

A RADIO TEST REPORT

FOR

PACE Plc

ON

**PX022ANX HYBRID GATEWAY SET TOP BOX
MODEL: XG2v2**

DOCUMENT NO. TRA-025866-02-47-00A

HULL

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TRaC Wireless Test Report : TRA-025866-02-47-00A

Applicant : Pace Plc

Apparatus : PX022ANX HYBRID GATEWAY SET TOP BOX

Specification(s) : CFR47 Part 15.247

FCCID : NQ8PX022ANX

Purpose of Test : Certification

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Section 1:**Introduction****1.1 General**

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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1.2 Tests Requested By

This testing in this report was requested by :

Pace Plc
Salts Mill
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West Yorkshire
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1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 13th – 24th February 2015

PX022ANX HYBRID GATEWAY SET TOP BOX

The above equipment contains a RFCE 2.4 GHz transmitter operating in the 2400 MHz - 2483.5 MHz band.

This report covers the Part 15 C transmitter requirements.

For emissions not related directly to the transmitter see TRaC test report TRA-025866GUS1.

1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

Test Type	Regulation	Measurement standard	Result
Radiated spurious emissions (Restricted bands)	Title 47 of the CFR: Part 15 Subpart C; 15.247	ANSI C63.10:2013 & KDB 558074	Pass
Conducted spurious emissions	Title 47 of the CFR: Part 15 Subpart C; 15.247	ANSI C63.10:2013 & KDB 558074	Pass
Occupied Bandwidth	Title 47 of the CFR : Part 15 Subpart C; 15.247(a)(2)	ANSI C63.10:2013& KDB 558074	Pass
Conducted Carrier Power	Title 47 of the CFR : Part 15 Subpart C; 15.247(b)	ANSI C63.10:2013 & KDB 558074	Pass
Power Spectral Density	Title 47 of the CFR : Part 15 Subpart C; 15.247(d)	ANSI C63.10:2013 & KDB 558074	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart C; 15.207	ANSI C63.10:2013 & KDB 558074	Pass
Digital Modulation	Title 47 of the CFR: Part 15 Subpart C; 15.403	-	Pass
RF Safety	KDB 447498	-	Pass

KDB 558074 - 558074 D01 DTS Meas Guidance v03r02 June 14

Abbreviations used in the above table:

Mod	: Modification	ANSI	: American National Standards Institution
CFR	: Code of Federal Regulations	PLCE	: Power Line Conducted Emissions
REFE	: Radiated Electric Field Emissions		

ANSI C 63.10:2013 is outside the scope of the laboratories UKAS accreditation.

1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, "Pass" indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2:

Measurement Uncertainty

2.1 Measurement Uncertainty Values

For the test data recorded the following measurement uncertainty was calculated:

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Power Meter) = **1.08dB**

Uncertainty in test result (Spectrum Analyser) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Frequency Counter) = **0.113ppm**

Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,

Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,

Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result – Up to 8.1GHz = **3.31dB**

Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**

Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**

Uncertainty in test result – Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**,
Uncertainty in time measurement = **0.59%**,
Uncertainty in Amplitude measurement = **0.82%**

[12] Power Line Conduction

Uncertainty in test result = **3.4dB**

[13] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[14] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[15] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[16] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[17] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[18] Receiver Threshold

Uncertainty in test result = **3.23dB**

[19] Transmission Time Measurement

Uncertainty in test result = **7.98%**

Section 3:

Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Section 4

General Test Procedures

4.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst case determined for function, operation, orientation etc for both vertical and horizontal polarisations

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

For devices with intentional emissions below 30 MHz, a shielded loop antenna is used as the test antenna. It is placed at a 1 meter receive height and appropriate low frequency magnetic field extrapolation to the regulatory limit distance is employed. The EUT is rotated through 360° in the azimuth.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360° in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Where regulations allow for direct measurement of field strength, power values measured on the test receiver / analyzer are converted to dBuV/m at the regulatory distance, using:

$$FS = PR + AF + CL - PA + KG + DC - CF \text{ (dBuV/m)}$$

Where:

PR is the power recorded on receiver / spectrum analyzer (dBuV),

AF is the test antenna factor in dB/m,

CL is the cable loss in dB,

PA is the pre-amplifier gain dB (when applicable),

DC is duty correction factor (when applicable) in dB, and

CF is a distance correction (employed only for measurements at alternate distance to limit) in dB.

This field strength value is then compared with the regulatory limit.

If effective radiated power (ERP) or effective isotropic radiated power (EIRP) is required, it is computed as per ANSI C63.10

$$P = \frac{(Ed)^2}{30G}$$

Where

P is the power, in W

E is the measured peak field strength, in V/m

d is the distance at which the measurement was made, in m

G is the numeric gain of the radiating element

If the gain of the radiating element is not known, then either the effective radiated power (ERP) or the effective isotropic radiated power (EIRP) may be calculated from the measured peak field strength, by using either $G = 1.64$ or $G = 1$, respectively.

4.2 AC Powerline Conducted Emissions Test Setup and Procedures

AC Powerline Conducted Emissions from the EUT are checked first by preview scans with Peak and average detectors covering both live and neutral lines. A spectrum analyser is used to determine if any periodic emissions are present. Preview scans are performed in standby or receive mode if the device is subject to these requirements. For transmit mode of operation the device is set to one of the following modes.

- Transmitting operating at full power (single mode device)
- Transmitting at freq / modulation that gives highest output power (multi mode device)
- Transmitter operating in normal TX mode (e.g. FHSS, TDMA etc)

Formal measurements using the correct detector(s) and bandwidth are made on frequencies identified from the preview scans.

Battery Power devices are not subject to power line conducted emissions measurements when it is powered solely by its internal battery.

4.3 Antenna Port Conducted Emissions

Antenna port conducted emissions can include, but are not limited to, Carrier power, Power Spectral Density, Occupied bandwidth and spurious emission.

Spurious Emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked to identify frequencies to perform formal measurements on.

Formal measurements are made on frequencies identified from the preview scans and fundamental emission(s). Measurements are made using the correct instrumentation (inc. power meter, receiver, spectrum analyser) that operate with the required detector(s) and bandwidth.

Care is taken to ensure the measurement instrument is not overloaded by the presence of the transmitted signal by use of external attenuation and filtering where required.

Measured levels are corrected for cables, attenuators, and filters. If applicable, for the specific measurement, antenna gain is also taken into account.

4.4 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case the EUT is designed for operation from a lead-acid battery power source, the extreme test voltages are evaluated between 90% and 130% of the nominal battery voltage declared by the manufacturer.

For float charge applications using gel-cell type batteries, extreme test voltages are evaluated between 85% and 115% of the nominal battery voltage declared.

For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

4.5 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

Tests are performed at the upper and lower extremes as required and typically at 10° steps between.

Before any temperature measurements are made, the equipment is allowed to reach a thermal balance in the test chamber.

4.6 Time Domain Measurements

Time domain measurements are made for (but not limited to) use in duty cycle correction, to ensure compliance with time restrictions on certain types of devices.

If measurements of a transmitter's on time are required these are performed with a spectrum analyser in the time domain or with an oscilloscope and RF detector. If time on a specific frequency is required (e.g. FHSS timing) the measurement can only be made with a spectrum analyser.

The triggering, timescale and amplitude settings are adjusted according to the signal to be measured on a case by case basis.

For devices with sharp rise/fall times measurements are made between RF reaching full power (T_{on}) and RF dropping to the measurement instrument noise floor (T_{off}). For longer rise times measurements are made for T_{on} and T_{off} at the RF level required by the occupied bandwidth measurement (e.g. 6 dB, 20 dB etc).

Appendix A:**Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
		ATS	: Alternative Test Site
EUT	: Equipment Under Test		
SE	: Support Equipment	Ref	: Reference
		Freq	: Frequency
L	: Live Power Line		
N	: Neutral Power Line	MD	: Measurement Distance
E	: Earth Power Line	SD	: Spec Distance
Pk	: Peak Detector	Pol	: Polarisation
QP	: Quasi-Peak Detector	H	: Horizontal Polarisation
Av	: Average Detector	V	: Vertical Polarisation
CDN	: Coupling & decoupling network		

A1 6 dB Bandwidth

Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2) requires the measurement of the bandwidth of the transmission between the -6 dB points on the transmitted spectrum.

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2)
Measurement standard	ANSI C63.10, KDB 558074
EUT sample number	S31 & S23
Modification state	0
SE in test environment	S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	25°C

Antenna 0					
Channel Frequency (MHz)	F _{lower} (MHz)	F _{Higher} (MHz)	Measured 20 dB Bandwidth (kHz)	Limit	Result
2425.0 MHz	2424.198718	2425.817308	1618.590	> 500kHz	Pass
2450.0 MHz	2449.182692	2450.817308	1634.616	> 500kHz	Pass
2475.0 MHz	2474.182692	2475.817308	1634.616	> 500kHz	Pass

Antenna 1					
Channel Frequency (MHz)	F _{lower} (MHz)	F _{Higher} (MHz)	Measured 20 dB Bandwidth (kHz)	Limit	Result
2425.0 MHz	2424.214744	2425.801282	1586.538	> 500kHz	Pass
2450.0 MHz	2449.198718	2450.817308	1618.590	> 500kHz	Pass
2475.0 MHz	2474.214744	2475.801282	1586.538	> 500kHz	Pass

Measurements made using guidance from 558074 D01 DTS Meas Guidance v03r02 June 14

Plots of the 6 dB bandwidth are contained in Appendix B of this test report.

Conducted measurements were performed with a temporary antenna connector provided by the client.

A2 Transmitter Peak Output Power

Carrier power was verified with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details:	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(3)
Measurement standard	ANSI C63.10, KDB 558074
EUT sample number	S31 & S23
Modification state	0
SE in test environment	S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	25 °C

Antenna 0				
Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2425.0 MHz	0.76	0.0012	1	Pass
2450.0 MHz	0.68	0.0012	1	Pass
2475.0 MHz	0.56	0.0011	1	Pass

Antenna 1				
Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2425.0 MHz	1.70	0.0015	1	Pass
2450.0 MHz	1.51	0.0014	1	Pass
2475.0 MHz	1.25	0.0013	1	Pass

Measurements made using guidance from 558074 D01 DTS Meas Guidance v03r02 June 14

Plots of the transmitter peak output power are contained in Appendix B of this test report.

Conducted measurements were performed with a temporary antenna connector provided by the client.

A3 Transmitter Power Spectral Density

Transmitter Power Spectral Density was verified with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details:	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(3)
Measurement standard	ANSI C63.10, KDB 558074
EUT sample number	S31 & S23
Modification state	0
SE in test environment	S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	25 °C

Antenna 0			
Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2425.0 MHz	-2.48	8	Pass
2450.0 MHz	-2.64	8	Pass
2475.0 MHz	-2.63	8	Pass

Antenna 1			
Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2425.0 MHz	-1.76	8	Pass
2450.0 MHz	-2.02	8	Pass
2475.0 MHz	-2.21	8	Pass

Measurements made using guidance from 558074 D01 DTS Meas Guidance v03r02 June 14

Plots of the power spectral density are contained in Appendix B of this test report.

Conducted measurements were performed with a temporary antenna connector provided by the client.

A4 RF Antenna Conducted Spurious Emissions

Measurement of conducted spurious emissions at the antenna port was performed using a peak detector with the RBW set to 100kHz and the VBW>RBW. Frequencies were scanned up through to the 10th harmonic with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details: Antenna 0	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d)
Measurement standard	ANSI C63.10, KDB 558074
Frequency range	9 kHz to 25 GHz
EUT sample number	S31 & S23
Modification state	0
SE in test environment	S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	25 °C

The worst case conducted emission measurements at the antenna port are listed below:

Antenna 0						
Ref No.	Measured Freq (MHz)	Det.	Is measured Frequency within the Restricted bands (Y/N)	Measured Peak Conducted power (RBW =100kHz) (dBuV)	15.247(d) Limit (dBuV)	Summary
2425.0 MHz						
No Significant Emissions Within 20 dB of Limit						
2450.0 MHz						
No Significant Emissions Within 20 dB of Limit						
2475.0 MHz						
No Significant Emissions Within 20 dB of Limit						

Measurements made using guidance from 558074 D01 DTS Meas Guidance v03r02 June 14

Plots of the conducted spurious emissions are contained in Appendix B of this test report.

Conducted measurements were performed with a temporary antenna connector provided by the client.

Test Details: Antenna 1	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d)
Measurement standard	ANSI C63.10, KDB 558074
Frequency range	9 kHz to 25 GHz
EUT sample number	S31 & S23
Modification state	0
SE in test environment	S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	25 °C

The worst case conducted emission measurements at the antenna port are listed below:

Antenna 1						
Ref No.	Measured Freq (MHz)	Det.	Is measured Frequency within the Restricted bands (Y/N)	Measured Peak Conducted power (RBW =100kHz) (dBuV)	15.247(d) Limit (dBuV)	Summary
2425.0 MHz						
No Significant Emissions Within 20 dB of Limit						
2450.0 MHz						
No Significant Emissions Within 20 dB of Limit						
2475.0 MHz						
No Significant Emissions Within 20 dB of Limit						

Measurements made using guidance from 558074 D01 DTS Meas Guidance v03r02 June 14

Plots of the conducted spurious emissions are contained in Appendix B of this test report.

Conducted measurements were performed with a temporary antenna connector provided by the client.

Notes:

1. The conducted emission limit are defined in 47CFR15.205(a) are based on a transmitted carrier level of 15.247(b). With the EUT transmitting on its lowest, centre and highest carrier frequencies in turn, emissions from the EUT are required to be 20 dB below the level of the highest fundamental as measured within a 100 kHz RBW in accordance with 15.247(d) using a peak detector.
2. The RBW = 100 kHz, Video bandwidth (VBW) > RBW and the radio spectrum was investigated up to the 10th harmonic in accordance 15.33 (a)(1).
3. The measurements at 2400 MHz and 2483.5 MHz were made to ensure band edge compliance.
4. The carrier level was measured whilst varying the supply voltage between 85% and 105% of the nominal supply voltage as required by 15.31(e). No variation in carrier level was observed.

The limit outside the restricted band in 100 kHz RBW is defined using the following formula in accordance with 15.247(d):

$$\text{The limit in 100 kHz RBW} = (\text{Maximum Peak Conducted Carrier}) - 20\text{dB}$$

Where:

The maximum peak conducted power was measured using a peak power meter. Please refer to section A1 of this test report.

A5 Radiated Electric Field Emissions within the Restricted Bands

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to spurious emissions and harmonics that fall within the restricted bands listed in Section 15.205. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit on its lowest, centre and highest carrier frequency.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site :

☐

3m alternative test site :

☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details: Antenna 0	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz – 25GHz
EUT sample number	S01 & S02
Modification state	0
SE in test environment	S17
SE isolated from EUT	S03, S04, S11, S13, S14, S15, S19, S20, S22
EUT set up	Refer to Appendix C
Temperature	26 °C
Photographs (Appendix F)	1 & 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below:

Antenna 0									
DET	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT F ACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
2425.0 MHz									
Pk	4850.92	53.24	4.0	32.9	35.9	54.24	0.00	515.23	5012
Av	4850.92	44.00	4.0	32.9	35.9	45.00	0.00	177.83	500
Pk	7276.47	56.03	4.8	36.4	36.6	60.64	0.00	1076.47	5012
Av	7276.47	47.97	4.8	36.4	36.6	52.58	0.00	425.60	500
2450.0 MHz									
Pk	4899.1	53.32	4.0	33.1	35.9	54.52	0.00	532.11	5012
Av	4899.1	44.17	4.0	33.1	35.9	45.37	0.00	185.57	500
Pk	7349.11	53.48	4.8	36.6	36.6	58.27	0.00	819.41	5012
Av	7349.11	43.92	4.8	36.6	36.6	48.71	0.00	272.58	500
2475.0 MHz									
Pk	4950.03	53.65	3.9	33.2	35.9	54.86	0.00	553.35	5012
Av	4950.03	43.81	3.9	33.2	35.9	45.02	0.00	178.24	500
Pk	7426.46	52.61	4.9	36.7	36.6	57.57	0.00	755.96	5012
Av	7426.46	42.14	4.9	36.7	36.6	47.10	0.00	226.46	500

Measurements made using guidance from 558074 D01 DTS Meas Guidance v03r02 June 14
 For emissions not related directly to the transmitter see TRaC test report TRA-025866GUS1.

