
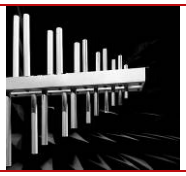
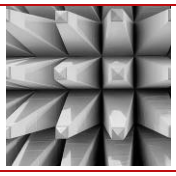

CETECOM™
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consulting - testing - certification

TEST REPORT

Test report no.: 1-4795/12-01-03-A

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01
Area of Testing: Radio/Satellite Communications

Applicant

ROBERT BOSCH GmbH
Daimlerstr. 6
71229 Leonberg / Germany
Phone: +49 7118 114-7527
Fax: +49 7118 114-7548
Contact: Jürgen Hildebrand
e-mail: Juergen.Hildebrandt@de.bosch.com
Phone: +49 7118 114-7527

Manufacturer

ROBERT BOSCH GmbH
Daimlerstr. 6
71229 Leonberg / Germany

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS – 210 Issue 8	Low Power Licence-exempt Radiocommunication Devices Annex 13, Section A13.1 Vehicle -Mounted Field Disturbance Sensors in the Band 76.0 - 77.0 GHz

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**SRD; Motion Detector for RTTT application**
Model name:	**MRR1Plus**
FCC ID:	**NF3-MRR1Plus**
IC:	**3887A-MRR1Plus**
Frequency:	76.0 - 77.0 GHz
Antenna:	integrated patch antenna
Power Supply:	12.0 V DC from power supply
Temperature Range:	-20°C to +55 °C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorised: **Test performed:**

M. Walla

Meheza Walla

CETECOM Cetecom ICT Services Accredited Test Laboratory Untertürkheimer Str. 6-10 D-66117 Saarbrücken

Geraldy Karsten

Karsten Geraldy

1 Table of contents

2 General information

2.1 Notes and disclaimer

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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2012-07-17
Date of receipt of test item:	2012-08-01
Start of test:	2012-08-01
End of test:	2012-08-10
Person(s) present during the test:	Mr. Hildebrandt

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	2011-10	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS – 210 Issue 8	2010-12	Low Power Licence-exempt Radiocommunication Devices Annex 13, Section A13.1 Vehicle -Mounted Field Disturbance Sensors in the Band 76.0 - 77.0 GHz
FCC 12-72	2012-07-05	Report and Order Amendment of Sections 15.35 and 15.253 of the Commission's Rules Regarding Operation of Radar Systems in the 76-77 GHz Band Amendment of Section 15.253 of the Commission's Rules to Permit Fixed Use of Radar in the 76-77 GHz Band

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+55 °C during high temperature tests
	T_{min}	-20 °C during low temperature tests
Relative humidity:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	12.0 V DC from power supply
	V_{min}	9.0 V DC
	V_{max}	16.0 V DC

5 Test item

Kind of test item	**:**	**SRD; Motion Detector for RTTT application**
Type identification	**:**	**MRR1Plus**
S/N serial number	**:**	**0265B60376**
HW hardware status	**:**	**C-sample**
SW software status	**:**	**R 8.6 X81**
Frequency band	**:**	**76.0 - 77.0 GHz**
Type of modulation	**:**	**FMCW**
Number of channels	**:**	**1**
Antenna	**:**	**integrated patch antenna**
Power supply	**:**	**12.0 V DC from power supply**
Temperature range	**:**	**-20°C to +55 °C**

5.1 Additional information

Special test software was used to change from normal operation mode to stopped mode (bottom / middle / top) as required by CFR 47 Part 15.31 (c).

6 Test laboratories sub-contracted

None

7 Summary of measurement results

☒	**No deviations from the technical specifications were ascertained**
☐	There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 15 / RSS- 210 Issue 8, Annex 13	Passed	2012-11-12	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Results (max.)
§15.253 (b)(1)(2) RSS210 Issue 8 A13.1.3	Power density	Nominal and Extreme	Nominal and Extreme	☒	☐	☐	☐	Peak: 27.3 dBm AVG: 24.8 dBm
RSS210 Issue 8 A13.1.2 (a)	Not in Motion Mode	Nominal and Extreme	Nominal and Extreme	☒	☐	☐	☐	7.5 dBm
§1.1310	MPE Calculation	Nominal and Extreme	Nominal and Extreme	☒	☐	☐	☐	0.6 mW/cm²
§2.1049 RSS210 Issue 8 A13.1.1	Occupied bandwidth (99% bandwidth)	Nominal and Extreme	Nominal and Extreme	☒	☐	☐	☐	454.2 MHz
§15.253 (c)(2)(ii) §15.253 (3) §15.209 (a) RSS210 Issue 8 A13.1.2 (2)a/b/c	Field strength of emissions (radiated spurious)	Nominal	Nominal	☒	☐	☐	☐	complies
§15.253 (e) RSS210 Issue 8 A13.1.5	Frequency stability	Nominal and Extreme	Nominal and Extreme	☒	☐	☐	☐	complies

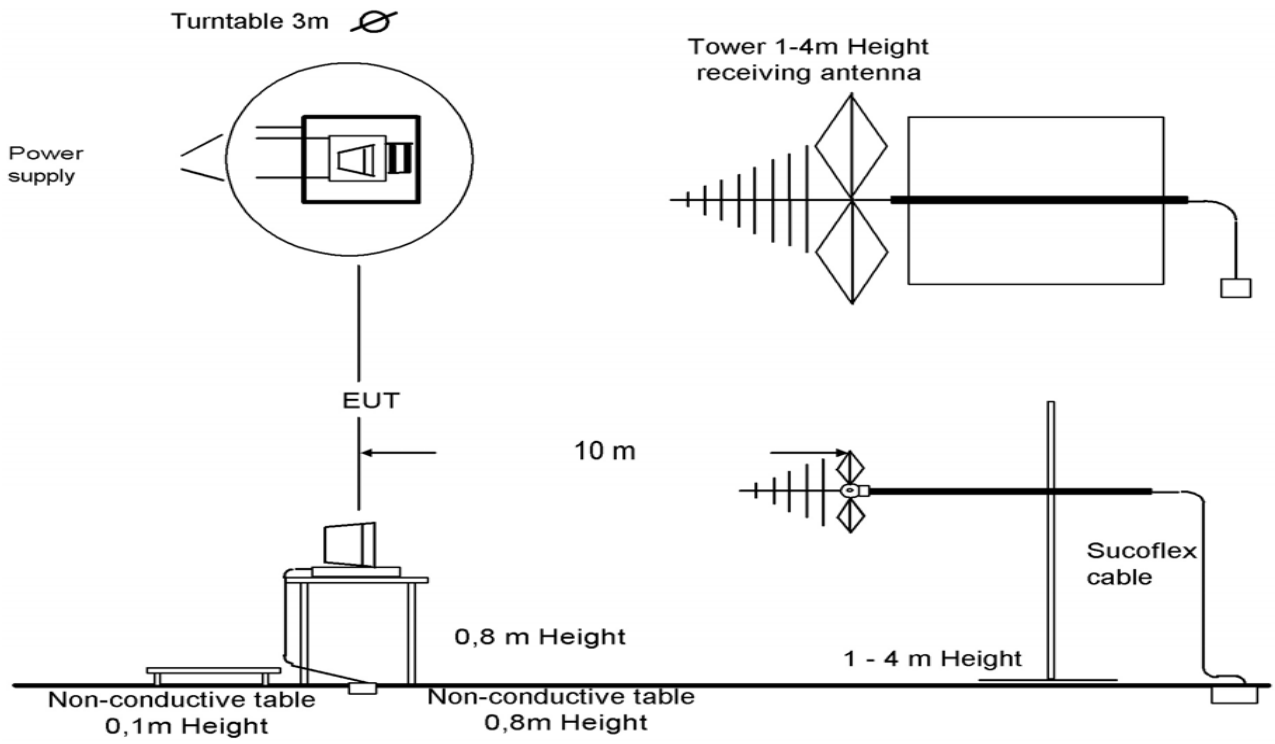
Note: NA = Not Applicable; NP = Not Performed

8 Test setup

8.1 Radiated measurements

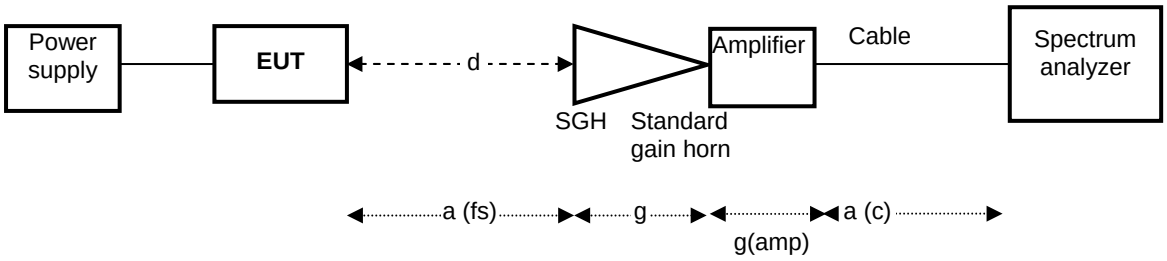
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2009 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2009 clause 4.2.
Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



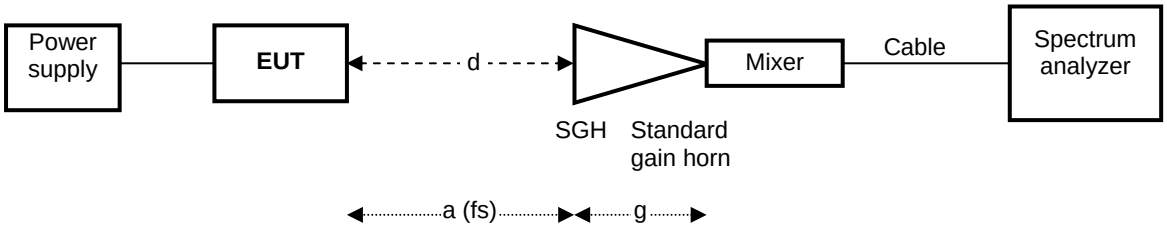
Picture 1: Diagram radiated measurements (Up to 15 GHz)

Test set-up for the measurement of spurious radiation in the frequency range 15 GHz to 50 GHz:



Picture 2: Diagram radiated measurements (12 GHz – 50 GHz)

Test set-up for the measurement of spurious radiation and EIRP in the frequency range 50 GHz to 325 GHz:



Picture 3: Diagram radiated measurements (50 GHz – 325 GHz)

8.2 Conducted measurements

Not applicable!

8.3 Additional comments

Special test software was used to change from normal operation mode to stopped mode (bottom / middle / top) as required by CFR 47 Part 15.31 (c).

During the development process the shielding material was changed from copper coating to aluminium foil. The manufacturer declared that there are no changes concerning the observed emissions. See pictures.

9 Measurement results

9.1 Power density

Measurement results:

TEST CONDITIONS (T_{nom} / $V_{min-max}$)	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
normal operation mode	26.9	7.5
CW, low frequency	25.8	24.3
CW, mid frequency	22.0	20.1
CW, high frequency	25.8	24.8

TEST CONDITIONS (T_{min} / V_{nom})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
normal operation mode	26.8	4.9
CW, low frequency	26.4	24.1
CW, mid frequency	25.0	23.1
CW, high frequency	27.3	24.7

TEST CONDITIONS (T_{max} / V_{nom})	TRANSMITTER Power Density	
	Peak EIRP [dBm]	AVG EIRP [dBm]
normal operation mode	25.9	4.0
CW, low frequency	24.7	22.4
CW, mid frequency	23.6	21.2
CW, high frequency	26.0	23.7

Limits: **FCC §15.253 (b) (1) (2)**

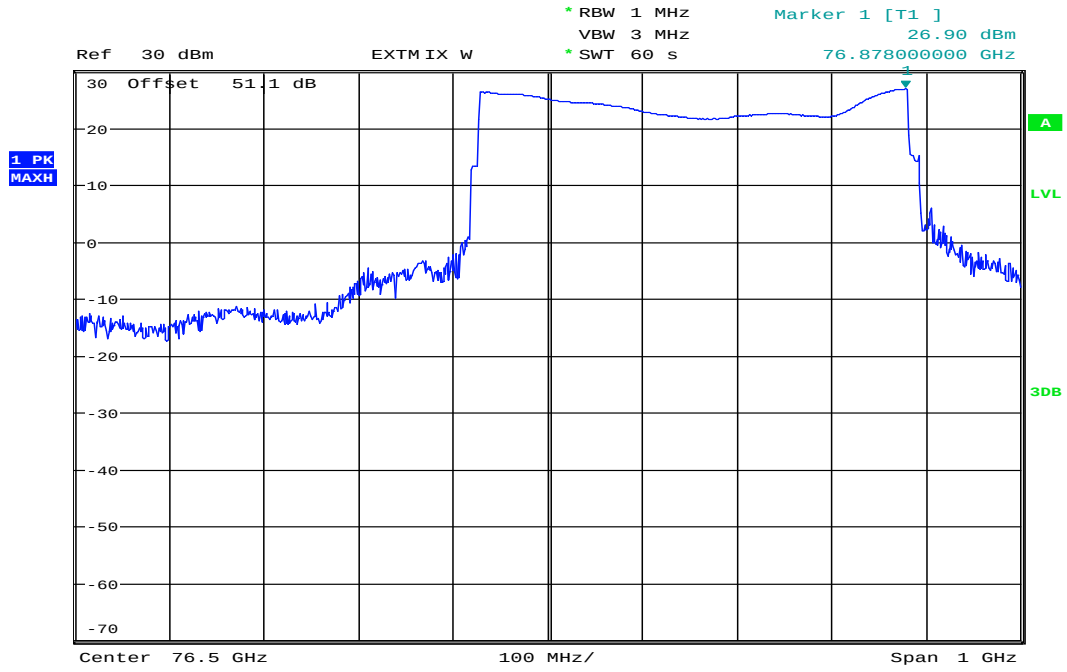
Frequency	Measurement distance	Power Density ➔ EIRP
76.0 - 77.0 GHz	3.0 m	60 µW/cm^2 → 48.3 dBm

Limits: **RSS 210 Issue 8, Annex 13.1.3**

There is no limit on peak transmitter output power

Result: **The measurement is passed.**

Plot 1: EIRP (Peak detector), T_{nom} / $V_{min-max}$, normal operation mode

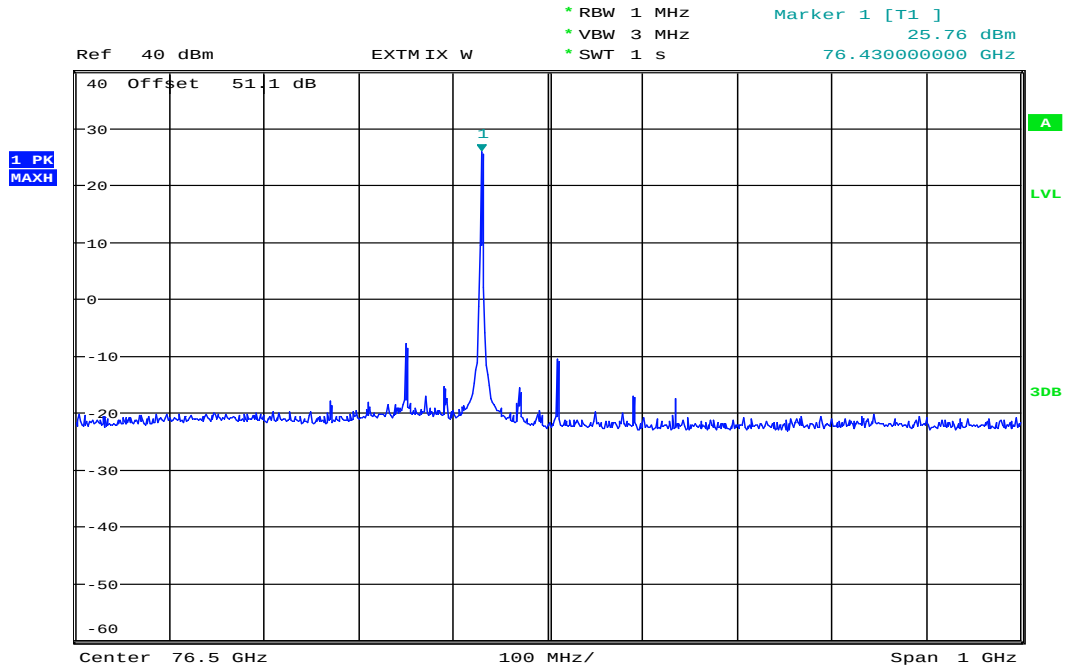


Date: 1.AUG.2012 10:58:14

Plot 2: EIRP (Average detector), T_{nom} / $V_{min-max}$, normal operation mode

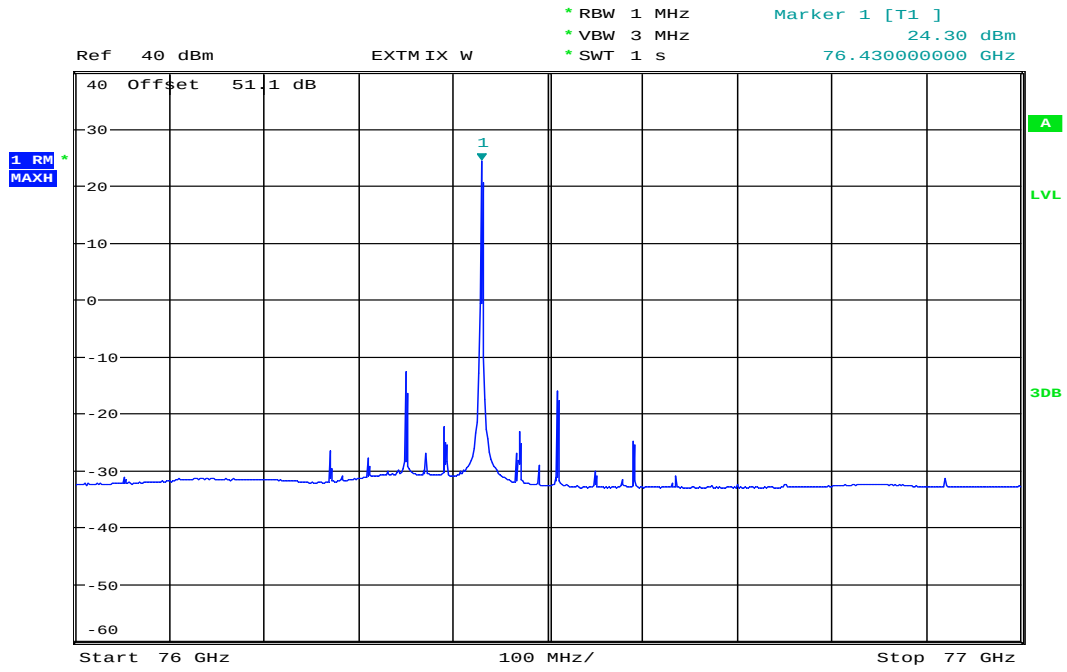
Date: 1.AUG.2012 11:12:35

Plot 3: EIRP (Peak detector), T_{nom} / $V_{min-max}$, CW-Test mode, low frequency



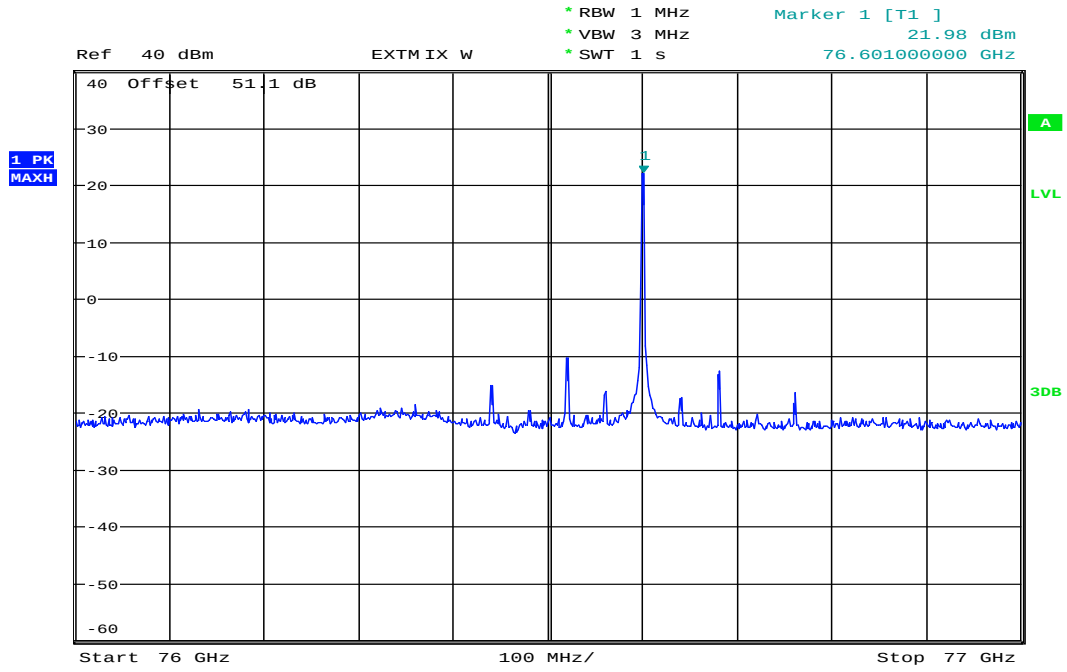
Date: 1.AUG.2012 13:02:12

Plot 4: EIRP (Average detector), T_{nom} / $V_{min-max}$, CW-Test mode, low frequency

