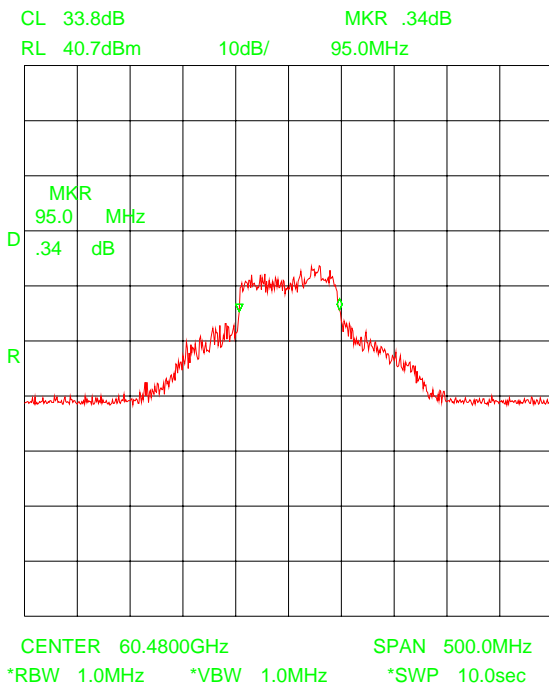
Plot 3: Occupied bandwidth (99%) (Channel 2, 60.48 GHz):



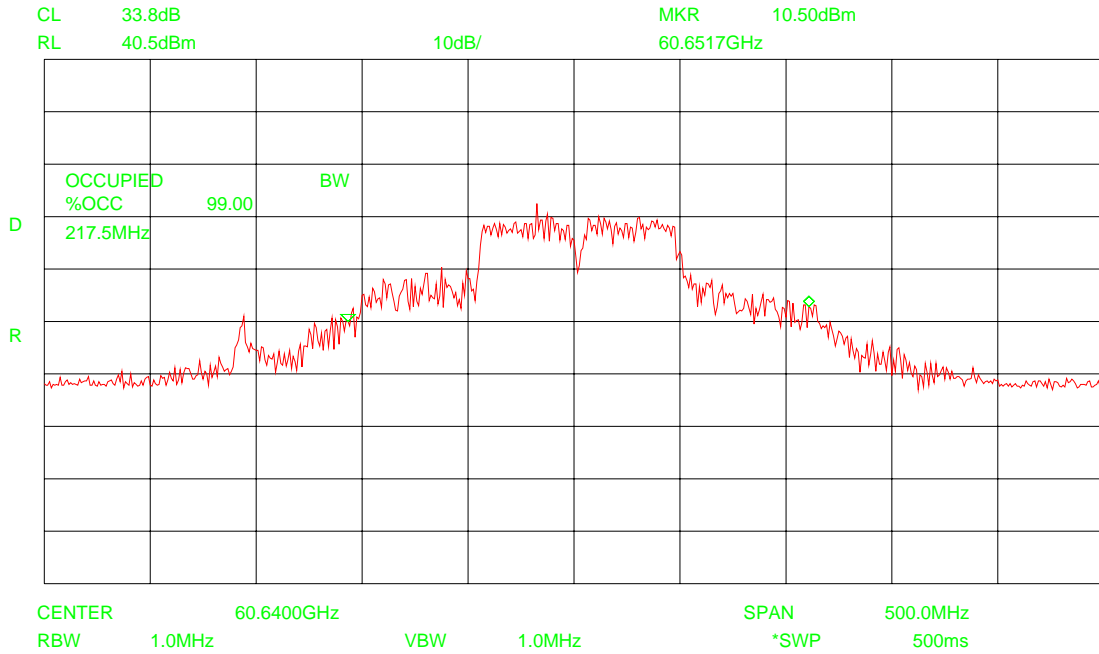
Plot 4 a and b: 6 dB bandwidth (Channel 2, 60.48 GHz):

Plot with 1 MHz resolution bandwidth

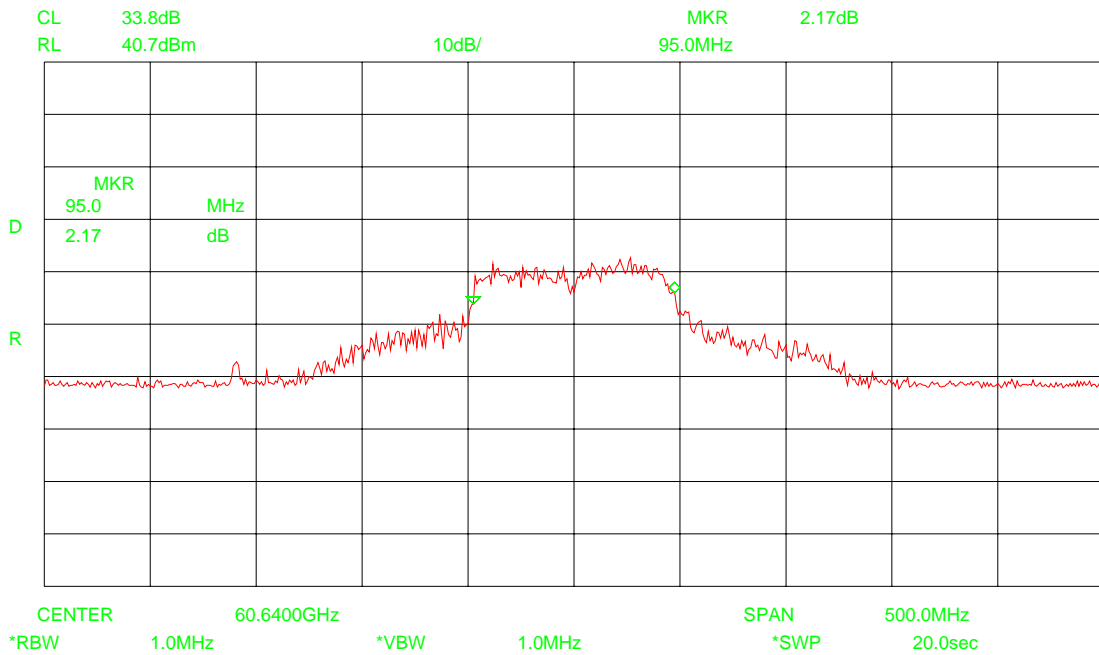
Plot with 100 kHz resolution bandwidth



Plot 5: Occupied bandwidth (99%) (Channel 3, 60.64 GHz):



Plot 6: 6 dB bandwidth (Channel 3, 60.64 GHz):



Remark:

The plots show two sets of tests:

- Occupied bandwidth (99%) according to FCC CFR 47 Part 2.1049 and RSS-GEN 4.6.1
- 6 dB bandwidth according to FCC CFR 47 Part 15.255(e)(1) and RSS-GEN 4.6.2

Results:

TEST CONDITIONS		Occupied Bandwidth / 6 dB Bandwidth [MHz]		
		60.32	60.48	60.64
Frequency [GHz]				
T _{nom} 23 °C	V _{nom} 110 Vac	220.0 / 94.2	225.0 / 95.0	217.5 / 95.0

Description according to FCC §2.1049:

Under normal test conditions only	The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.
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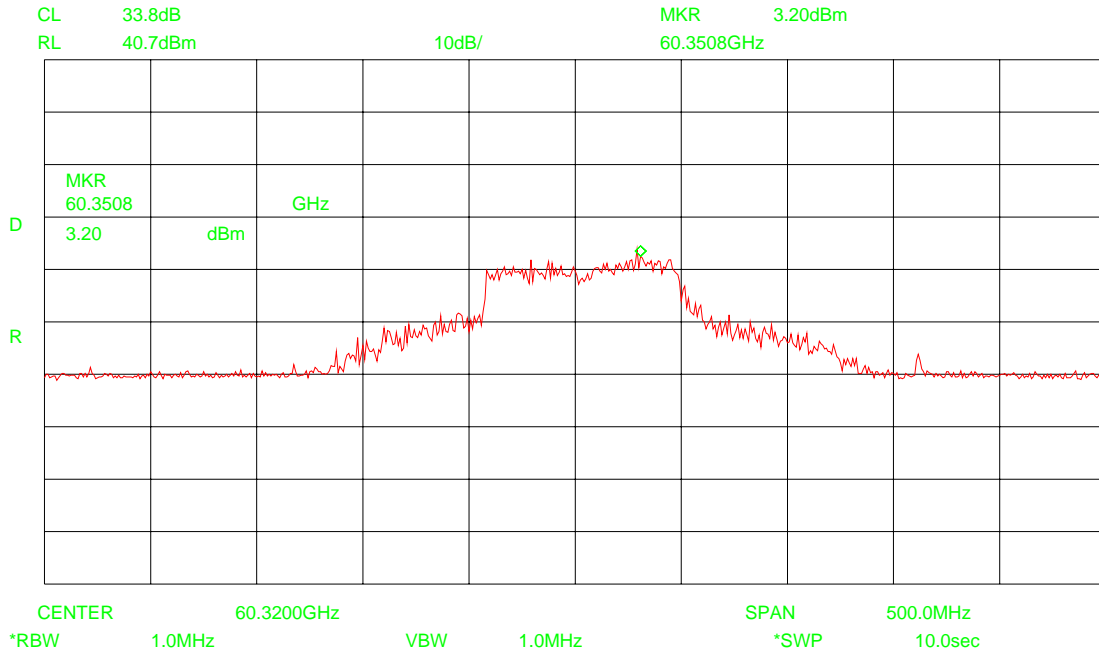
Description according to RSS-GEN 4.6.2:

Under normal test conditions only	Where indicated, the 6 dB bandwidth is measured at the points when the spectral density of the signal is 6 dB down from the in-band spectral density of the modulated signal, with the transmitter modulated by a representative signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.
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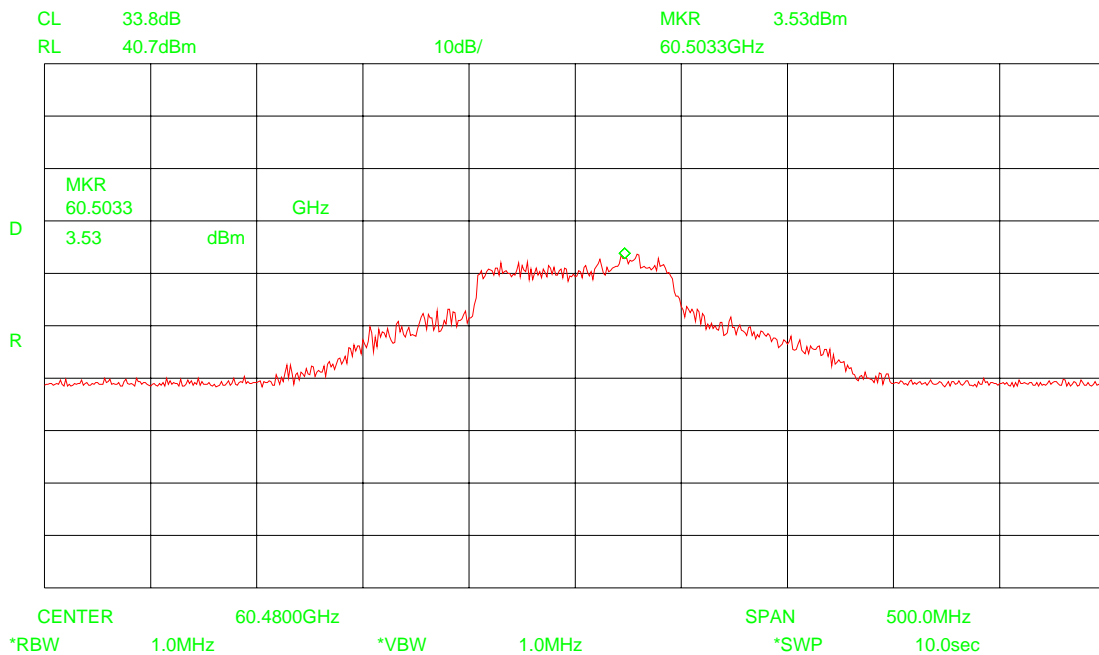
Test Result: pass

5.5 Power Density §15.255(b)(1) / RSS-210 A13.2.2

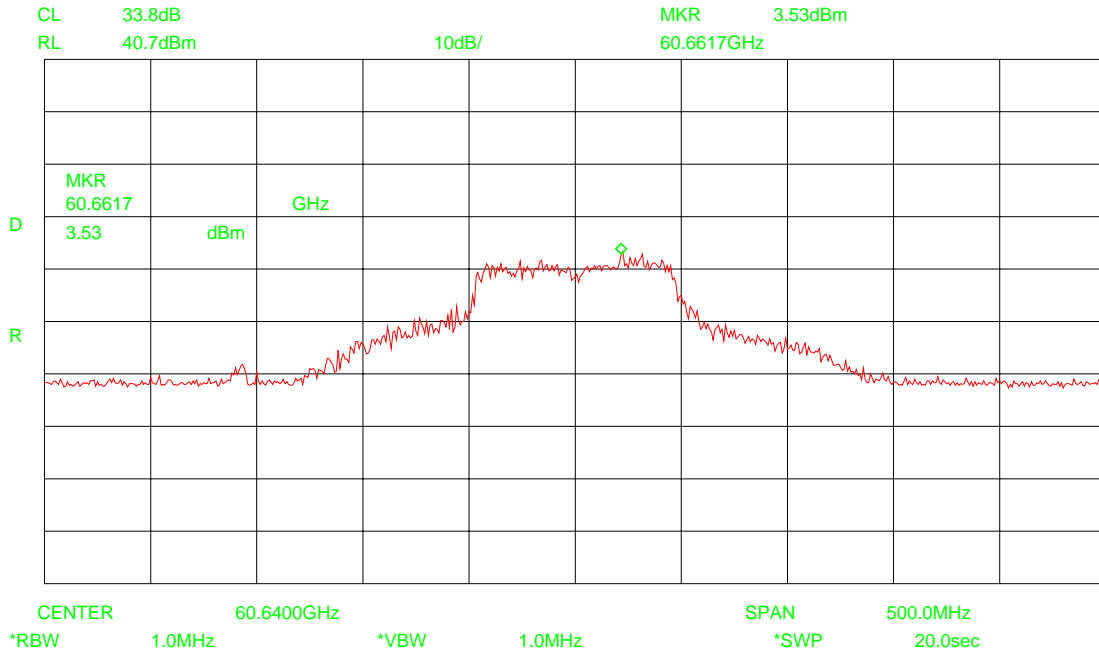
Plot 7: (Channel 1, 60.32 GHz)



Plot 8: (Channel 2, 60.48 GHz)



Plot 9: (Channel 3, 60.64 GHz)



The mark “R” in the plots indicates a reference level offset. This offset is calculated as follows:

$$\begin{aligned} \text{System attenuation} &= \text{free field attenuation} - \text{antenna gain} \\ &= 62.1 \text{ dB} - 25.2 \text{ dBi} = 36.9 \text{ dB} \end{aligned}$$

Farfield conditions: $r = 2 * d^2 / \lambda = 2 * d^2 * f / c = 2 * (0.023\text{m})^2 * 60.48 \text{ GHz} / 3\text{E}8$
 $r = 0.21 \text{ m}$

Measurements were done on $r = 0.5 \text{ m} \Rightarrow$ farfield conditions are met.