Test Details: Antenna 1	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz – 25GHz
EUT sample number	S01 & S02
Modification state	0
SE in test environment	S17,
SE isolated from EUT	S03, S04, S11, S13, S14, S15, S19, S20, S22
EUT set up	Refer to Appendix C
Temperature	26 °C
Photographs (Appendix F)	1 & 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below:

Antenna 1									
DET	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
2425.0 MHz									
Pk	4850.92	53.22	4	32.9	35.9	54.22	0.00	514.04	5012
Av	4850.92	43.81	4	32.9	35.9	44.81	0.00	173.98	500
Pk	7276.47	49.91	4.8	36.4	36.6	54.52	0.00	532.11	5012
Av	7276.47	38.54	4.8	36.4	36.6	43.15	0.00	143.71	500
2450.0 MHz									
Pk	4899.1	51.88	4	33.1	35.9	53.08	0.00	450.82	5012
Av	4899.1	41.98	4	33.1	35.9	43.18	0.00	144.21	500
Pk	7349.11	49.94	4.8	36.6	36.6	54.73	0.00	545.13	5012
Av	7349.11	38.91	4.8	36.6	36.6	43.70	0.00	153.11	500
2475.0 MHz									
Pk	4950.03	51.39	3.9	33.2	35.9	52.60	0.00	426.58	5012
Av	4950.03	41.36	3.9	33.2	35.9	42.57	0.00	134.43	500
Pk	7426.46	49.53	4.9	36.7	36.6	54.49	0.00	530.27	5012
Av	7426.46	37.43	4.9	36.7	36.6	42.39	0.00	131.67	500

Measurements made using guidance from 558074 D01 DTS Meas Guidance v03r02 June 14
For emissions not related directly to the transmitter see TRaC test report TRA-025866GUS1.

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1
- 2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 Measurements at 2400 & 2483.5 MHz were made to ensure band edge compliance.
- 4 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- 5 For Frequencies below 1 GHz, RBW= 100 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak	RBW=VBW= 1MHz
Average	RBW=VBW= 1MHz

These settings as per ANSI C63.10

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits (47 CFR Part 15: Clause 15.209) for emissions falling within the restricted bands defined in 15.205(a):

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Measurement Distance m	Field strength $\text{dB}\mu\text{V/m}$
0.009-0.490	$2400/F(\text{kHz})$	300	$67.6/F(\text{kHz})$
0.490-1.705	$24000/F(\text{kHz})$	30	$87.6/F(\text{kHz})$
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

Notes:

- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left(\frac{\text{measurement distance}}{\text{specification distance}} \right)$$

The results displayed take into account applicable antenna factors and cable losses.

- (b) The levels may have been rounded for display purposes.
- (c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓	✓	✓	✓
Effect of EUT internal configuration on emission levels	✓	✓	✓	✓
Effect of Position of EUT cables & samples on emission levels	✓	✓	✓	✓
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

A6 Antenna Gain

The maximum antenna gain for the antenna types to be used with the EUT, as declared by the client, is 2 dBi.

Daniel Winstanley

From: Robert Turner [Robert.Turner@pace.com]
Sent: 23 February 2015 15:49
To: John Charters; Joseph Ryan
Cc: Steven Hodgkinson; Alastair Lusted; Neil Mason; Daniel Winstanley
Subject: RE: TRA-025866-02 progress

I'm informed that the antenna peak gain is 2dBi

Robert Turner MIET
Approvals Manager – North America
Pace plc
Victoria Road, Saltaire, West Yorkshire, BD18 3LF, United Kingdom. www.pace.com

From: John Charters [mailto:John.Charters@tracglobal.com]
Sent: 23 February 2015 15:18
To: Joseph Ryan
Cc: Steven Hodgkinson; Robert Turner; Alastair Lusted; Neil Mason; Daniel Winstanley
Subject: RE: TRA-025866-02 progress

Hi Joe

Please can you supply the antenna gain for the unit. So we can add the value it into the report.

Regards
John

John Charters
Radio Product Manager

TRaC Global Limited

T +44 (0)1695 556666
M +44 (0)7801 185874
Visit our website at www.tracglobal.com

A7 Power Line Conducted Emissions

Preview power line conducted emission measurements were performed with a peak detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector. The EUT was set to transmit on its lowest, centre and highest carrier frequency in turn. The formal measurements are detailed below:

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207
Measurement standard	ANSI C63.10
Frequency range	150kHz to 30MHz
EUT sample number	S01 & S02
Modification state	0
SE in test environment	S17,
SE isolated from EUT	S03, S04, S11, S13, S14, S15, S19, S20, S22
EUT set up	Refer to Appendix C

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.155000	42.5	15000.0	10.000	GND	N	10.2	23.2	65.7
0.190000	39.5	15000.0	10.000	GND	L1	10.1	24.6	64.0
0.585000	35.1	15000.0	10.000	GND	N	10.1	20.9	56.0
1.295000	33.8	15000.0	10.000	GND	N	10.1	22.2	56.0
1.610000	34.7	15000.0	10.000	GND	L1	10.0	21.3	56.0
14.975000	33.6	15000.0	10.000	GND	N	10.9	26.4	60.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.155000	35.7	15000.0	10.000	GND	N	10.2	20.0	55.7
0.190000	25.0	15000.0	10.000	GND	L1	10.1	29.0	54.0
0.585000	25.7	15000.0	10.000	GND	N	10.1	20.3	46.0
1.295000	25.4	15000.0	10.000	GND	N	10.1	20.6	46.0
1.610000	25.8	15000.0	10.000	GND	L1	10.0	20.2	46.0
14.975000	27.2	15000.0	10.000	GND	N	10.9	22.8	50.0

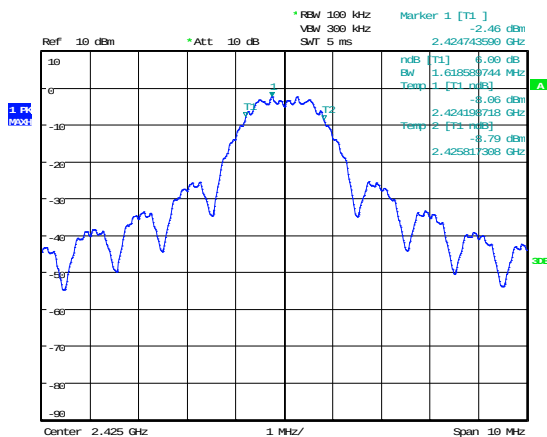
Appendix B:**Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

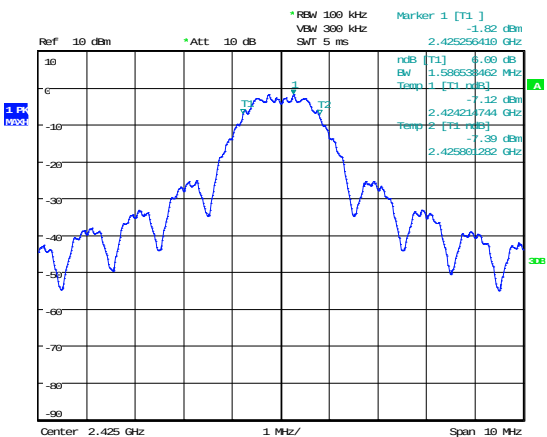
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.
- (d) Appendix C details the numbering system used to identify the sample and its modification state.
- (e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

6dB Bandwidth



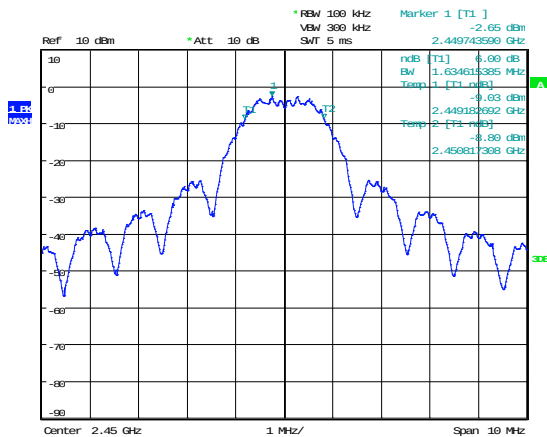
Date: 23.FEB.2015 11:19:52

Antenna 0 2425.0 MHz



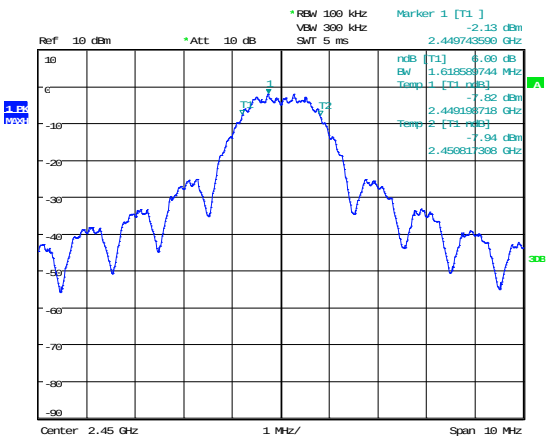
Date: 23.FEB.2015 09:46:05

Antenna 1 2425.0 MHz



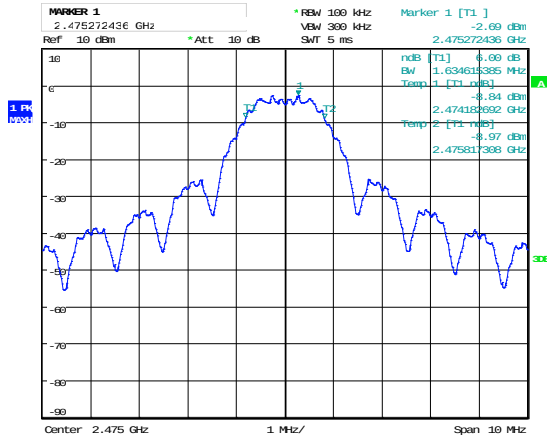
Date: 23.FEB.2015 11:09:47

Antenna 0 2450.0 MHz



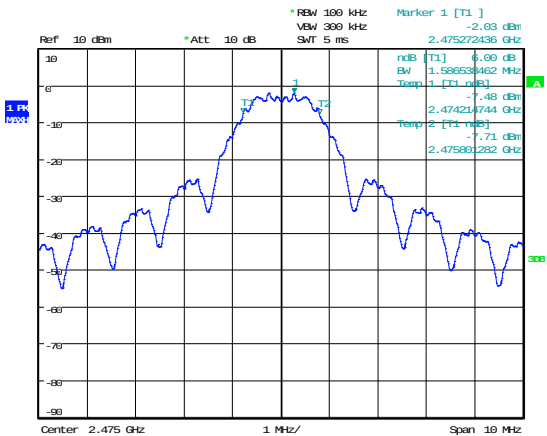
Date: 23.FEB.2015 09:43:53

Antenna 1 2450.0 MHz



Date: 23.FEB.2015 11:07:11

Antenna 0 2475.0 MHz

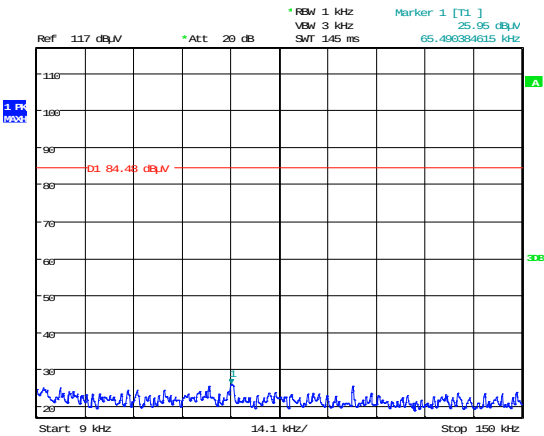


Date: 23.FEB.2015 09:41:51

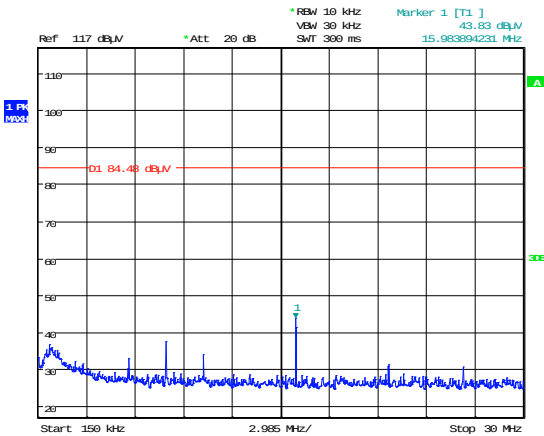
Antenna 1 2475.0 MHz

Conducted Spurious emissions

Antenna 0 2425.0 MHz



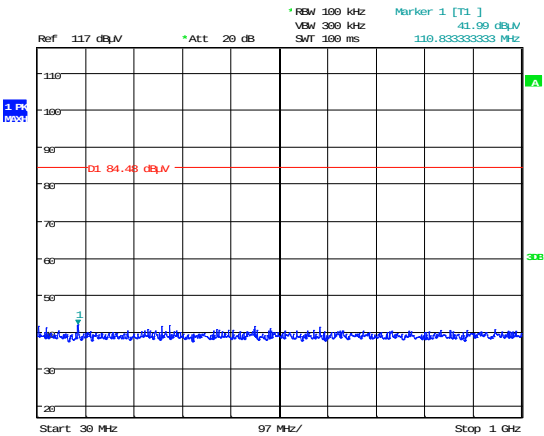
Date: 23.FEB.2015 11:47:11



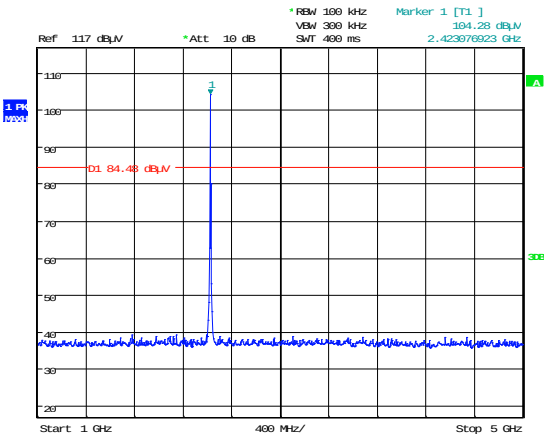
Date: 23.FEB.2015 11:47:47

9 kHz – 150 kHz

150kHz to 30 MHz



Date: 23.FEB.2015 11:48:05



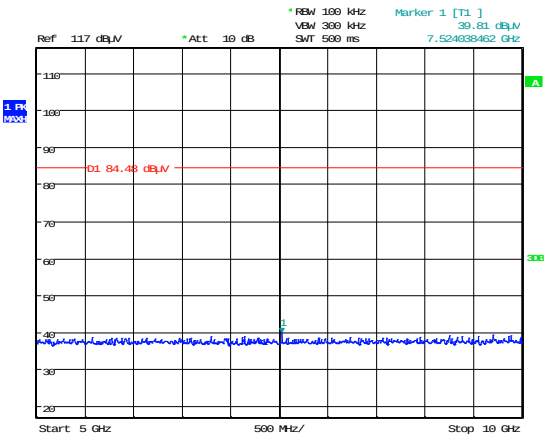
Date: 23.FEB.2015 11:44:10

30 MHz – 1 GHz

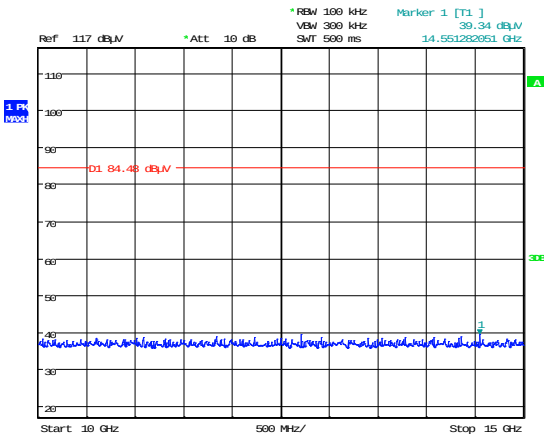
1 GHz – 5 GHz

Conducted Spurious emissions

Antenna 0 2425.0 MHz



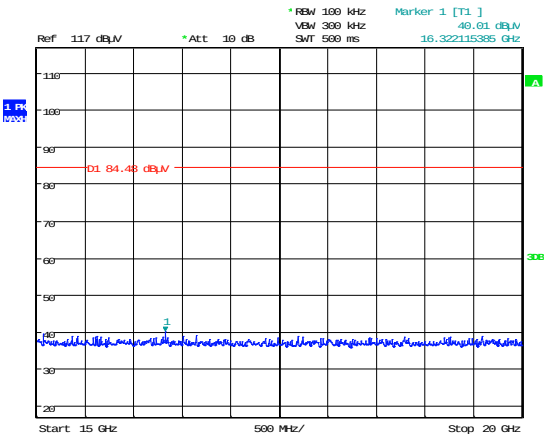
Date: 23.FEB.2015 11:45:28



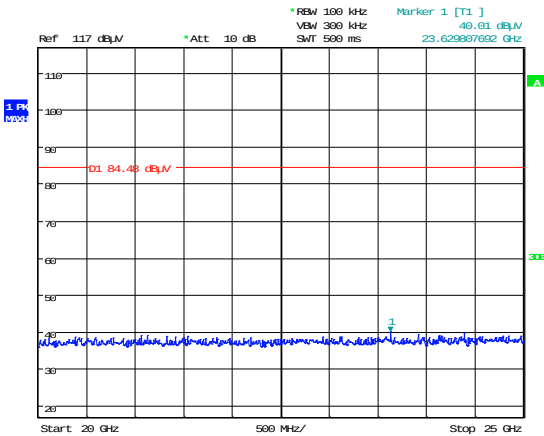
Date: 23.FEB.2015 11:45:53

5 GHz – 10 GHz

10 GHz – 15 GHz



Date: 23.FEB.2015 11:46:13



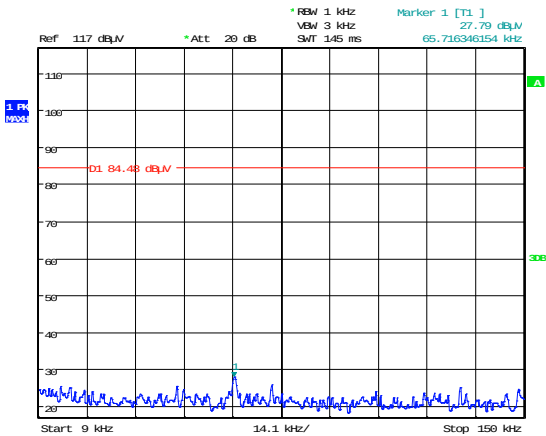
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15 GHz – 20 GHz