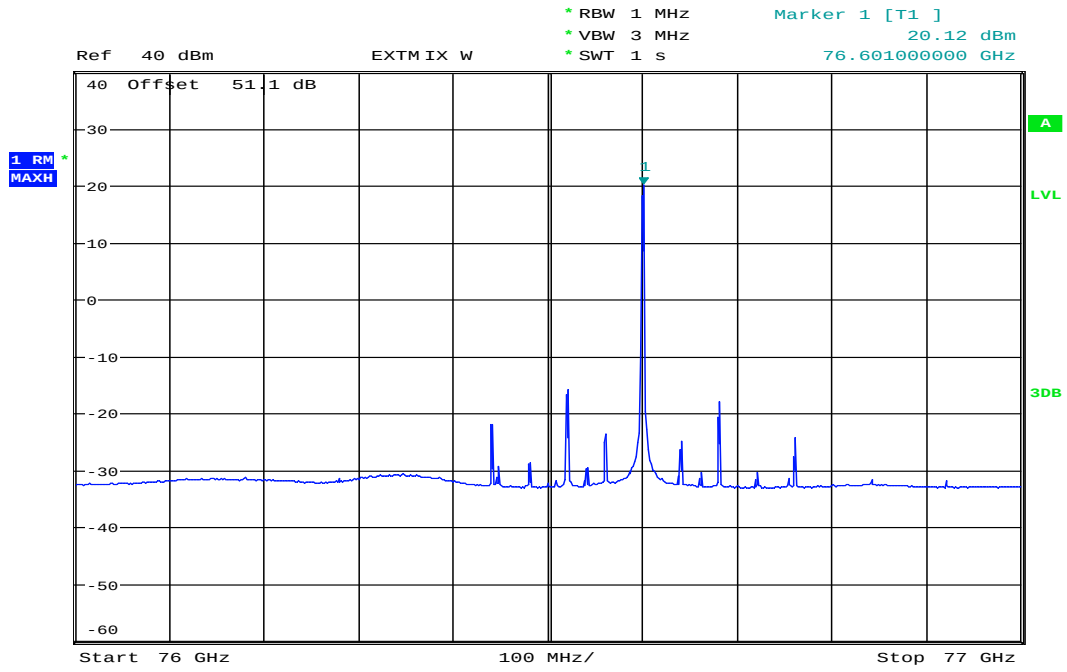


Date: 1.AUG.2012 13:03:20

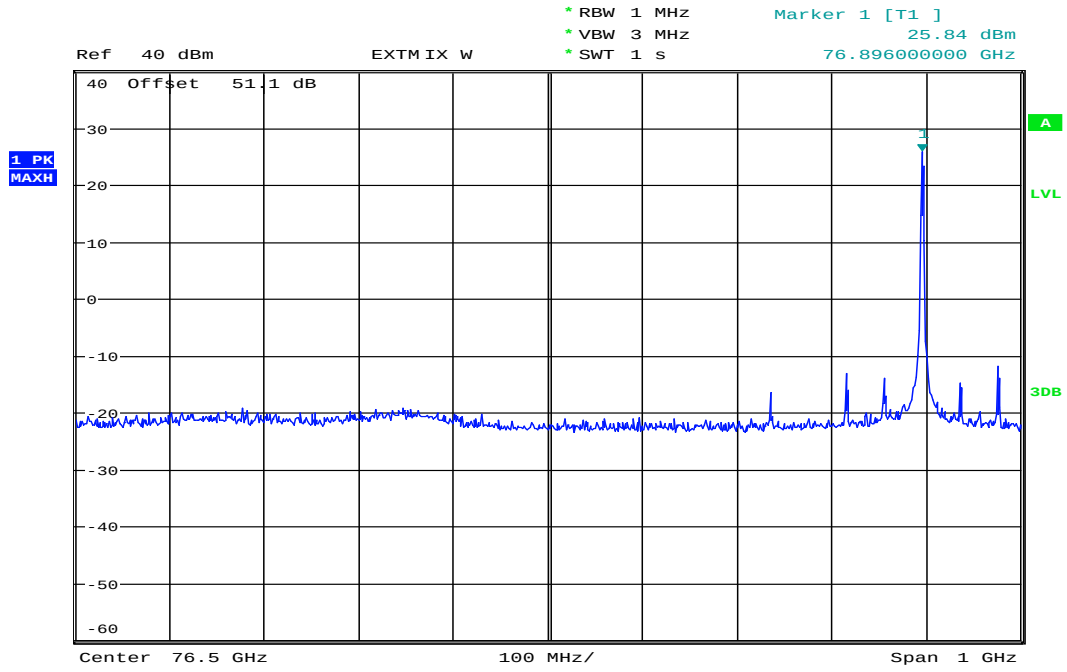
Plot 5: EIRP (Peak detector), T_{nom} / $V_{min-max}$, CW-Test mode, mid frequency



Plot 6: EIRP (Average detector), T_{nom} / $V_{min-max}$, CW-Test mode, mid frequency

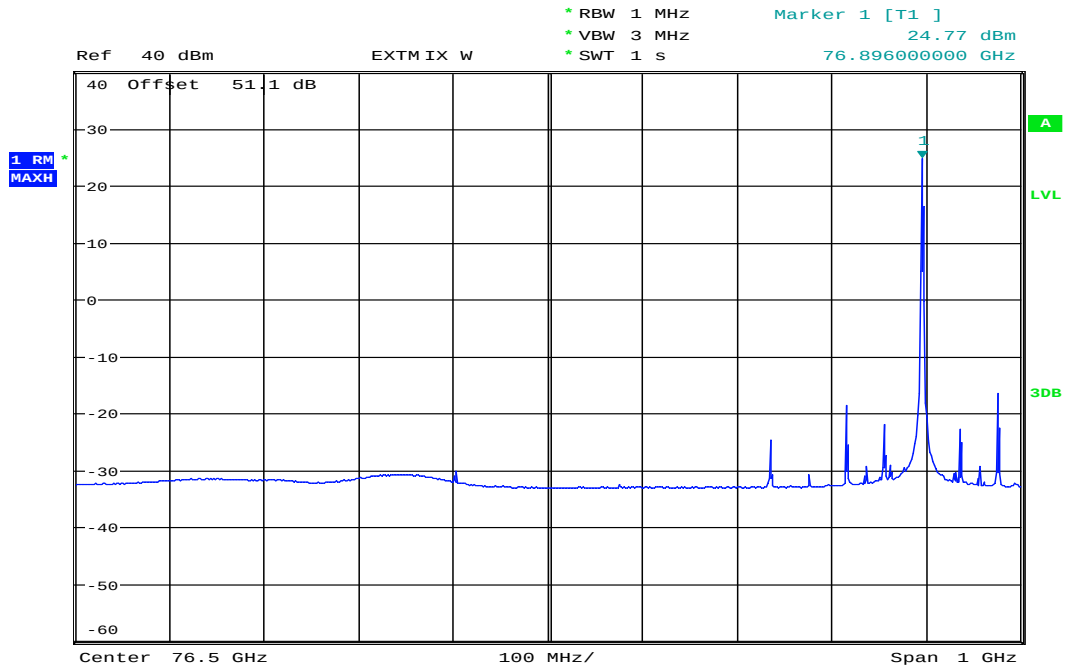


Plot 7: EIRP (Peak detector), T_{nom} / $V_{min-max}$, CW-Test mode, high frequency



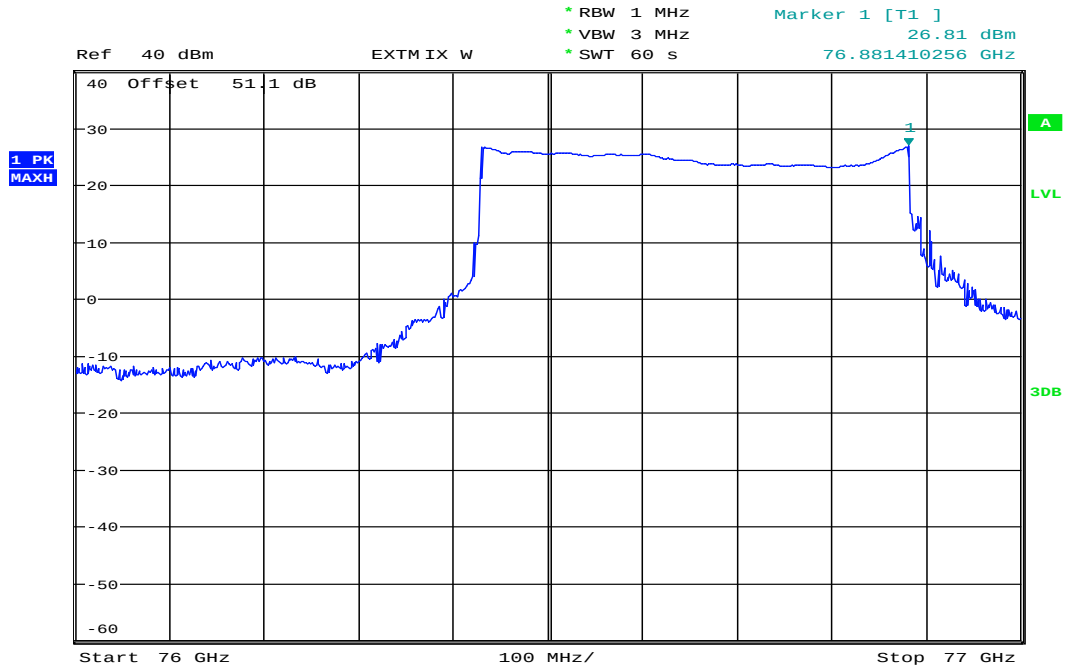
Date: 1.AUG.2012 13:13:39

Plot 8: EIRP (Average detector), T_{nom} / $V_{min-max}$, CW-Test mode, high frequency



Date: 1.AUG.2012 13:14:17

Plot 9: EIRP (Peak detector), T_{min} / V_{nom}, normal operation mode

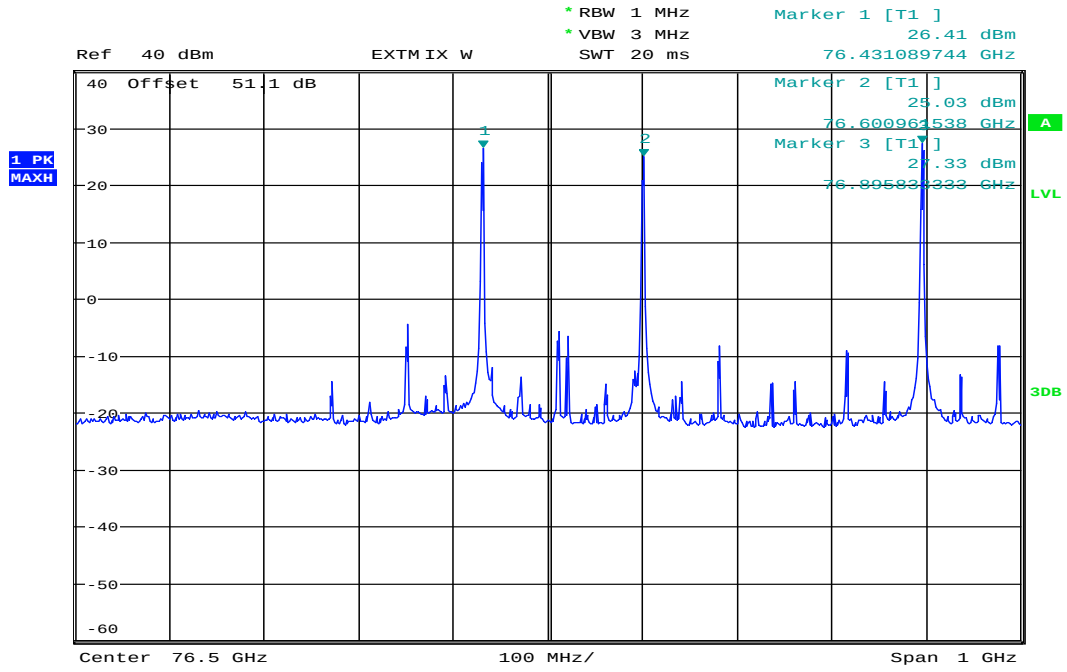


Date: 2.AUG.2012 13:18:04

Plot 10: EIRP (Average detector), T_{min} / V_{nom}, normal operation mode

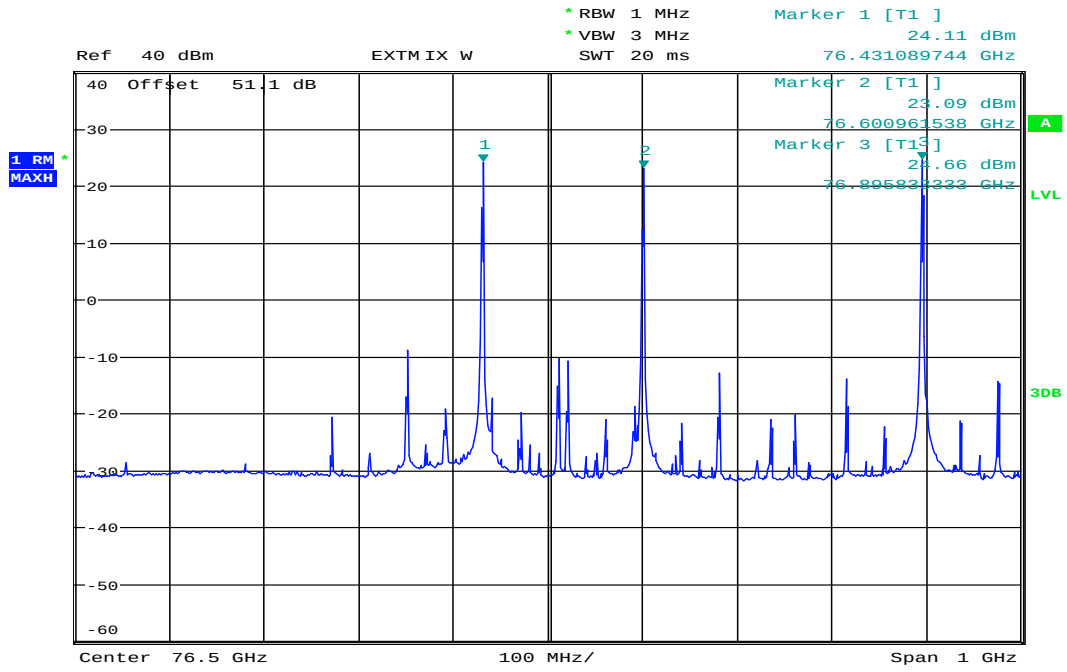
Date: 2.AUG.2012 13:30:34

Plot 11: EIRP (Peak detector), T_{min} / V_{nom}, CW-Test mode, low/mid/high frequency



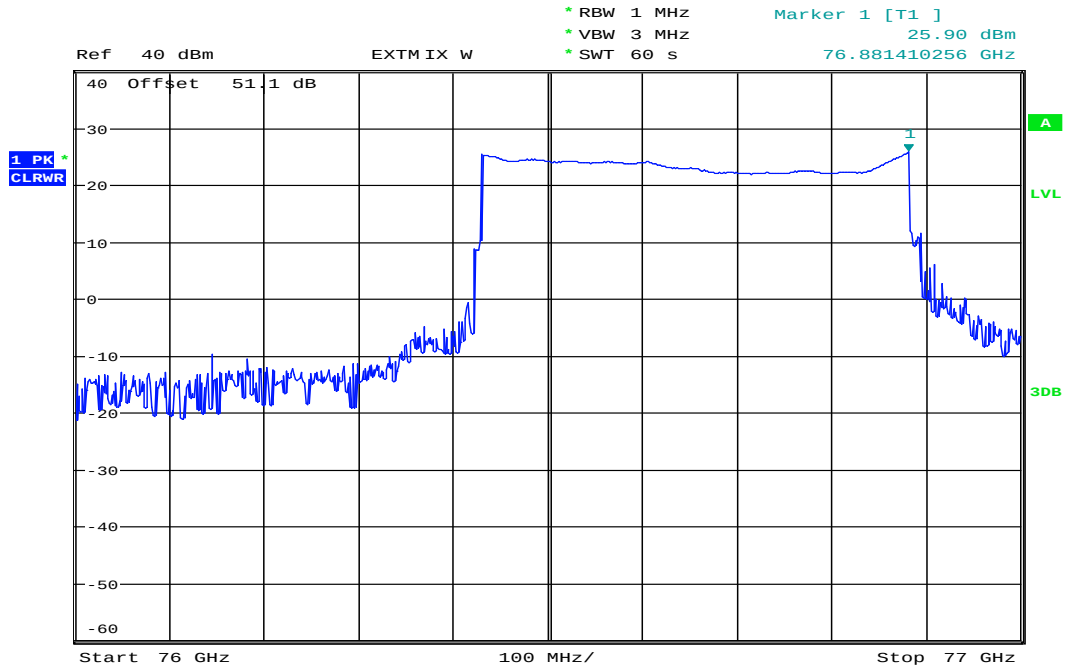
Date: 2.AUG.2012 13:48:41

Plot 12: EIRP (Average detector), T_{min} / V_{nom}, CW-Test mode, low/mid/high frequency



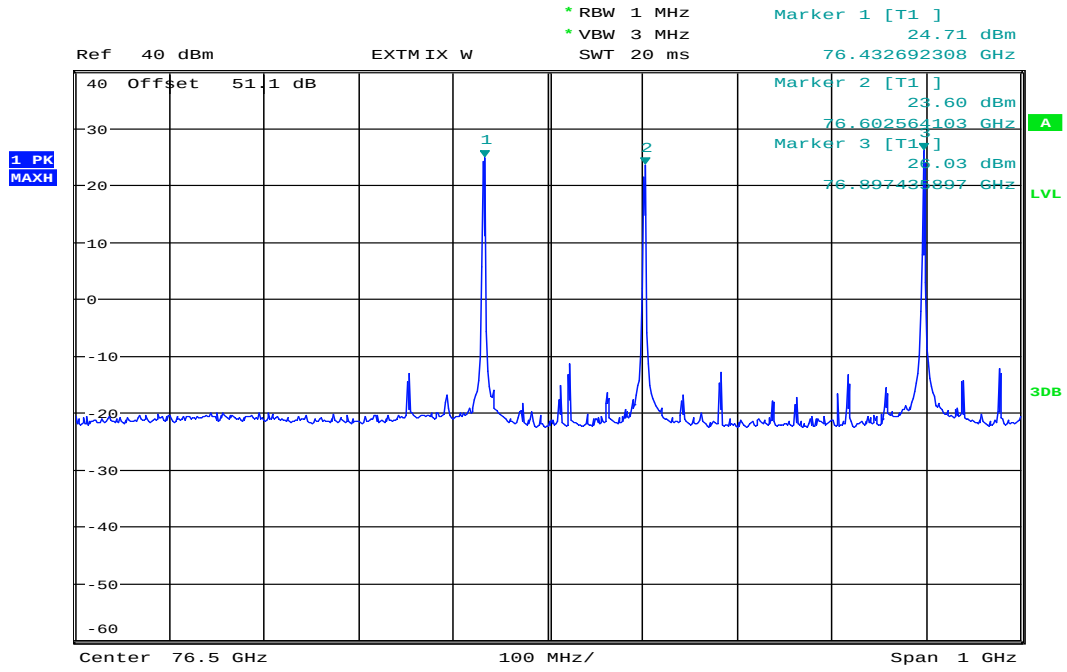
Date: 2.AUG.2012 13:49:43

Plot 13: EIRP (Peak detector), T_{max} / V_{nom}, normal operation mode



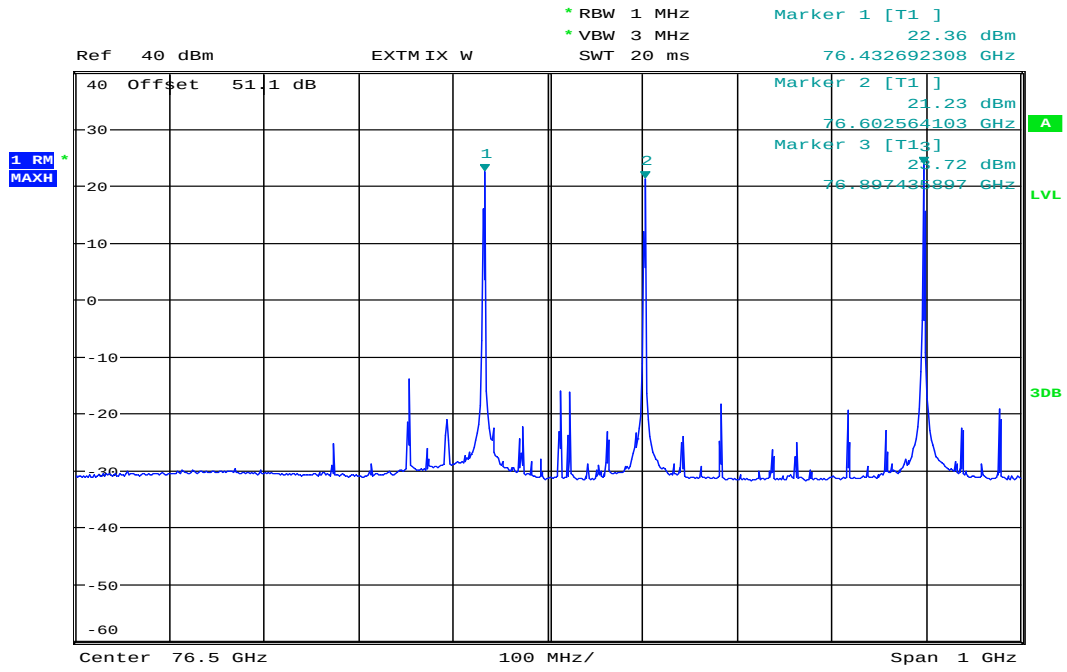
Plot 14: EIRP (Average detector), T_{max} / V_{nom}, normal operation mode

Plot 15: EIRP (Peak detector), T_{max} / V_{nom}, CW-Test mode, low/mid/high frequency



Date: 2.AUG.2012 11:50:32

Plot 16: EIRP (Average detector), T_{max} / V_{nom}, CW-Test mode, low/mid/high frequency



Date: 2.AUG.2012 11:51:35

9.2 Not in Motion Mode

Measurement results:

Normal operation mode:

TEST CONDITIONS	TRANSMITTER Power Density
	AVG EIRP [dBm]
T_{nom} / $V_{min-max}$	7.5
T_{min} / V_{nom}	4.9
T_{max} / V_{nom}	4.0

Limits: **RSS 210 Issue 8, Annex 13.1.2 (a)**

200 nW/cm^2 → 23.5 dBm if the vehicle is moving than 1 km / hour

Result: **The measurement is passed.**

9.3 Maximum Permissible Exposure (MPE)

MPE Calculation:

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

PD = Power Density (mW/cm2)
OP = DUT Output Power (dBm)
AG = DUT Antenna Gain (dBi)
d = MPE Distance (cm)

Note: OP [mW], AG as lin.factor

§ 1.1310 Radiofrequency radiation exposure limits.

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, ''Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation.''