Results:

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER / MAXIMUM PEAK POWER DENSITY		
			60.32	60.48	60.64
Frequency (GHz)					
$T_{\text{nom}} 23 \text{ }^\circ\text{C}$	$V_{\text{nom}} 110 \text{ Vac}$	Peak	3.2 dBm / 1.85 nW/cm ²	3.5 dBm / 1.98 nW/cm ²	3.5 dBm / 1.98 nW/cm ²
Measurement uncertainty			±3dB		

If peak measured results meet the average limit, then the average calculation is not required.

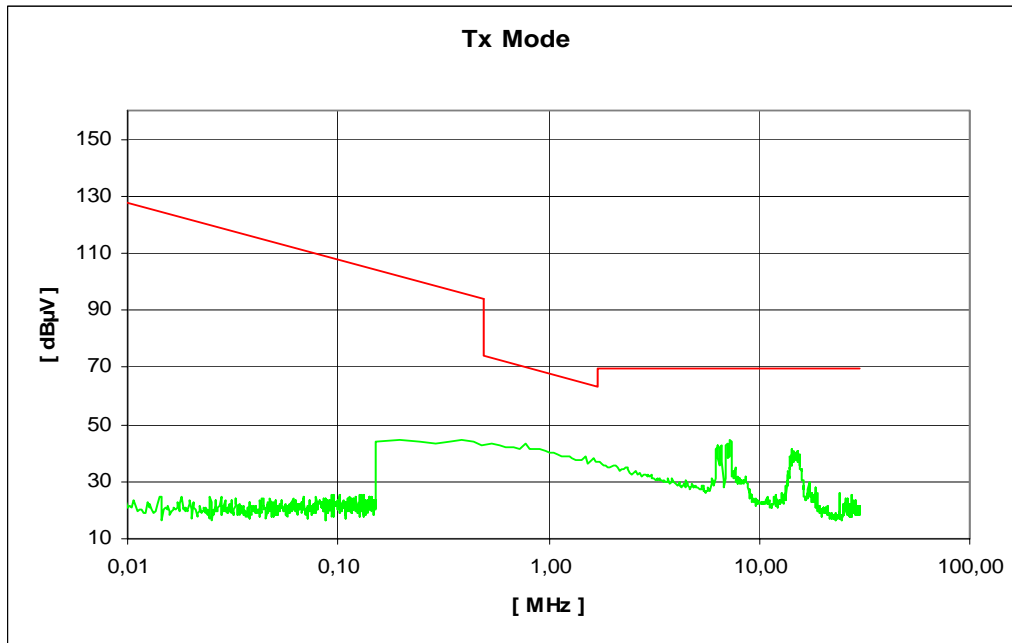
Limits according to §15.255(b)(1):

Under normal test conditions only	For products other than fixed field disturbance sensors, the average power density of any emission, measured during the transmit interval, shall not exceed 9 μW/cm ² , as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed 18 μW/cm ² , as measured 3 meters from the radiating structure. [9 μW/cm ² is equivalent to an EIRP of 10.2 W; 18 μW/cm ² is equivalent to an EIRP of 20.4 W.]
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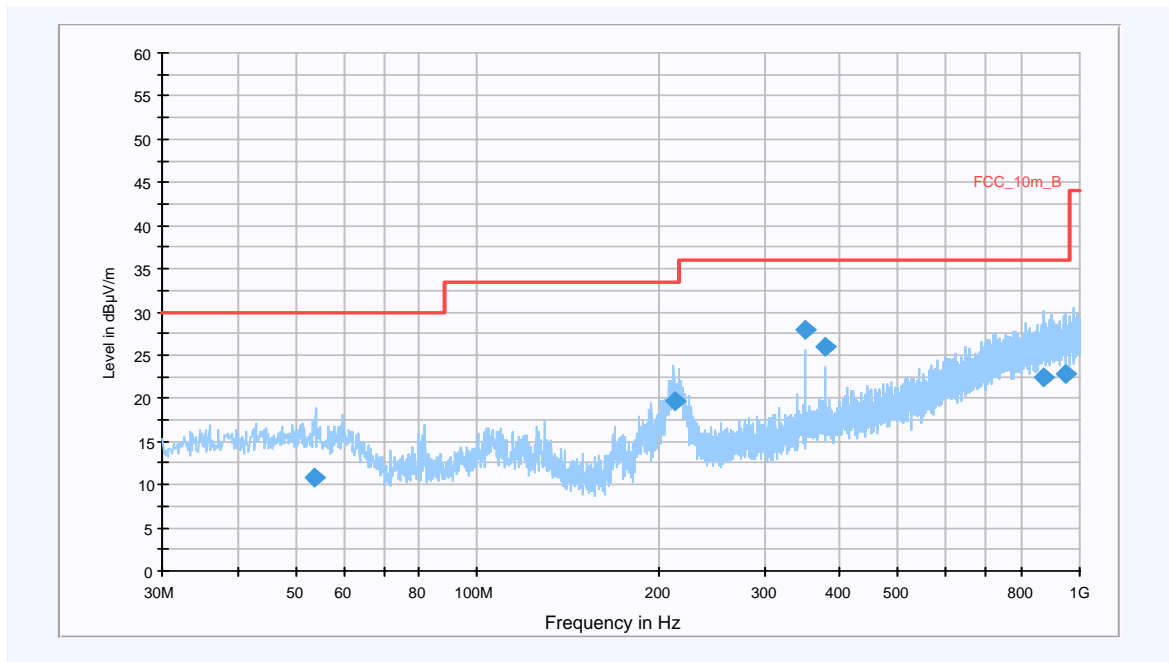
Test Result: pass

5.6 Radiated Spurious Emissions §15.255 (c) / RSS-210 A13.2.2

Plot 10: 9 kHz - 30 MHz (valid for all 3 channels)

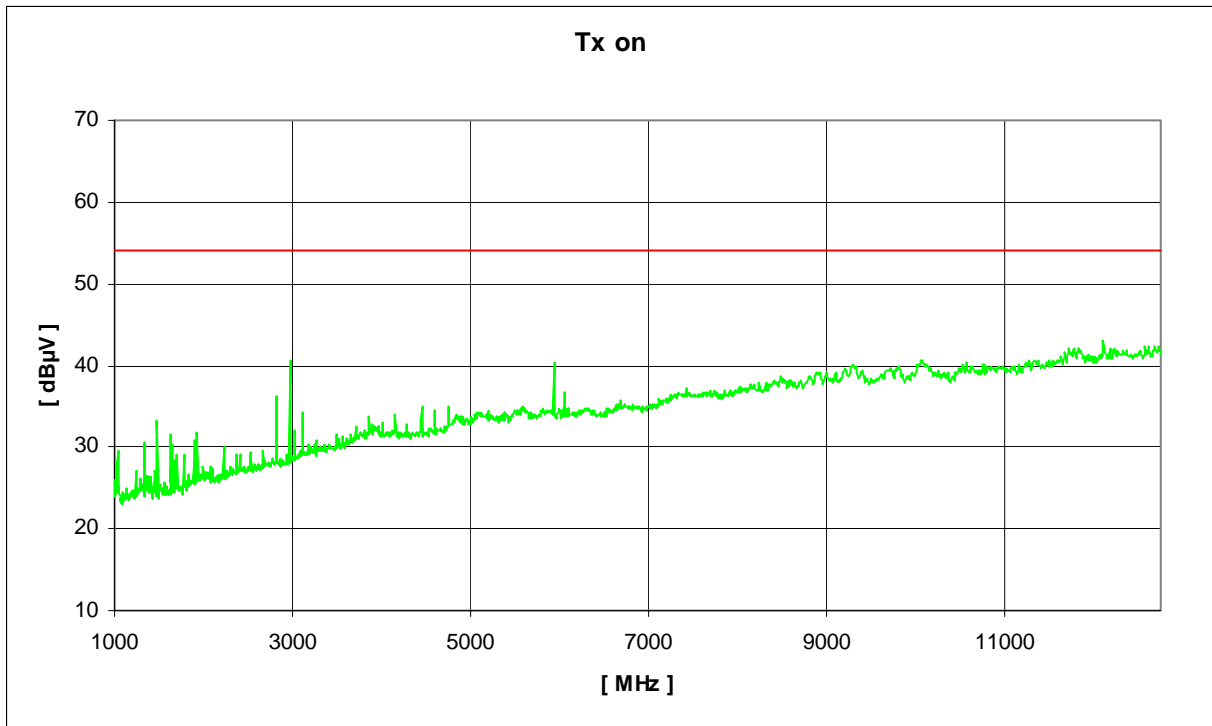


Plot 11: 30 MHz - 1 GHz (valid for all 3 channels)

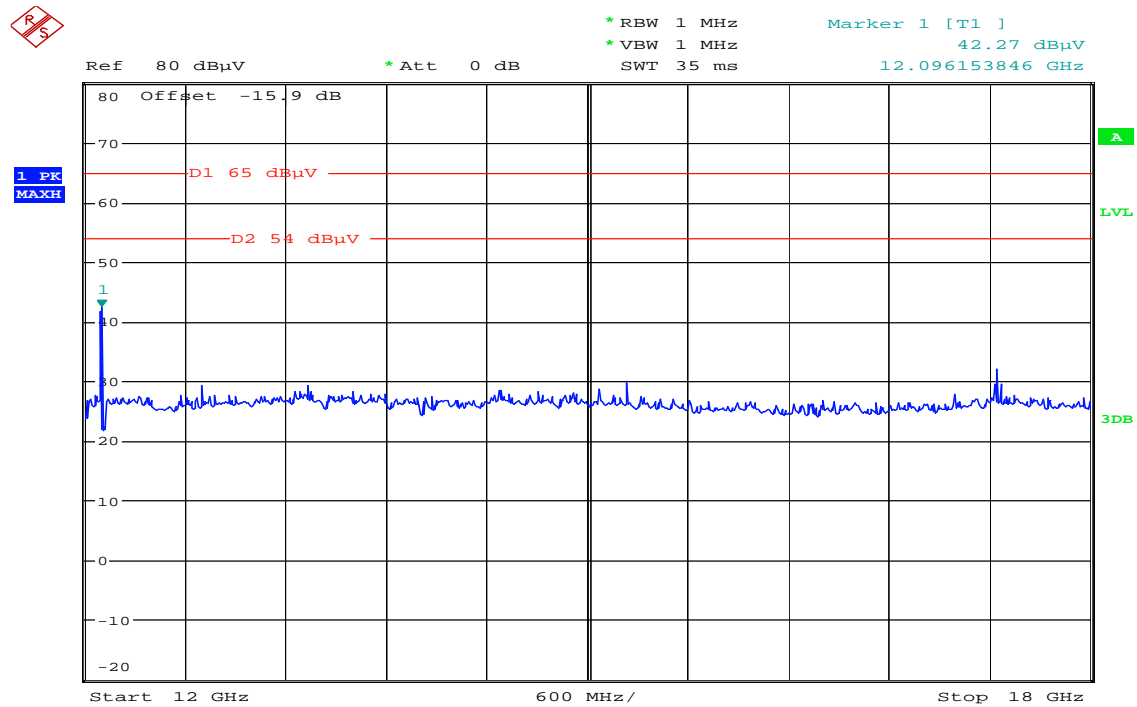


Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
53.834250	10.9	15000.000	120.000	220.0	V	8.0	13.2	19.1	30.0
212.239750	19.8	15000.000	120.000	120.0	V	51.0	12.4	13.7	33.5
350.994800	27.9	15000.000	120.000	220.0	H	261.0	16.4	8.1	36.0
378.001300	26.0	15000.000	120.000	220.0	H	86.0	16.9	10.0	36.0
871.174050	22.5	15000.000	120.000	220.0	V	143.0	25.3	13.5	36.0
947.362400	22.8	15000.000	120.000	220.0	H	77.0	25.8	13.2	36.0