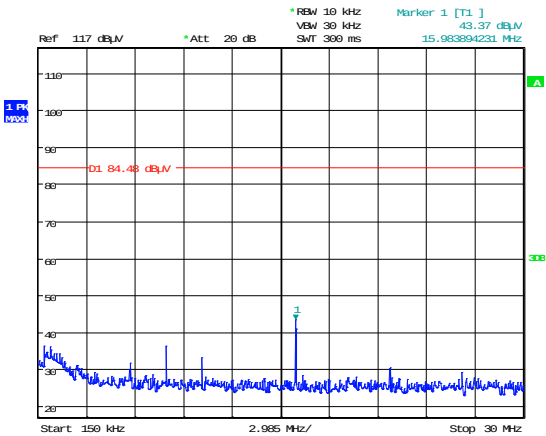
20 GHz – 25 GHz

Conducted Spurious emissions

Antenna 0 2450.0 MHz



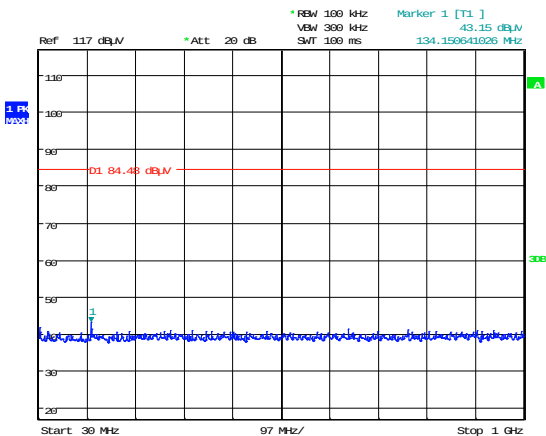
Date: 23.FEB.2015 11:49:03



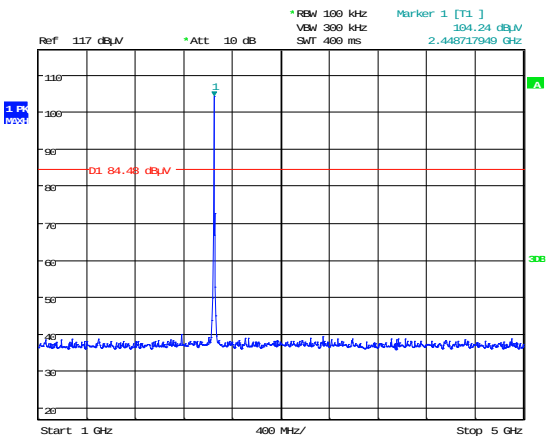
Date: 23.FEB.2015 11:49:22

9 kHz – 150 kHz

150kHz to 30 MHz



Date: 23.FEB.2015 11:48:45



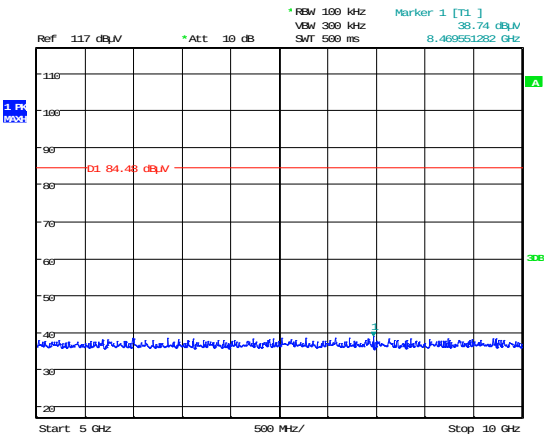
Date: 23.FEB.2015 11:49:58

30 MHz – 1 GHz

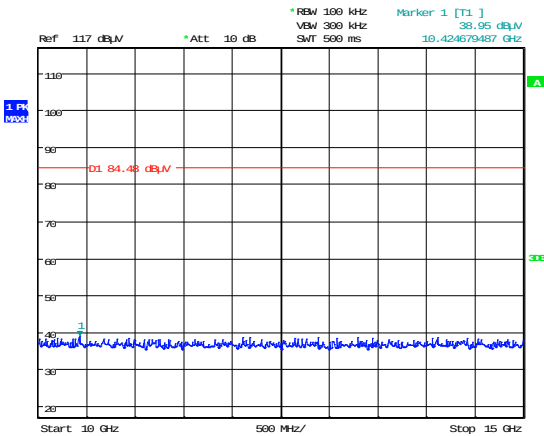
1 GHz – 5 GHz

Conducted Spurious emissions

Antenna 0 2450.0 MHz



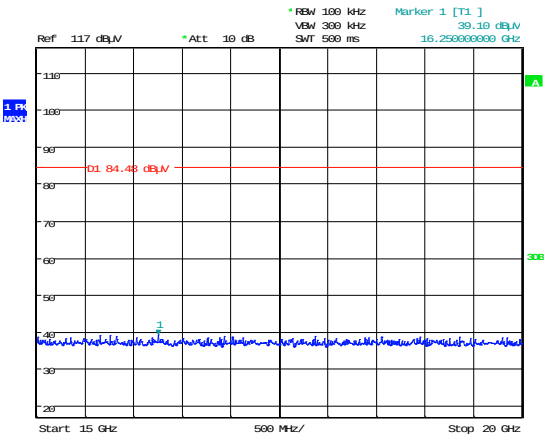
Date: 23.FEB.2015 11:50:13



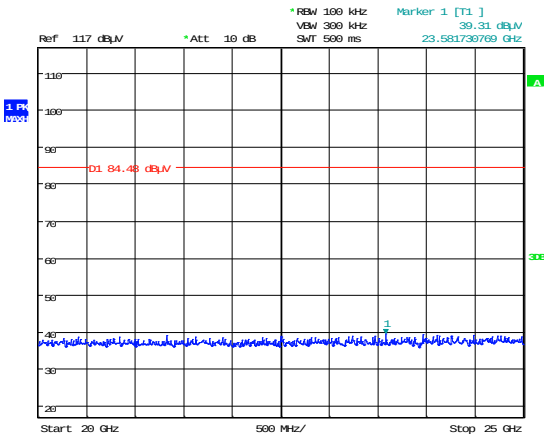
Date: 23.FEB.2015 11:50:29

5 GHz – 10 GHz

10 GHz – 15 GHz



Date: 23.FEB.2015 11:50:52



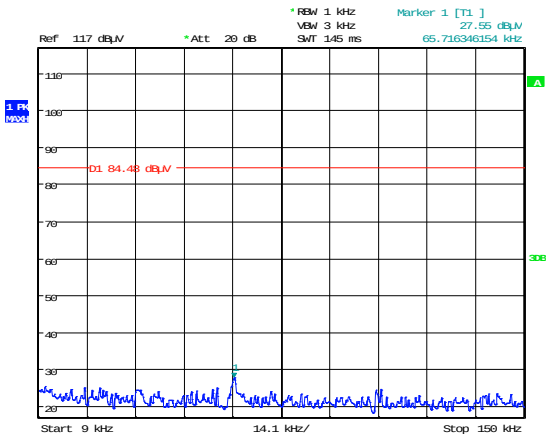
Date: 23.FEB.2015 11:51:11

15 GHz – 20 GHz

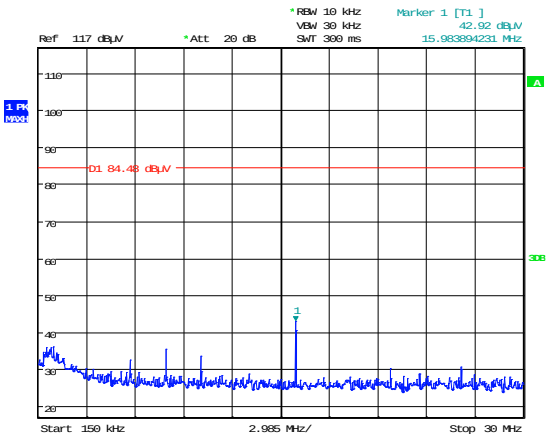
20 GHz – 25 GHz

Conducted Spurious emissions

Antenna 0 2475.0 MHz



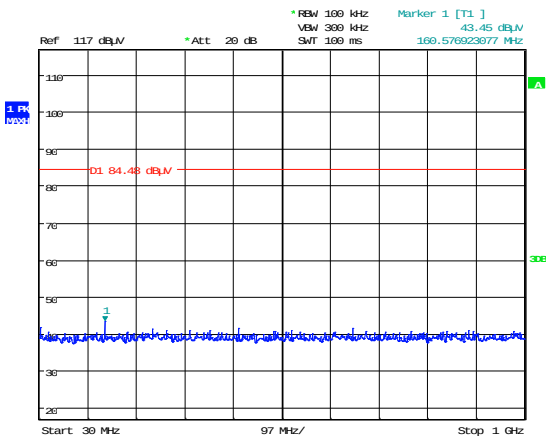
Date: 23.FEB.2015 11:54:36



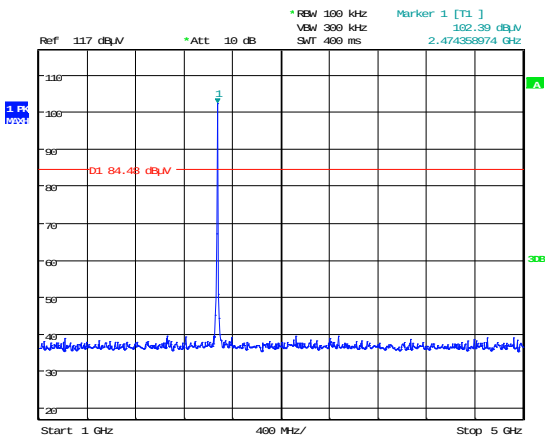
Date: 23.FEB.2015 11:54:17

9 kHz – 150 kHz

150kHz to 30 MHz



Date: 23.FEB.2015 11:53:47



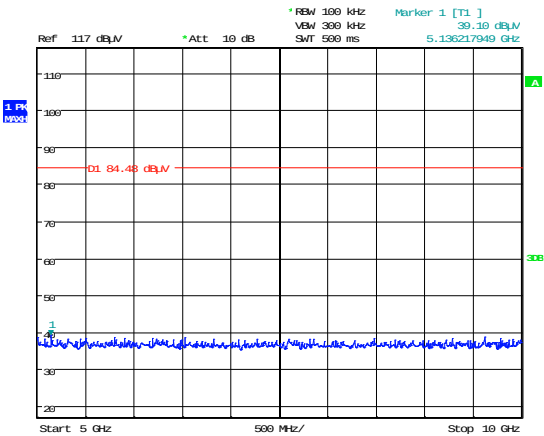
Date: 23.FEB.2015 11:53:29

30 MHz – 1 GHz

1 GHz – 5 GHz

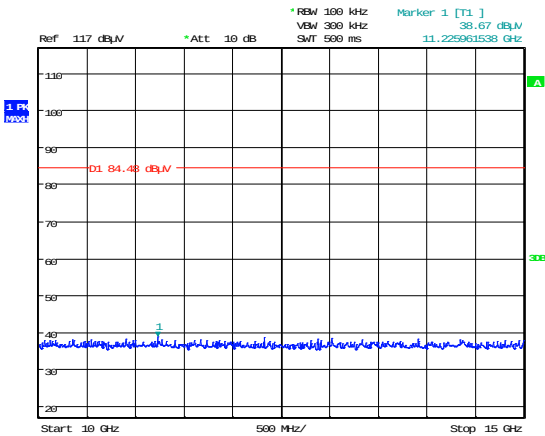
Conducted Spurious emissions

Antenna 0 2475.0 MHz



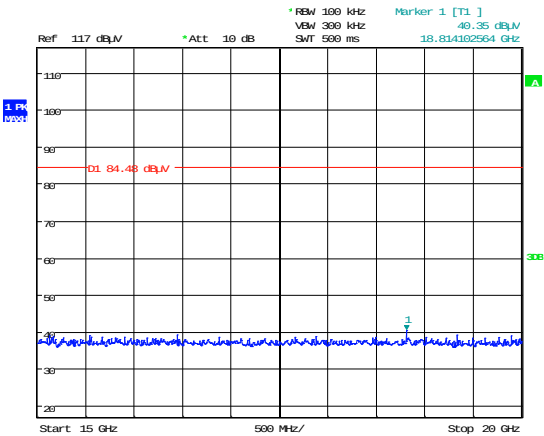
Date: 23.FEB.2015 11:53:10

5 GHz – 10 GHz



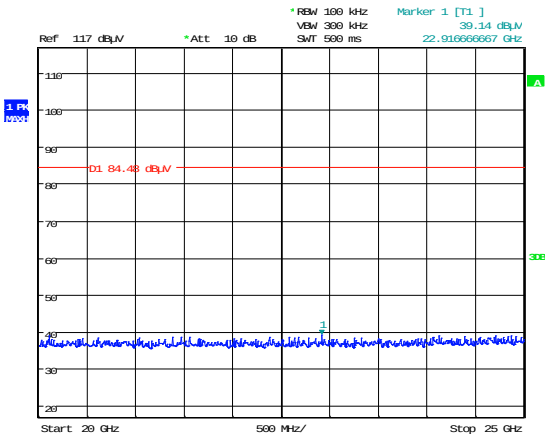
Date: 23.FEB.2015 11:52:53

10 GHz – 15 GHz



Date: 23.FEB.2015 11:52:38

15 GHz – 20 GHz

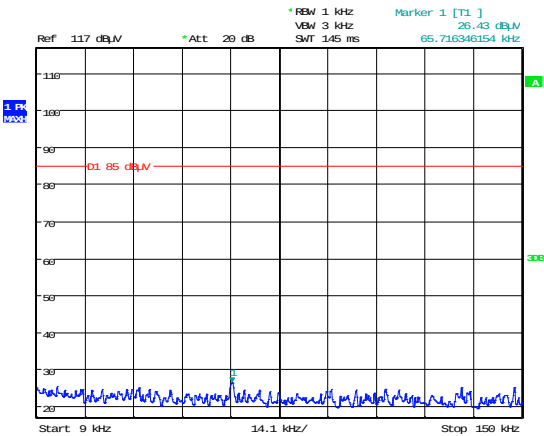


Date: 23.FEB.2015 11:52:15

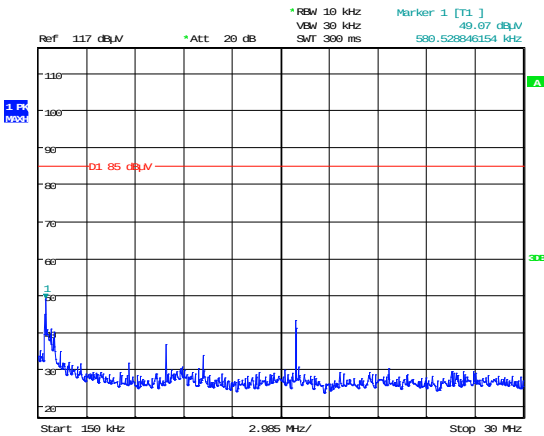
20 GHz – 25 GHz

Conducted Spurious emissions

Antenna 1 2425.0 MHz



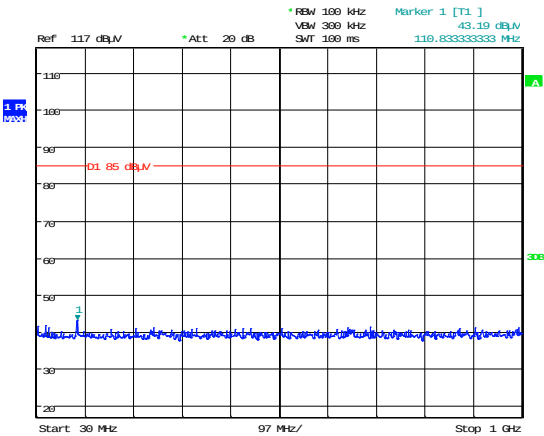
Date: 23.FEB.2015 10:48:10



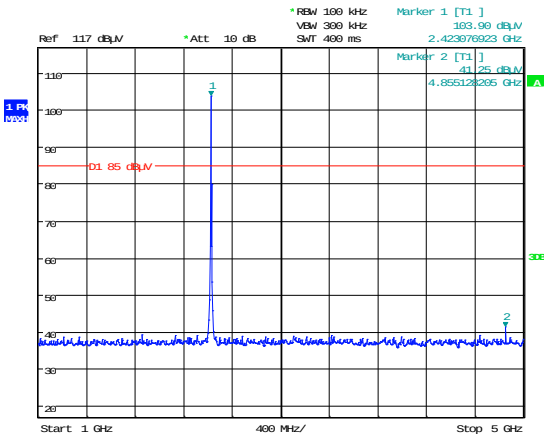
Date: 23.FEB.2015 10:48:45

9 kHz – 150 kHz

150kHz to 30 MHz



Date: 23.FEB.2015 10:49:10



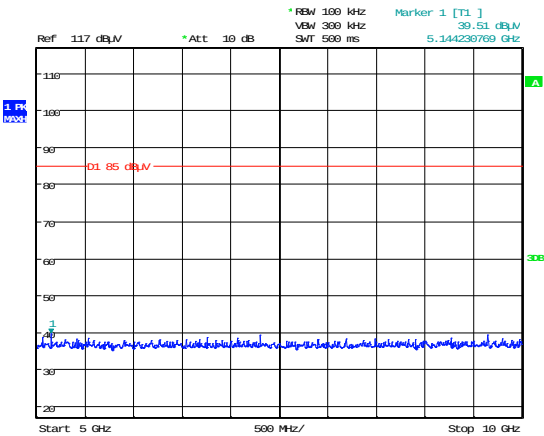
Date: 23.FEB.2015 10:31:29

30 MHz – 1 GHz

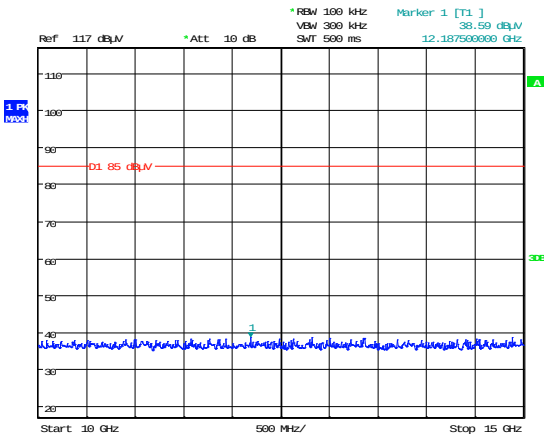
1 GHz – 5 GHz

Conducted Spurious emissions

Antenna 1 2425.0 MHz



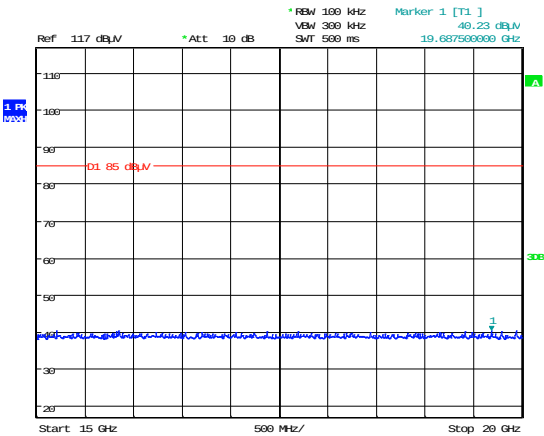
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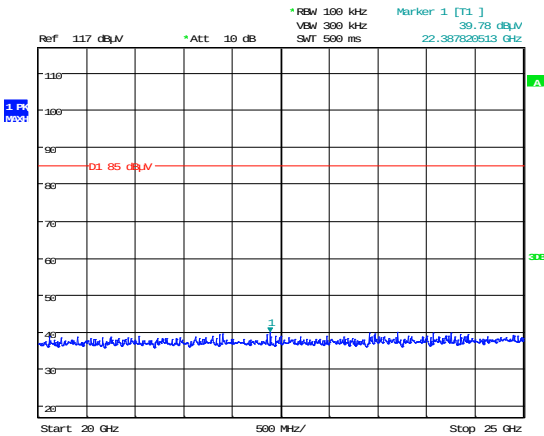
Date: 23.FEB.2015 10:32:00