NOTE TO INTRODUCTORY PARAGRAPH: These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in ''Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,'' NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3.
Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ''IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,'' ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

[61 FR 41016, Aug. 7, 1996]

Results:

Refer to 9.1 Power density, the max. EIRP measured = 24.8 dBm = 302 mW (AVG EIRP, high frequency, T_{nom})

d = 20 cm

➔ PD = 0.6 mW/cm^2

Limits: **FCC §1.1310 (B)**

Frequency [GHz]	Power Density [mW / cm^2]
1.500 GHz – 100.000 GHz	1 mW / cm^2

Result: **The measurement is passed.**

9.4 Occupied bandwidth

Measurement Results:

TEST CONDITIONS (T_{nom} / $V_{min-max}$)	Occupied Bandwidth (99%)	
	f_{low} / f_{high} [GHz]	Bandwidth [MHz]
normal operation mode	76.42760 / 76.88180	454.2
CW, low frequency	76.42905 / 76.43276	3.71
CW, mid frequency	76.59852 / 76.60225	3.73
CW, high frequency	76.89336 / 76.89721	3.85

TEST CONDITIONS (T_{min} / V_{nom})	Occupied Bandwidth (99%)	
	f_{low} / f_{high} [GHz]	Bandwidth [MHz]
normal operation mode	76.42904 / 76.88192	452.9
CW, low frequency	76.42883 / 76.43253	3.7
CW, mid frequency	76.59840 / 76.60208	3.7
CW, high frequency	76.89353 / 76.89734	3.8

TEST CONDITIONS (T_{max} / V_{nom})	Occupied Bandwidth (99%)	
	f_{low} / f_{high} [GHz]	Bandwidth [MHz]
normal operation mode	76.42808 / 76.88192	453.8
CW, low frequency	76.42910 / 76.43284	3.7
CW, mid frequency	76.59907 / 76.60277	3.7
CW, high frequency	76.89436 / 76.89813	3.8

Limits: **FCC §2.1049**

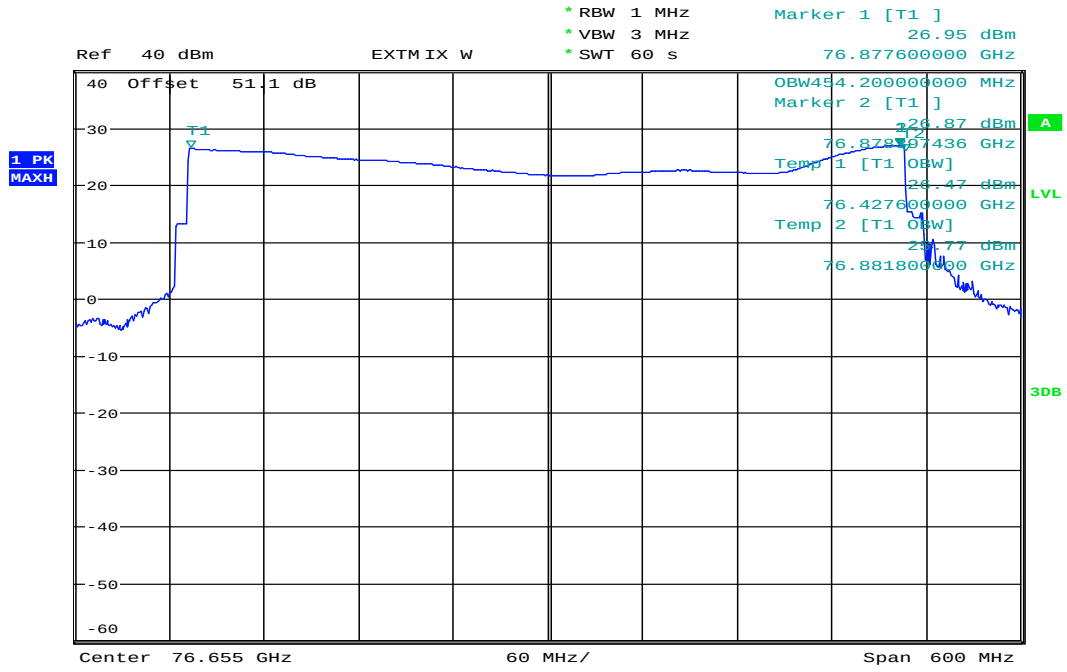
Frequency range	f(lowest) > 76.0 GHz	f(highest) < 77.0 GHz

Limits: **RSS 210 Issue 8, Annex 13.1.1**

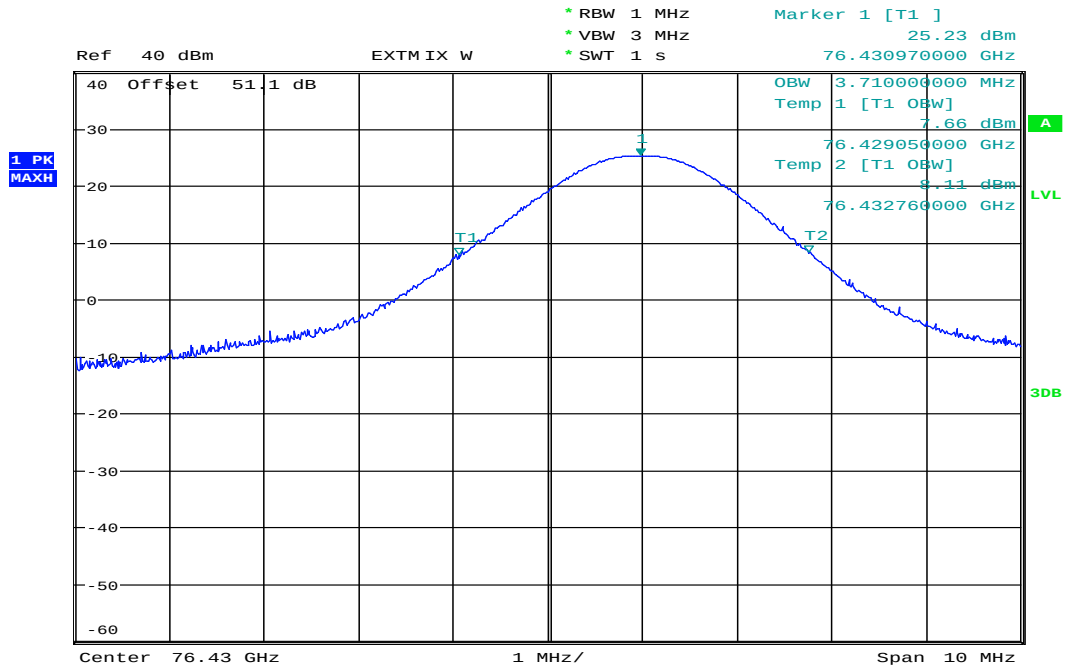
Frequency range	f(lowest) > 76.0 GHz	f(highest) < 77.0 GHz

Result: **The measurement is passed.**

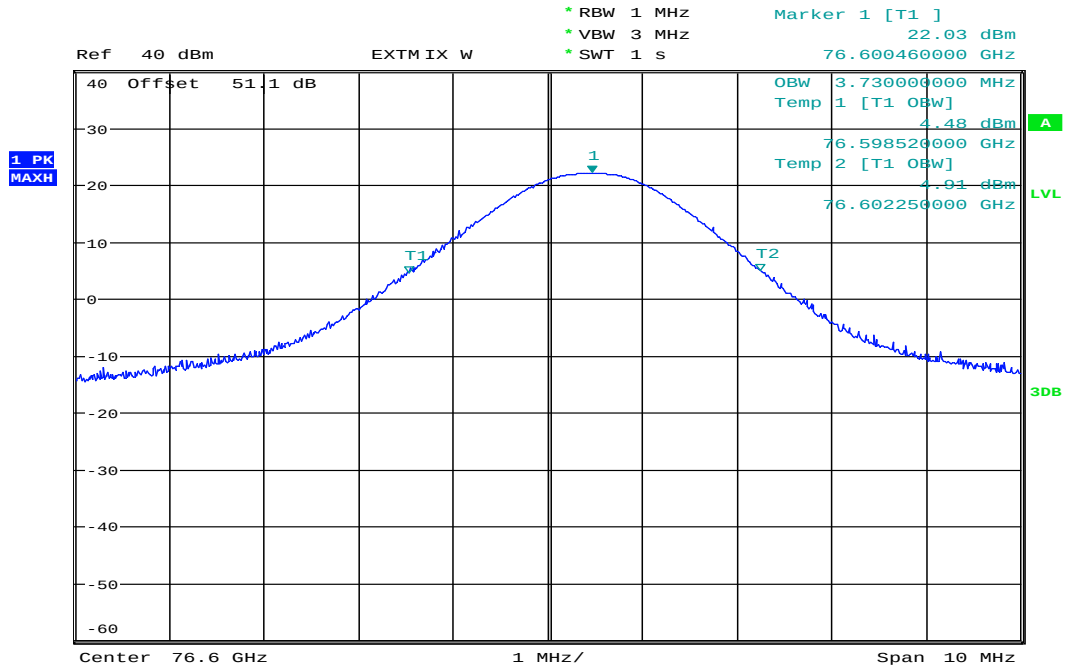
Plot 17: Occupied bandwidth (99%), T_{nom} / $V_{min-max}$, normal operation mode



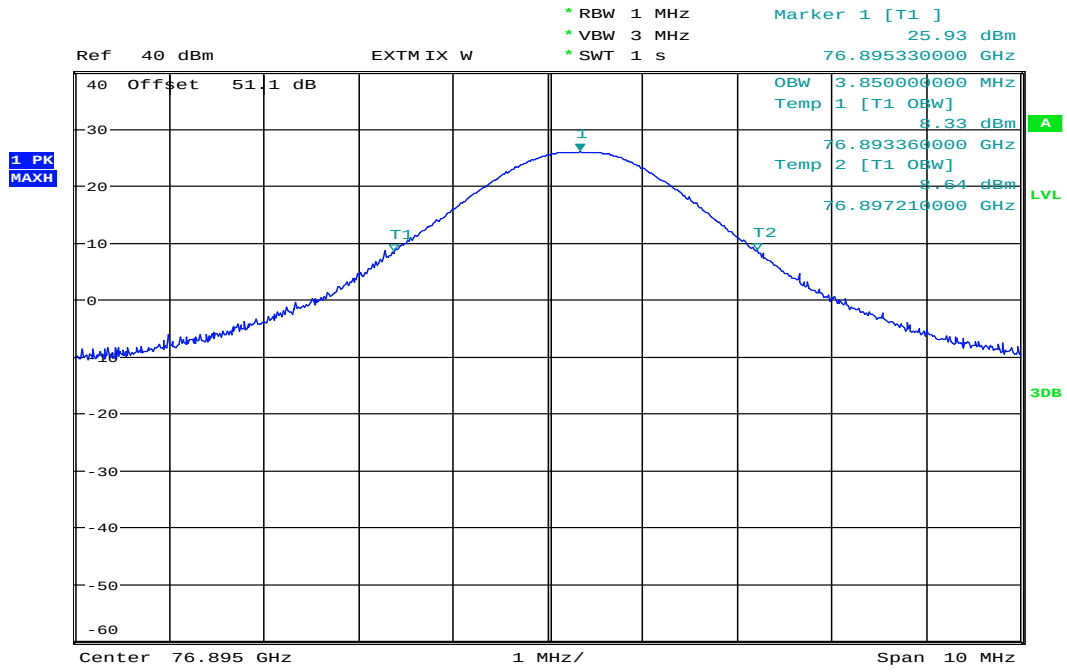
Plot 18: Occupied bandwidth (99%), T_{nom} / $V_{min-max}$, CW-Test mode, low frequency



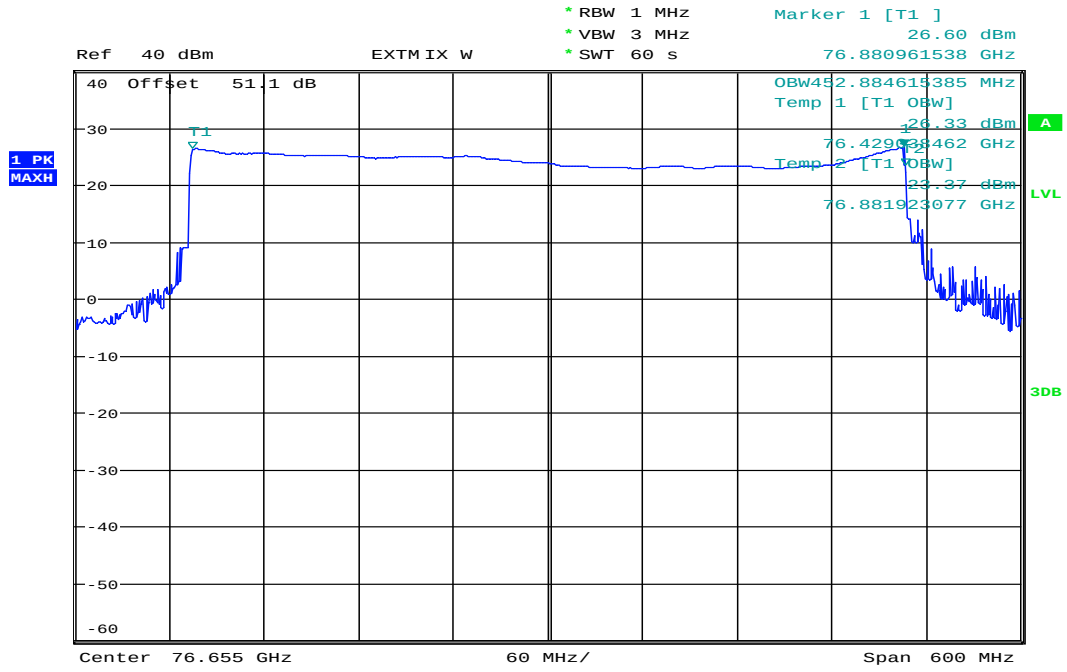
Plot 19: Occupied bandwidth (99%), T_{nom} / $V_{min-max}$, CW-Test mode, mid frequency



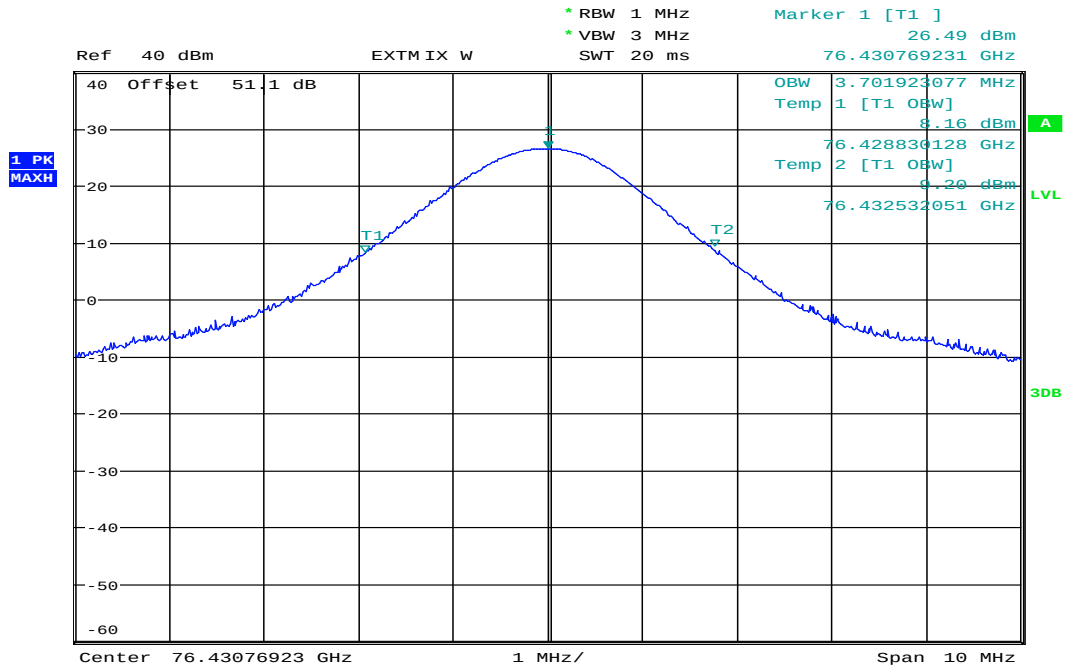
Plot 20: Occupied bandwidth (99%), T_{nom} / $V_{min-max}$, CW-Test mode, high frequency



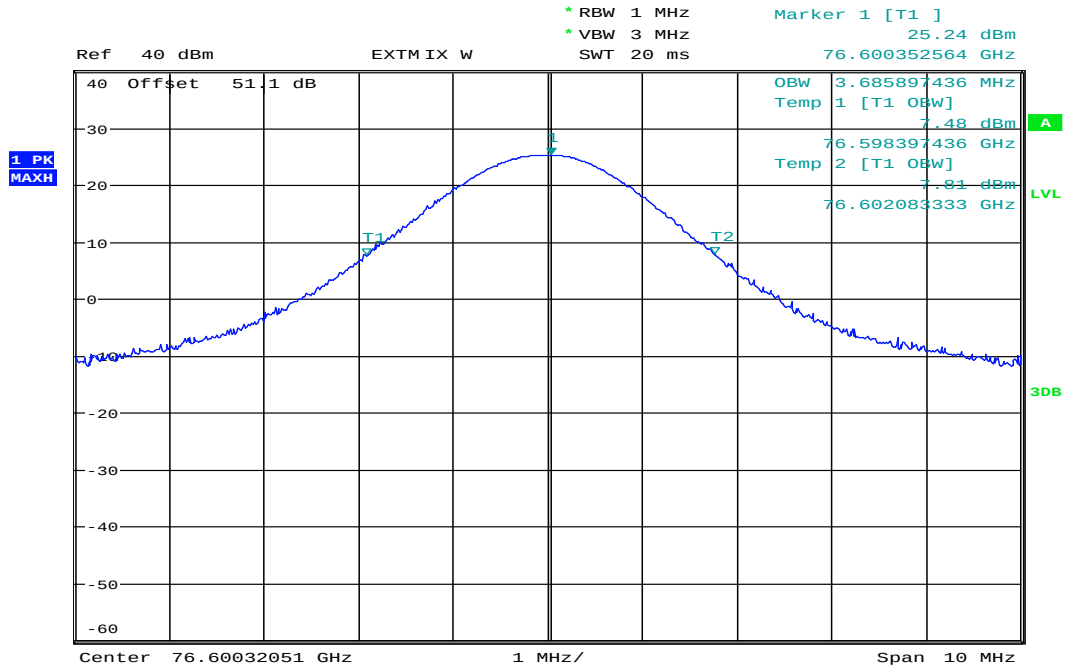
Plot 21: Occupied bandwidth (99%), T_{min} / V_{nom}, normal operation mode



Plot 22: Occupied bandwidth (99%), T_{min} / V_{nom}, CW-Test mode, low frequency

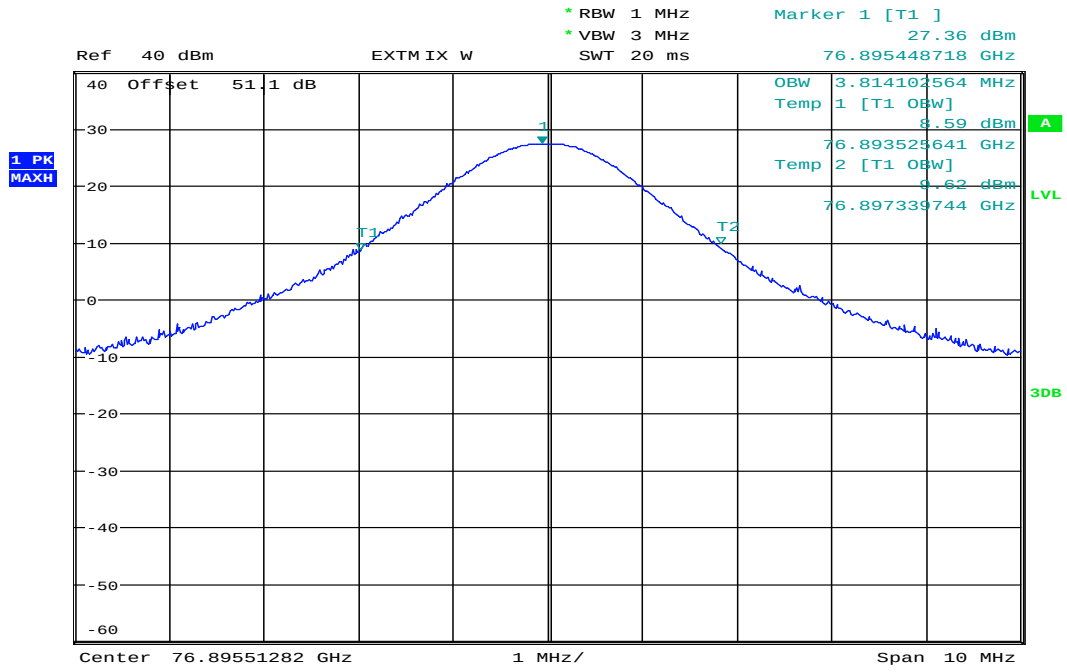


Plot 23: Occupied bandwidth (99%), T_{min} / V_{nom}, CW-Test mode, mid frequency



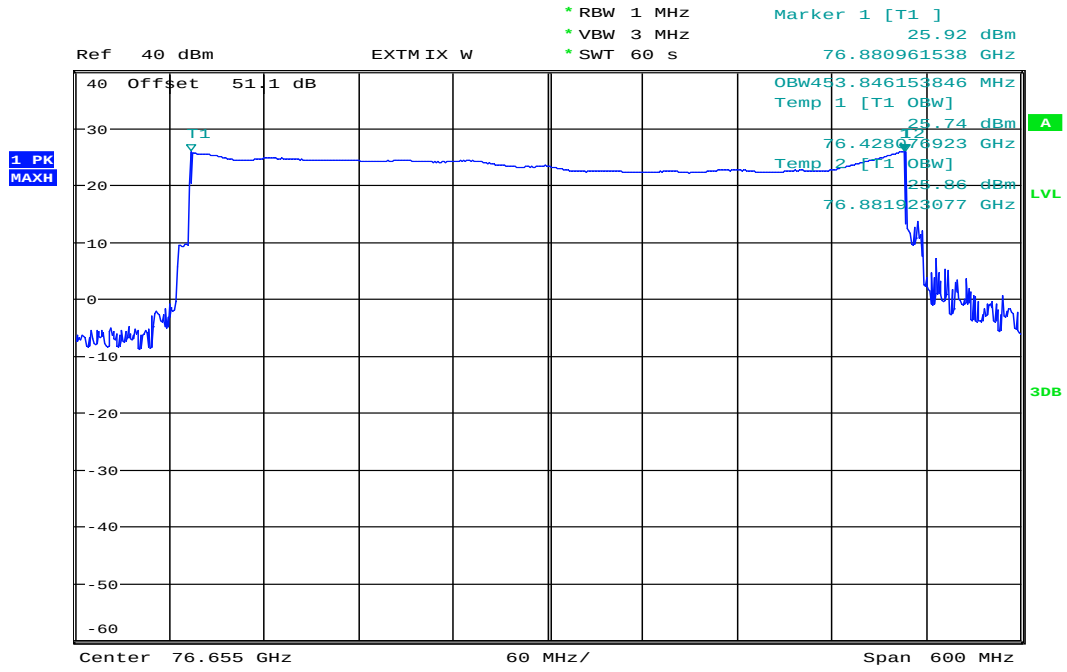
Date: 2.AUG.2012 13:43:50

Plot 24: Occupied bandwidth (99%), T_{min} / V_{nom}, CW-Test mode, high frequency