Plot 12: 1 - 12.75 GHz (valid for all 3 channels)

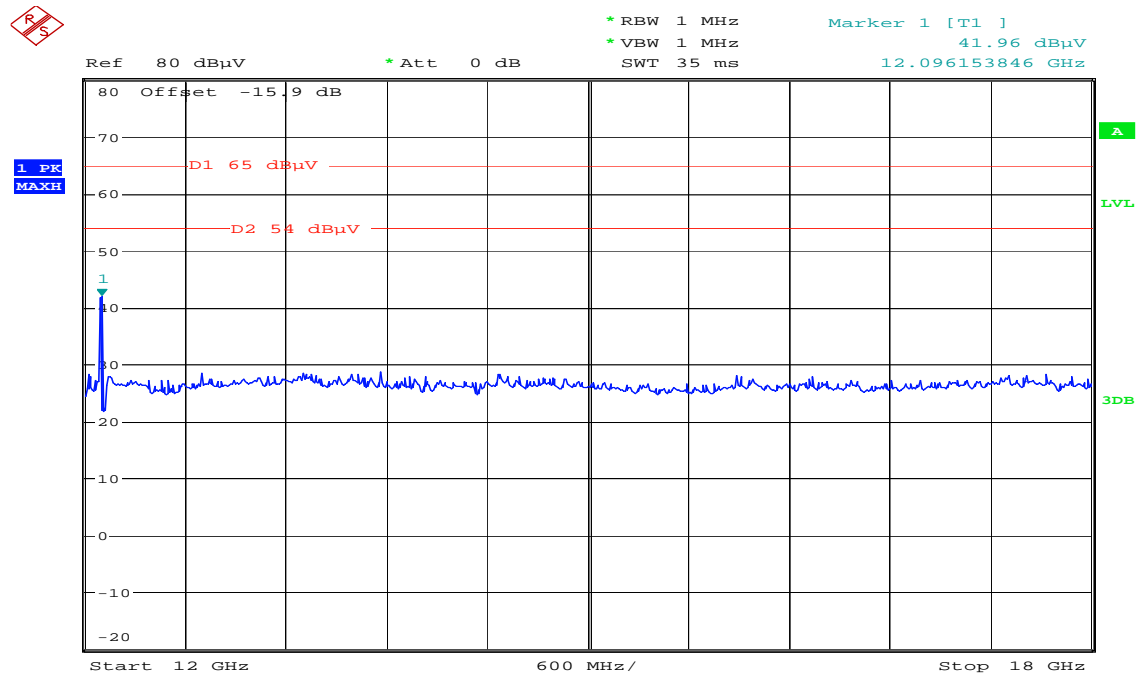


Plot 13: 12 - 18 GHz (channel 1)



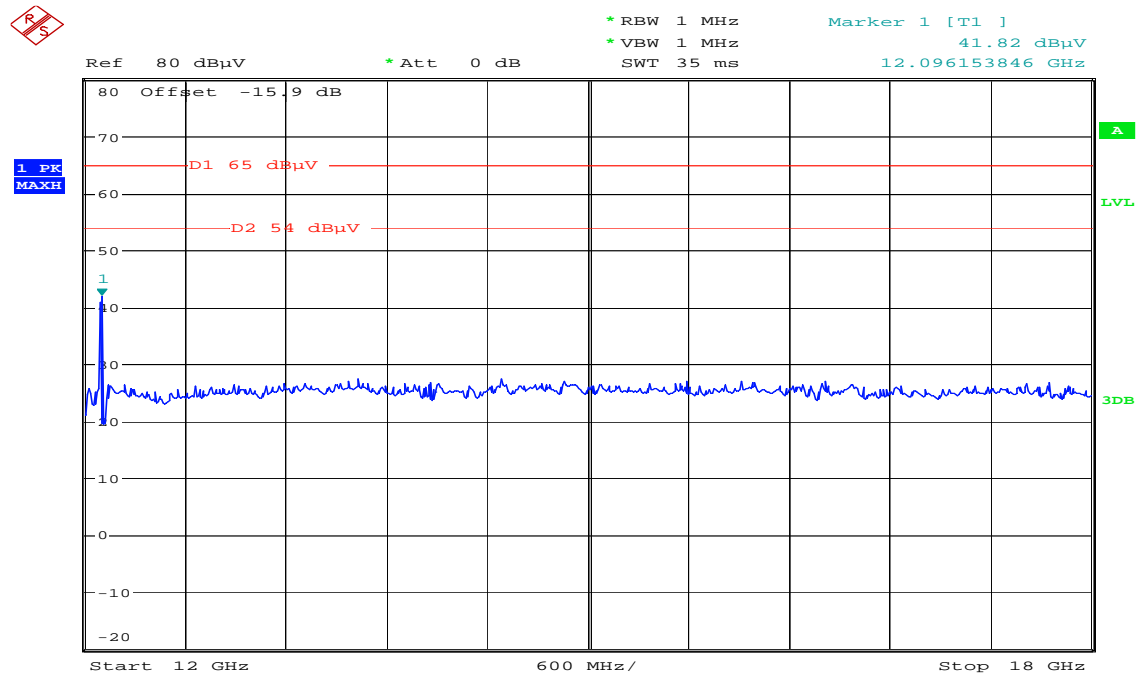
Date: 13.FEB.2009 15:11:43

Plot 14: 12 - 18 GHz (channel 2)



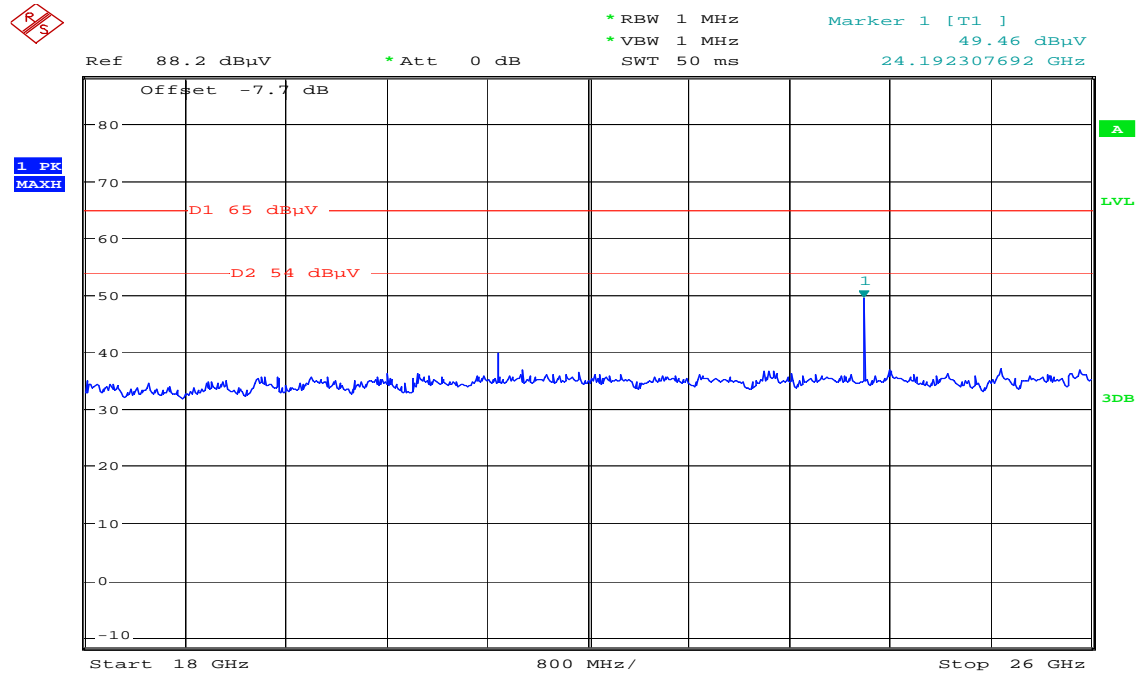
Date: 16.FEB.2009 12:22:38

Plot 15: 12 - 18 GHz (channel 3)



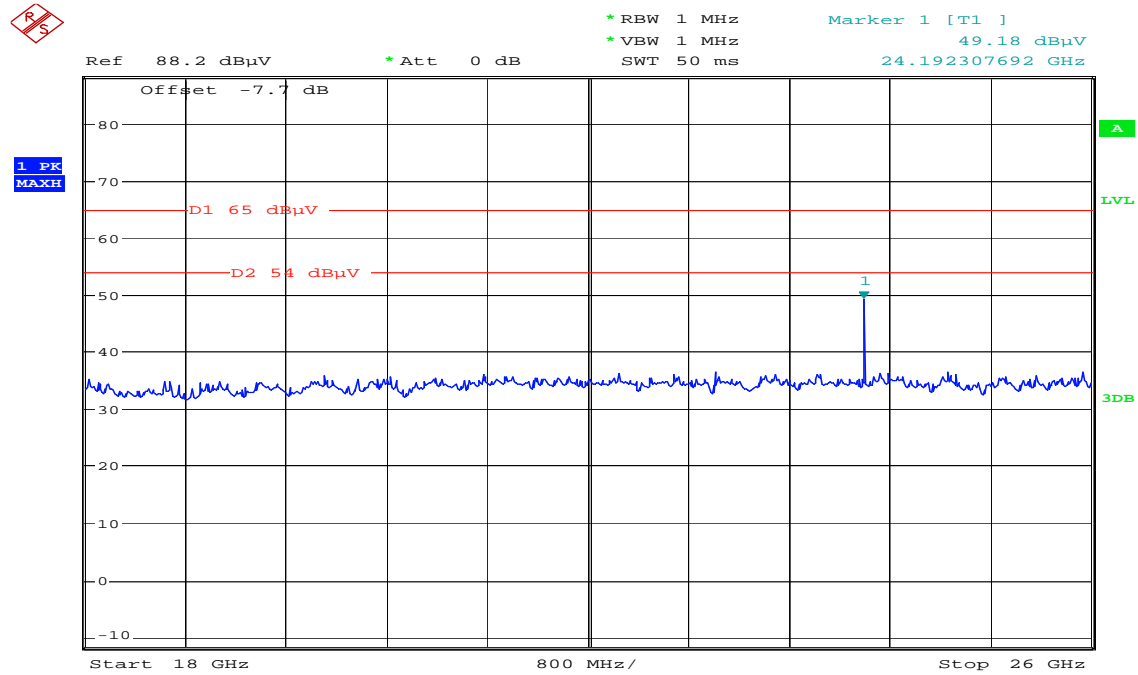
Date: 12.FEB.2009 17:03:33

Plot 16: 18 - 26 GHz (channel 1)



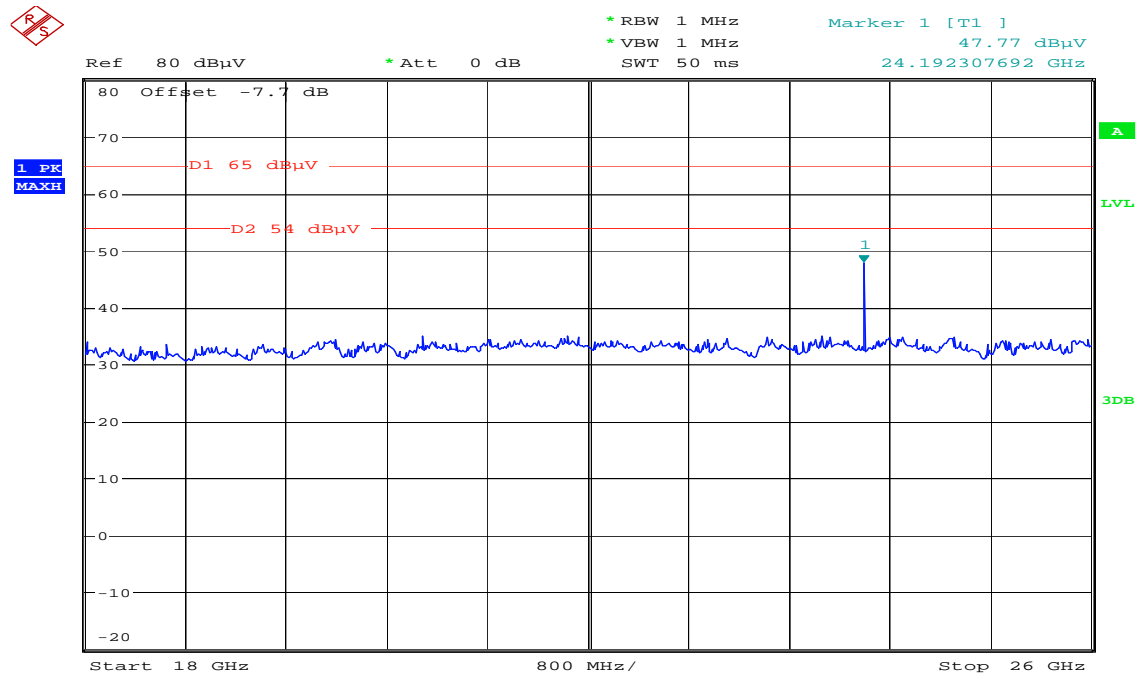
Date: 13.FEB.2009 15:15:30

Plot 17: 18 - 26 GHz (channel 2)