5 GHz – 10 GHz

10 GHz – 15 GHz



Date: 23.FEB.2015 10:47:06



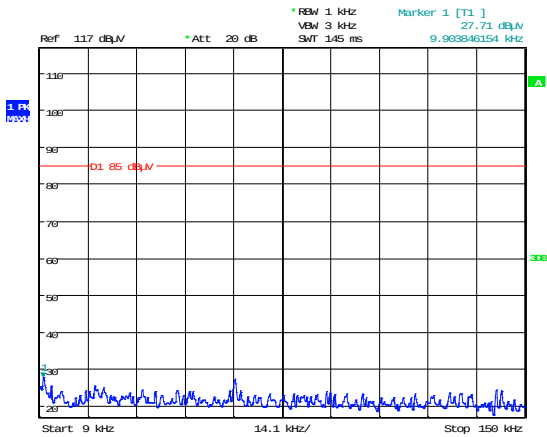
Date: 23.FEB.2015 10:47:28

15 GHz – 20 GHz

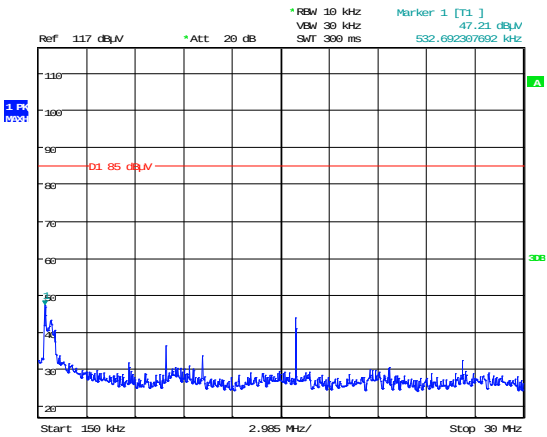
20 GHz – 25 GHz

Conducted Spurious emissions

Antenna 1 2450.0 MHz



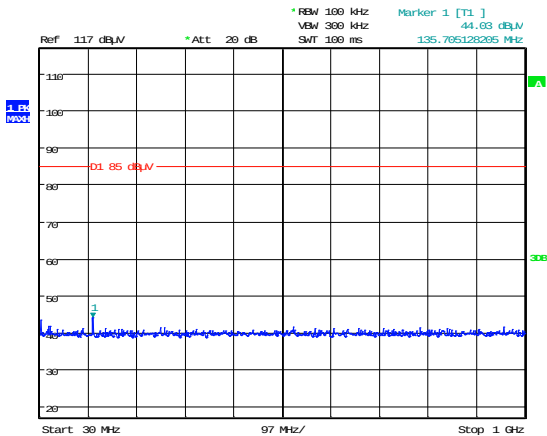
Date: 23.FEB.2015 10:53:18



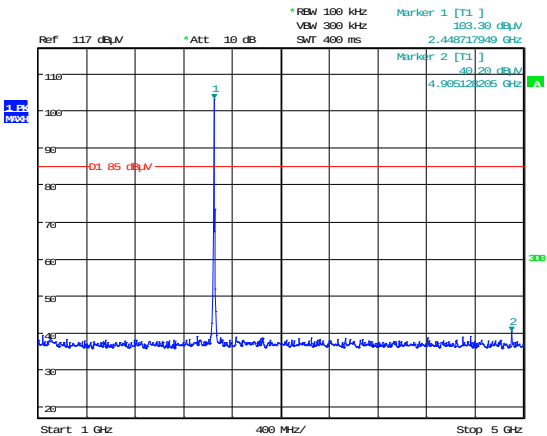
Date: 23.FEB.2015 10:53:55

9 kHz – 150 kHz

150kHz to 30 MHz



Date: 23.FEB.2015 10:50:50



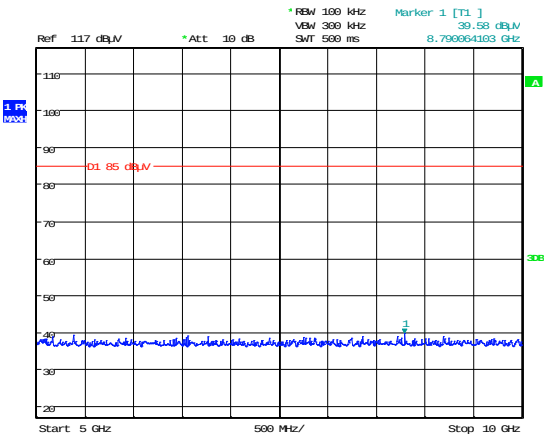
Date: 23.FEB.2015 10:51:32

30 MHz – 1 GHz

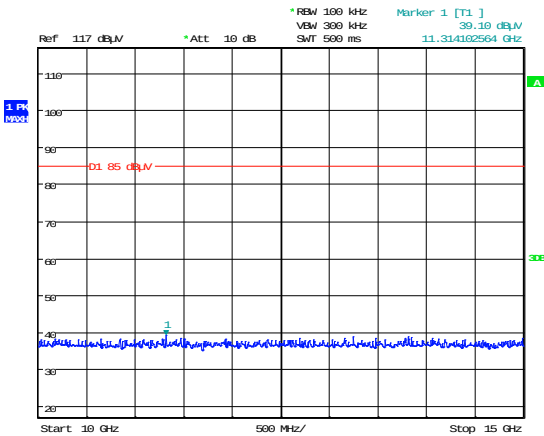
1 GHz – 5 GHz

Conducted Spurious emissions

Antenna 1 2450.0 MHz



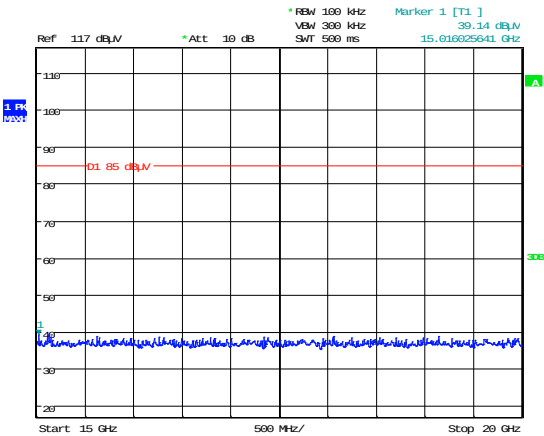
Date: 23.FEB.2015 10:52:01



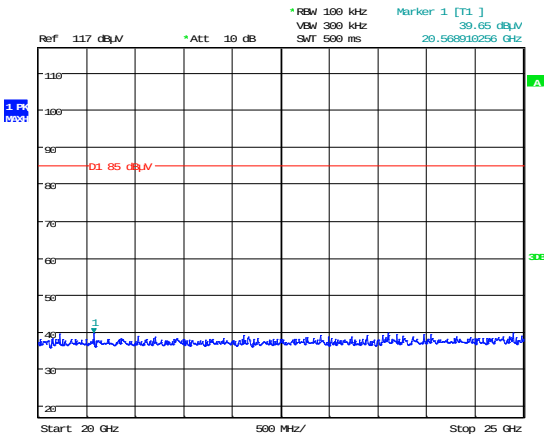
Date: 23.FEB.2015 10:52:19

5 GHz – 10 GHz

10 GHz – 15 GHz



Date: 23.FEB.2015 10:52:37



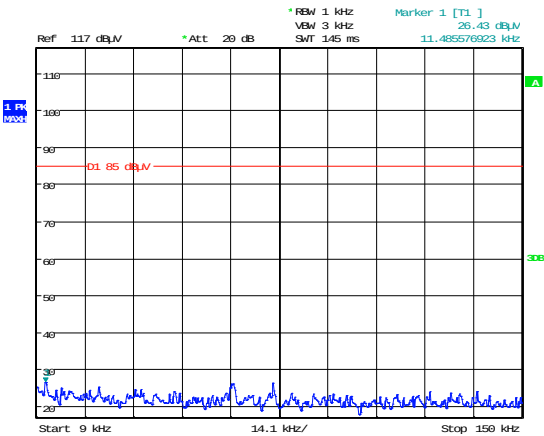
Date: 23.FEB.2015 10:52:57

15 GHz – 20 GHz

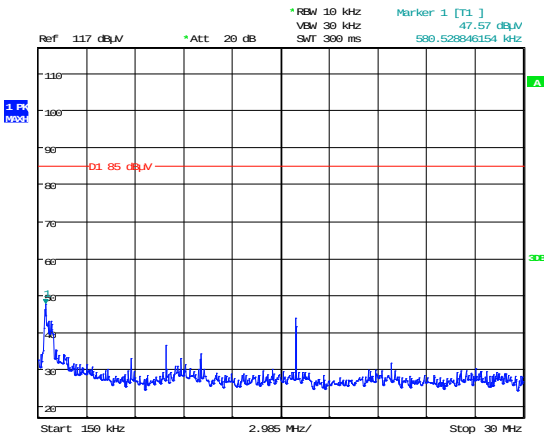
20 GHz – 25 GHz

Conducted Spurious emissions

Antenna 1 2475.0 MHz



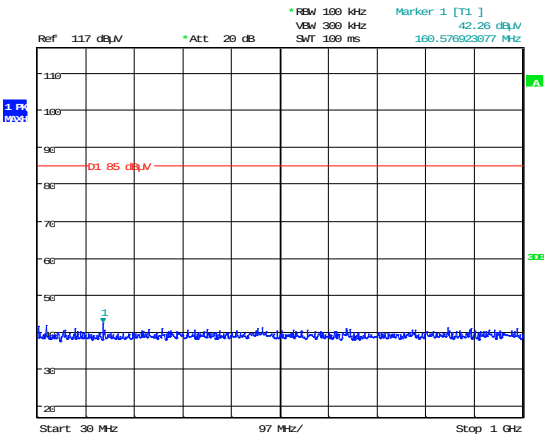
Date: 23.FEB.2015 10:55:55



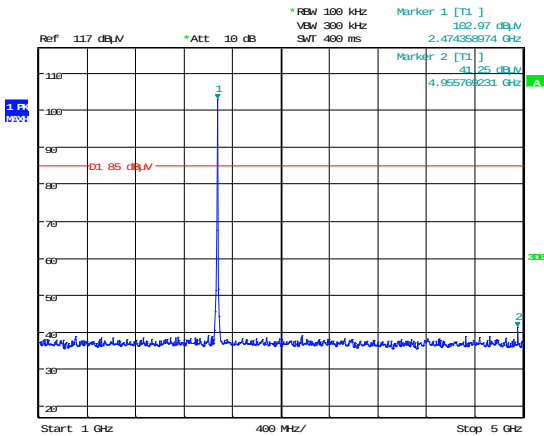
Date: 23.FEB.2015 10:55:36

9 kHz – 150 kHz

150kHz to 30 MHz



Date: 23.FEB.2015 10:56:12



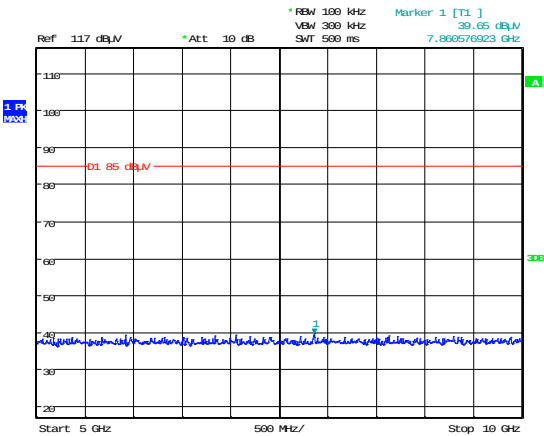
Date: 23.FEB.2015 10:56:46

30 MHz – 1 GHz

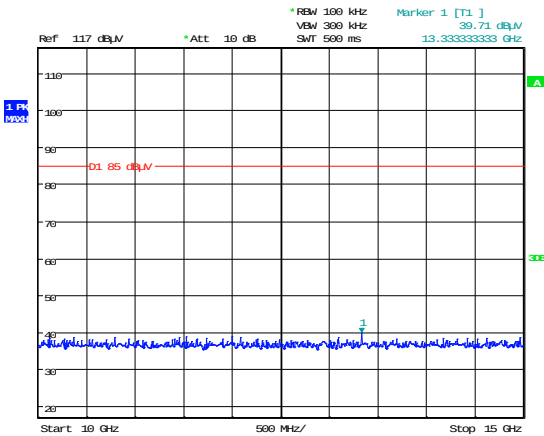
1 GHz – 5 GHz

Conducted Spurious emissions

Antenna 1 2475.0 MHz