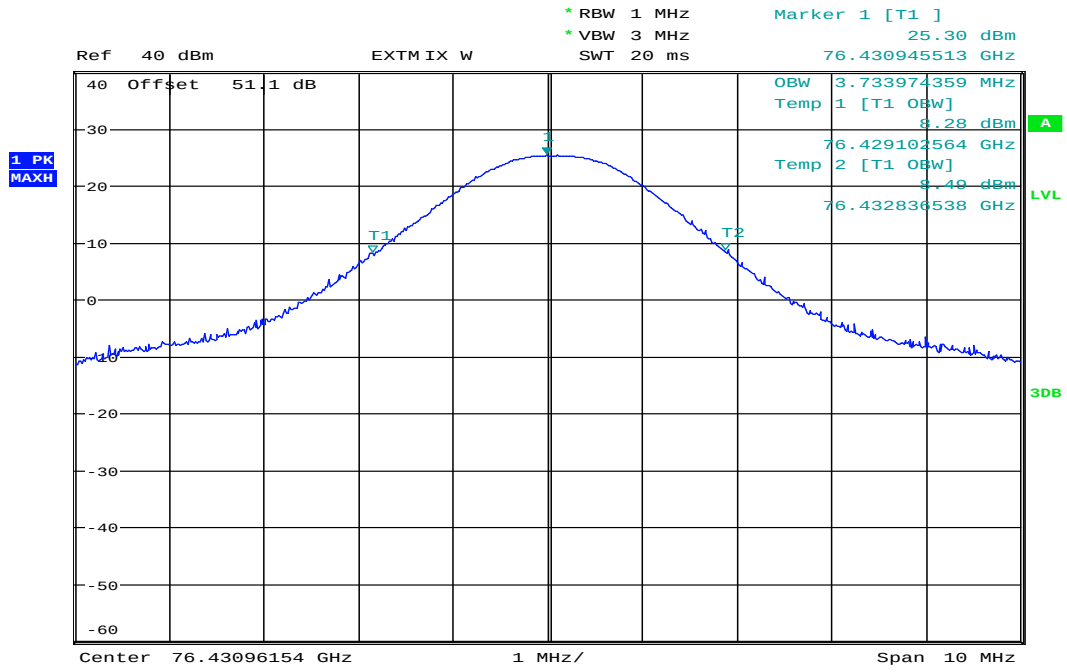


Date: 2.AUG.2012 13:45:04

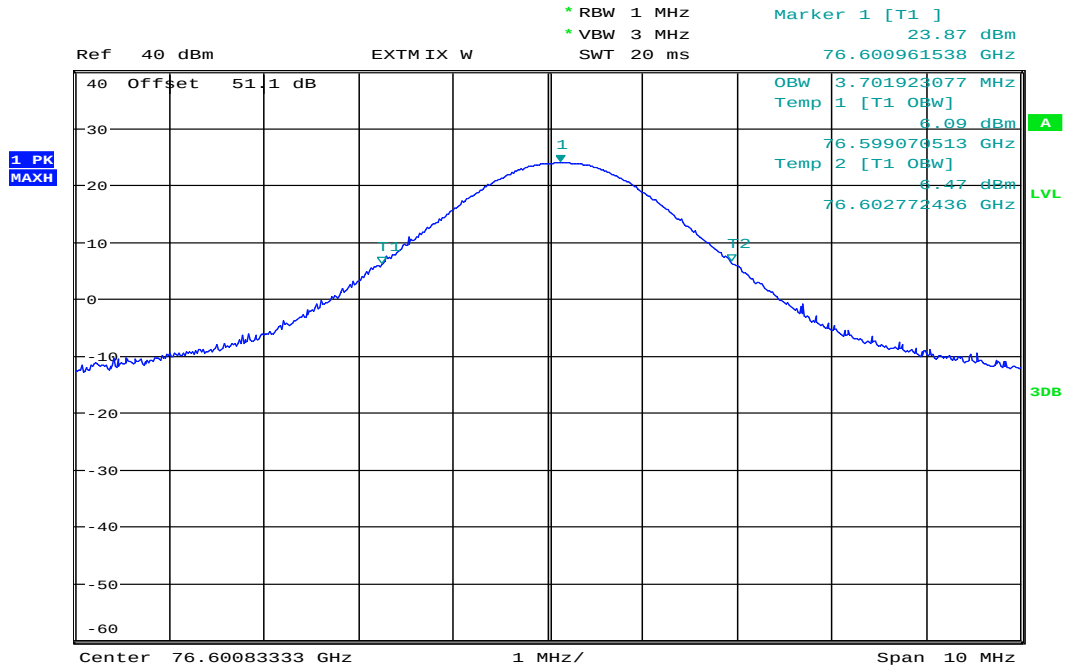
Plot 25: Occupied bandwidth (99%), T_{max} / V_{nom}, normal operation mode



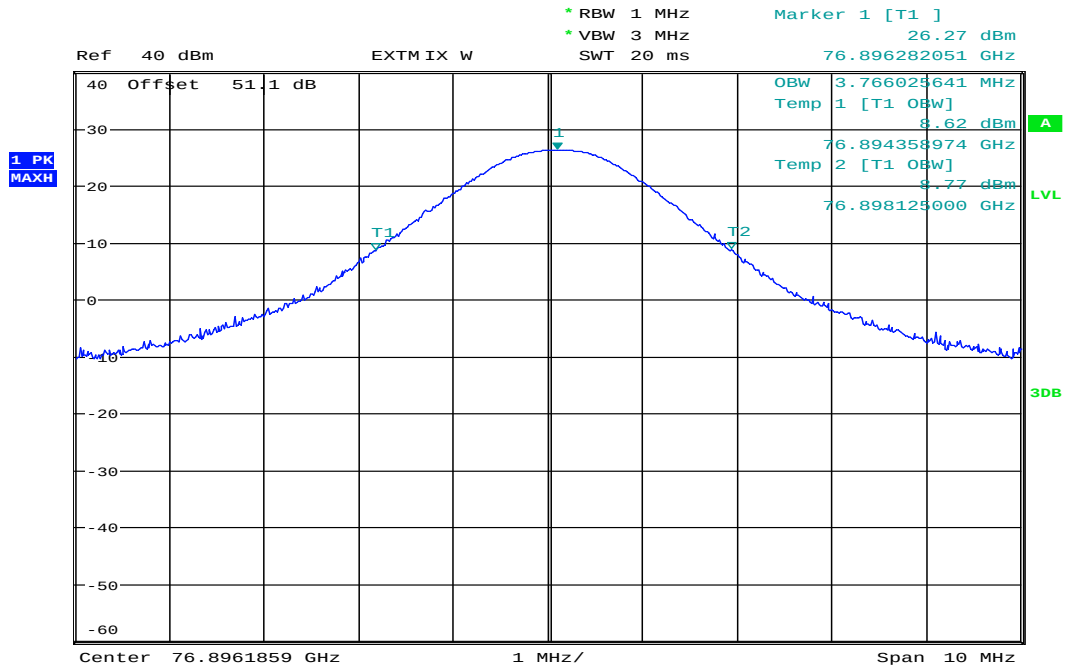
Plot 26: Occupied bandwidth (99%), T_{max} / V_{nom}, CW-Test mode, low frequency



Plot 27: Occupied bandwidth (99%), T_{max} / V_{nom}, CW-Test mode, mid frequency



Plot 28: Occupied bandwidth (99%), T_{max} / V_{nom}, CW-Test mode, high frequency



9.5 Field strength of emissions (radiated spurious)

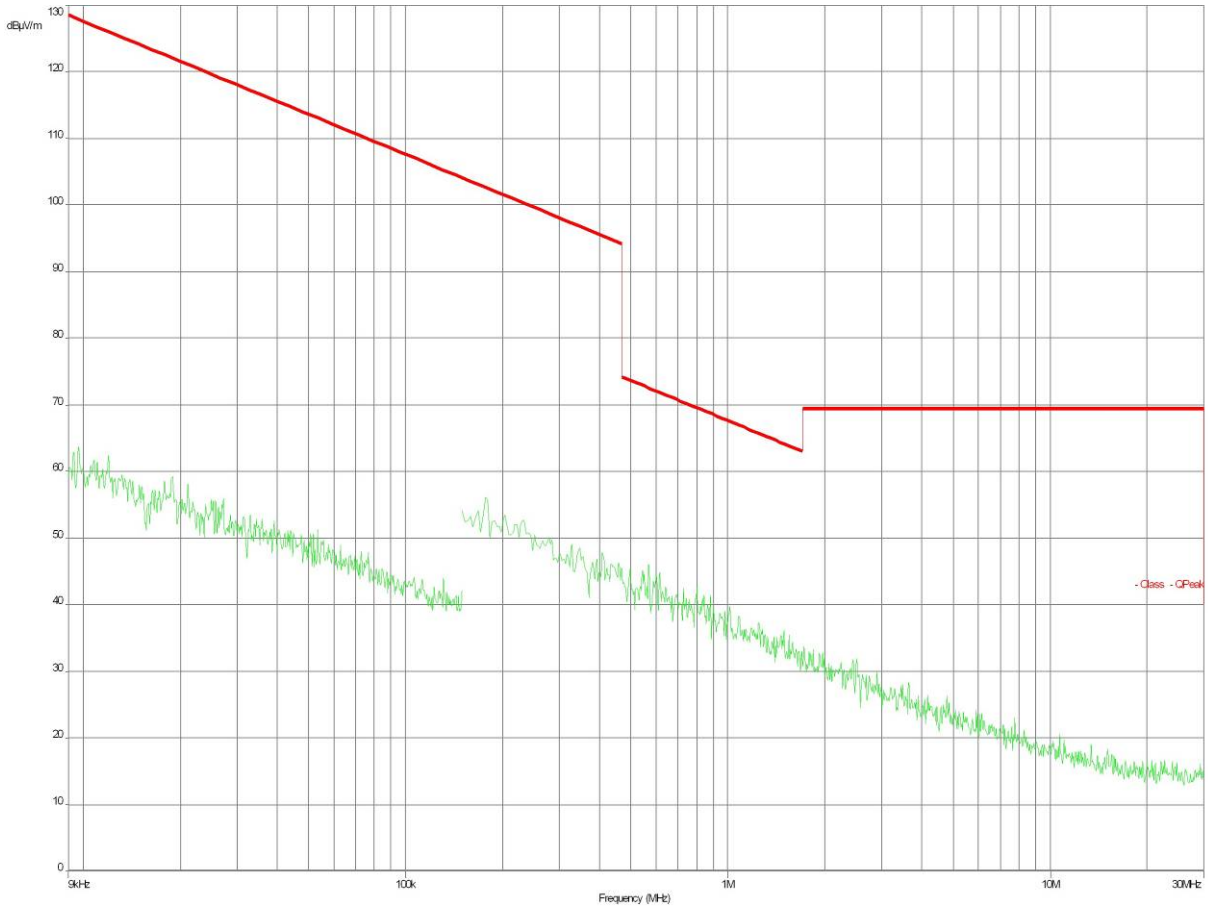
Description:

Measurement of the radiated spurious emissions in transmit mode.

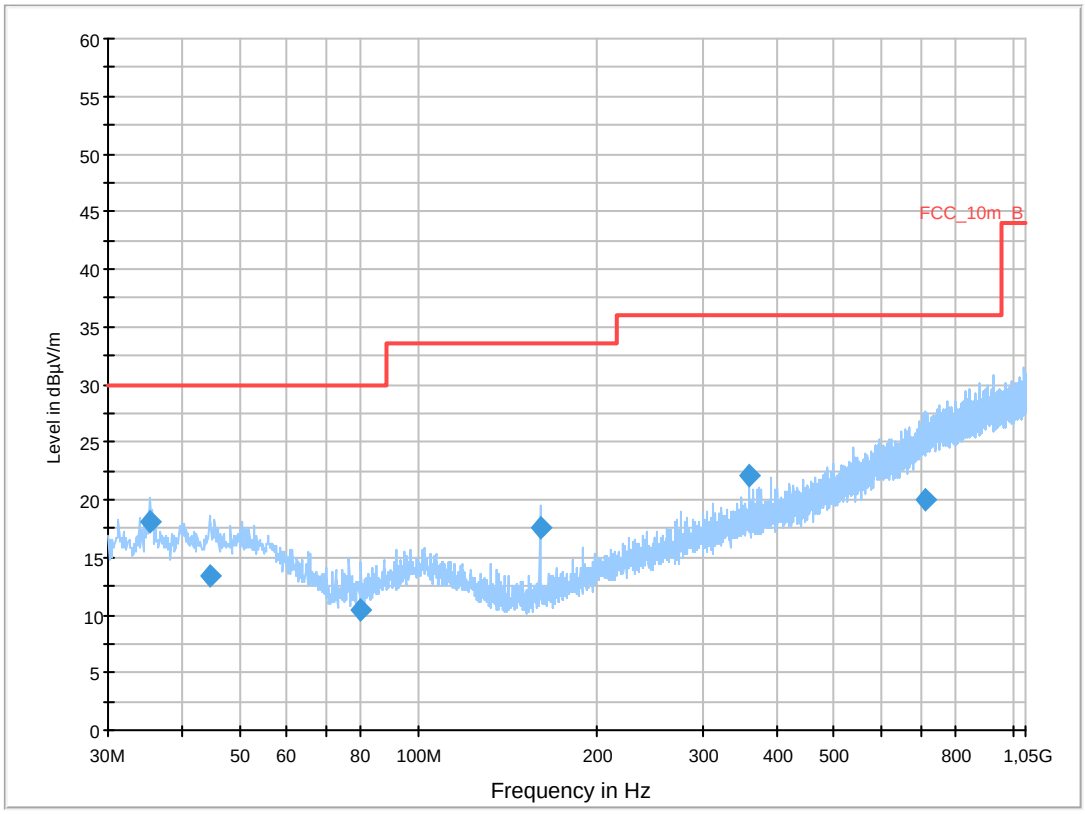
Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Frequency range:	30 MHz to 235 GHz
Trace-Mode:	Max Hold

Plot 29: 9 kHz – 30 MHz, magnetic loop antenna

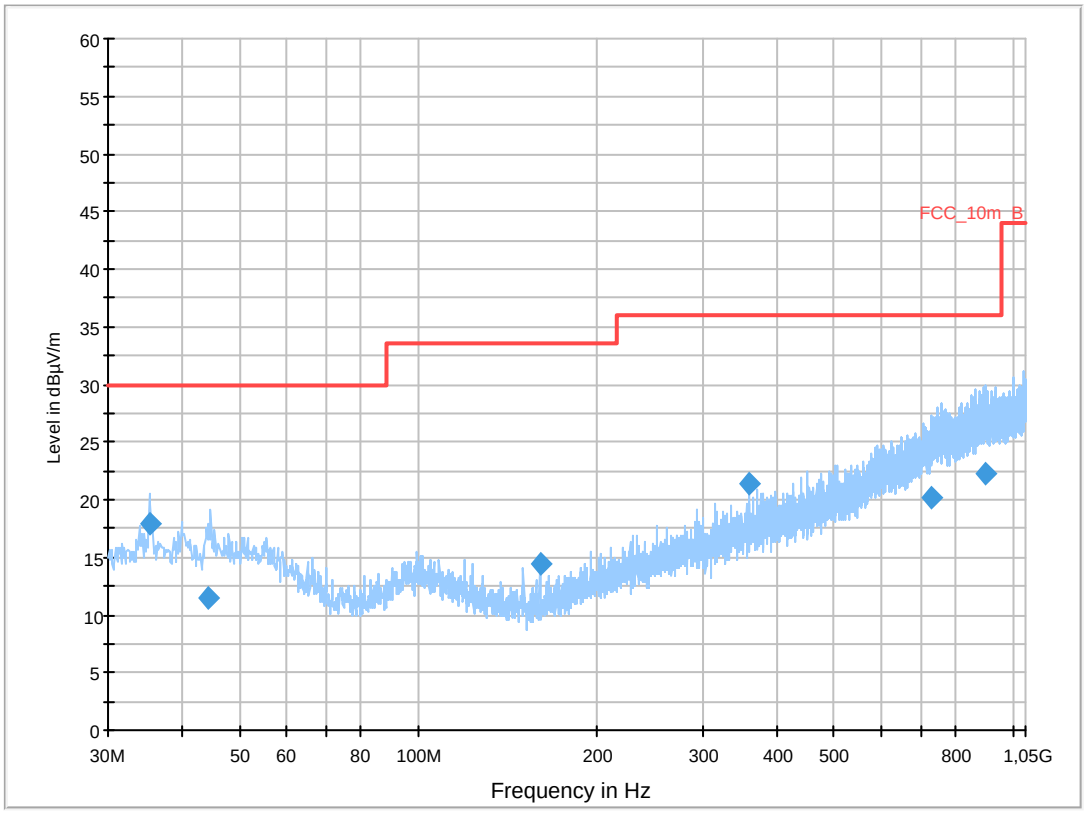


Plot 30: 30 MHz – 1 GHz, antenna horizontal / vertical, low frequency



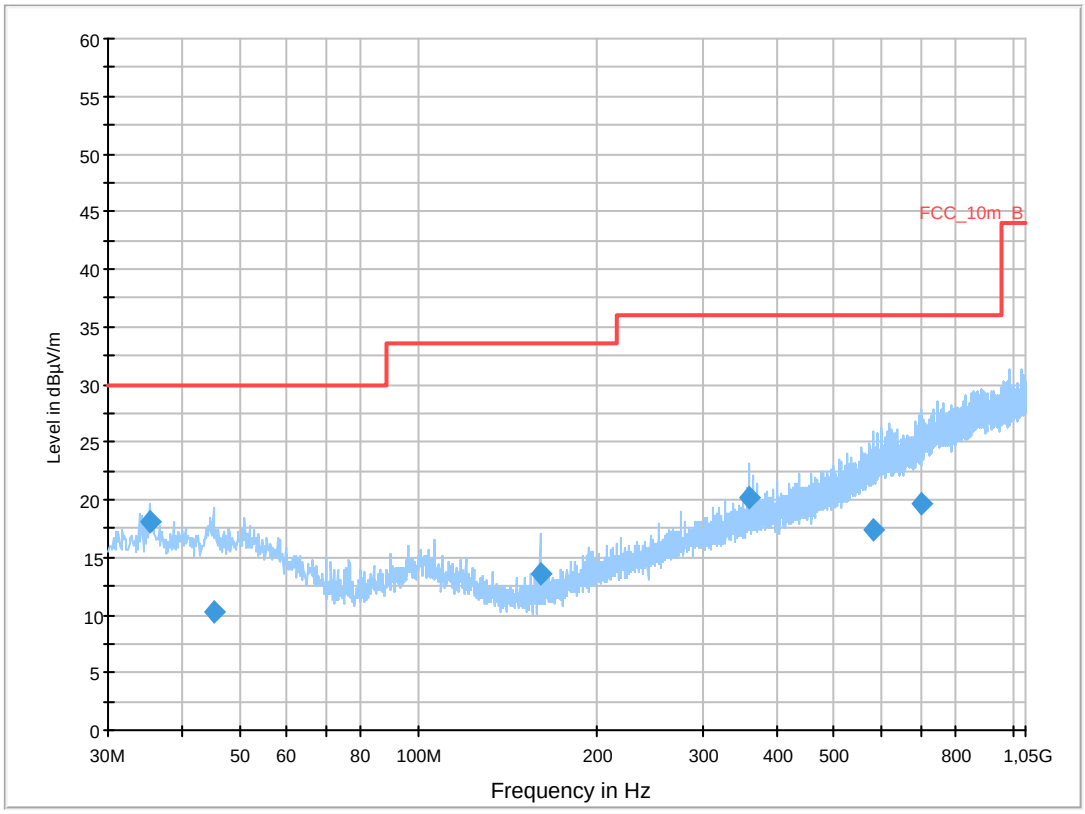
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.320950	18.1	120.000	200.0	V	-18.0	13.1	11.9	30.0
44.506050	13.3	120.000	124.0	V	36.0	13.3	16.7	30.0
79.997550	10.5	120.000	400.0	V	-27.0	9.1	19.5	30.0
160.001400	17.6	120.000	244.0	V	152.0	9.2	15.9	33.5
360.005100	22.1	120.000	100.0	V	99.0	16.2	13.9	36.0
713.451900	20.0	120.000	279.0	H	320.0	22.8	16.0	36.0

Plot 31: 30 MHz – 1 GHz, antenna horizontal / vertical, mid frequency



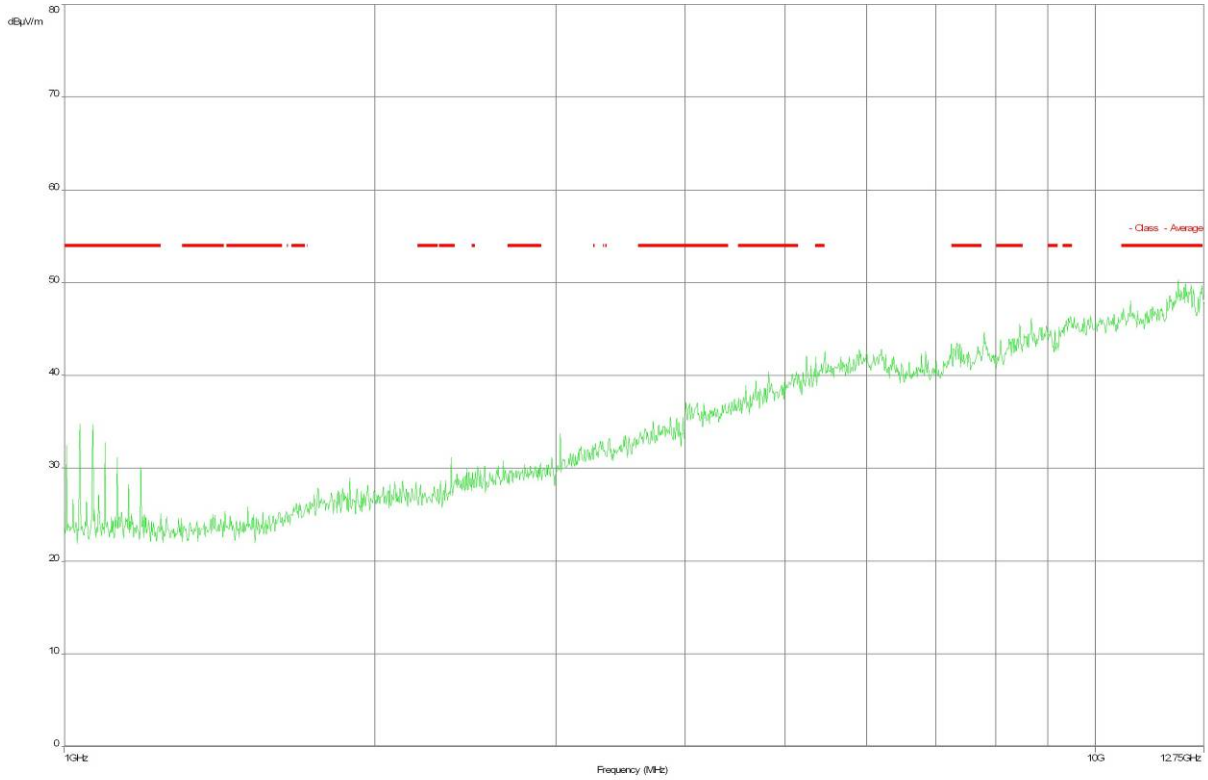
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.309700	18.0	120.000	170.0	V	92.0	13.0	12.0	30.0
44.225550	11.6	120.000	112.0	V	182.0	13.3	18.4	30.0
160.014600	14.5	120.000	98.0	V	100.0	9.2	19.0	33.5
360.020850	21.4	120.000	98.0	V	190.0	16.2	14.6	36.0
727.067250	20.3	120.000	98.0	V	260.0	23.1	15.7	36.0
898.863000	22.3	120.000	170.0	H	10.0	25.2	13.7	36.0