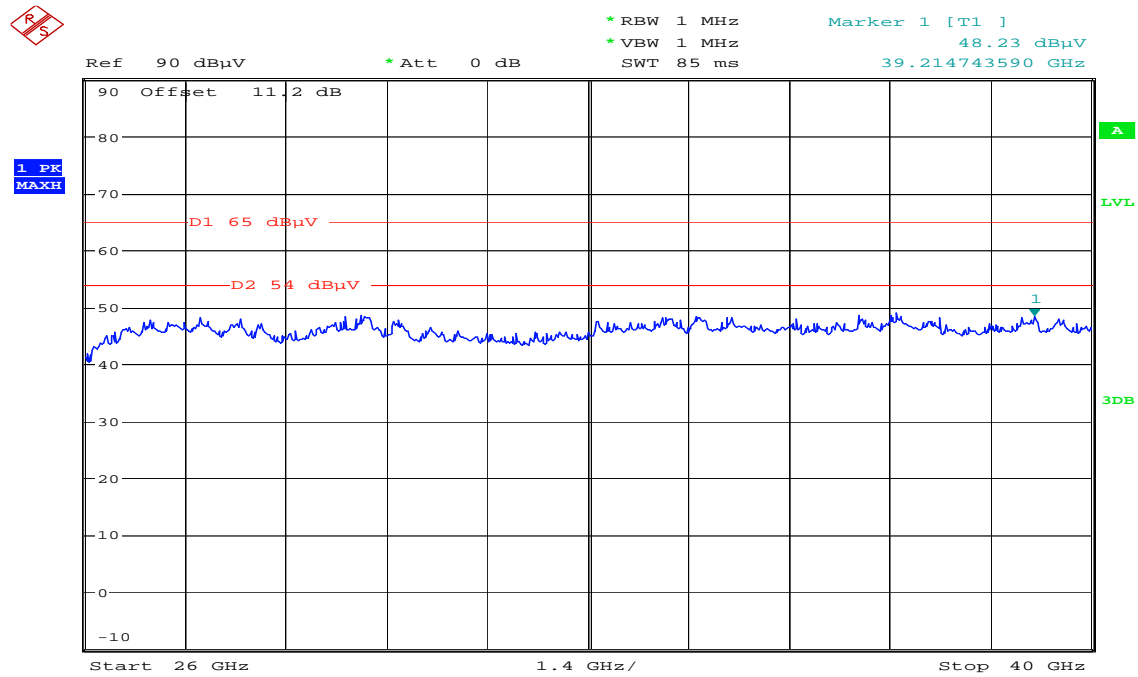
Date: 16.FEB.2009 17:51:59

Plot 18: 18 - 26 GHz (channel 3)



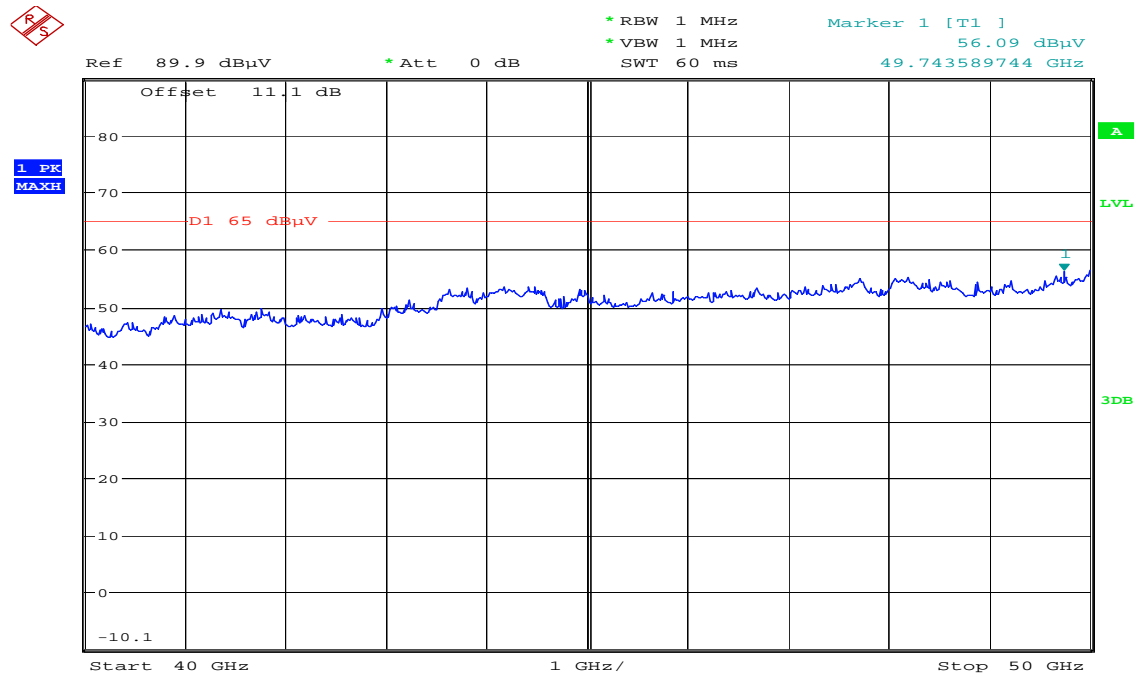
Date: 12.FEB.2009 17:06:19

Plot 19: 26 - 40 GHz (channel 1)



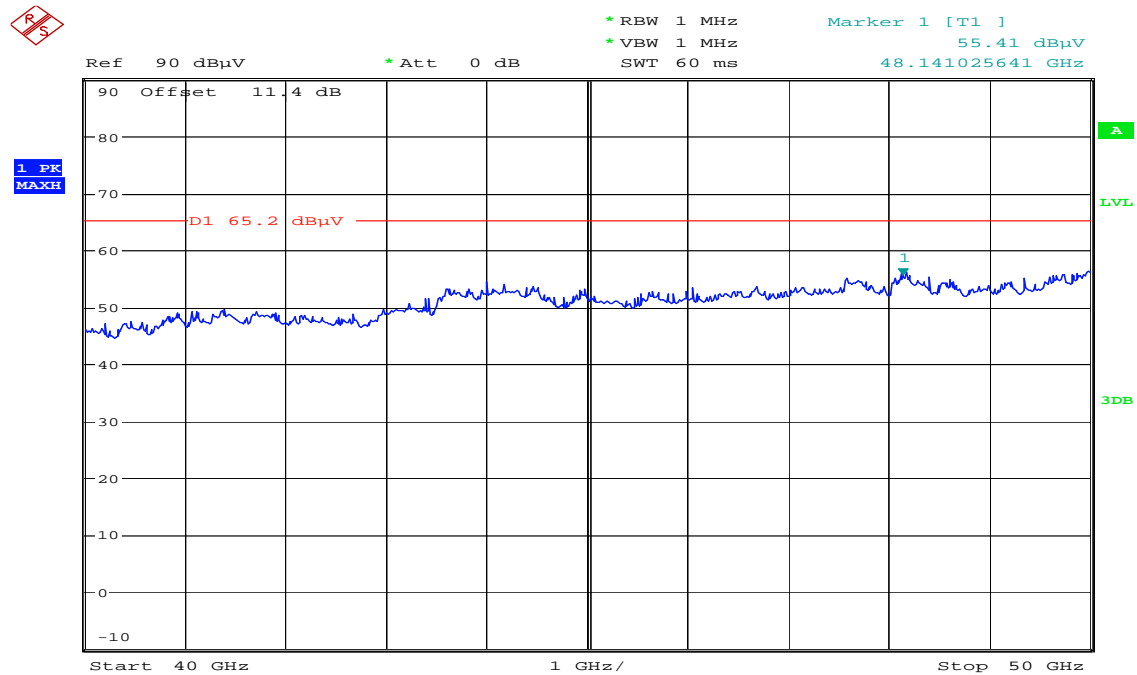
Date: 13.FEB.2009 15:40:36

Plot 22: 40 - 50 GHz (channel 1)



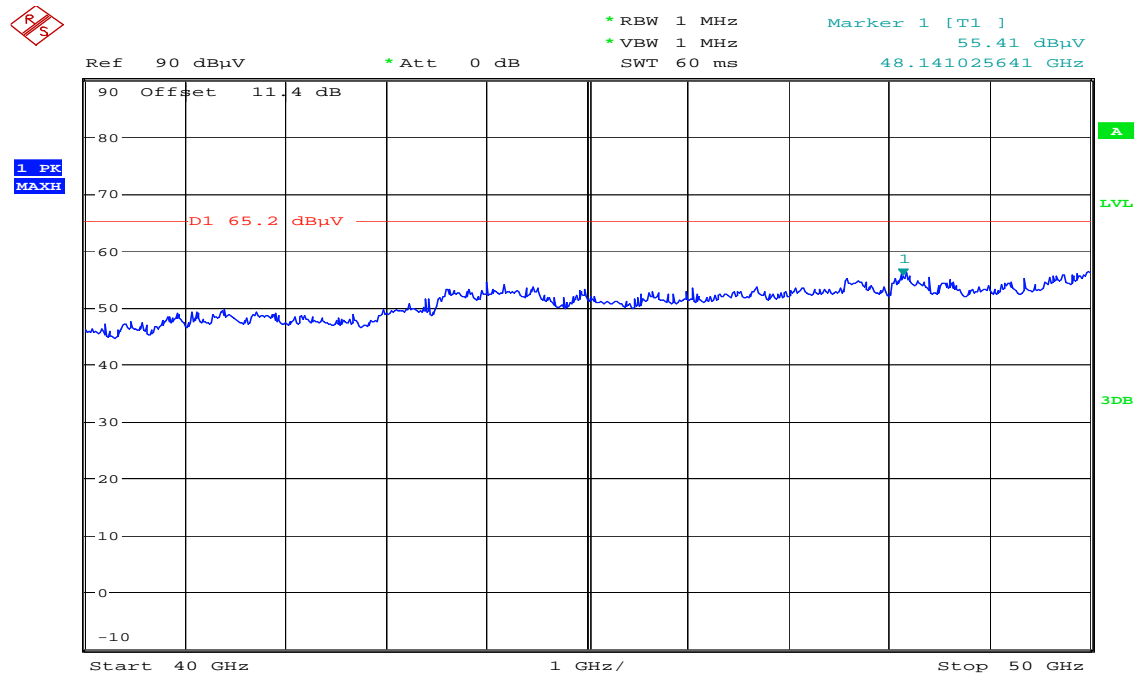
Date: 13.FEB.2009 15:28:40

Plot 23: 40 - 50 GHz (channel 2)



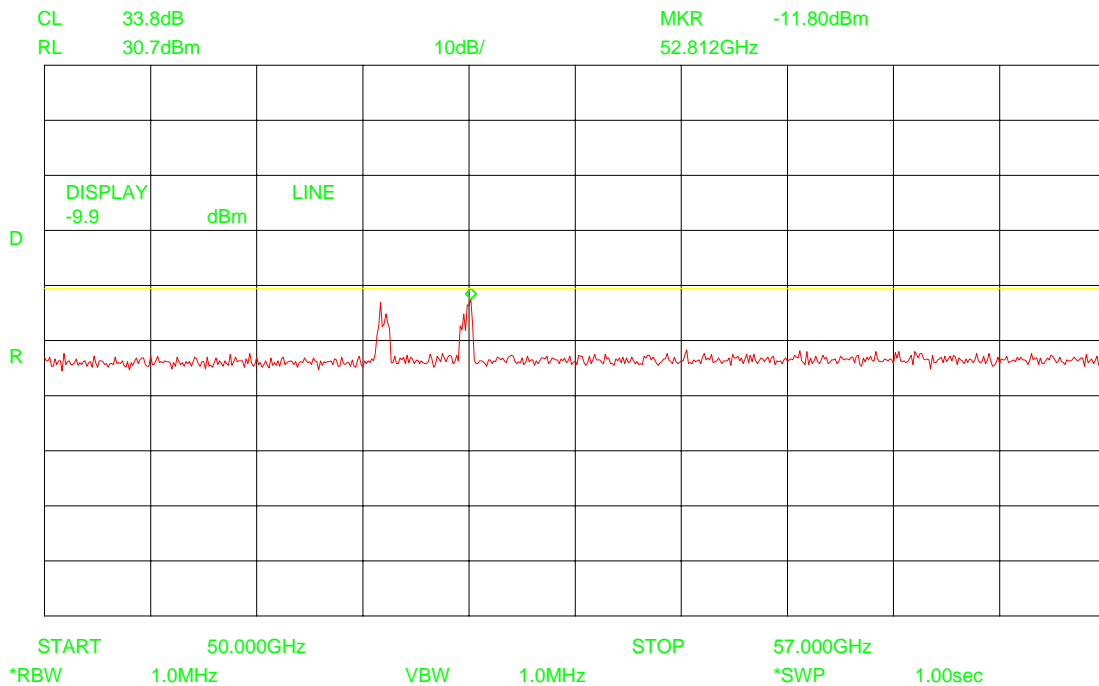
Date: 12.FEB.2009 17:27:01

Plot 24: 40 - 50 GHz (channel 3)