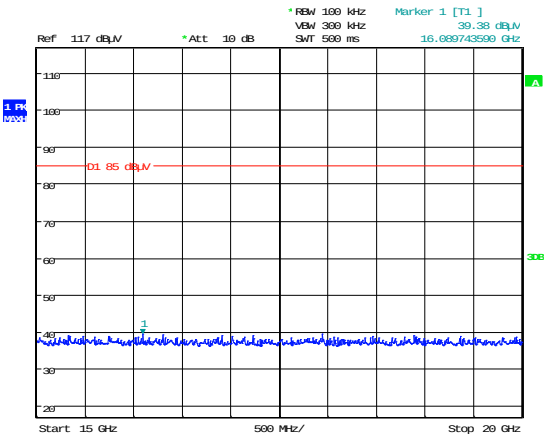
Date: 23.FEB.2015 10:57:47



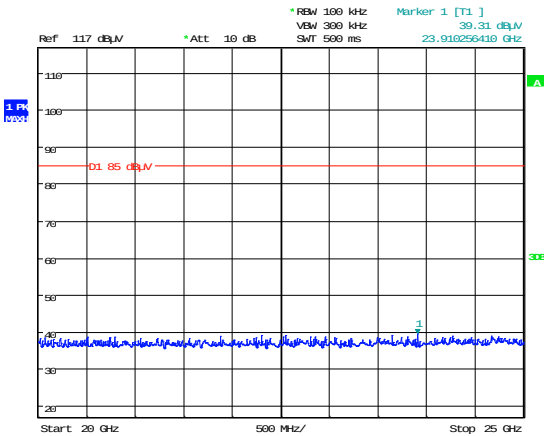
Date: 23.FEB.2015 10:58:03

5 GHz – 10 GHz

10 GHz – 15 GHz



Date: 23.FEB.2015 10:58:31

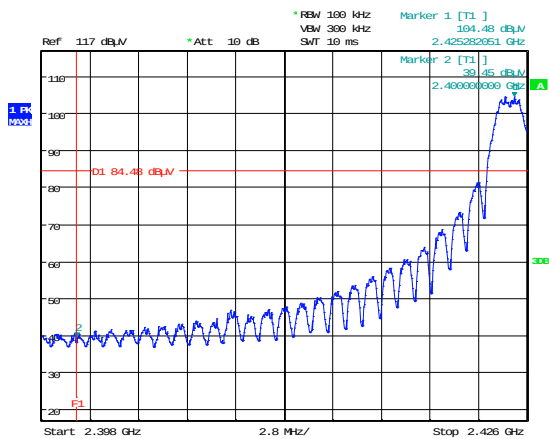


Date: 23.FEB.2015 10:58:46

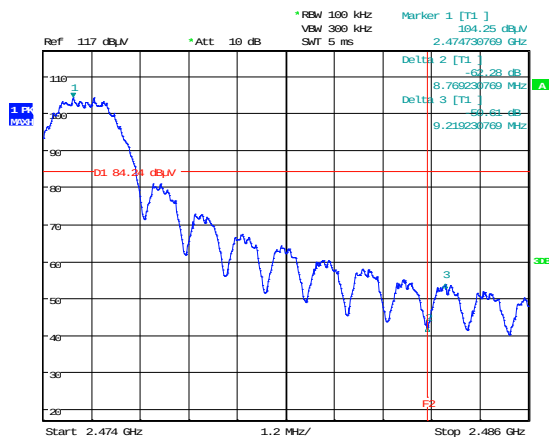
15 GHz – 20 GHz

20 GHz – 25 GHz

Conducted Bandedge Compliance

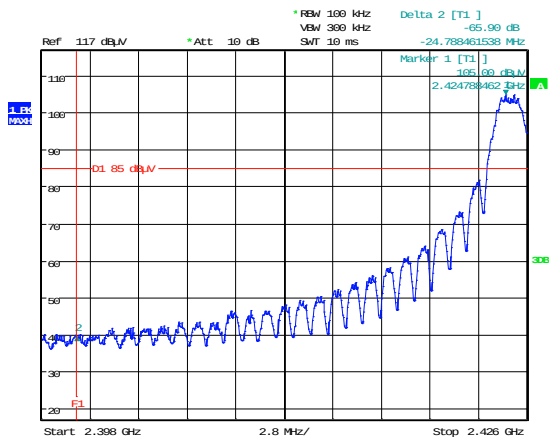


Date: 23.FEB.2015 11:43:16



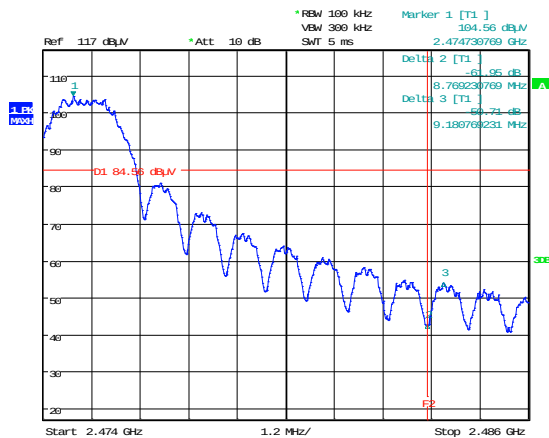
Date: 23.FEB.2015 11:41:07

Antenna 0 - Lower Bandedge



Date: 23.FEB.2015 10:30:52

Antenna 0 - Upper Bandedge

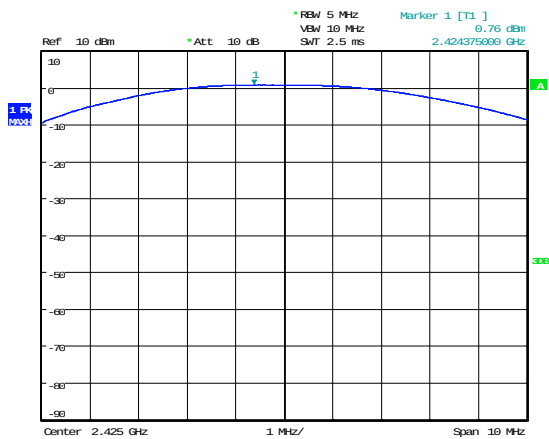


Date: 23.FEB.2015 10:28:09

Antenna 1 - Lower Bandedge

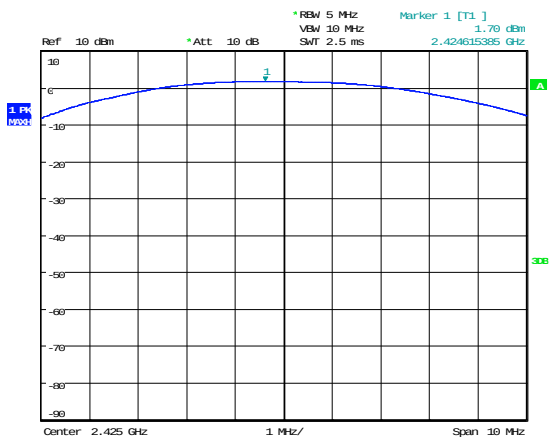
Antenna 1 - Upper Bandedge

Conducted carrier power



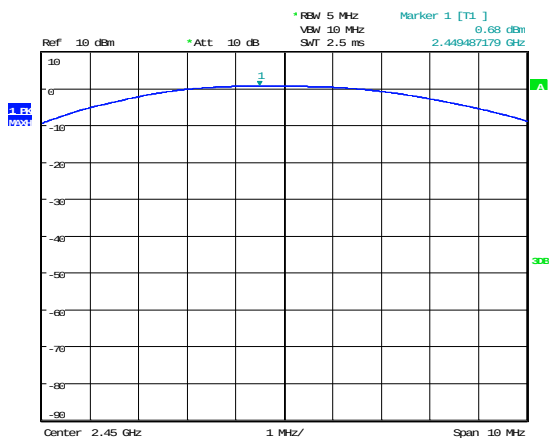
Date: 23.FEB.2015 11:03:07

Antenna 0 2425.0 MHz



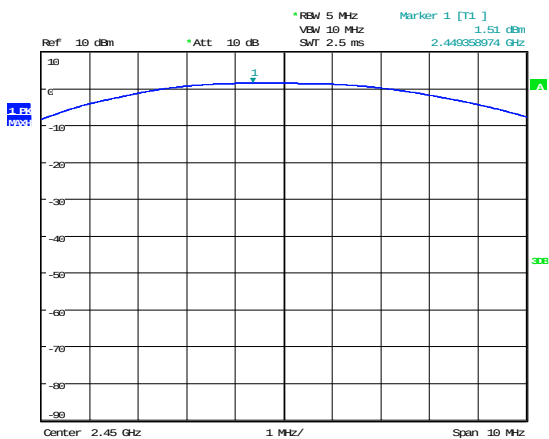
Date: 23.FEB.2015 09:31:54

Antenna 1 2425.0 MHz



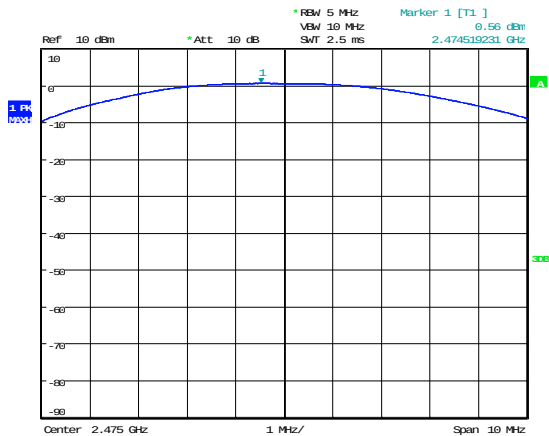
Date: 23.FEB.2015 11:03:40

Antenna 0 2450.0 MHz



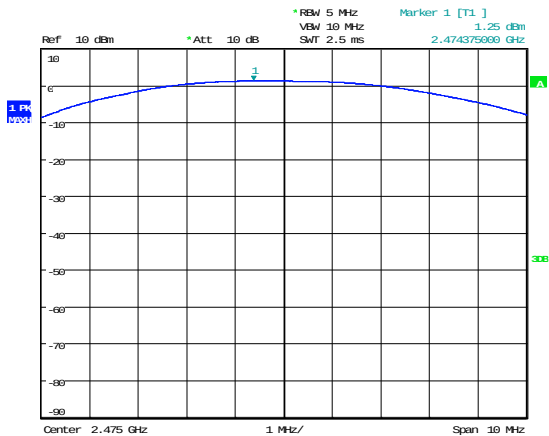
Date: 23.FEB.2015 09:33:09

Antenna 1 2450.0 MHz



Date: 23.FEB.2015 11:04:09

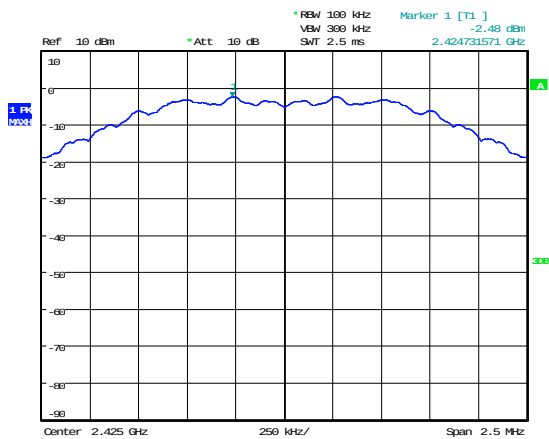
Antenna 0 2475.0 MHz



Date: 23.FEB.2015 09:33:45

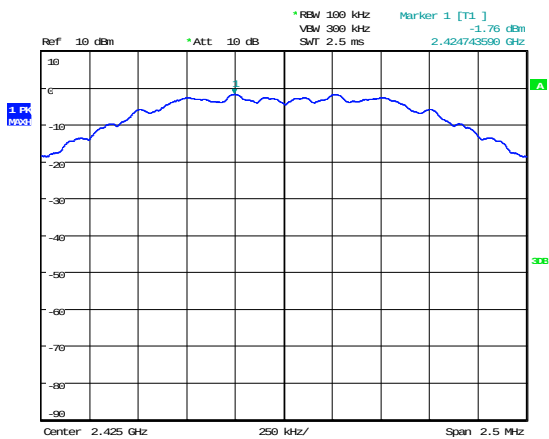
Antenna 1 2475.0 MHz

Conducted Power Spectral Density



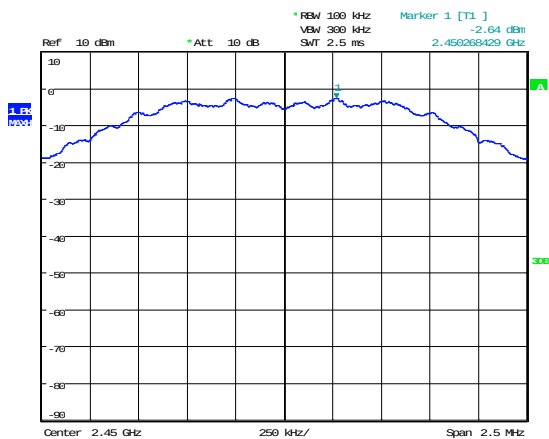
Date: 23.FEB.2015 11:31:56

Antenna 0 2425.0 MHz



