

**CETECOM™**

**CETECOM ICT Services**  
consulting - testing - certification >>>

## TEST REPORT

Test report no.: 1-0164/15-01-02-A



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-00

### Testing laboratory

**CETECOM ICT Services GmbH**

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**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-12076-01-00

### Applicant

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### Manufacturer

**ifm electronic gmbh**

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45128 Essen / 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

Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

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

### Test Item

**Kind of test item:** 13.56 MHz RFID Reader

**Model name:** DTM424 / DTM426 / DTM427

**FCC ID:** UN6-DTMHFGB (for DTM424 and DTM426)

UN6-DTMHFGN (for DTM427)

**IC:** 6799A-DTMHFGB (for DTM424 and DTM426)

6799A-DTMHFGN (for DTM427)

Frequency: 13.56 MHz

Technology tested: RFID

Antenna: Integrated antenna

Power supply: 9 V to 36 V DC

Temperature range: -40°C to +85°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 authorized:

Stefan BöS  
Lab Manager  
Radio Communications & EMC

### Test performed:

Christoph Schneider  
Testing Manager  
Radio Communications & EMC

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## 2 General information

### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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**This test report replaces the test report with the number 1-0164/15-01-02 and dated 2015-11-02**

### 2.2 Application details

Date of receipt of order:	2015-08-06
Date of receipt of test item:	2015-10-09
Start of test:	2015-10-16
End of test:	2015-10-20
Person(s) present during the test:	-/-

## 3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15		Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	December 2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

### 3.1 Measurement guidance

Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices



## 6 Test laboratories sub-contracted

None

## 7 Description of the test setup

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 signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

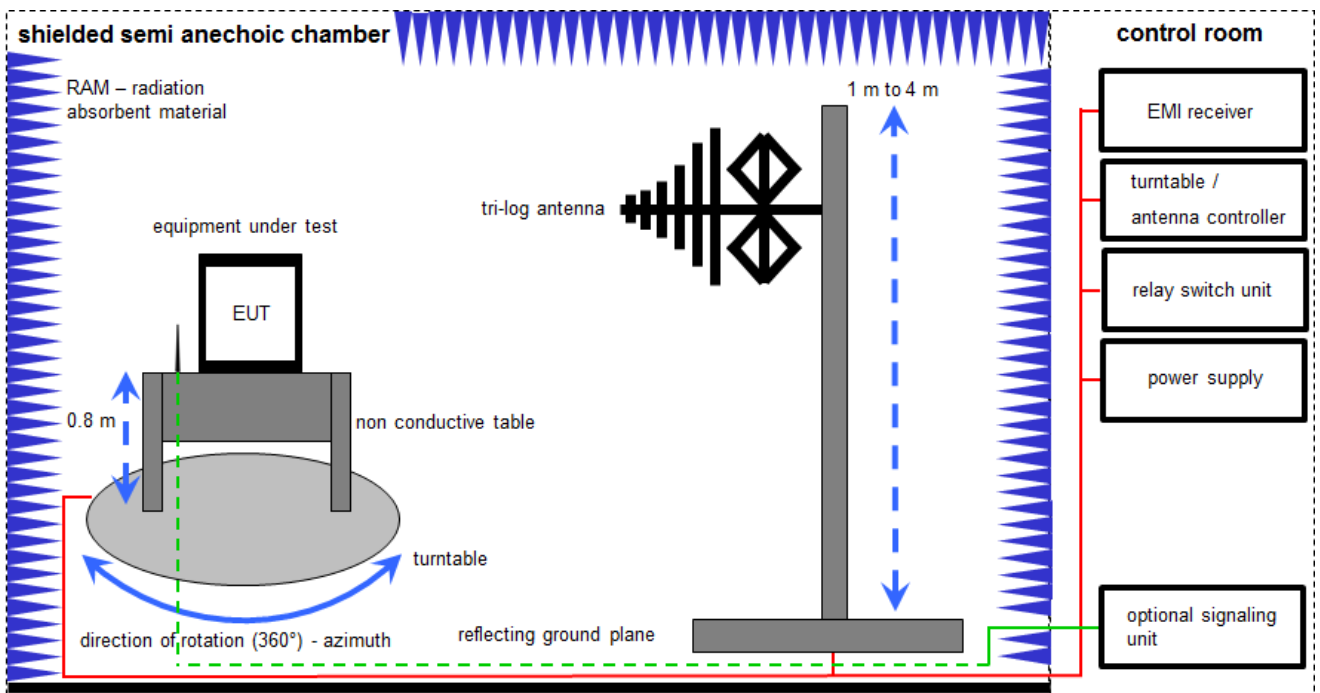
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

### **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
v/k!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

## 7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 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. 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.