Plot 32: 30 MHz – 1 GHz, antenna horizontal / vertical, high frequency

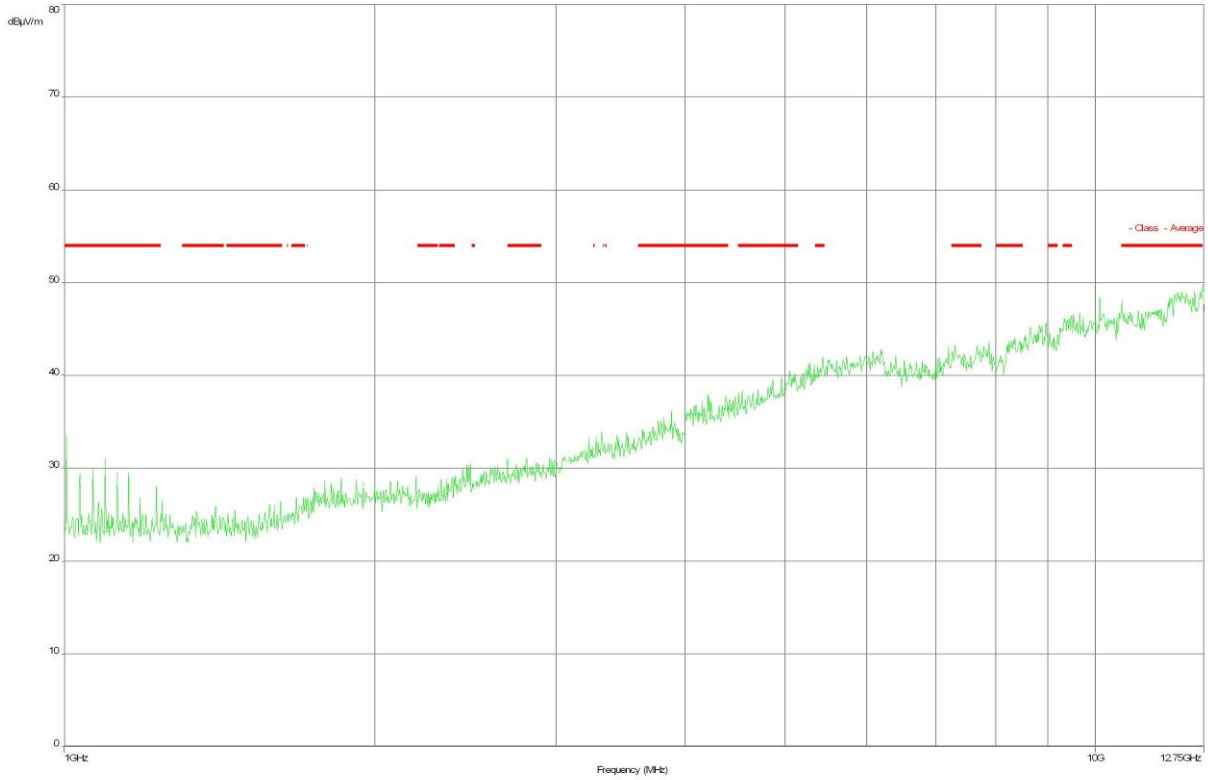


Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.295750	18.1	120.000	200.0	V	-11.0	13.0	11.9	30.0
45.391800	10.2	120.000	100.0	H	49.0	13.3	19.8	30.0
160.033050	13.6	120.000	106.0	V	326.0	9.2	19.9	33.5
359.963700	20.1	120.000	200.0	V	64.0	16.2	15.9	36.0
581.246700	17.3	120.000	400.0	H	160.0	20.3	18.7	36.0
701.979300	19.7	120.000	167.0	H	212.0	22.5	16.3	36.0

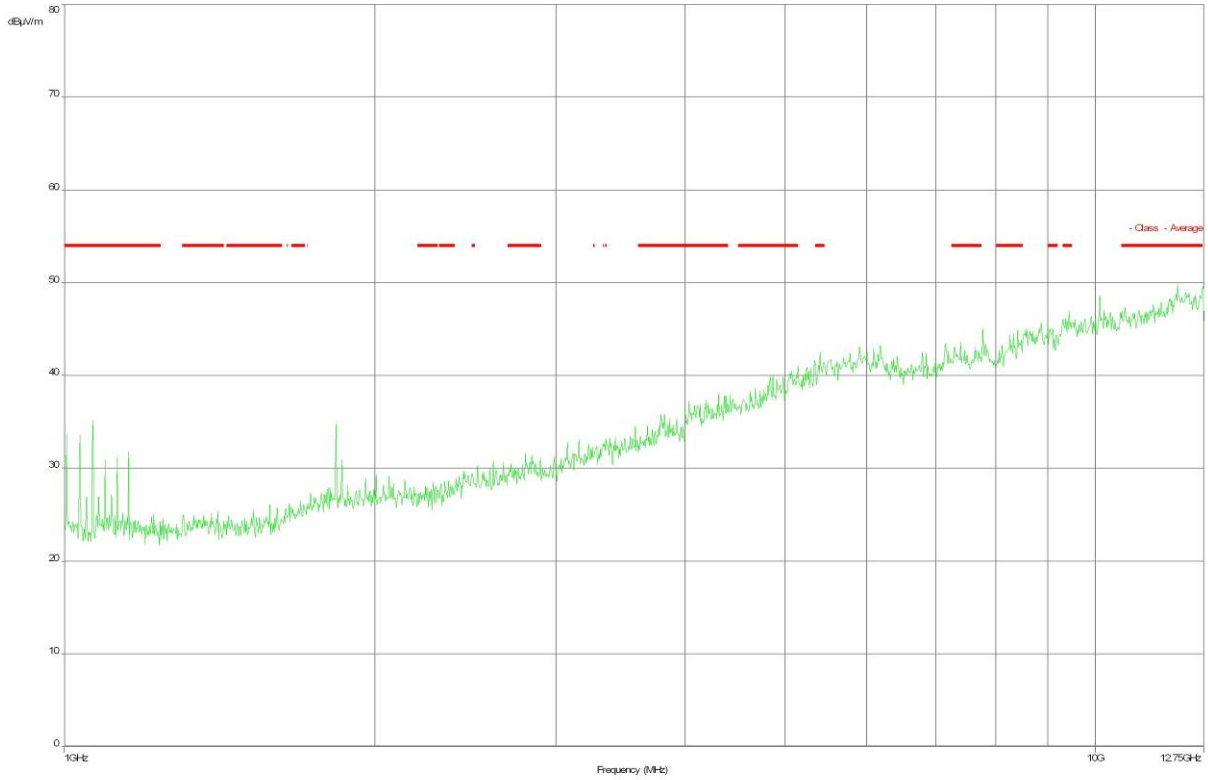
Plot 33: 1 GHz – 12 GHz, Pos-Peak, antenna horizontal / vertical, low frequency



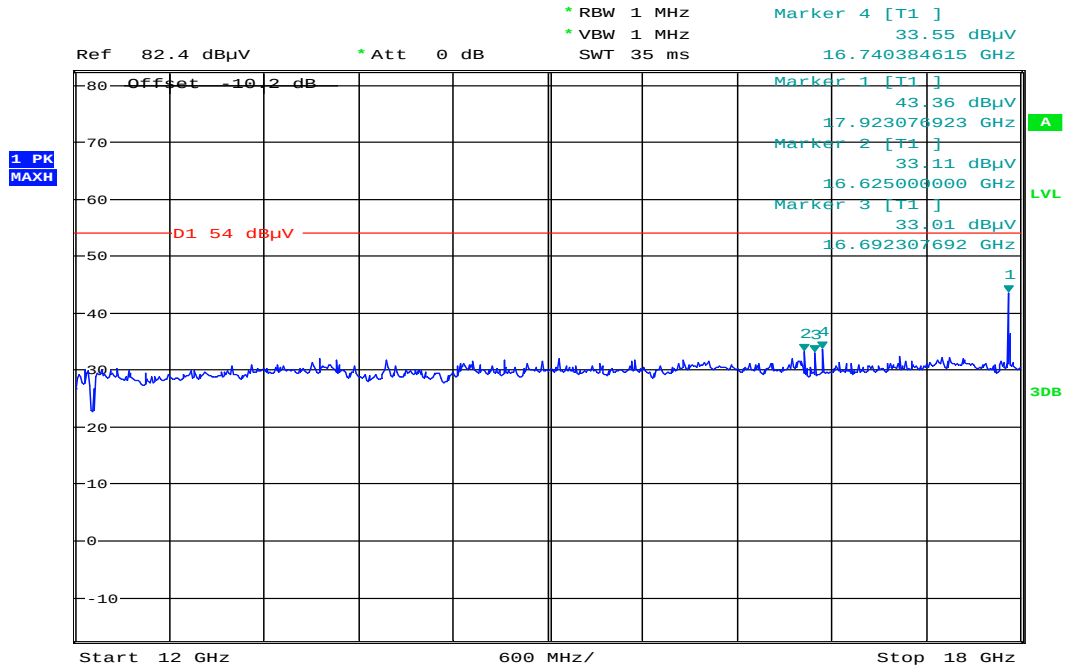
Plot 34: 1 GHz – 12 GHz, Pos-Peak, antenna horizontal / vertical, mid frequency



Plot 35: 1 GHz – 12 GHz, Pos-Peak, antenna horizontal / vertical, high frequency

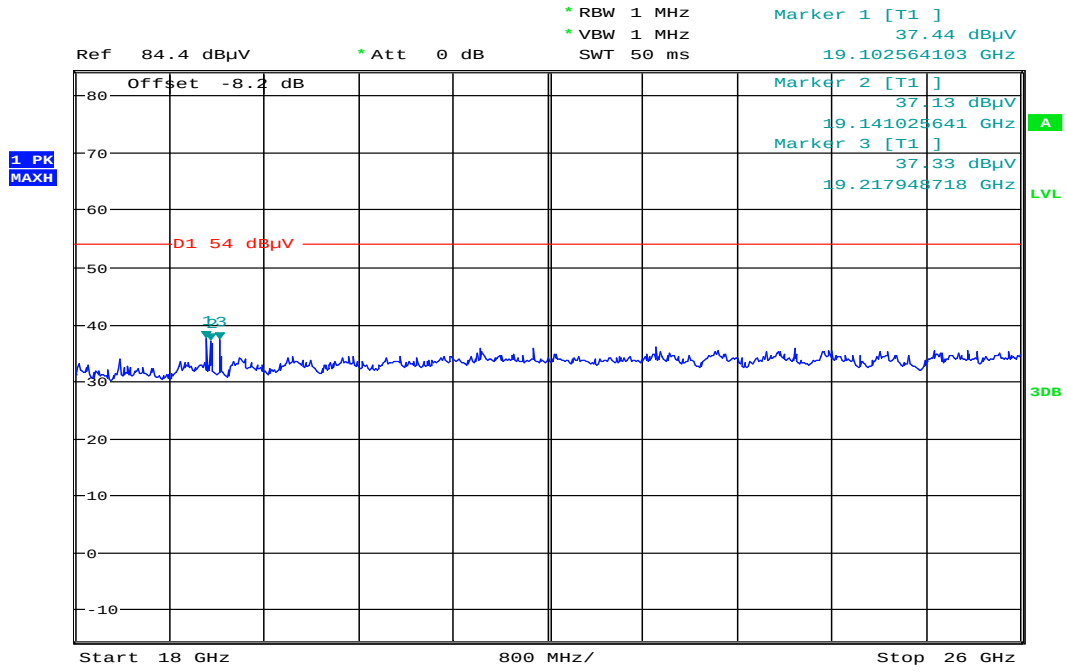


Plot 36: 12 GHz – 18 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



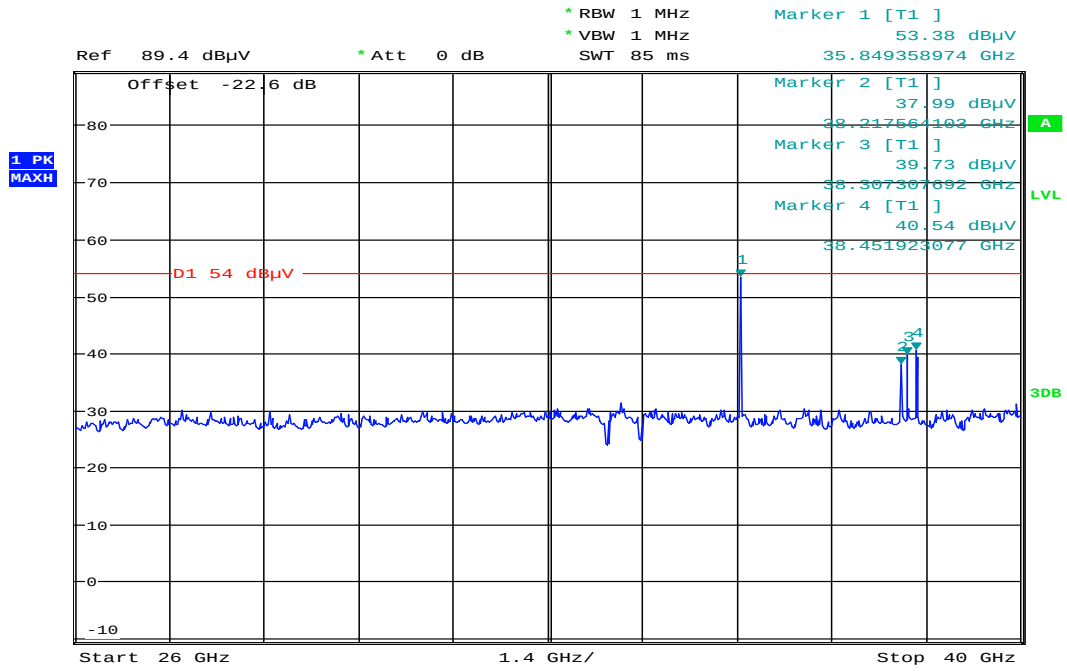
Date: 10.AUG.2012 12:03:02

Plot 37: 18 GHz – 26 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



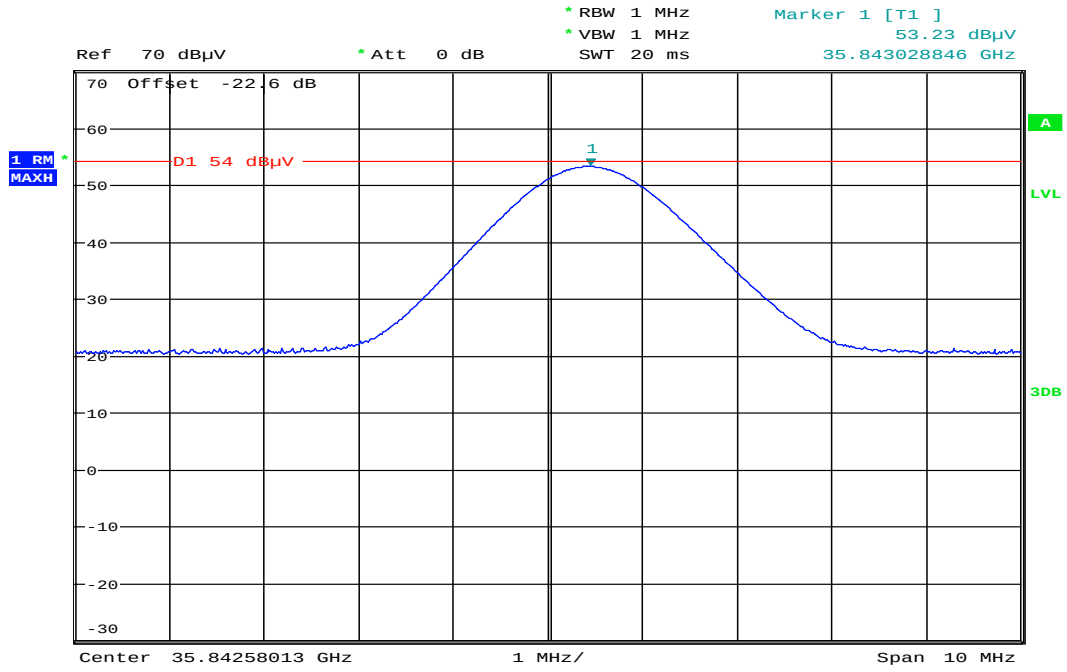
Date: 10.AUG.2012 12:40:22

Plot 38: 26 GHz – 40 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



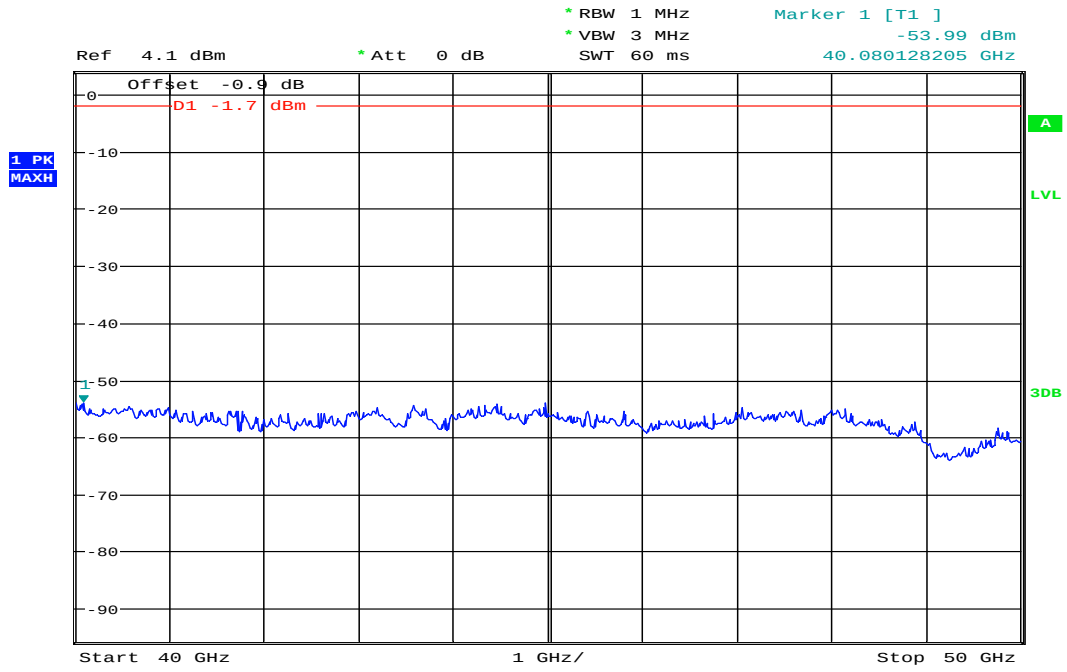
Date: 10.AUG.2012 12:45:15

Plot 39: 35.8 GHz, RMS, antenna horizontal / vertical, low / mid / high frequency



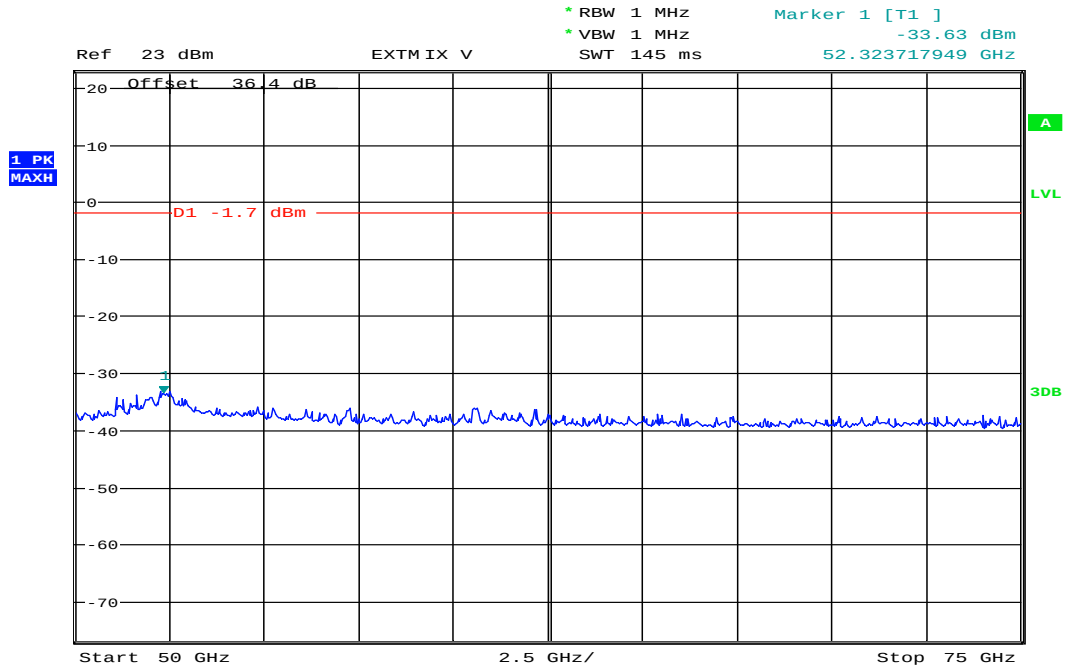
Date: 10.AUG.2012 10:57:36

Plot 40: 40 GHz – 50 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



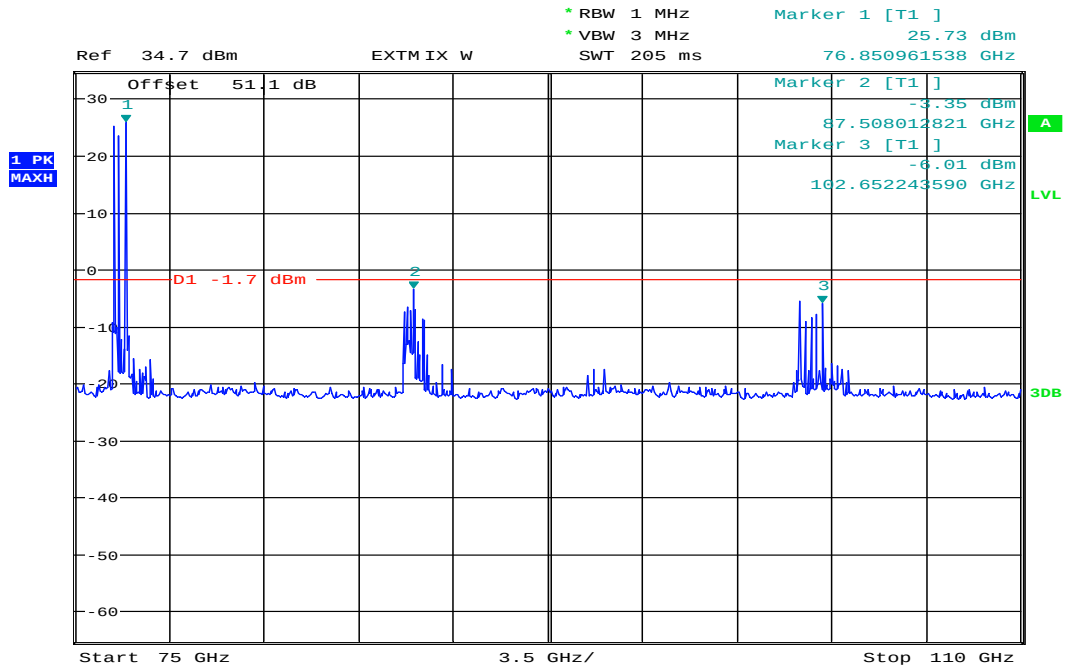
Date: 2.AUG.2012 09:55:11

Plot 41: 50 GHz – 75 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



Date: 10.AUG.2012 12:59:53

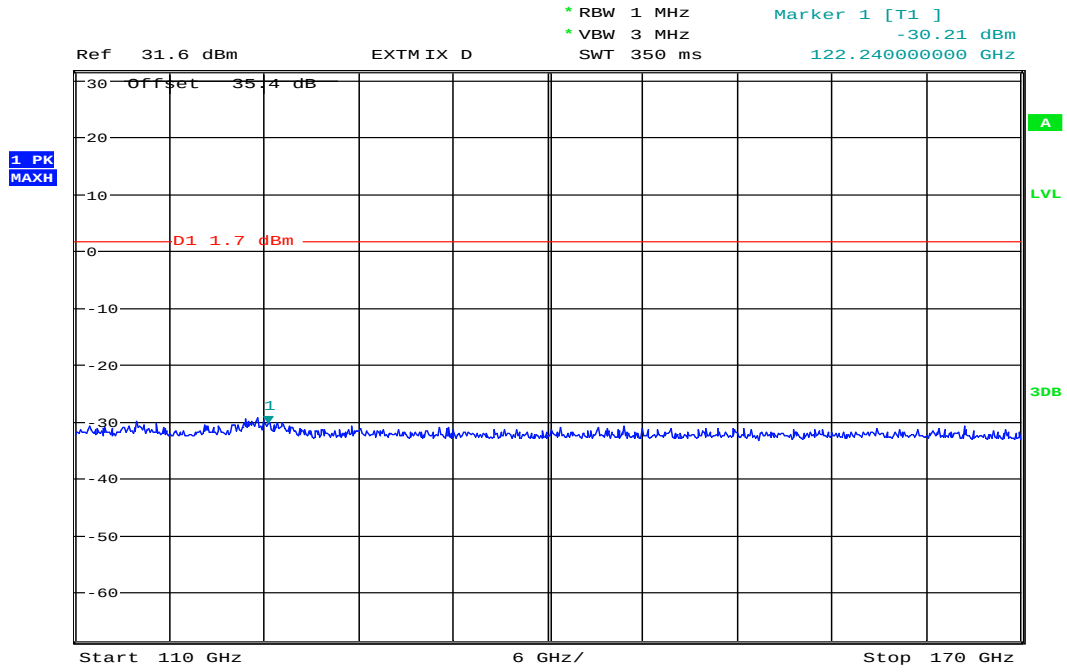
Plot 42: 75 GHz – 110 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