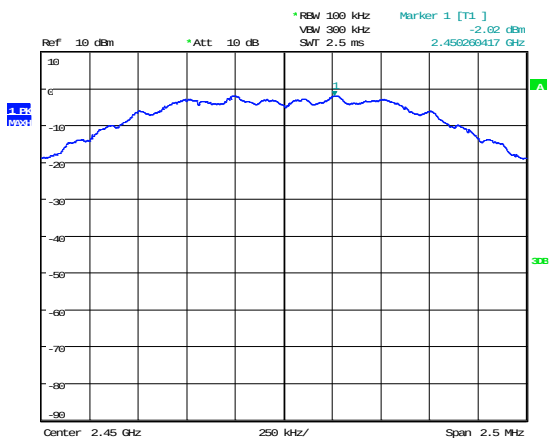
Date: 23.FEB.2015 09:53:07

Antenna 1 2425.0 MHz



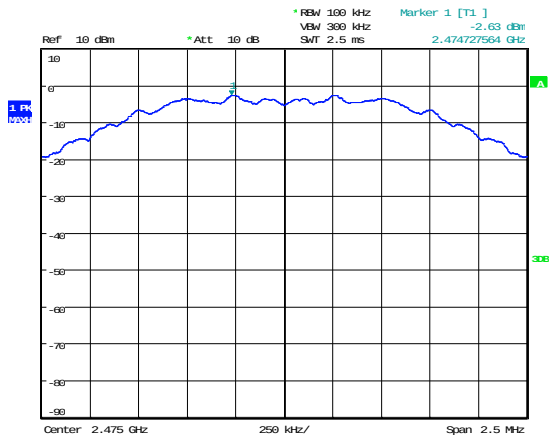
Date: 23.FEB.2015 11:34:17

Antenna 0 2450.0 MHz



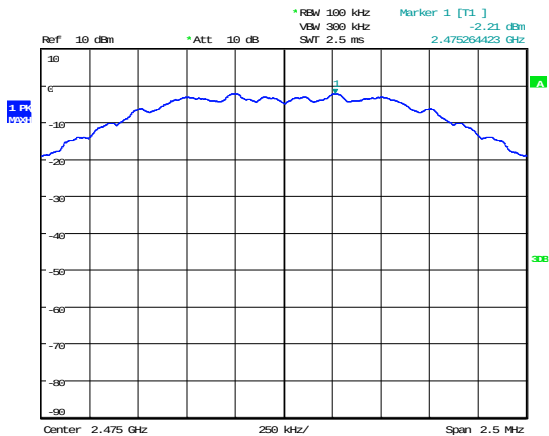
Date: 23.FEB.2015 09:55:38

Antenna 1 2450.0 MHz



Date: 23.FEB.2015 11:38:45

Antenna 0 2475.0 MHz

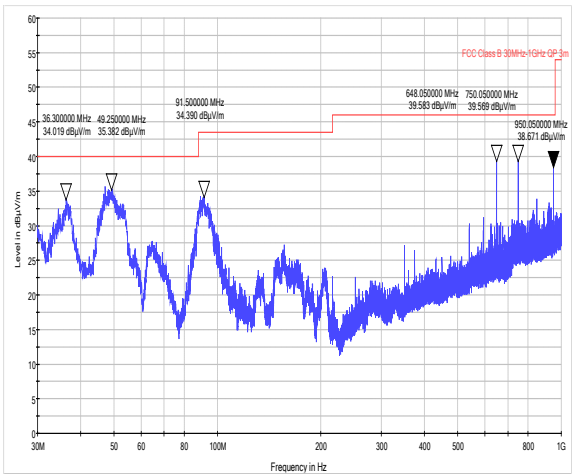


Date: 23.FEB.2015 10:09:42

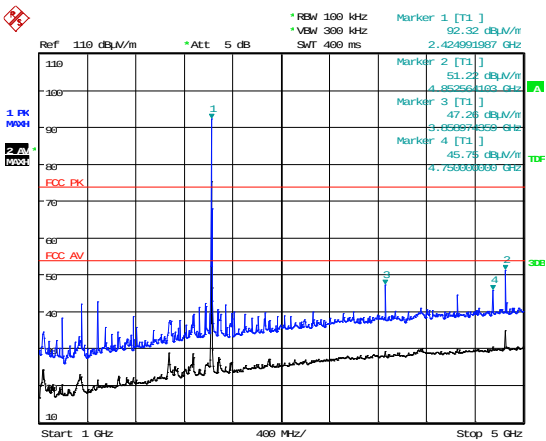
Antenna 1 2475.0 MHz

Radiated Spurious emissions

Antenna 0 - 2425.0 MHz

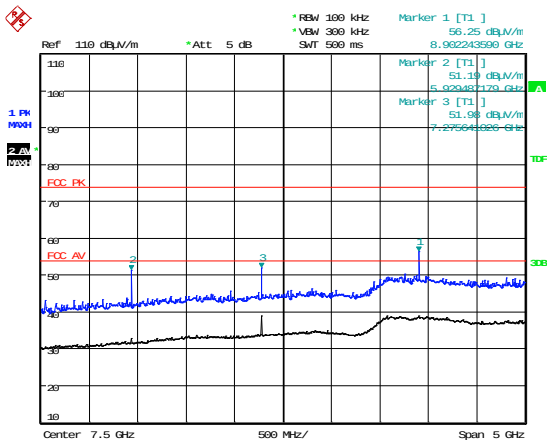


30 MHz to 1 GHz

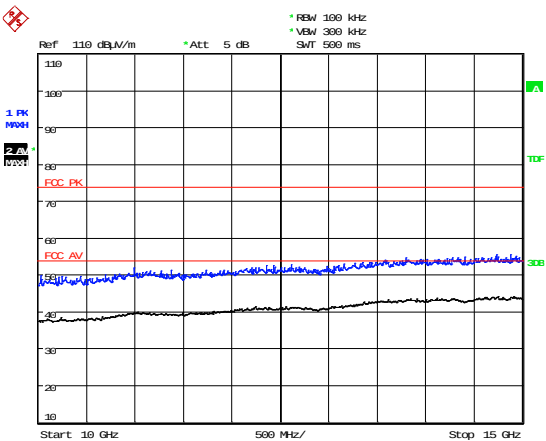


1 GHz to 5 GHz

Date: 17.FEB.2015 15:40:14

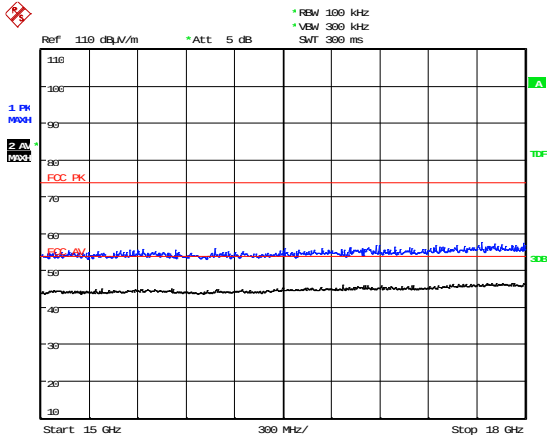


5 GHz – 10 GHz

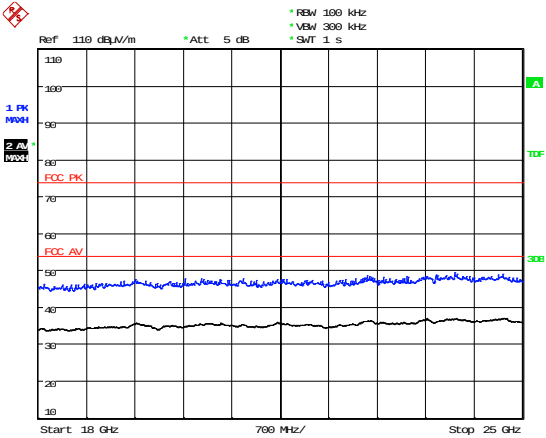


10 GHz – 15 GHz

Date: 17.FEB.2015 15:42:58



15 GHz – 18 GHz



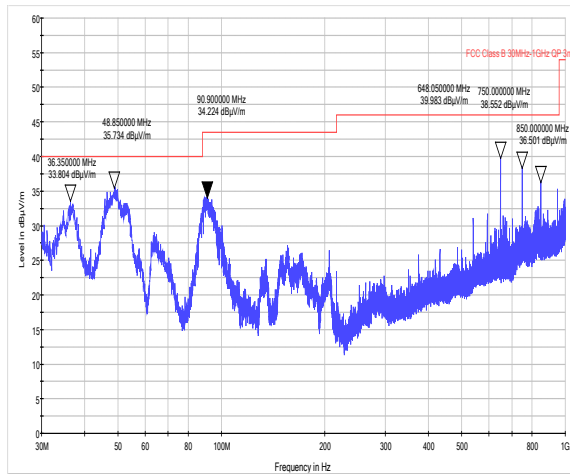
18 GHz – 25 GHz

Date: 17.FEB.2015 15:46:51

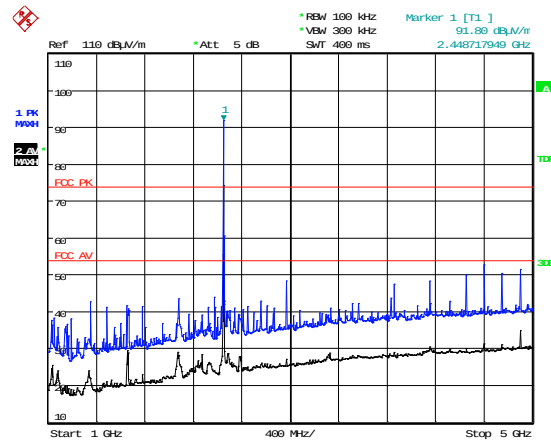
Date: 20.FEB.2015 13:33:02

Radiated Spurious emissions

Antenna 0 - 2450.0 MHz

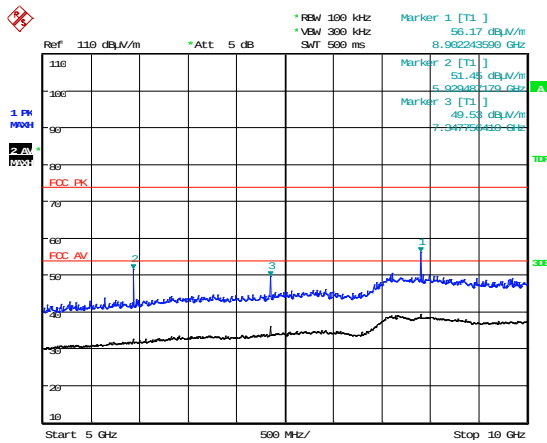


30 MHz to 1 GHz



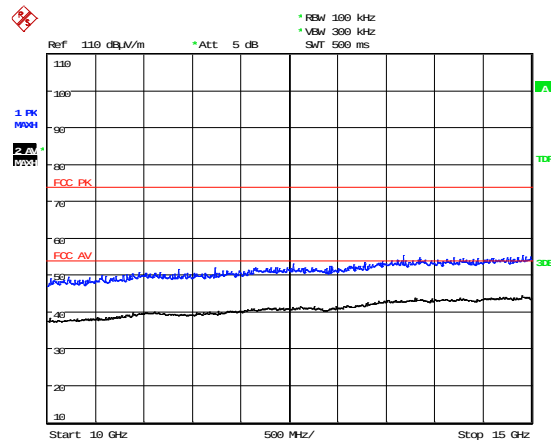
1 GHz to 5 GHz

Date: 17.FEB.2015 16:03:41



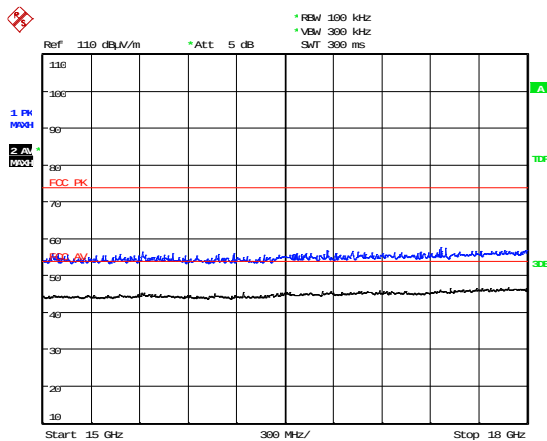
5 GHz – 10 GHz

Date: 17.FEB.2015 16:05:10



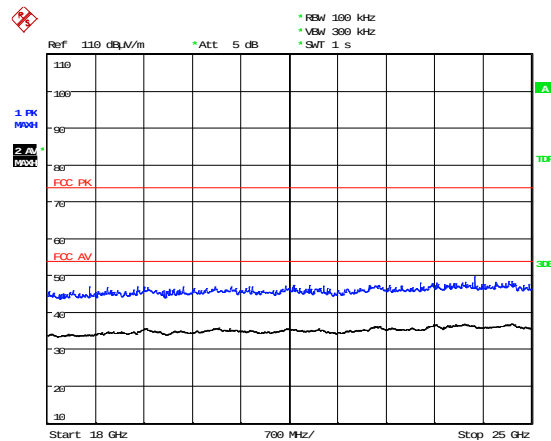
10 GHz – 15 GHz

Date: 17.FEB.2015 16:06:26



15 GHz – 18 GHz

Date: 17.FEB.2015 16:07:56

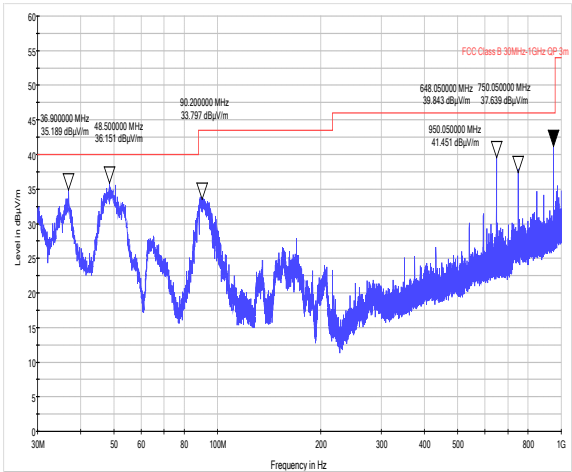


18 GHz – 25 GHz