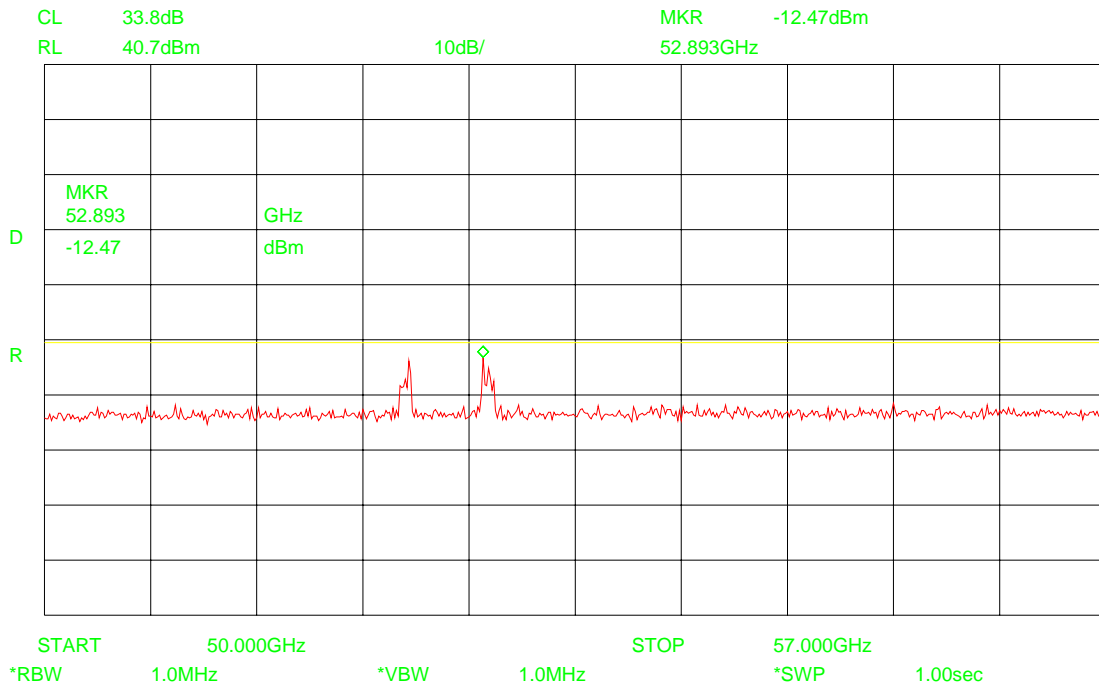
Date: 12.FEB.2009 17:27:01

Plot 25: 50 - 57 GHz (channel 1)



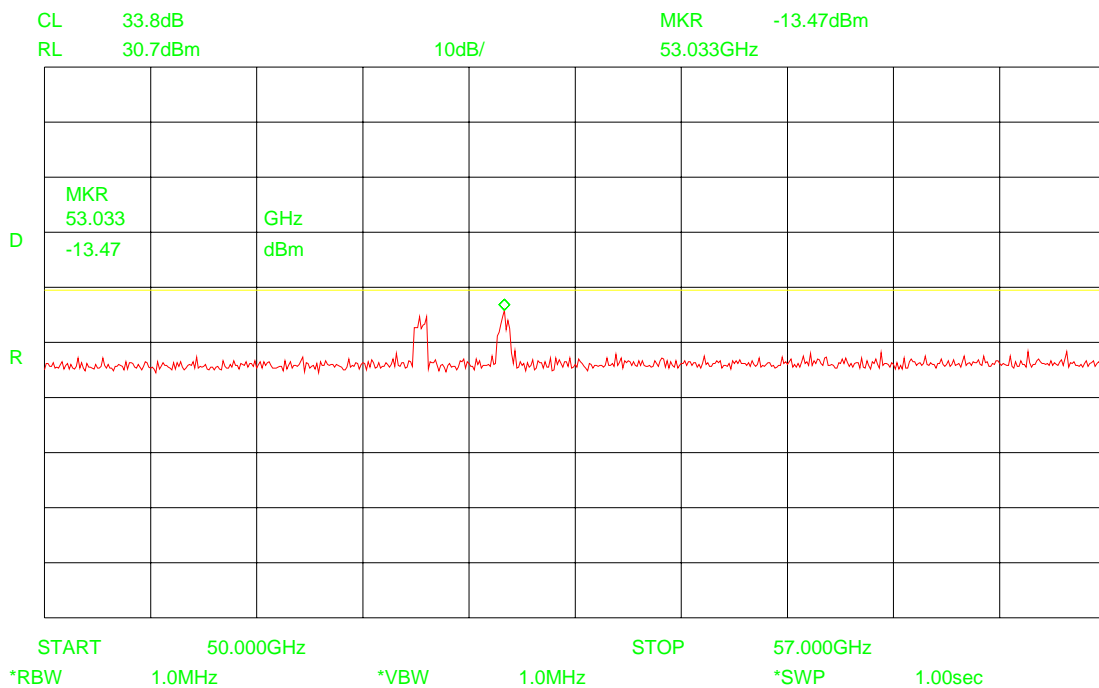
The plot shows peaks caused by the harmonic mixer. Signal Identification function was used.

Plot 26: 50 - 57 GHz (channel 2)



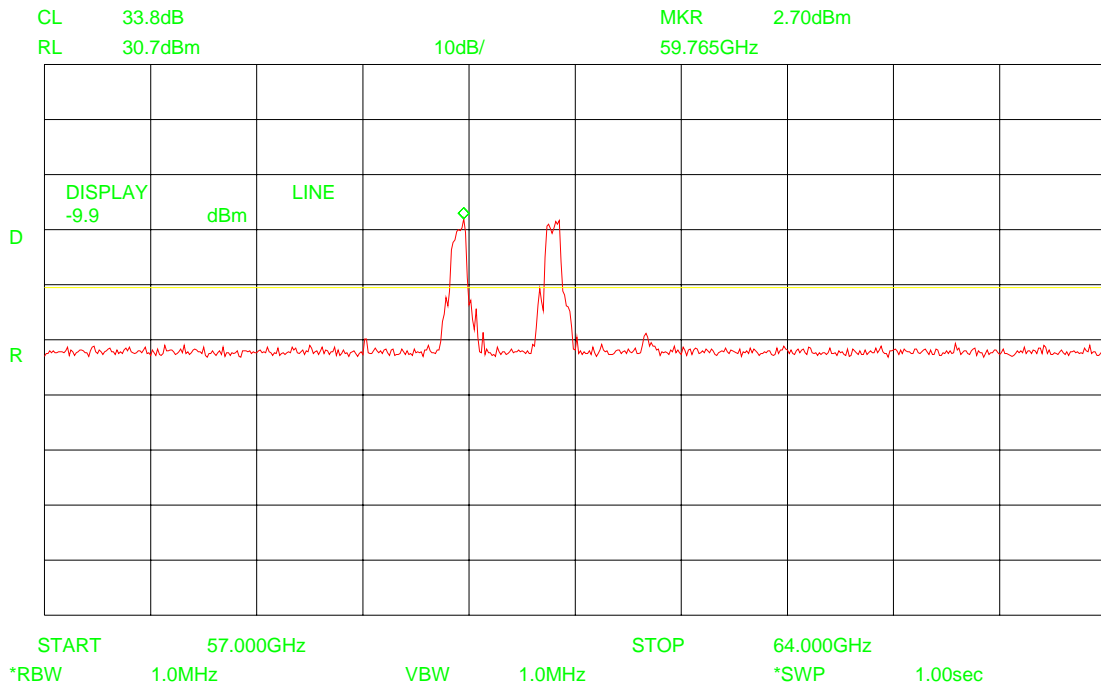
The plot shows peaks caused by the harmonic mixer. Signal Identification function was used.

Plot 27: 50 - 57 GHz (channel 3)



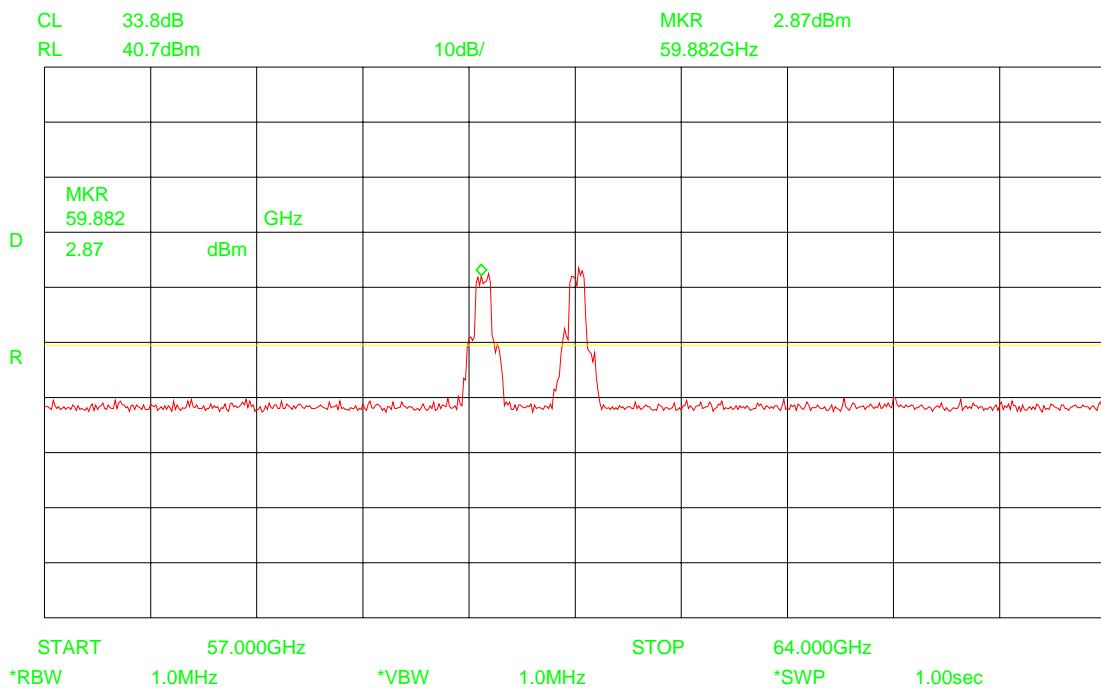
The plot shows peaks caused by the harmonic mixer. Signal Identification function was used.

Plot 28: 57 - 64 GHz (channel 1)



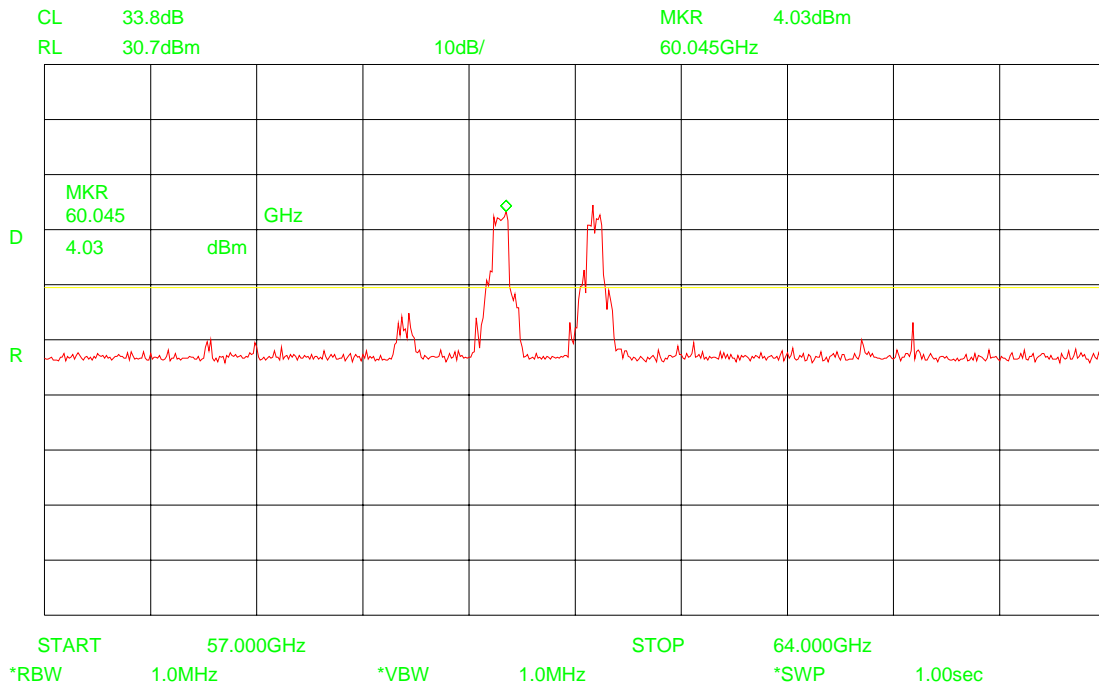
The left peak is caused by the harmonic mixer. The right peak is the wanted signal at 60.32 GHz.