Date: 2.AUG.2012 10:24:18

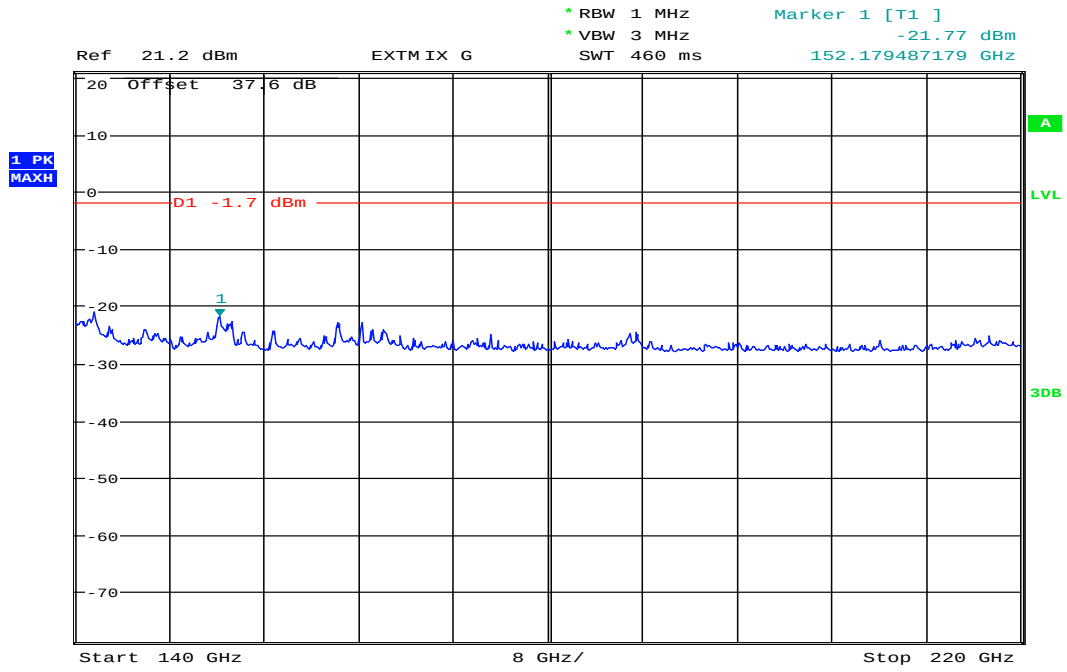
Note: Marker 1 shows the wanted signals, marker 2 and 3 show peaks produced by the harmonic mixer!

Plot 43: 110 GHz – 170 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



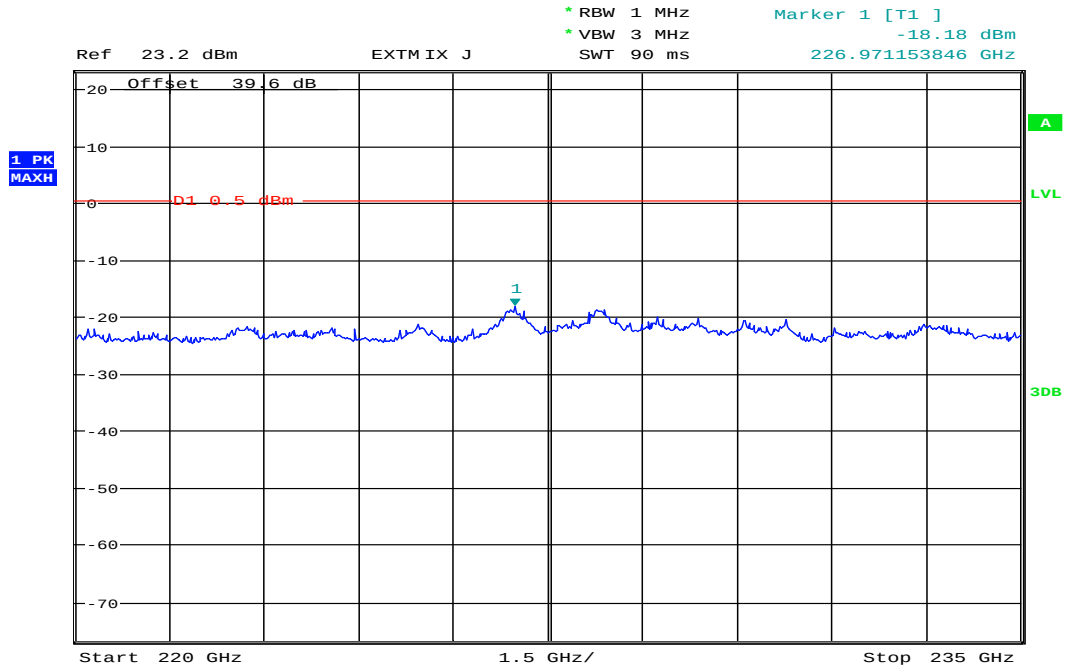
Date: 1.AUG.2012 16:17:00

Plot 44: 140 GHz – 220 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



Date: 2.AUG.2012 10:35:32

Plot 45: 220 GHz – 235 GHz, Pos-Peak, antenna horizontal / vertical, low / mid / high frequency



Date: 2.AUG.2012 10:41:01

Results:

TX Spurious Emissions Radiated [dBµV/m]								
Low frequency			Mid frequency			High frequency		
F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]
No critical peaks found!			35.8	RMS	53.2	No critical peaks found!		
Measurement uncertainty			± 3 dB					

Limits: **FCC §15.253 / 15.209 / 15.205**

FCC		
CFR Part 15.253 (c) (1) / CFR Part 15.209 (a) / CFR Part 15.205		
Radiated Spurious Emissions		
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.		
Frequency [MHz]	Field Strength [dBµV/m]	Measurement distance
0.009 – 0.490	2400/F[kHz]	300
0.490 – 1.705	24000/F[kHz]	30
1.705 – 30.0	30	30
30 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
960 – 40 000	54.0	3

Limits: **FCC §15.253 (c) (2) (ii) + (3)**

Frequency Range [GHz]	Measurement distance	Power Density
40 – 200	3.0 m	600 pW/cm^2 → -1.7 dBm
200 – 231	3.0 m	1000 pW/cm^2 → +0.5 dBm

Limits: **RSS 210 Issue 8, Annex 13.1.2 (2) (a) / (b) / (c)**

Frequency Range [GHz]	Measurement distance	Power Density
40 – 200	3.0 m	600 pW/cm^2 → -1.7 dBm
200 – 231	3.0 m	1000 pW/cm^2 → +0.5 dBm

Result: The measurement is passed.

9.6 Frequency stability

- **Low frequency**

TEST CONDITIONS	Carrier Frequency
(T_{nom} / $V_{min-max}$)	76.43097
(T_{min} / V_{nom})	76.43077
(T_{max} / V_{nom})	76.43095

- **Mid frequency**

TEST CONDITIONS	Carrier Frequency
(T_{nom} / $V_{min-max}$)	76.60046
(T_{min} / V_{nom})	76.60035
(T_{max} / V_{nom})	76.60096

- **High frequency**

TEST CONDITIONS	Carrier Frequency
(T_{nom} / $V_{min-max}$)	76.89533
(T_{min} / V_{nom})	76.89545
(T_{max} / V_{nom})	76.89628

Limits: **FCC §15.253 (e)**

Frequency range	f(lowest) > 76.0 GHz	f(highest) < 77.0 GHz

Limits: **RSS 210 Issue 8, Annex 13.1.5**

Frequency range	f(lowest) > 76.0 GHz	f(highest) < 77.0 GHz

Result: **The measurement is passed.**

10 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Labor/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	CR 79	Std. Gain Horn Antenna 26.5-40.0 GHz	V637	Narda	7911	300001751	ne		
2	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP Meßtechnik	00419	300002268	ev		
3	A022	Std. Gain Horn Antenna 26.4-40.1 GHz	2224-20	Flann	235	300001976	ne		
4	A023	Std. Gain Horn Antenna 39.3-59.7 GHz	2424-20	Flann	75	300001979	ne		
5	A025	Std. Gain Horn Antenna 49.9-75.8 GHz	2524-20	Flann	*	300001983	ne		
6	A028	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001991	ne		
7	A032	Std. Gain Horn Antenna 114-173 GHz	2924-20	Flann	*	300001999	ne		
8	A033	Std. Gain Horn Antenna 145-220 GHz	3024-20	Flann	*	300002000	ne		
9	A035	Std. Gain Horn Antenna 220-330 GHz	3224-20	Flann	*	300002002	ne		
10	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda		300000787	ne		
11	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda		300002442	ne		
12	n. a.	Power Supply	LA30/5GA	Zentro Elektronik	2046	300000711	NK!		
13	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	ve	30.08.2012	30.08.2014
14	n. a.	Spectrum Analyzer Mixer 2-Port	SAM-110-7	Radiometer Physics GmbH	002	300004155	k		
15	n. a.	Spectrum Analyzer Mixer 3-Port	SAM-170	Radiometer Physics GmbH	100014	300004156	k		
16	n. a.	Spectrum Analyzer Mixer 3-Port	SAM-220	Radiometer Physics GmbH	200001	300004157	k		
17	n. a.	Spectrum Analyzer Mixer 3-Port ohne Isolator	SAM-325	Radiometer Physics GmbH	100002	300004158	k		
18	n. a.	Broadband Low Noise Amplifier 18-50 GHz	CBL19503 070-XX	CERNEX	19338	300004273	ne		
19	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	12.01.2012	12.01.2015
20	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	11.05.2011	11.05.2013
21	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
22	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
23	Spec.A. 2_2e	System rack for EMI measurement solution	85900	HP I.V.	*	300000222	ne		
24	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	06.01.2012	06.01.2014
25	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
26	n. a.	Relais Matrix	PSU	R&S	890167/024	300001168	ne		
27	n. a.	Isolating Transformer	RT5A	Grundig	9242	300001263	ne		
28	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
29	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
30	n. a.	Amplifier	js42-00502650-	Parzich GMBH	928979	300003143	ne		

			28-5a						
31	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
32	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
33	n. a.	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev		
34	n. a.	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev		
35	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
36	n. a.	MXG Microwave Analog Signal Generator	N5183A	Agilent Technologies	MY47420220	300003813	k	13.09.2010	13.09.2012
37	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKI!	14.10.2011	14.10.2014
38	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	19.12.2011	19.12.2012
39	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
40	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		
41	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081;B5979	300000210	ne		
42	n. a.	EMI Test Receiver	ESCI 1166.5950.03	R&S	100083	300003312	k	04.01.2012	04.01.2013
43	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/00205	300003314	k	14.07.2011	14.07.2013
44	n. a.	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
45	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
46	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		
47	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
48	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k		
49	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	06.01.2012	06.01.2014

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkI!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

11 Observations

No observations exceeding those reported with the single test cases have been made.

Annex A Photographs of the test setup

Photo No. 1:

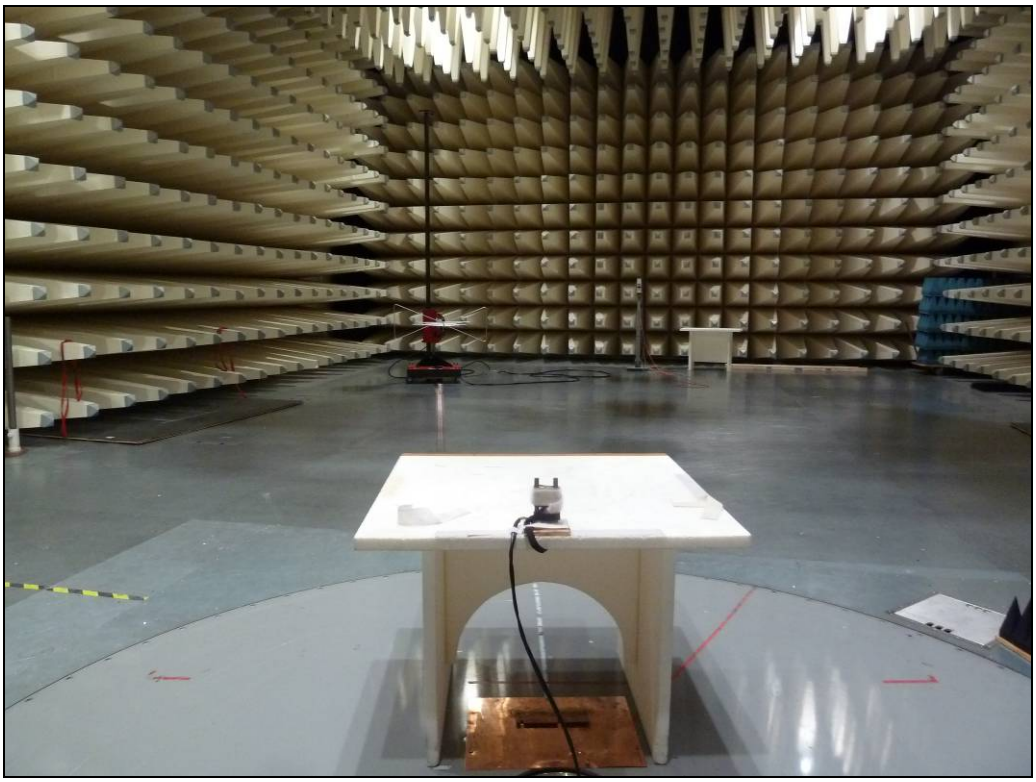


Photo No. 2:

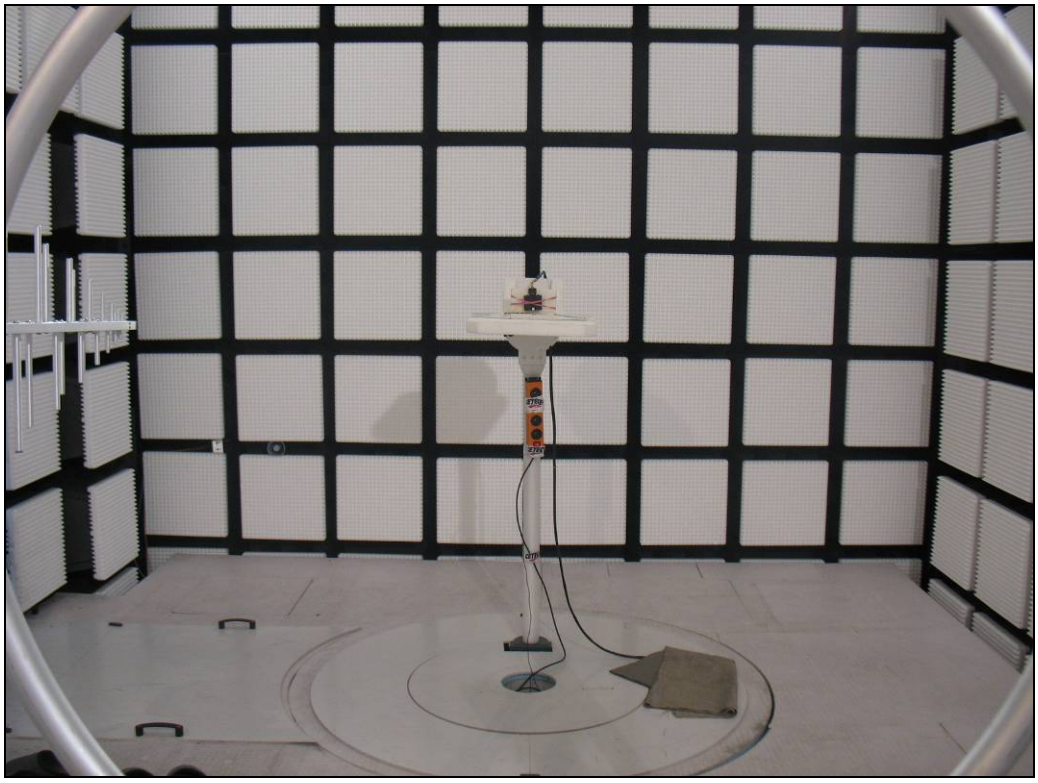
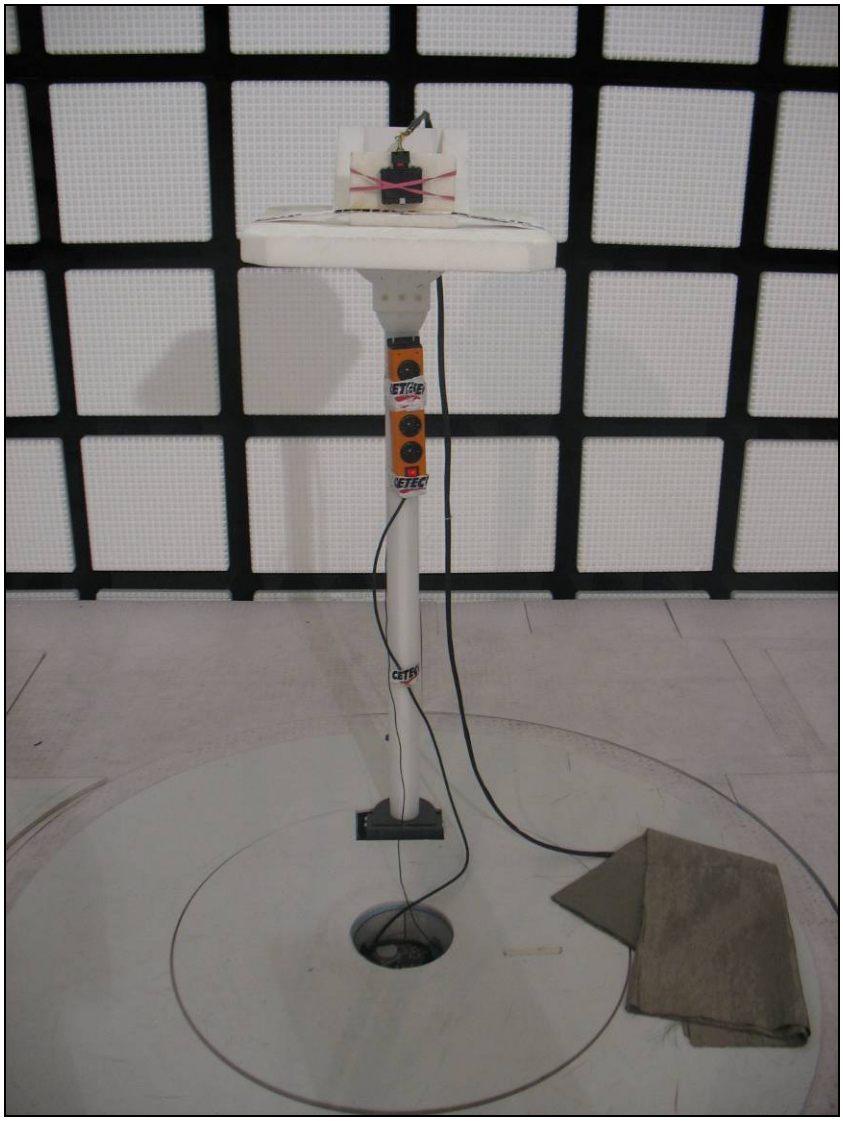


Photo No. 3:



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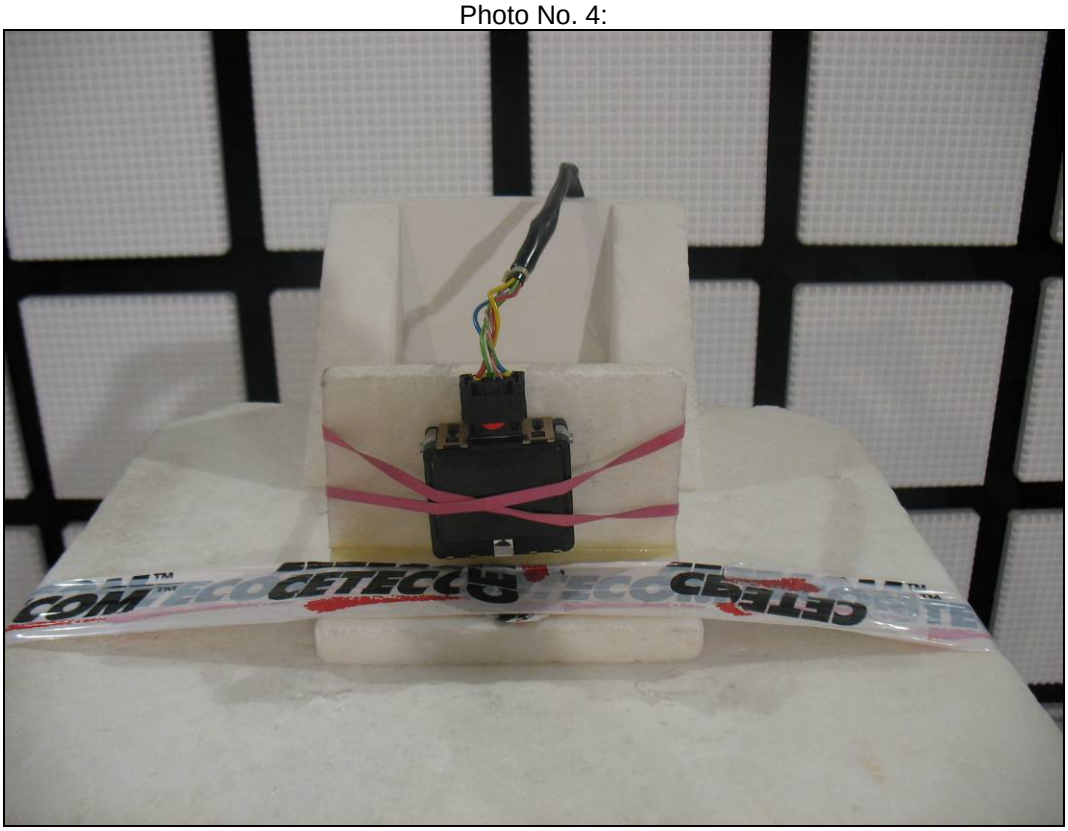
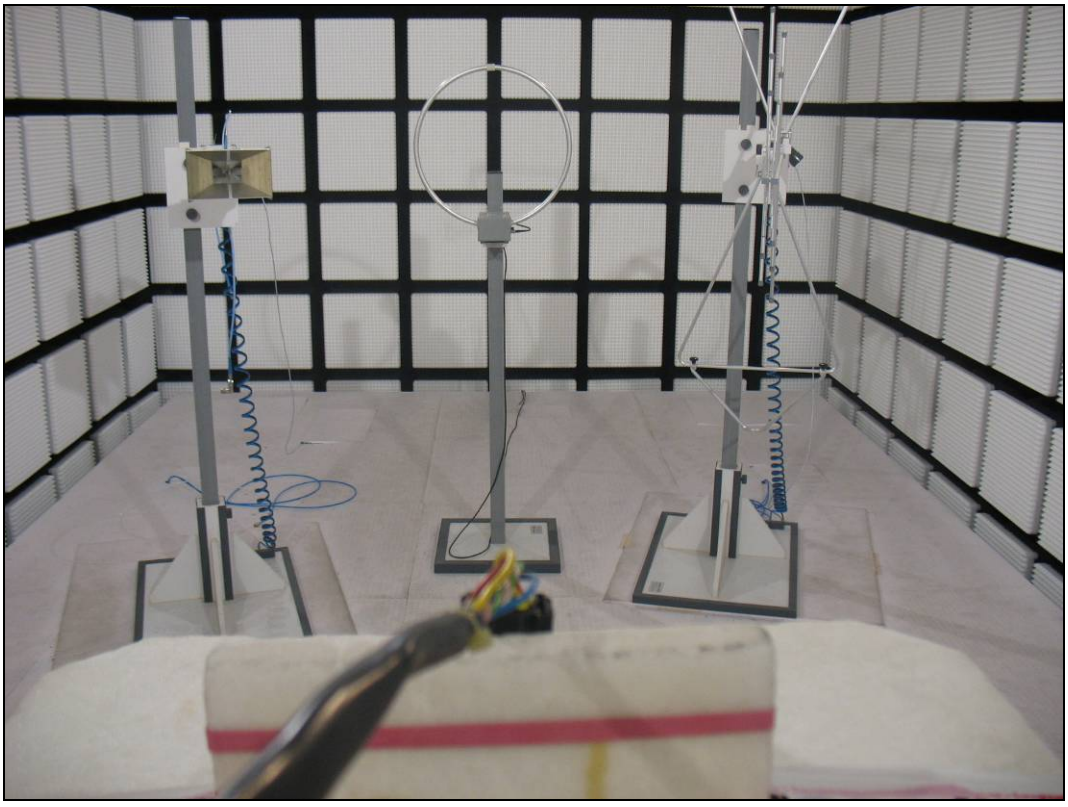


Photo No. 5:



Annex B External photographs of the EUT

Photo No. 6:

Photo No. 7:

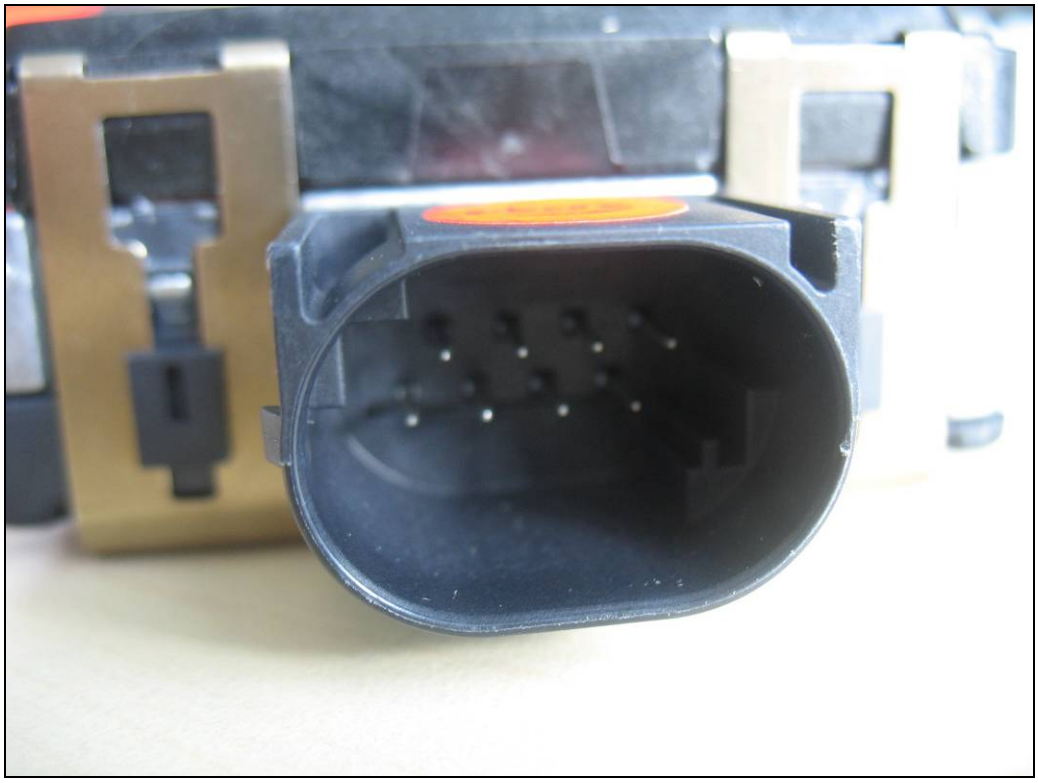


Photo No. 8:

Photo No. 9:

Photo No. 10:

Photo No. 11:

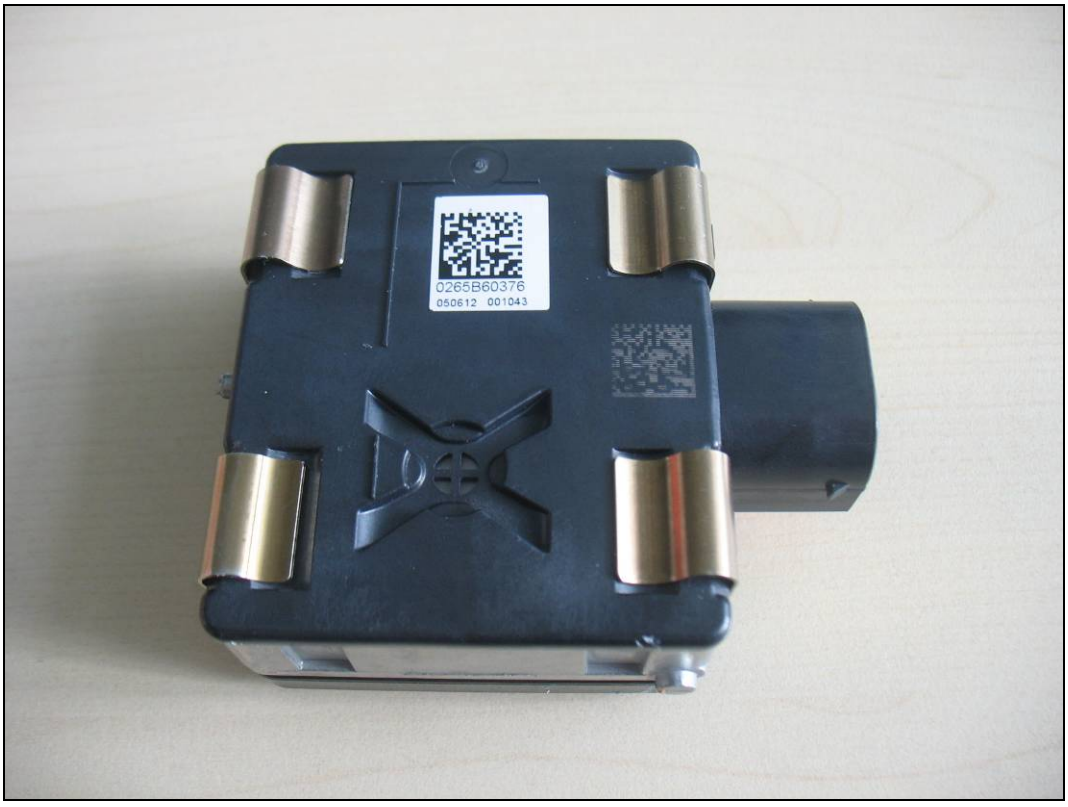


Photo No. 12:

Annex C Internal photographs of the EUT

Photo No. 13:

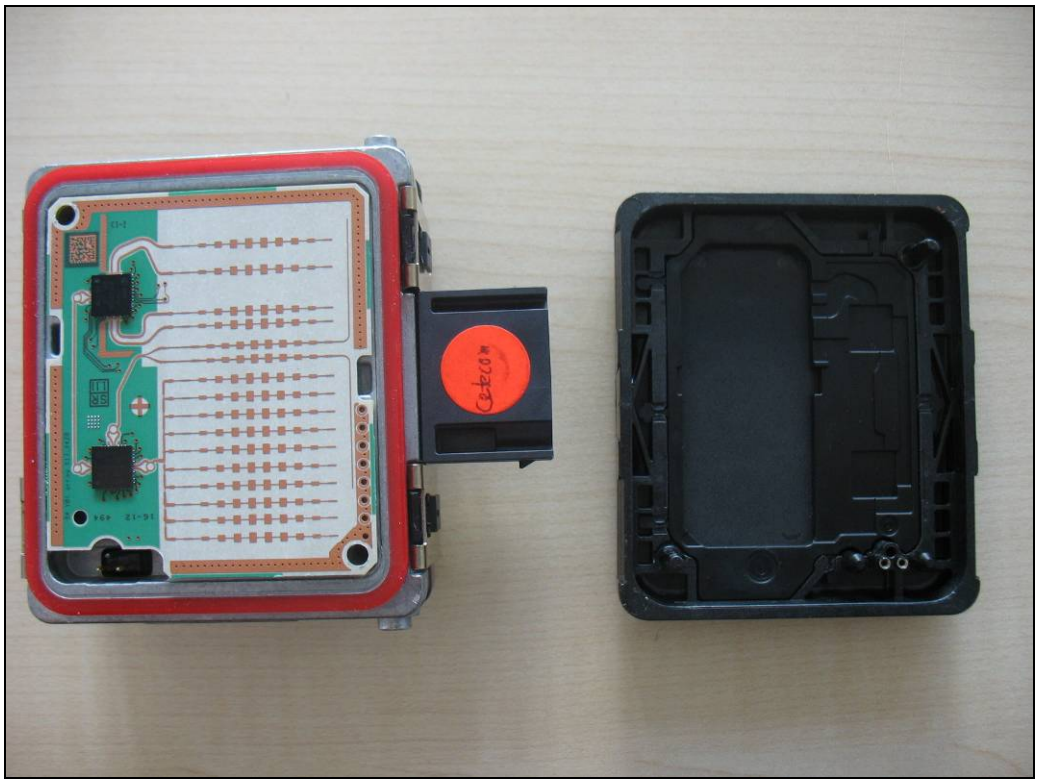
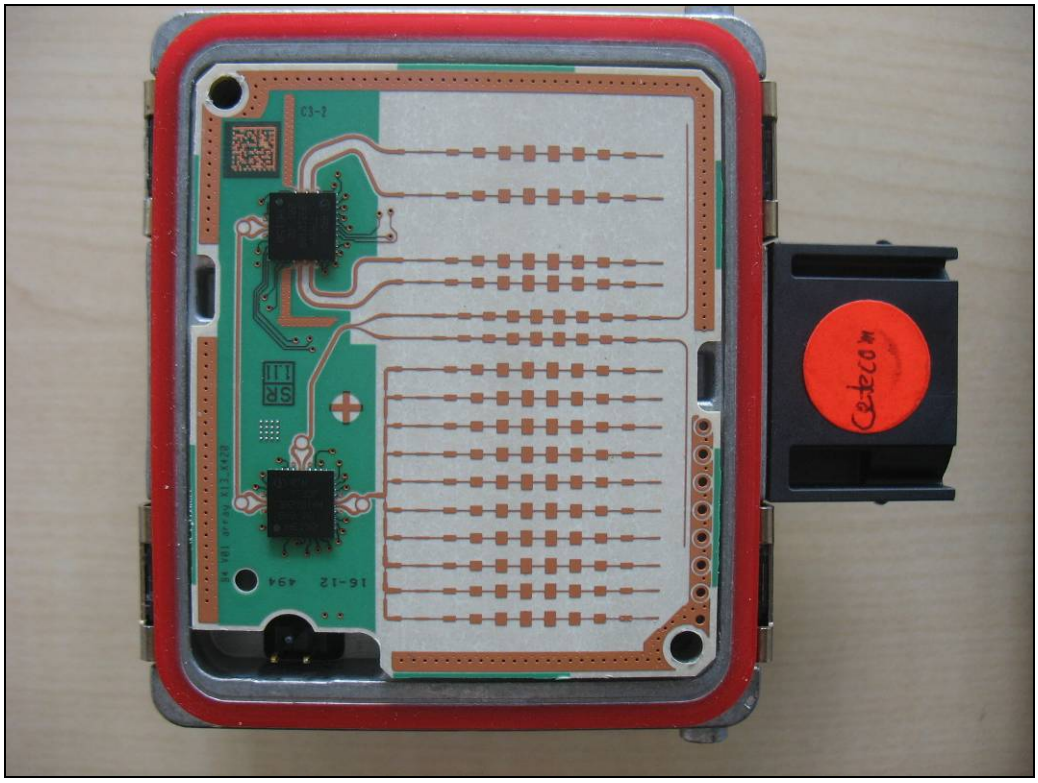


Photo No. 14:



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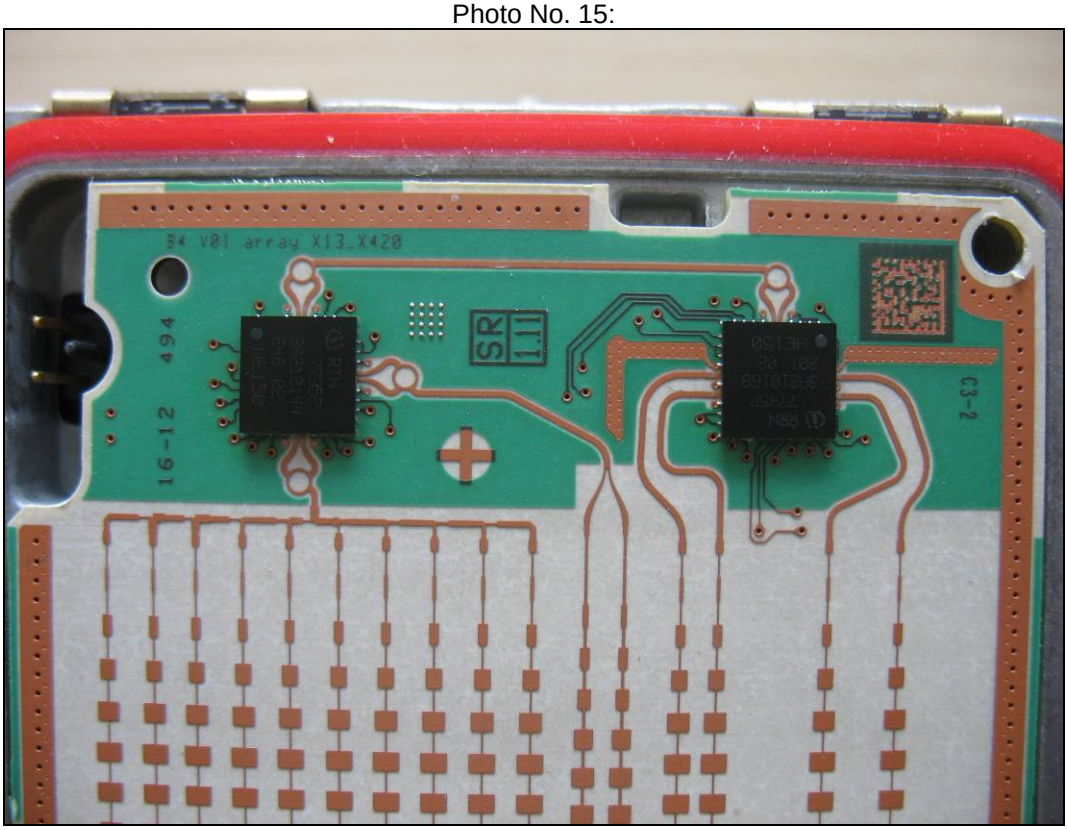
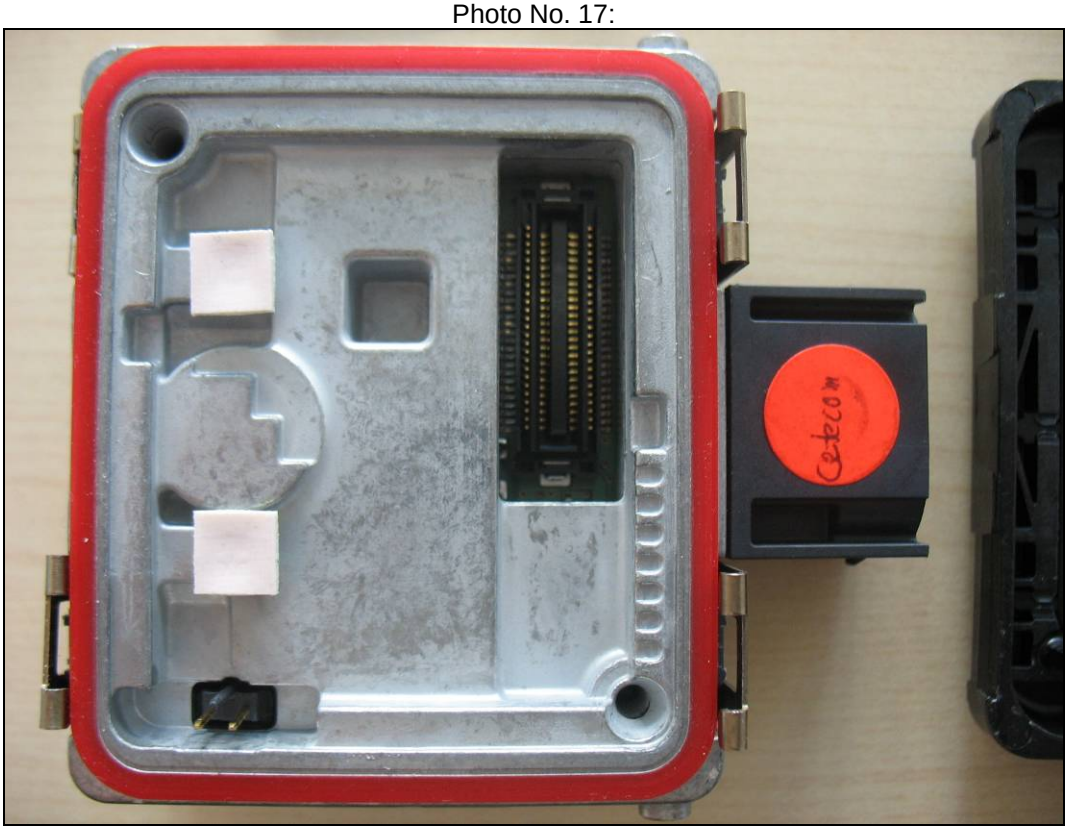


Photo No. 16:

Photo No. 17:



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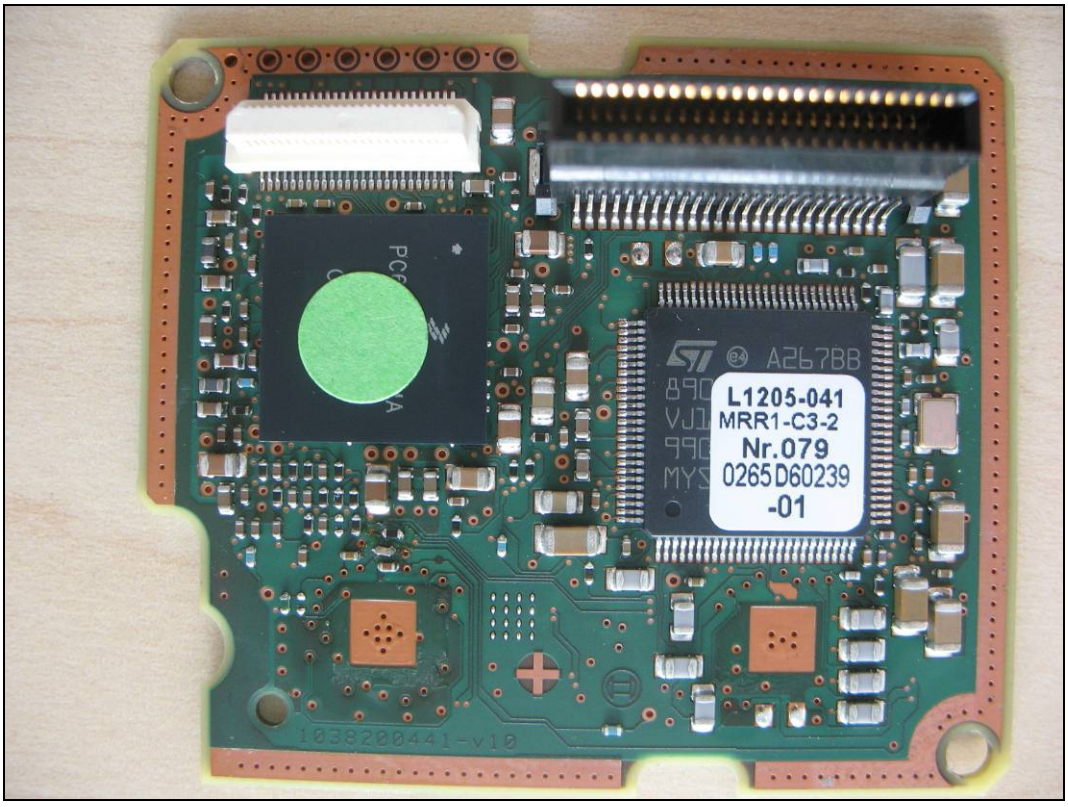