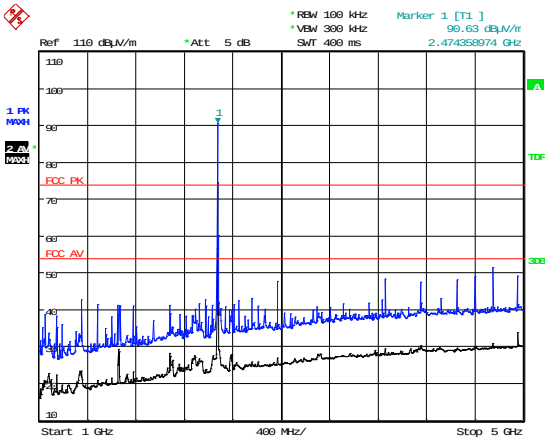
Date: 20.FEB.2015 13:45:07

Radiated Spurious emissions

Antenna 0 - 2475.0 MHz

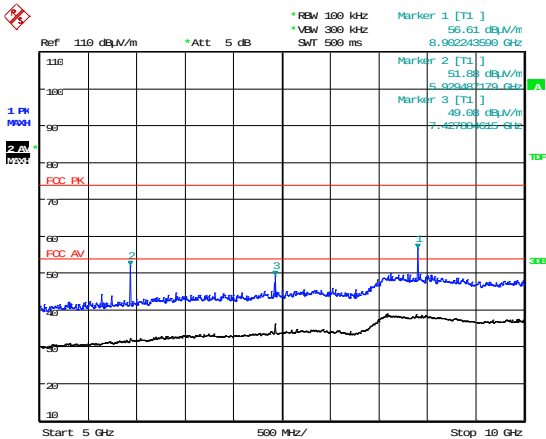


30 MHz to 1 GHz

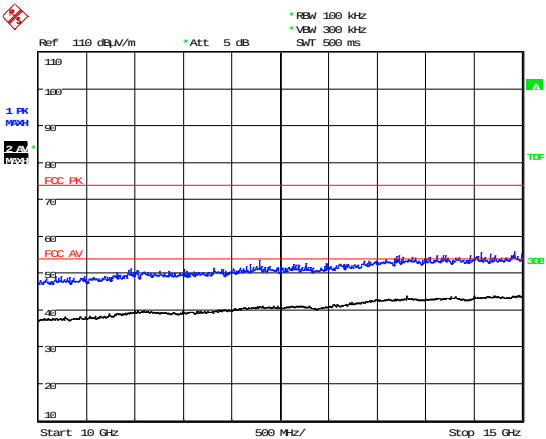


1 GHz to 5 GHz

Date: 17.FEB.2015 16:21:38

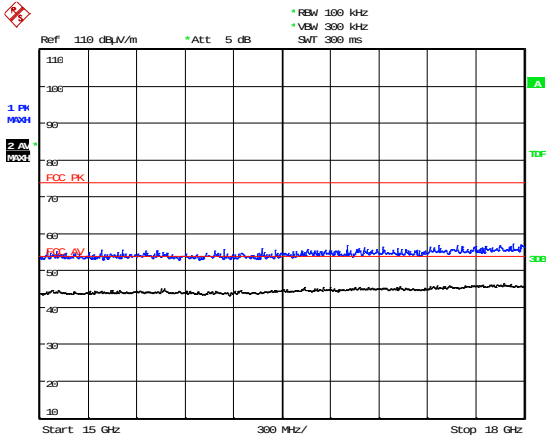


5 GHz – 10 GHz

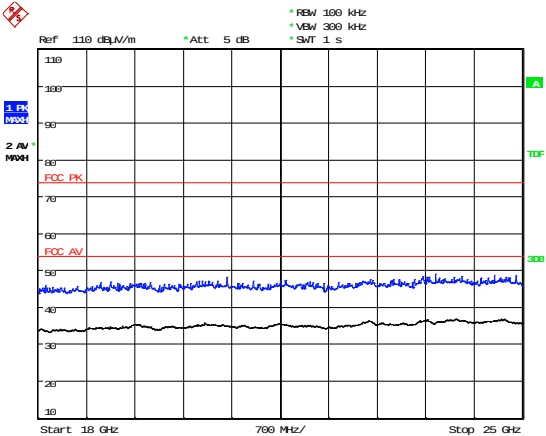


10 GHz – 15 GHz

Date: 17.FEB.2015 16:24:28



15 GHz – 18 GHz

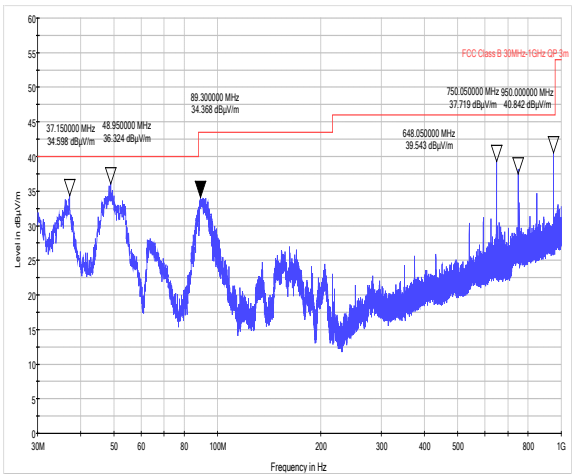


18 GHz – 25 GHz

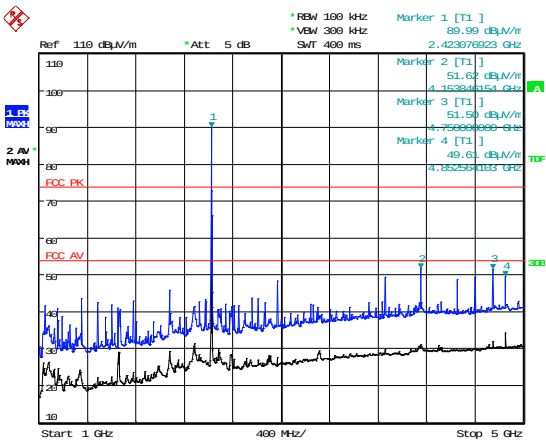
Date: 20.FEB.2015 13:51:05

Radiated Spurious emissions

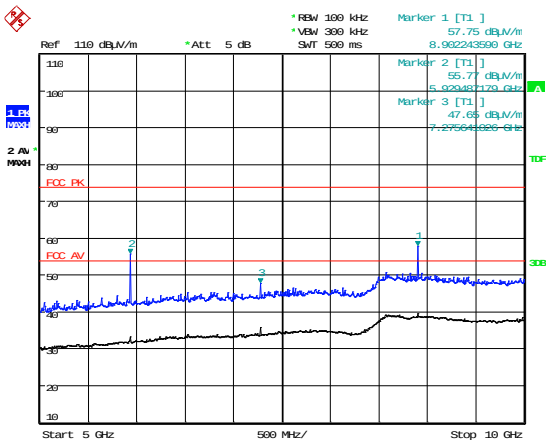
Antenna 1 - 2425.0 MHz



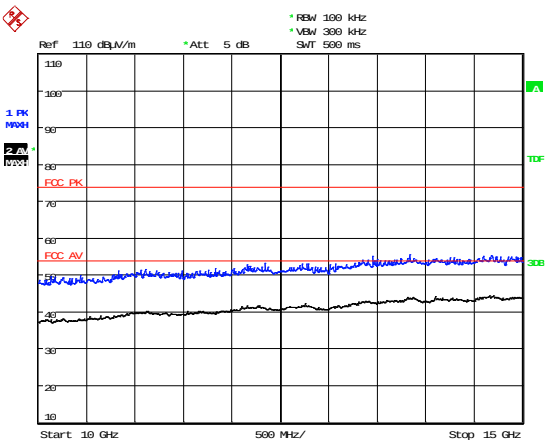
30 MHz to 1 GHz



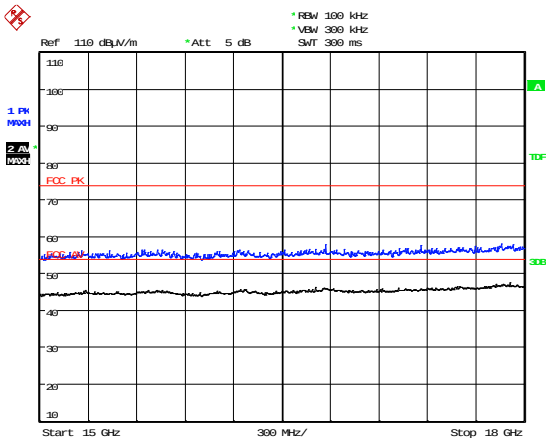
1 GHz to 5 GHz



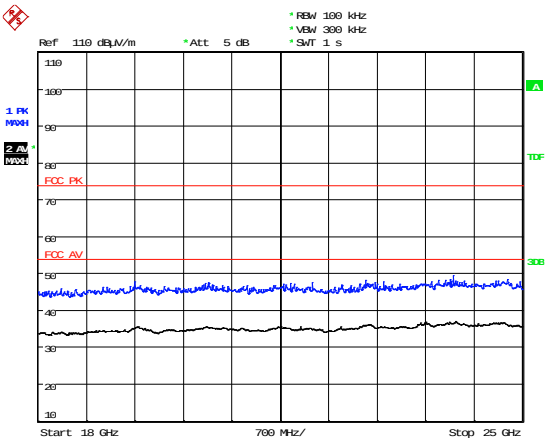
5 GHz – 10 GHz



10 GHz – 15 GHz



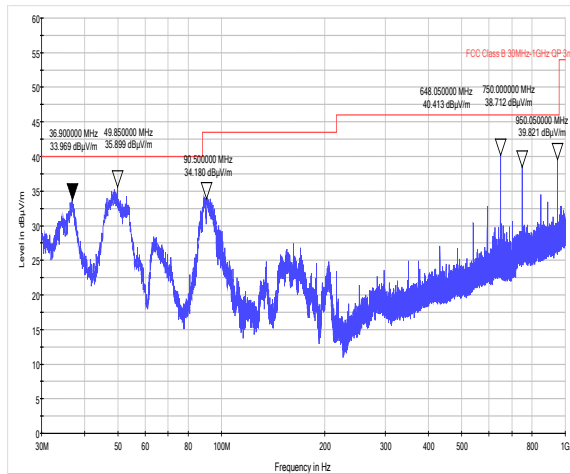
15 GHz – 18 GHz



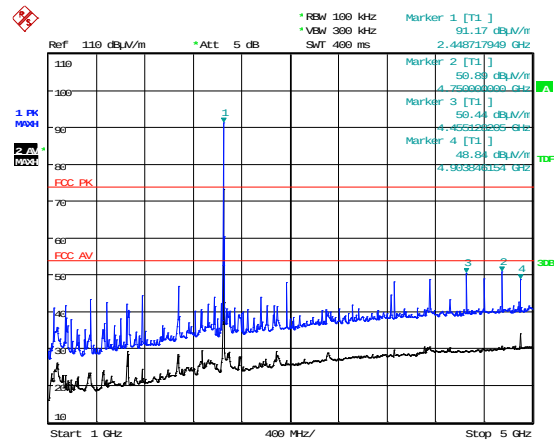
18 GHz – 25 GHz

Radiated Spurious emissions

Antenna 1 - 2450.0 MHz

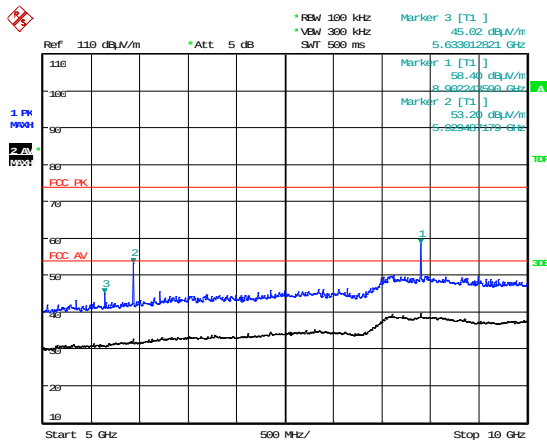


30 MHz to 1 GHz



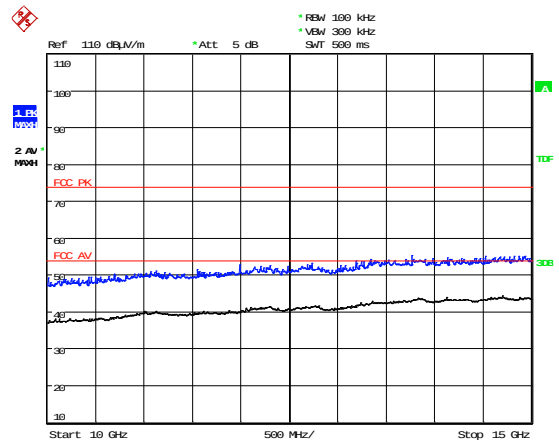
1 GHz to 5 GHz

Date: 18.FEB.2015 09:25:37



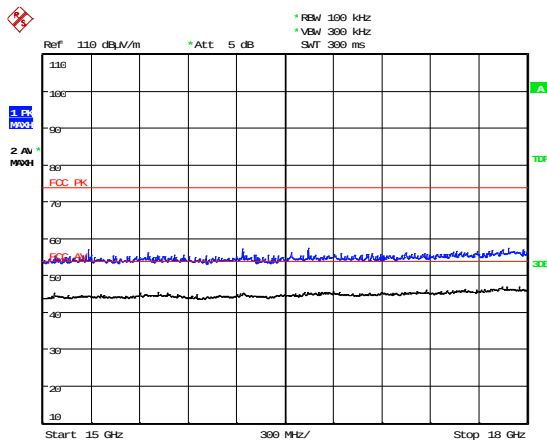
5 GHz – 10 GHz

Date: 18.FEB.2015 09:27:35



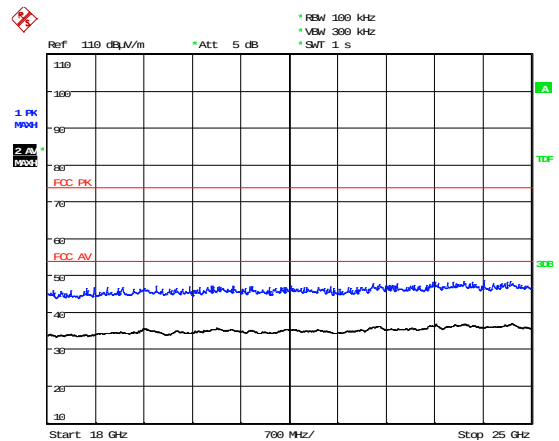
10 GHz – 15 GHz

Date: 18.FEB.2015 09:29:33



15 GHz – 18 GHz

Date: 18.FEB.2015 09:31:59

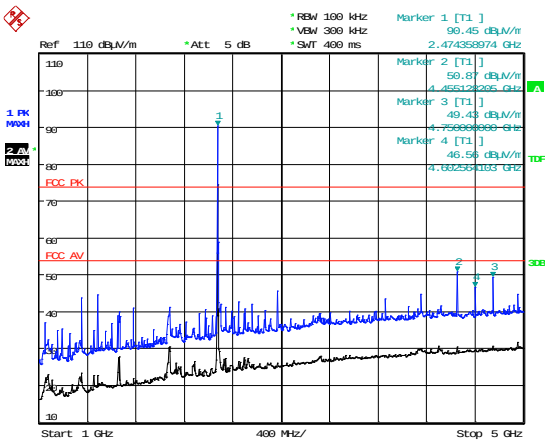
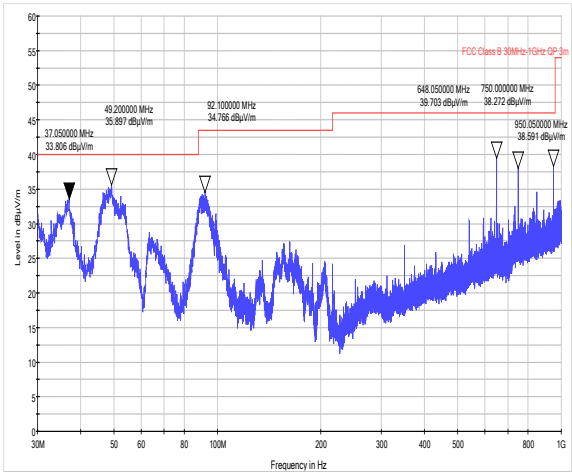