Plot 29: 57 - 64 GHz (channel 2)



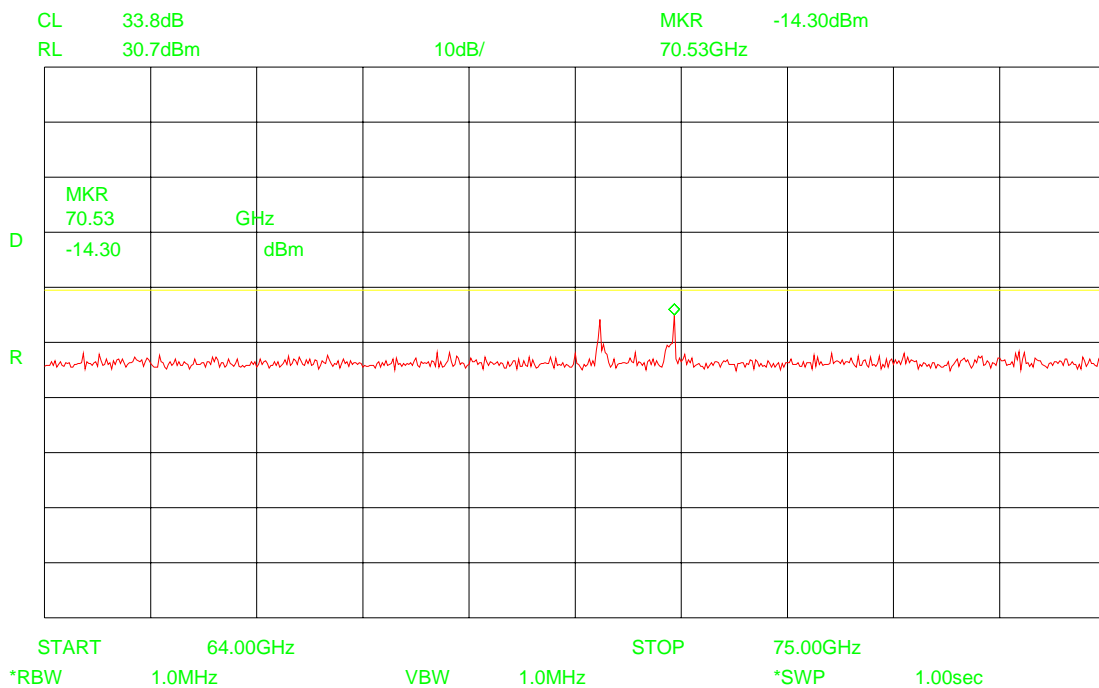
The left peak is caused by the harmonic mixer. The right peak is the wanted signal at 60.48 GHz.

Plot 30: 57 - 64 GHz (channel 3)



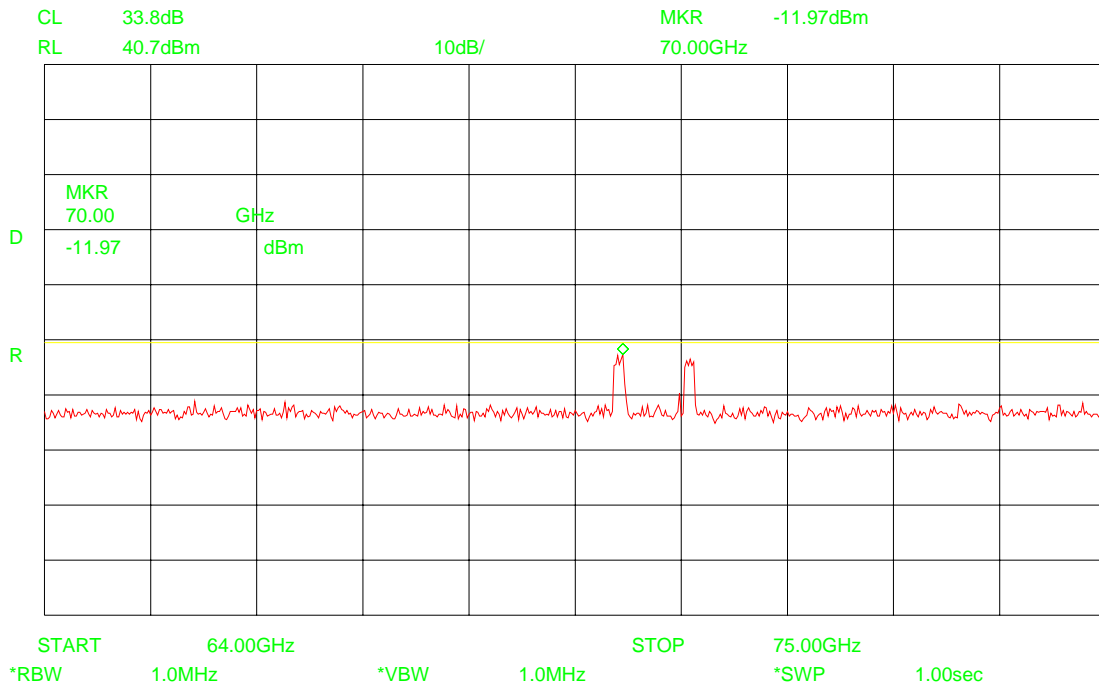
The left peak is caused by the harmonic mixer. The right peak is the wanted signal at 60.64 GHz.

Plot 31: 64 - 75 GHz (channel 1)



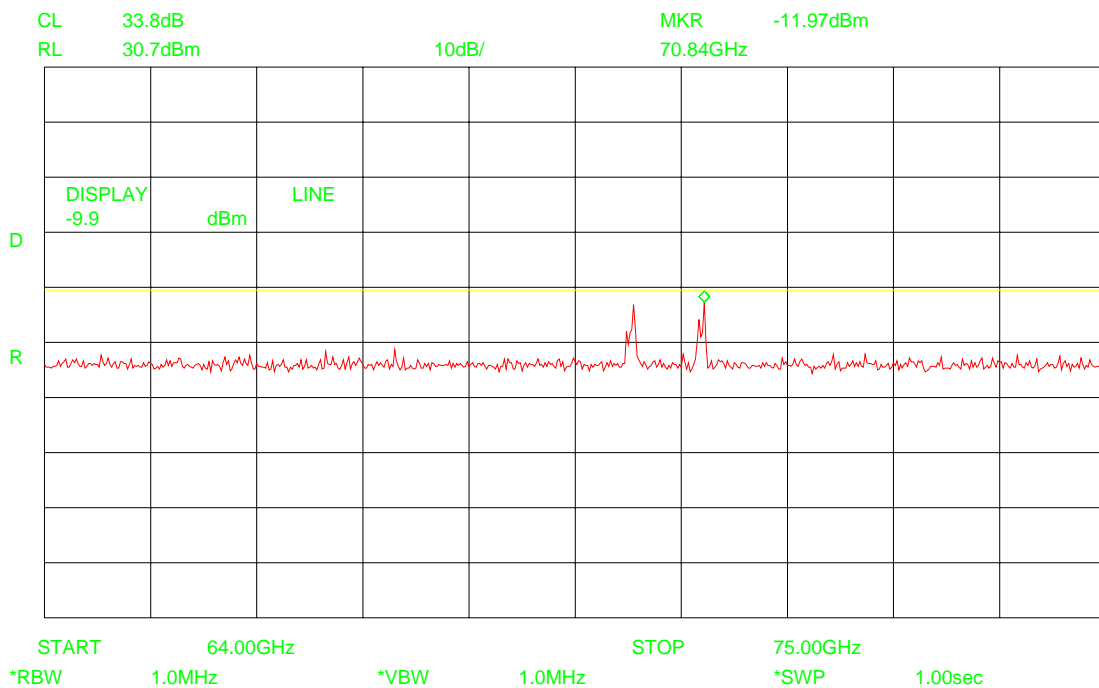
The plot shows peaks caused by the harmonic mixer. Signal Identification function was used.

Plot 32: 64 - 75 GHz (channel 2)



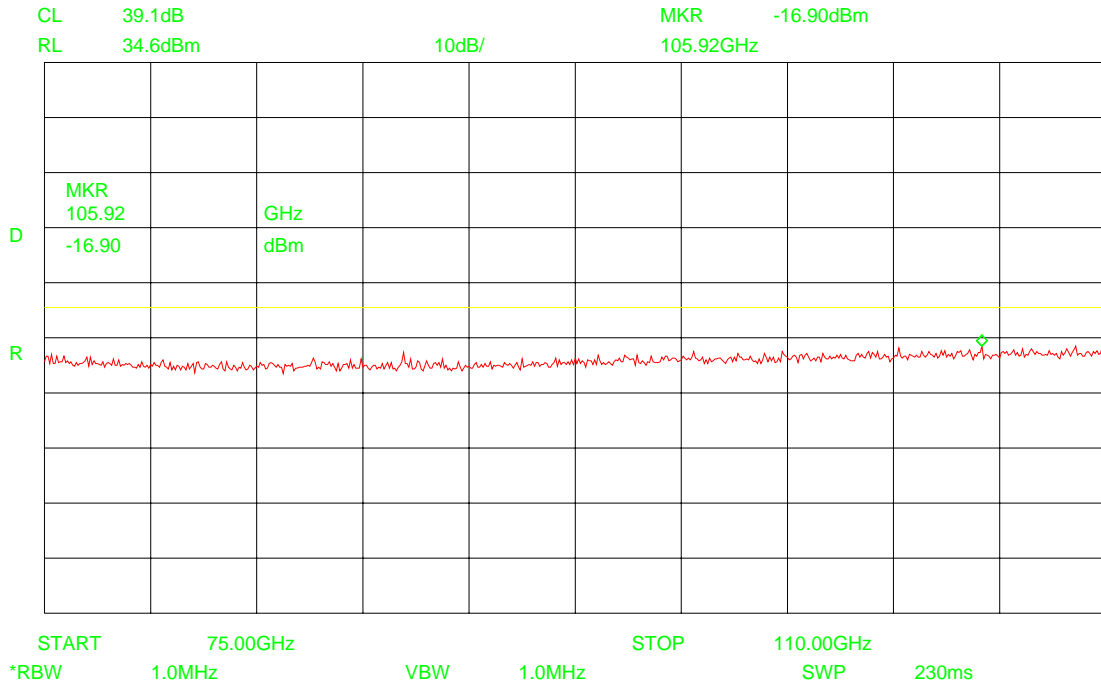
The plot shows peaks caused by the harmonic mixer. Signal Identification function was used.

Plot 33: 64 - 75 GHz (channel 3)

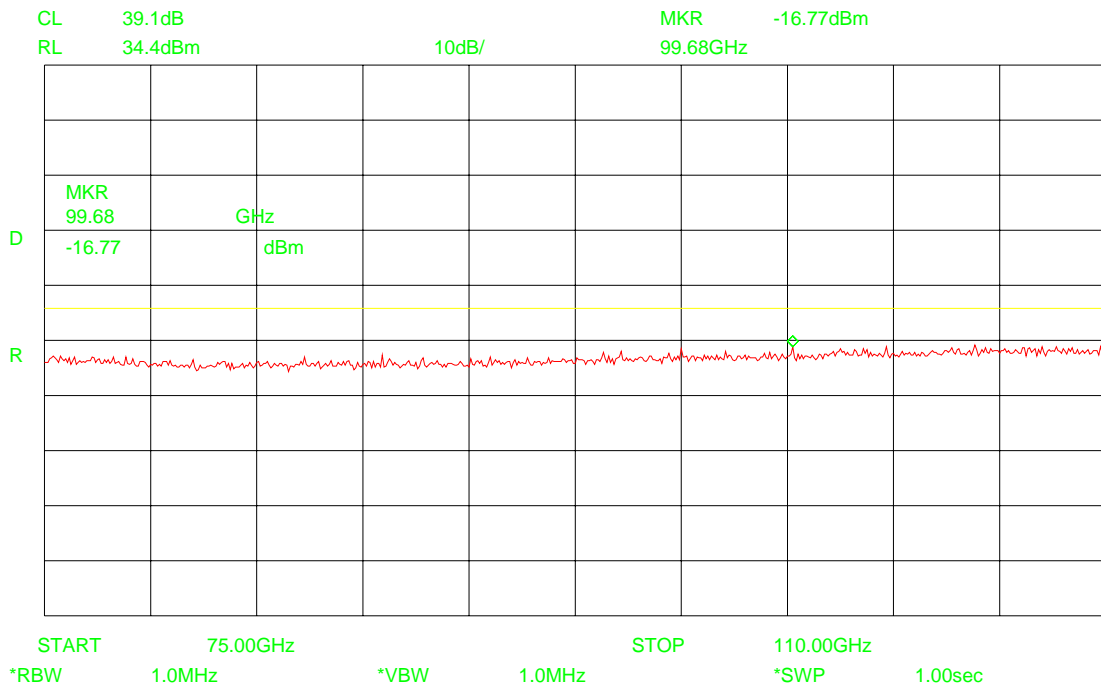


The plot shows peaks caused by the harmonic mixer. Signal Identification function was used.