Photo No. 19:

Photo No. 20:

Photo No. 21:

Photo No. 22:

Photo No. 23:

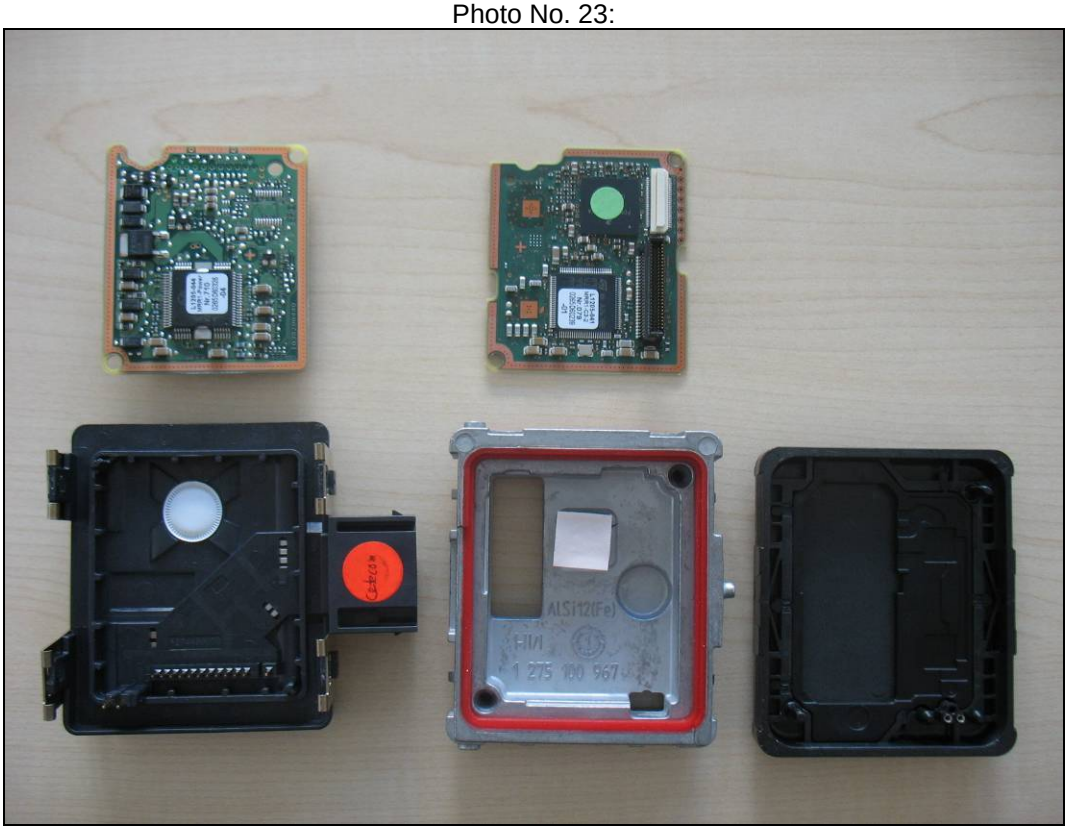


Photo No. 24:

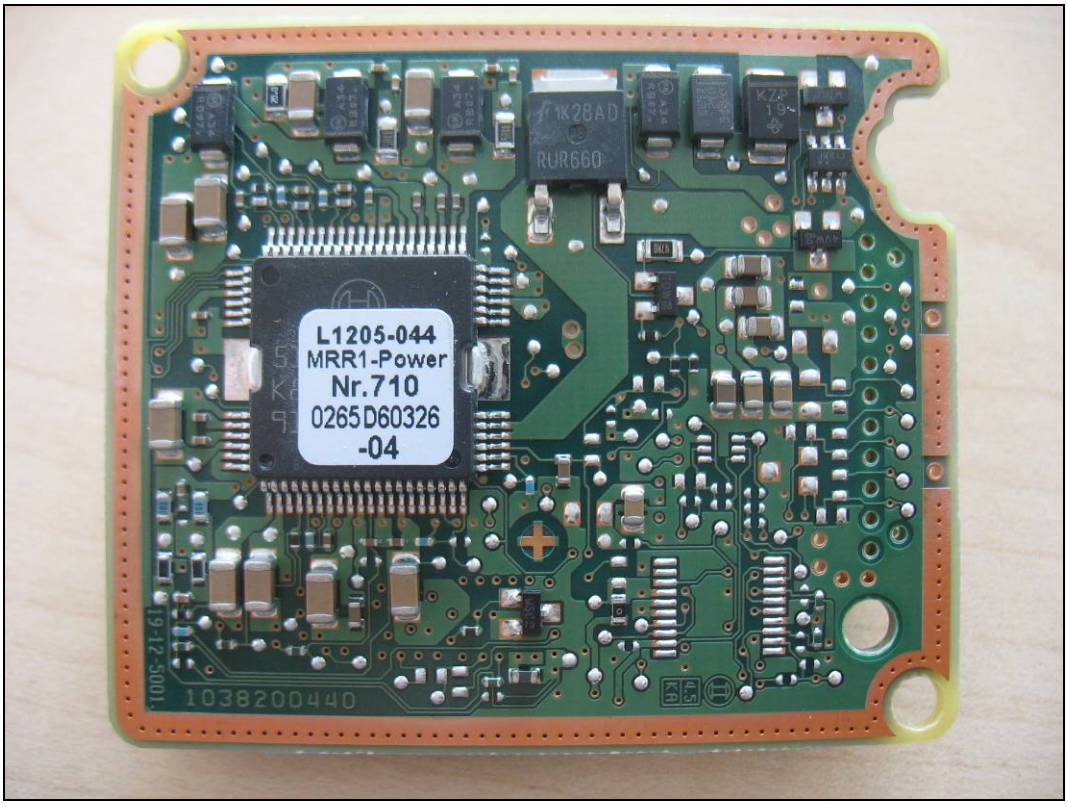


Photo No. 25:

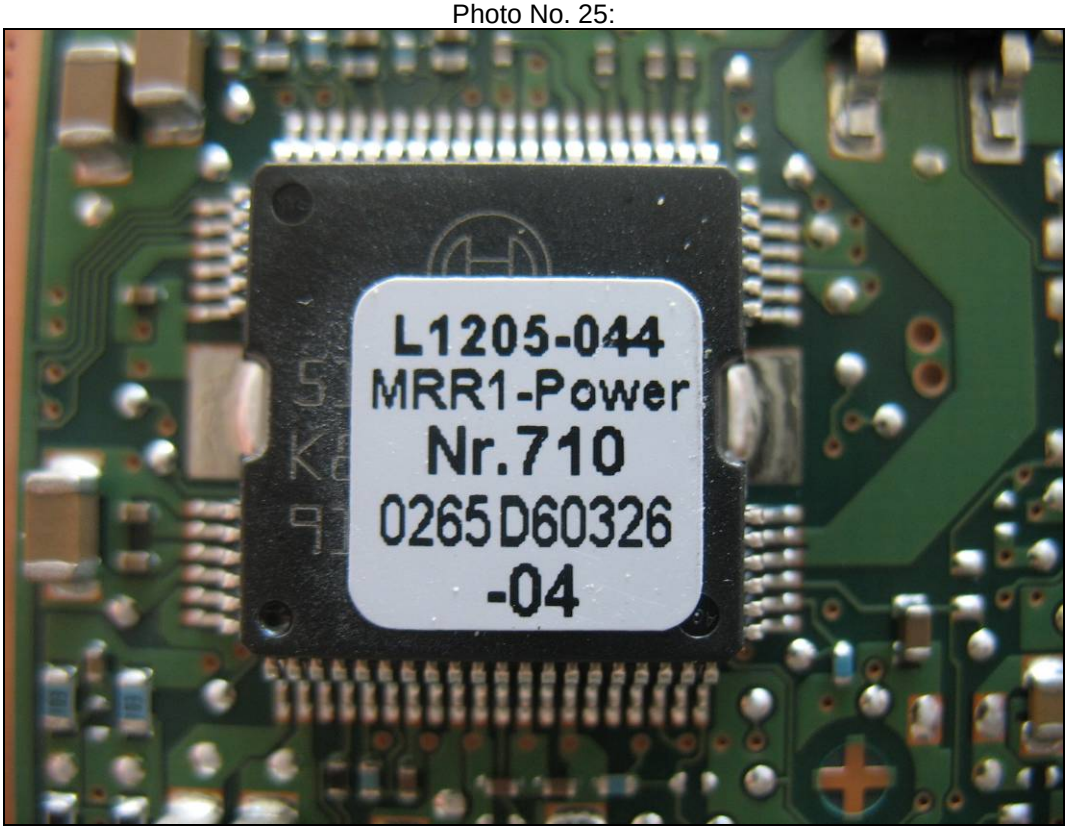
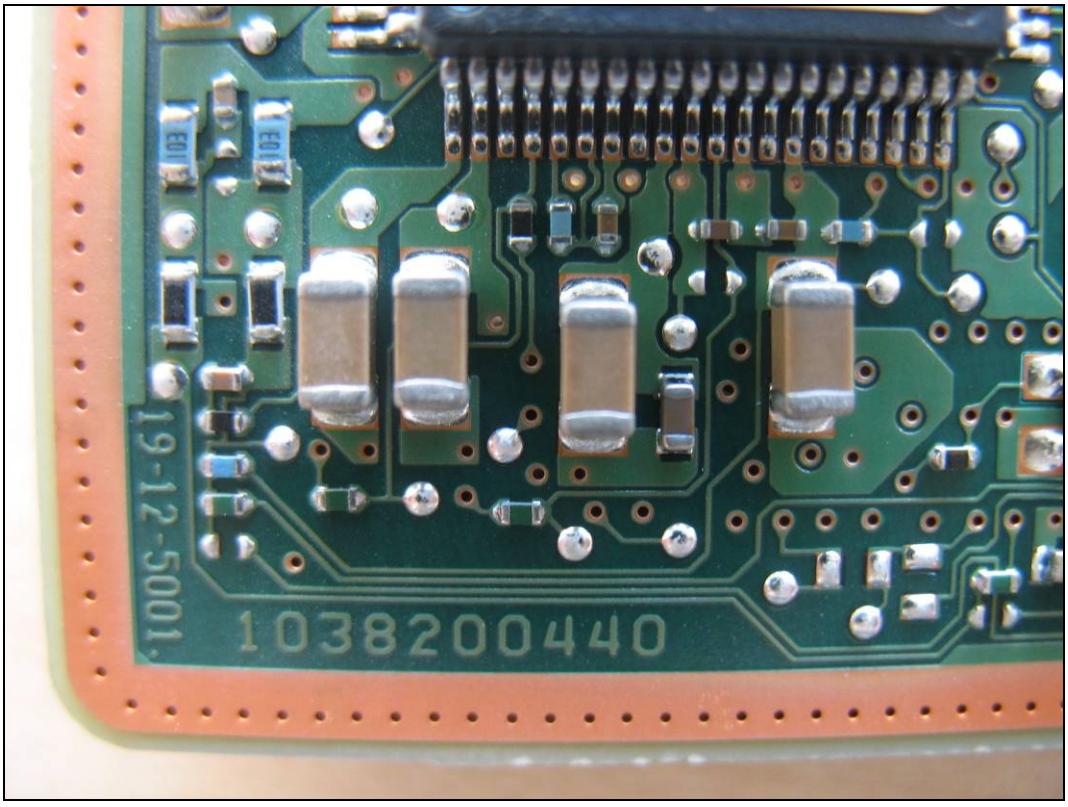


Photo No. 26:



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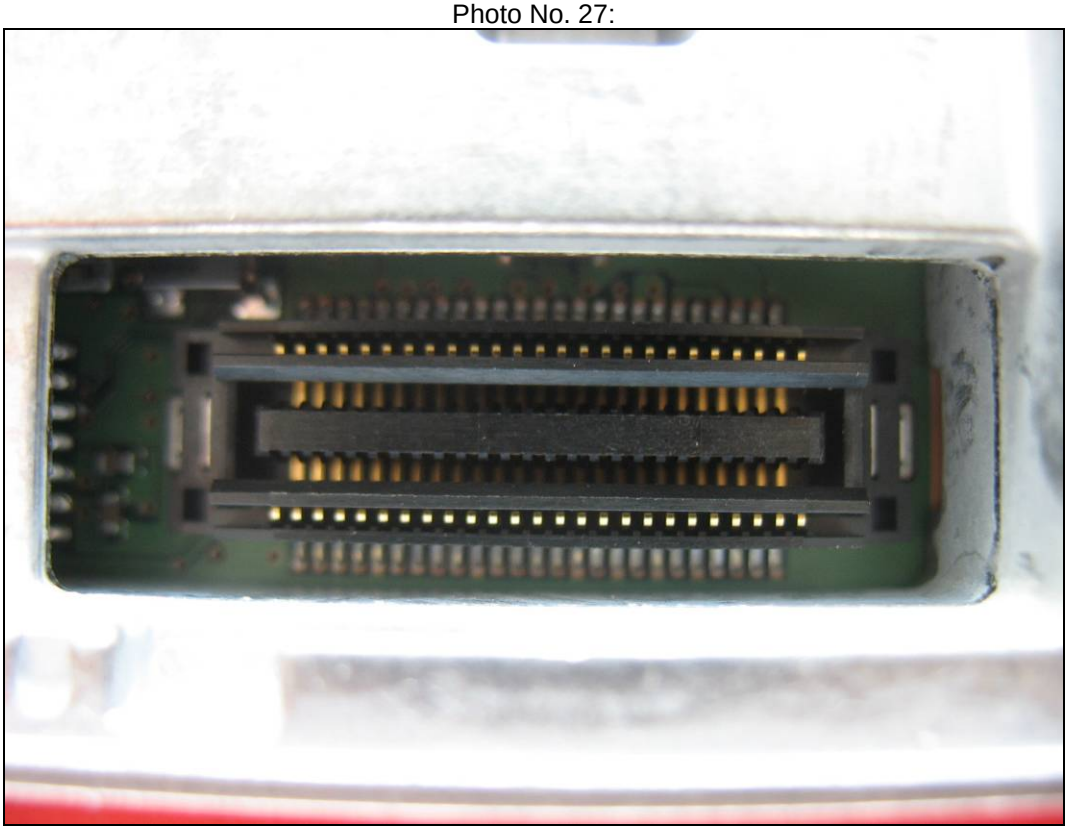

Photo No. 28:

Photo No. 29: cover with absorber material

Photo No. 30: absorber with copper coating

Photo No. 31: absorber with copper coating

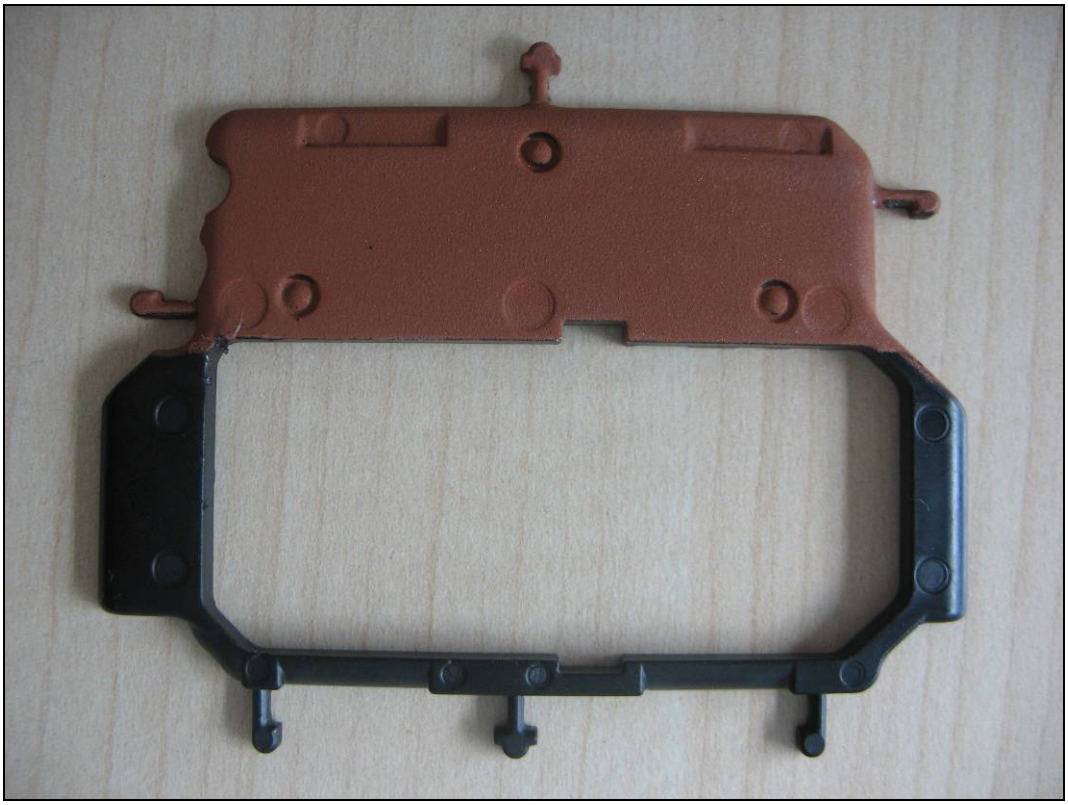

Photo No. 32: absorber

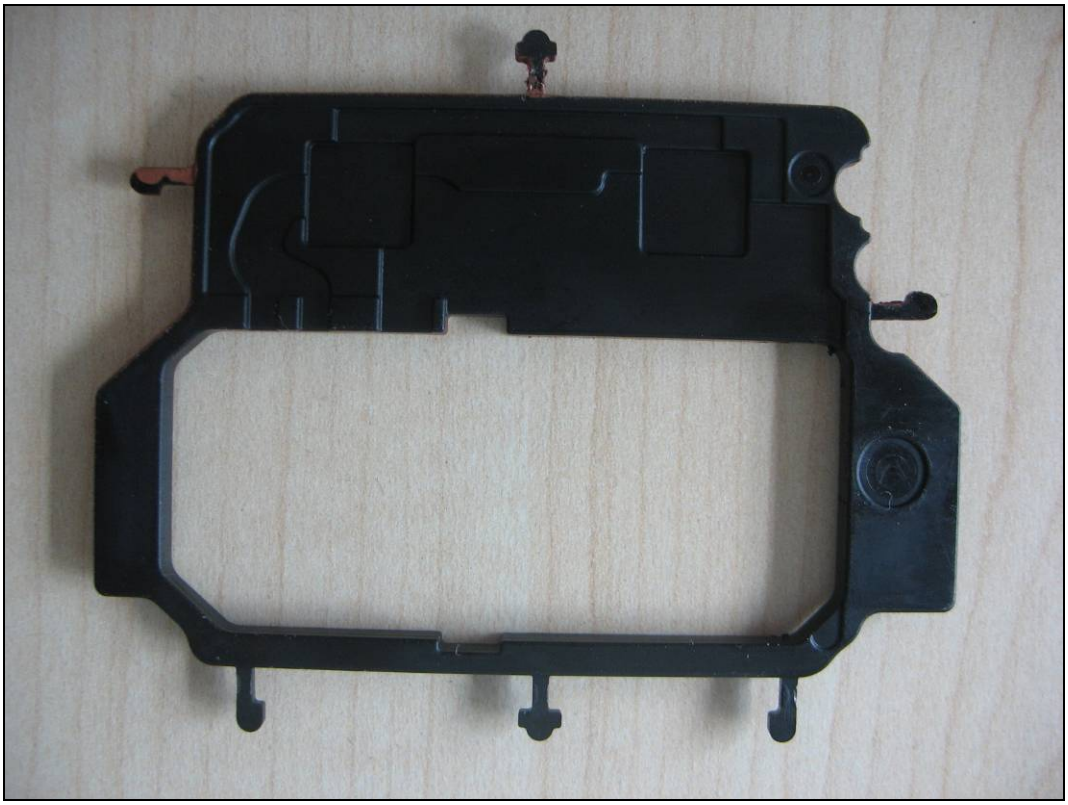

Photo No. 33: alternative absorber with aluminium foil

Annex D Document history

Version	Applied changes	Date of release
1.0	Initial release	2012-09-10
-A	Test report re-issued	2012-11-12

Annex E Further information

Glossary

DUT - Device under Test
EMC - Electromagnetic Compatibility
EUT - Equipment under Test
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - not applicable
S/N - Serial Number
SW - Software

Annex F Accreditation Certificate

DAkkS
Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH
German Accreditation Body

Entrusted according to Section 8 subsection1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of
EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10
66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

Wired communications and DECT
Acoustic
Radio
Shirt Range Devices (SRD)
RFID
WiMax and Richtfunk
Mobile radio (GSM / DCS), Over the Air (OTA) Performance
Electromagnetic Compatibility (EMC) incl. Automotive
Product safety
SAR and Hearing Aid Compatibility (HAC)
Environmental simulation
Smart Card Terminals
Bluetooth
WI-FI-Services

The accreditation certificate shall only apply in connection with the notice of accreditation of 13.04.2011 with the accreditation number D-PL-12076-01 and is valid until 03.09.2014. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 82 pages.

Registration number of the certificate: **D-PL-12076-01-01**

Frankfurt am Main, 13.04.2011

Dipl.-Ing. (FH) Ralf Egner
Head of Division 2

This document is a translation. The definitive version is the original German accreditation certificate.

Deutsche Akkreditierungsstelle GmbH

Office Berlin
Spittelmarkt 10
10117 Berlin

Office Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Office Braunschweig
Bundesallee 100
38116 Braunschweig

The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkkS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkkS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Front side of certificate

Back side of certificate

Note:
The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

http://www.cetecom.com/fileadmin/de/CETECOM_D_Saarbruecken/accreditations_Jan_2010/DAKKS_Akkredi_Urk_EN17025-En_incl_Annex.pdf