18 GHz – 25 GHz

Date: 20.FEB.2015 14:07:10

Radiated Spurious emissions

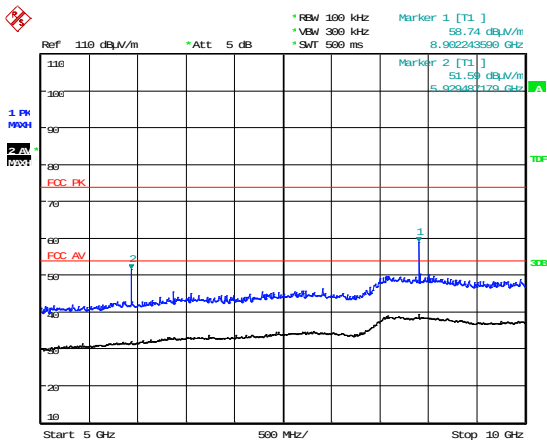
Antenna 1 - 2475.0 MHz



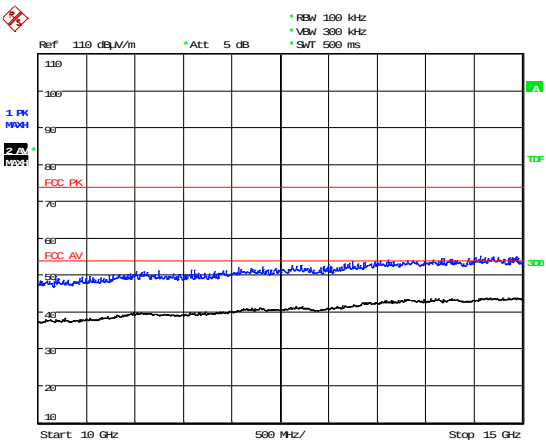
Date: 20.FEB.2015 11:53:05

30 MHz to 1 GHz

1 GHz to 5 GHz



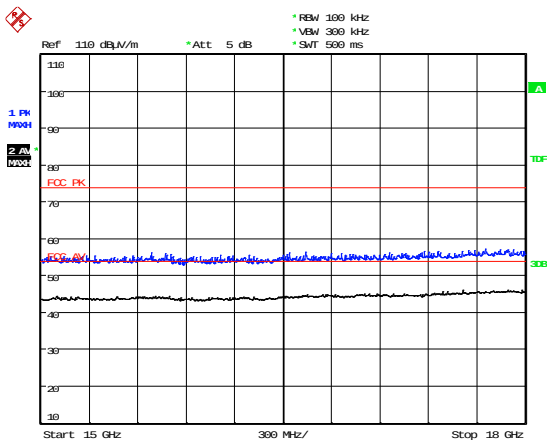
Date: 20.FEB.2015 11:52:06



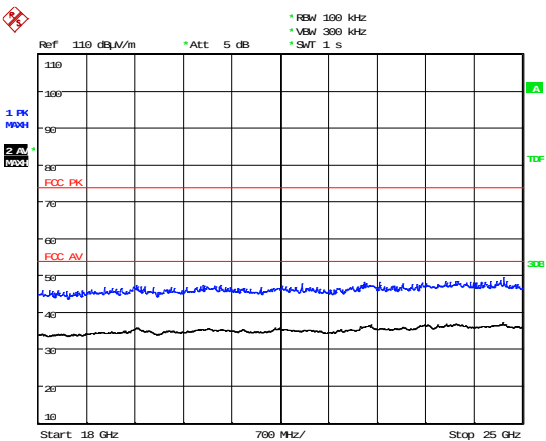
Date: 20.FEB.2015 11:53:15

5 GHz – 10 GHz

10 GHz – 15 GHz



Date: 20.FEB.2015 11:54:23

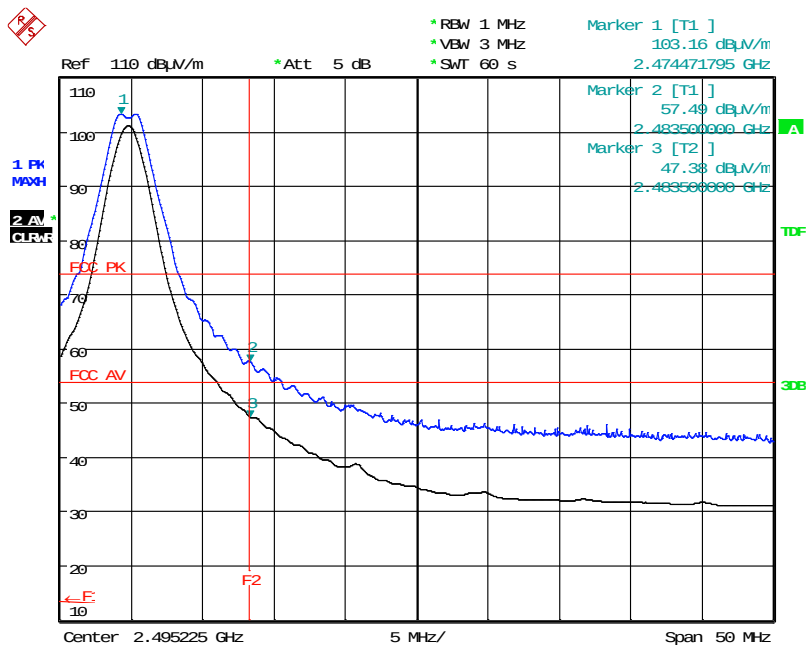


Date: 20.FEB.2015 14:22:36

15 GHz – 18 GHz

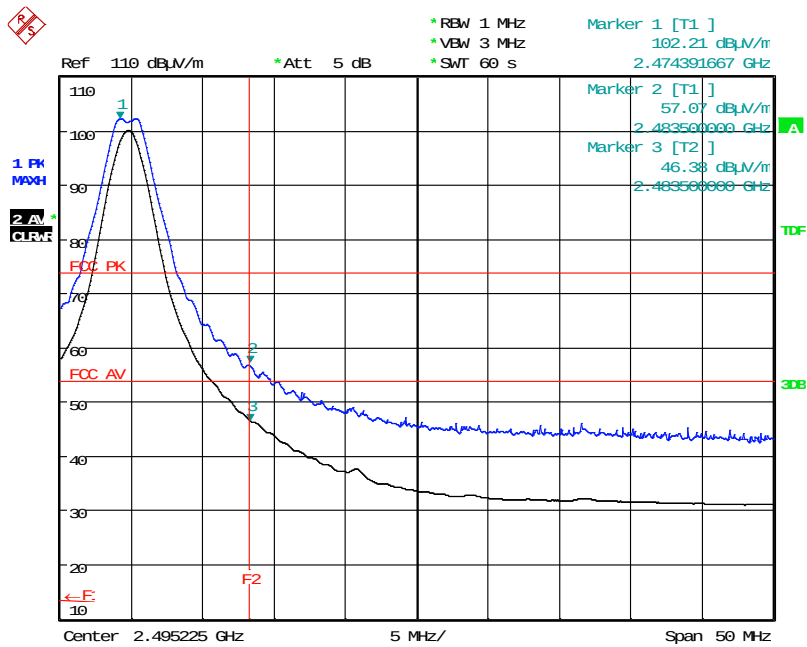
18 GHz – 25 GHz

Radiated Bandedge Compliance



Date: 20.FEB.2015 11:10:57

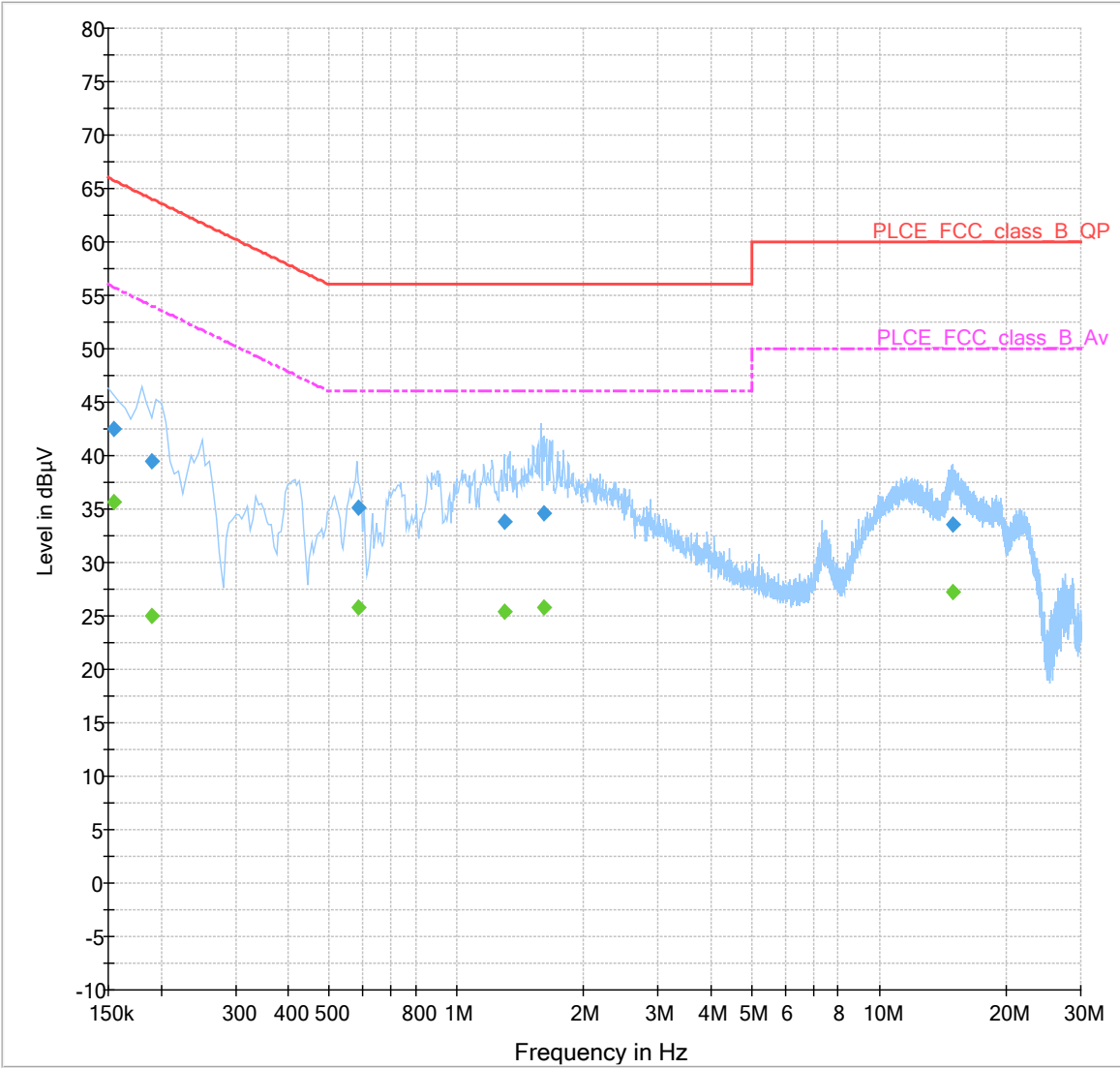
Antenna 0 - Upper Bandedge



Date: 20.FEB.2015 11:36:21

Antenna 1 - Upper Bandedge

AC Powerline Conducted Emissions



Appendix C: Additional Test and Sample Details

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

Sample No: Sxx Mod w

where:

xx	= sample number	eg. S01
w	= modification number	eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

- Positioning of cards in a chassis.
- Setting of any internal switches.
- Circuit board jumper settings.
- Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as "single possible configuration".

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

C1) Test samples

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S01	PX022ANX Hybrid Gateway Set Top Box (Radiated)	K8MD54516D0294
S02	ADP-36DR Delta Electronics PSU	HAAD4A700AF
S31	PX022ANX Hybrid Gateway Set Top Box (Conducted)	K8MD54516B0219
S23	ADP-36DR Delta Electronics PSU	HAAD4A700T6

- Software Revision: 1.109
- Build Level / Revision Number: E4063419300 rev AB
- Build level: CAD B

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification
S03	F-type load	None
S04	AV load	None
S11	USB memory Pen Drive	None
S13	SEIKI 4K TV	None
S14	Dell Laptop	None
S15	TRIAX F-type combiner	None
S17	XINFINTY D520	DP2012110026
S20	XINFINTY D911 CEB	None
S19	DEKTEC DTU-215 modulator	4215-002-007
S22	Dell Laptop	None

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

Identification	Description
None	

C2) EUT Operating Mode During Testing.

During testing, the EUT was exercised as described in the following tables :

Test	Description of Operating Mode
All tests detailed in this report	EUT transmitting a Modulated carrier Software power setting level 3

C3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S31
Tests : Conducted

Port	Description of Cable Attached	Cable length	Equipment Connected
dc power	2 core	1m	S02
Antenna 0	Co-Axial	<1m	Measurement System
Antenna 1	Co-Axial	<1m	Measurement System
USB	USB – Serial – USB	2m	S14

Sample : S01
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
dc power	2 core	1m	S02
Cable in	75 Ohm co-axial	1m	S15 (S19 & S20)
Cable out	75 Ohm co-axial	1m	S03
LAN	CAT5 UTP	10m	S22
HDMI in	HDMI cable	1.5m	S17
HDMI out	HDMI	10m	S13
Audio Left	Phono cable	1m	S04
Audio Right	Phono cable	1m	S04
Digital audio	Phono cable	1m	S04
USB	USB dongle	N/A	S11

C5 Details of Equipment Used

TRaC No	Equipment Type	Equipment Description	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
UH004	ESVS10	Receiver	R&S	27/02/2014	12	27/02/2015
UH093	CBL6112B	Bilog	Chase	08/07/2013	24	08/07/2015
UH281	FSU46	Spectrum Analyser	R&S	26/03/2014	12	26/03/2015
UH420	CBL6112	Bilog	Chase	25/07/2014	24	25/07/2016
L138	3115	1-18GHz Horn	EMCO	17/10/2013	24	17/10/2015
L300	20240-20	Horn 18-26GHz (&UH330)	Flann	10/02/2014	24	10/02/2016
L572	8449B	Pre Amp	Agilent	10/02/2015	12	10/02/2016
REF909	FSU26	Spectrum Analyser	R&S	13/02/2015	12	13/02/2016
REF940	ATS	Radio Chamber - PP	Rainford EMC	08/09/2014	24	08/09/2016

Appendix D:

Additional Information

No additional information is included within this test report.

Appendix E:**Calculation of the duty cycle correction factor**

Using a spectrum analyser in zero span mode, centred on the fundamental carrier frequency with a RBW of 1MHz and a video Bandwidth of 1MHz the sweep time was set accordingly to capture the pulse train. The transmit pulsewidths and period was measured. A plots of the pulse train is contained in Appendix B of this test report.

If the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulsewidths over one complete pulse train. However if the pulse train exceeds 100ms then the duty cycle was calculated by averaging the sum of the pulsewidths over the 100ms width with the highest average value. (The duty cycle is the value of the sum of the pulse widths in one period (or 100ms), divided by the length of the period (or 100ms). The duty cycle correction factor was then expressed in dB and the peak emissions adjusted accordingly to give an average value of the emission.

Correction factor dB = $20 \times (\text{Log}_{10} \text{ Calculated Duty Cycle})$

Therefore the calculated duty cycle was determined:

The pulse train period was greater than >100ms and in as shown from the plots in contained in appendix B of this test report.

Duty cycle = $\frac{\text{the sum of the highest average value pulsewidths over 100ms}}{100\text{ms}}$

e.g

$$= \frac{7.459\text{ms}}{100\text{ms}} = 0.07459$$

0.07459 or 7.459%

Correction factor (dB) = $20 \times (\text{Log}_{10} 0.07459) = -22.54\text{dB}$

Duty cycle correction may not be applicable / required by the device covered in this report. The correction factor above is for example of how the correction is calculated. Any applicable duty cycle used will be recorded in the relevant results sections of this report.

Appendix F:

Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: Over view.
2. Radiated electric field emissions arrangement: close up.

Remove for short term confidentiality

Photograph 1

Remove for short term confidentiality

Photograph 2

Appendix G: General SAR test reduction and exclusion guidance**KDB 447498****Section 4.3 General SAR test reduction and exclusion guidance**

For Standalone SAR exclusion consideration, when SAR Exclusion Threshold requirement in KDB 447498 is satisfied, standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.

In the frequency range below 100 MHz to 6 GHz and test separation distance of 50mm, the SAR Test Exclusion Threshold for operation in the 2400 – 2483.5 MHz band will be determined as follows

SAR Exclusion Threshold (SARET)

SAR Exclusion Threshold = Step 1 + Step 2

Step 1

$$NT = [(MP/TSD^A) * \sqrt{f_{GHz}}]$$

NT = Numeric Threshold (3.0 for 1-g SAR and 7.5 for 10-g SAR)
MP = Max Power of channel (mW) (inc tune up)
TSD^A = Min Test separation Distance or 50mm (whichever is lower) = 50

We can transpose this formula to allow us to find the maximum power of a channel allowed and compare this to the measured maximum power.

$$= [(NT \times TSD^A) / \sqrt{f_{GHz}}]$$

For Distances Greater than 50 mm Step 2 applies

Step 2

$$(TSD^B - 50mm) * 10\}$$

Where:

TSD^B = Min Test separation Distance (mm) = 50

Operating Frequency 2.402 GHz

$$\begin{aligned} \text{SARET} &= [(3.0 \times 50) / \sqrt{2.425}] + \{ (50 - 50) * 10 \} \\ \text{SARET} &= [150 / 1.55] + (0 * 10) \\ \text{SARET} &= 96.77\text{mW} \end{aligned}$$

Operating Frequency 2.440 GHz

$$\begin{aligned} \text{SARET} &= [(3.0 \times 50) / \sqrt{2.450}] + \{ (50 - 50) * 10 \} \\ \text{SARET} &= [150 / 1.56] + (0 * 10) \\ \text{SARET} &= 96.15\text{mW} \end{aligned}$$

Operating Frequency 2.480 GHz

$$\begin{aligned} \text{SARET} &= [(3.0 \times 50) / \sqrt{2.475}] + \{ (50 - 50) * 10 \} \\ \text{SARET} &= [150 / 1.57] + (0 * 10) \\ \text{SARET} &= 95.54\text{mW} \end{aligned}$$

Channel Frequency (MHz)	EIRP (W)	SAR Exclusion Threshold	SAR Evaluation
2425	0.0023	96.77mW	Not Required
2450	0.0022	96.15mW	Not Required
2475	0.0021	95.54mW	Not Required

Therefore standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.

Appendix G Continued**MPE Calculation****47 CFR §§1.1310****Prediction of MPE limit at a given distance**

$$S = \frac{EIRP}{4\pi R^2} \text{ re - arranged } R = \sqrt{\frac{EIRP}{S 4\pi}}$$

where:

S = power density

R = distance to the centre of radiation of the antenna

EIRP = EUT Maximum power

Result

Prediction Frequency (MHz)	Maximum EIRP (W)	Power density limit (S) (mW/cm ²)	Distance (R) cm Required to be less than 1 mW/cm ²
2425	0.0023	1	0.02
2450	0.0022	1	0.02
2475	0.0021	1	0.02



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