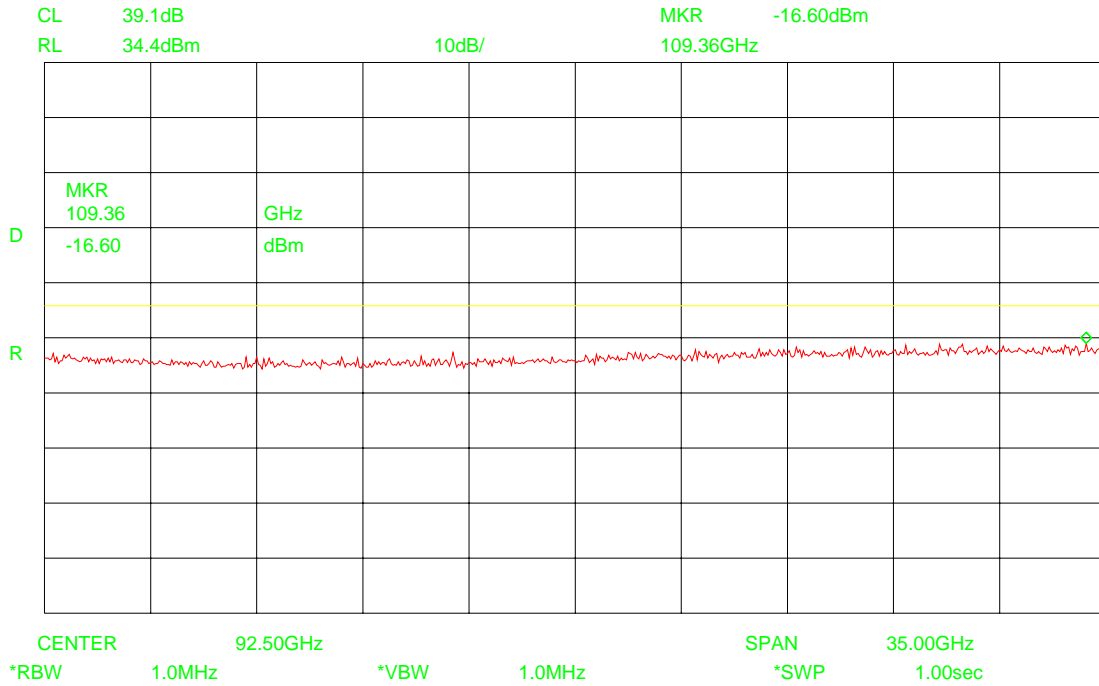
Plot 34: 75 - 110 GHz (channel 1)



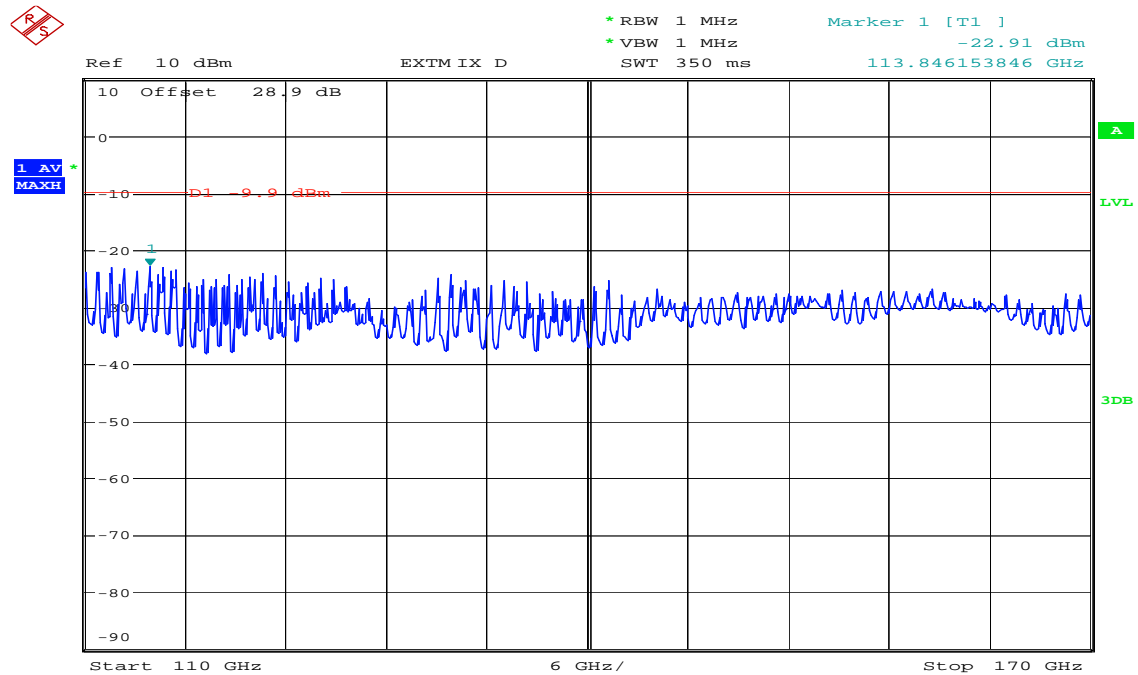
Plot 35: 75 - 110 GHz (channel 2)



Plot 36: 75 - 110 GHz (channel 3)

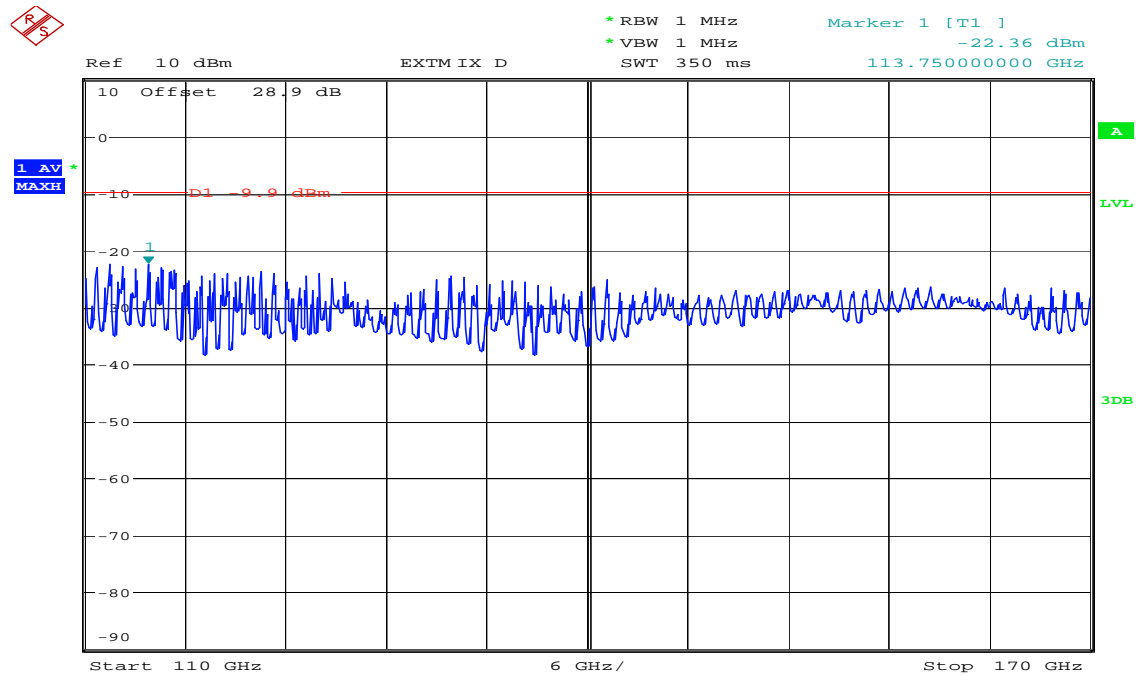


Plot 37: 110 - 170 GHz (channel 1)



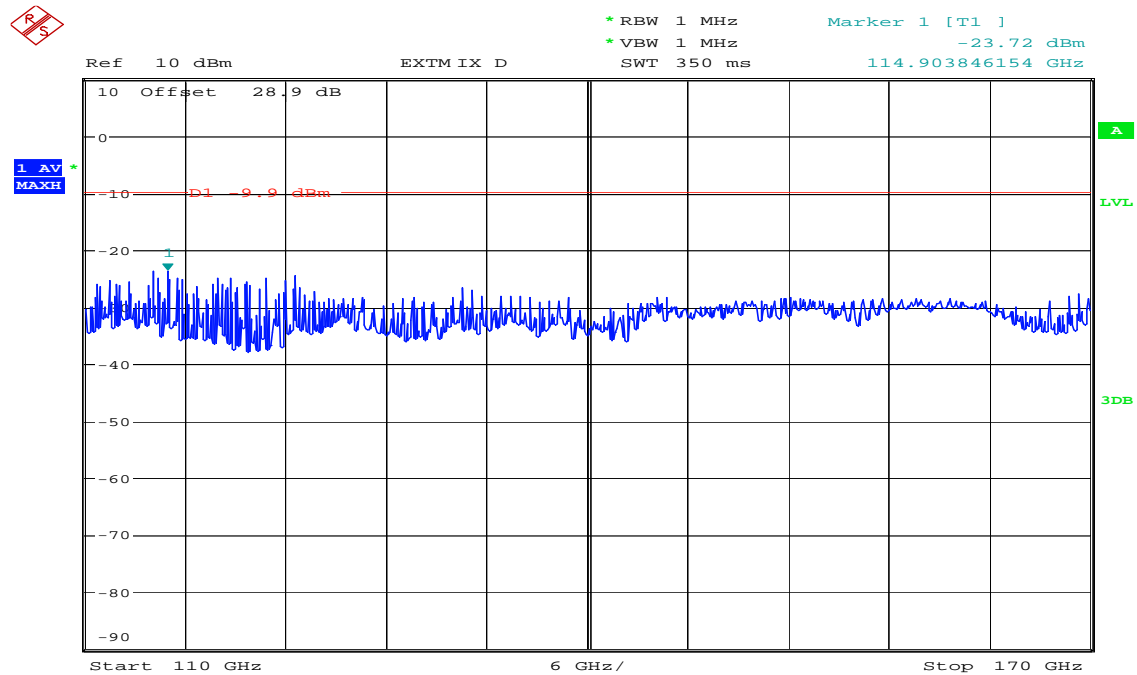
Date: 13.FEB.2009 15:43:46

Plot 38: 110 - 170 GHz (channel 2)



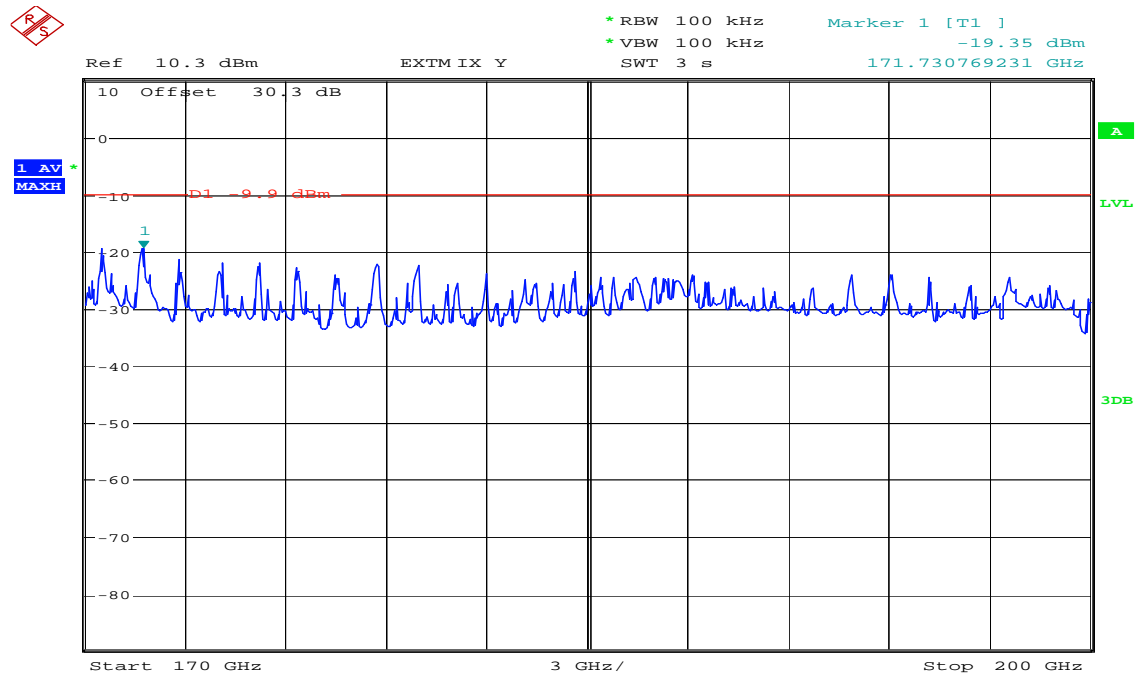
Date: 16.FEB.2009 18:22:25

Plot 39: 110 - 170 GHz (channel 3)



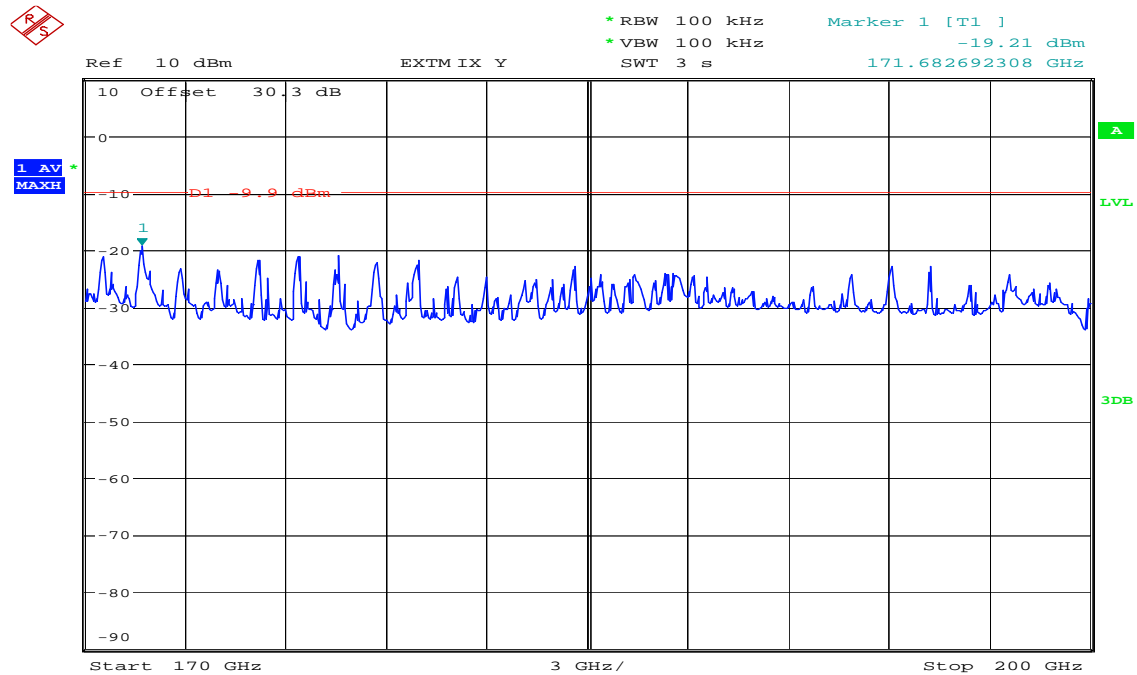
Date: 12.FEB.2009 17:53:53

Plot 40: 170 - 200 GHz (channel 1)



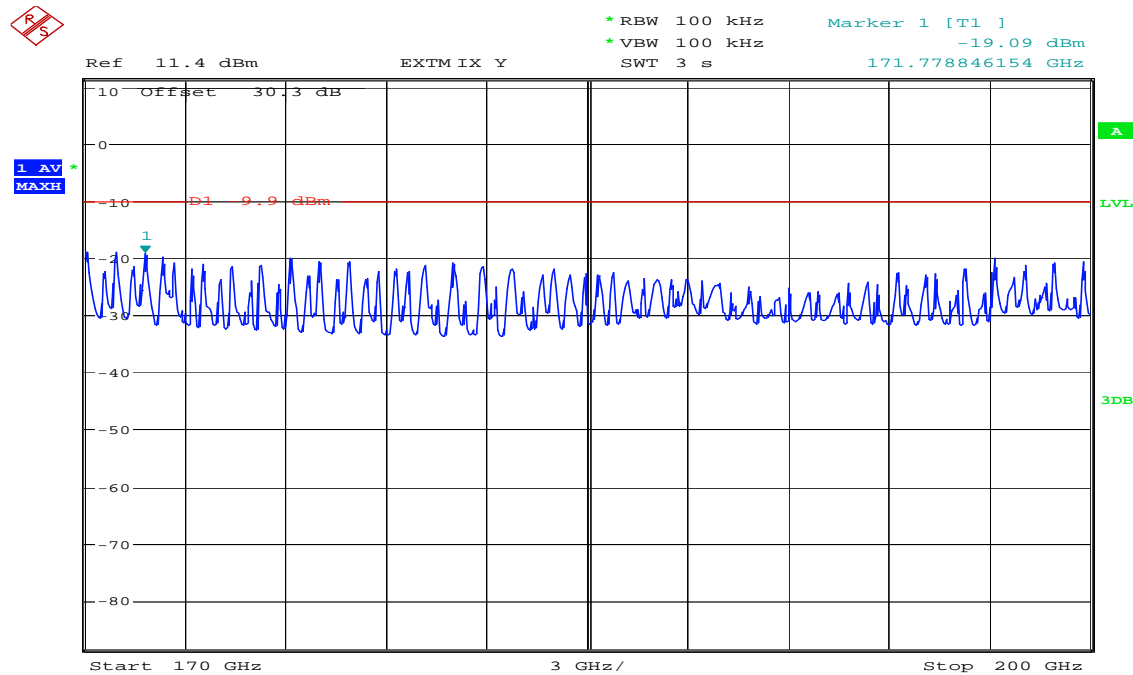
Date: 13.FEB.2009 14:57:07

Plot 41: 170 - 200 GHz (channel 2)



Date: 16.FEB.2009 18:27:34

Plot 42: 170 - 200 GHz (channel 3)



Date: 12.FEB.2009 17:57:05

All spurious emissions detected are lower in level than the fundamental signal.

Limit according to 15.255 (c):

- (c) Limits on spurious emissions:
- (1) The power density of any emissions outside the 57-64 GHz band shall consist solely of spurious emissions.
 - (2) Radiated emissions below 40 GHz shall not exceed the general limits in Section 15.209 of this part.
 - (3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm² at a distance of 3 meters. [Equivalent to an EIRP of 102 μW.]
 - (4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

Limit line:

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 - 0.490	2000/F(kHz)	300
0.490 - 1.705	20000/F(kHz)	30
1.705 - 30.0	30.0 μV/m / 29.5 dBμV/m	30
30 - 88	100 μV/m / 40.0 dBμV/m	3
88 - 216	150 μV/m / 43.5 dBμV/m	3
216 - 960	200 μV/m / 46.0 dBμV/m	3
above 960 up to 40 GHz	500 μV/m / 54.0 dBμV/m	3
40 GHz - 200 GHz	90 pW/cm ²	3

Remark:

90 pW/cm² measured at a distance of 3m corresponds to an EIRP of 102 μW / -9.9 dBm.

Test Result: pass

5.7 Peak Transmitter Output Power §15.255 (e) / RSS-210 A13.2.3

A maximum radiated peak power (EIRP) of 3.5 dBm was measured (see chapter 5.5 Power Density §15.255(b)(1))

Result:

max. radiated power (EIRP) [dBm]	antenna gain (as specified by the manufacturer) [dBi]	conducted power [dBm]	conducted power [mW]
3.5	12.0	-8.5	0.14

Remark:

Antenna gain was specified by the manufacturer (see annex 1).

Limit according to §15.255 (e):

(e) Except as specified below, the total peak transmitter output power shall not exceed 500 mW.
 (1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g. for frequency hopping devices).

Test Result: pass

5.8 Frequency Stability §15.255 (f) / RSS-210 A13.2.5

U _{AC} [V]	Temperature [°C]	Carrier frequency [GHz]	Measured frequency [GHz]	Difference [kHz]	Difference [ppm]
110	+50.0	60.48	60.47992	-80	-1.3
110	+40.0	60.48	60.47988	-120	-2.0
110	+30.0	60.48	60.47982	-180	-3.0
94	+20.0	60.48	60.47977	-230	-3.8
110	+20.0	60.48	60.47978	-220	-3.6
126	+20.0	60.48	60.47981	-190	-3.1
110	+10.0	60.48	60.47985	-150	-2.5
110	0	60.48	60.47983	-170	-2.8
110	-10.0	60.48	60.47981	-190	-3.1
110	-20.0	60.48	60.47979	-210	-3.5
110	-30.0	60.48	60.47982	-180	-3.0

Limit according to §15.255 (f):

(f) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

Test Result: pass

5.9 Group Installations §15.255 (h) / RSS-210 A13.2.6

Declaration:

The units are not equipped with an interface for external control of Tx/Rx signals in frequency, amplitude or phase. The units do not provide any feature to combine several units together which allows building of beam-forming arrays.

Limit according to §15.255 (h):

(h) Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

Test Result: pass

5.10 Transmitter Self-Identification Transmission §15.255 (i) / RSS-210 A13.2.7

Declaration:

The Wireless HDMI Transmission System is for indoor use only. There are no wanted transmissions directed to any outdoor unit outside of a building. Therefore this section is not applicable.

Limit according to §15.255 (i):

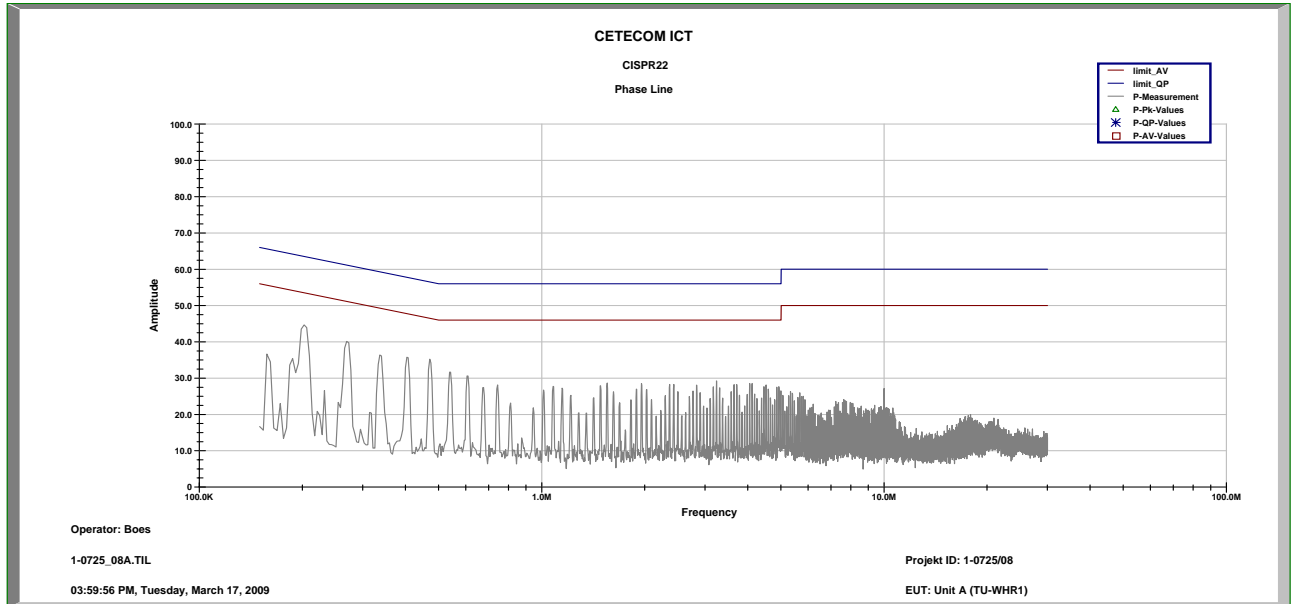
(i) For all transmissions that emanate from inside a building, within any one second interval of signal transmission, each transmitter with a peak output power equal to or greater than 0.1 mW or a peak power density equal to or greater than 3 nW/cm², as measured 3 meters from the radiating structure, must transmit a transmitter identification at least once. Each application for equipment authorization must declare that the equipment that will be used inside a building contains the required transmitter identification feature and must specify a method whereby interested parties can obtain sufficient information, at no cost, to enable them to fully detect and decode this transmitter identification information. Upon the completion of decoding, the transmitter identification data block must provide the following fields:

1. FCC Identifier, which shall be programmed at the factory.
2. Manufacturer's serial number, which shall be programmed at the factory.
3. Provision for at least 24 bytes of data relevant to the specific device, which shall be field programmable. The grantee must implement a method that makes it possible for users to specify and update this data. The recommended content of this field is information to assist in contacting the operator.

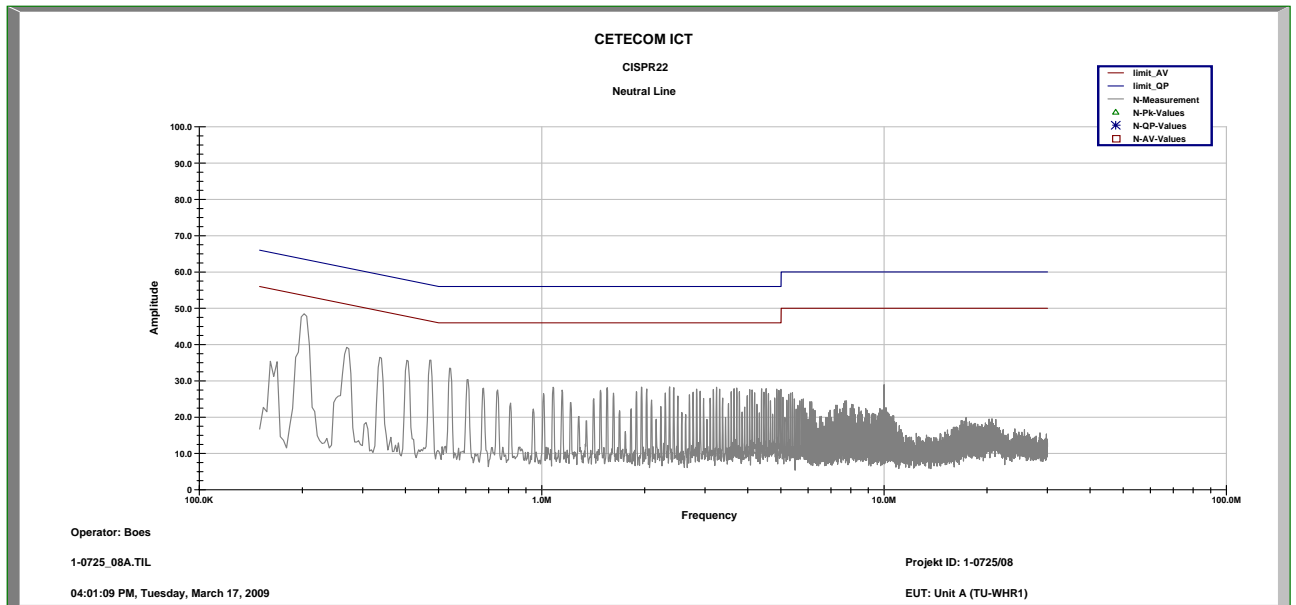
Test Result: not applicable

5.11 Conducted Spurious Emissions §15.207 / RSS-GEN 7.2.2

Plot 43: 150 kHz - 30 MHz



Plot 44: 150 kHz - 30 GHz



Limits according to §15.207:

Frequency (MHz)	Conducted Emission (dBμV) Quasi-Peak	Conducted Emission (dBμV) Average
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50

Test Result: pass

5.12 MPE Calculation

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a “worst case” prediction.

$$S = PG/4\pi R^2$$

where S = power density (in appropriate units, e.g. mW/cm²)
P = power input to the antenna (in appropriate units e.g. mW)
G = power gain of the antenna in the direction of interest relative to the isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = EIRP/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

Calculation:

Calculated based on EIRP value

Max. EIRP: 3.5 dBm = 2.24 mW

calculated at distance of 20 cm:

Peak power density = $2.24 \text{ mW} / 4\pi(20\text{cm})^2 = 0.45 \text{ } \mu\text{W} / \text{cm}^2$

Limit:

1mW/ cm ² is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.
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