Measurement distance: tri-log antenna 10 meter

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

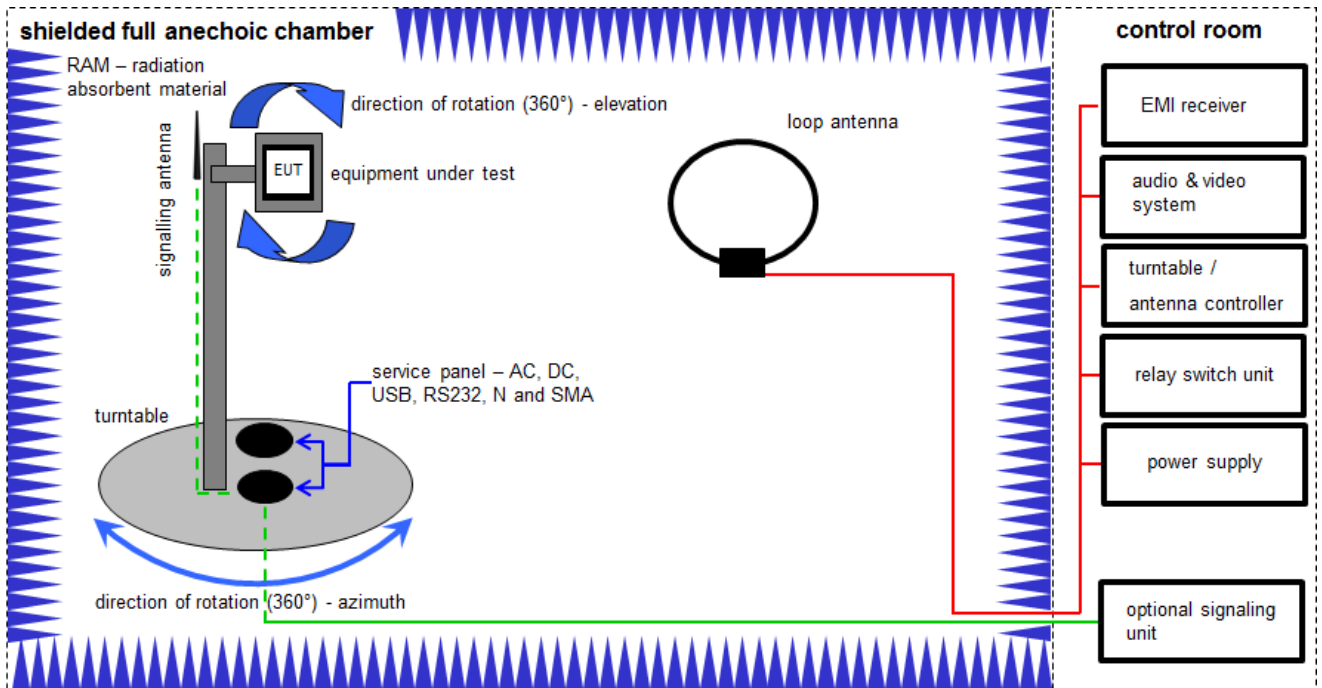
Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

### Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	k	27.11.2006	
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
4	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
7	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
8	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne		

## 7.2 Shielded fully anechoic chamber



Measurement distance: loop antenna 3 meter / 1 meter

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

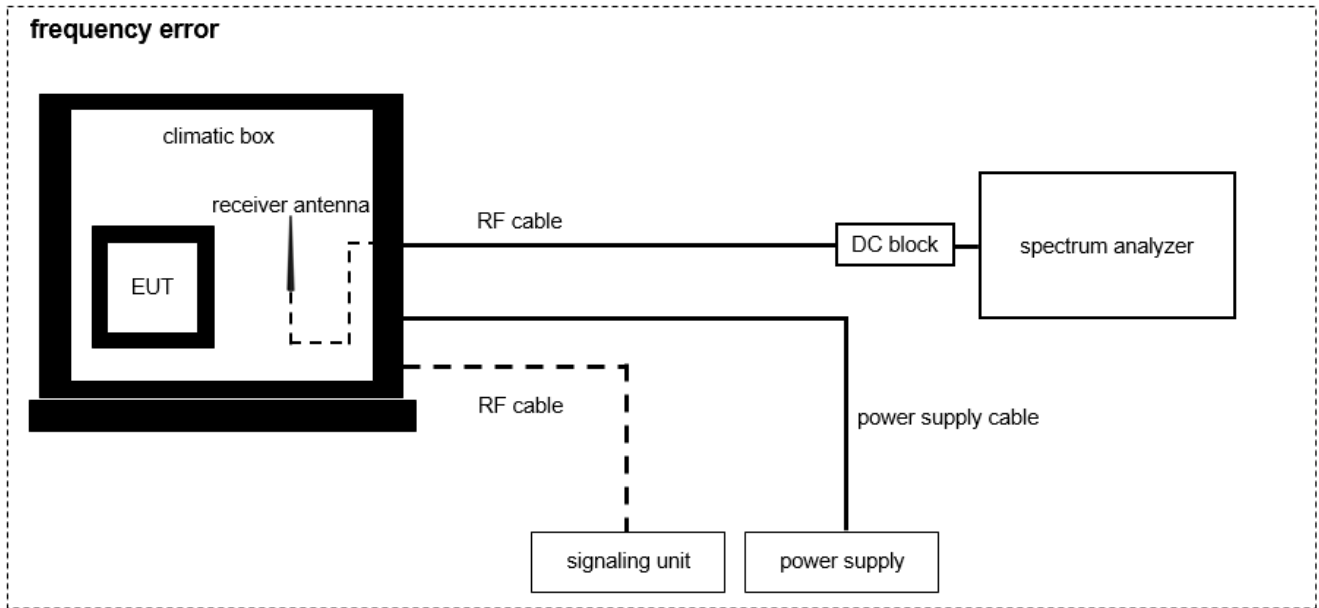
$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$$

### Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
2	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne		
3	A	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A54 21	300004591	ne		
4	A	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A54 21	300004682	ne		
5	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	22.01.2015	22.01.2016
6	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04590	300001041	Ve	20.01.2015	20.01.2018



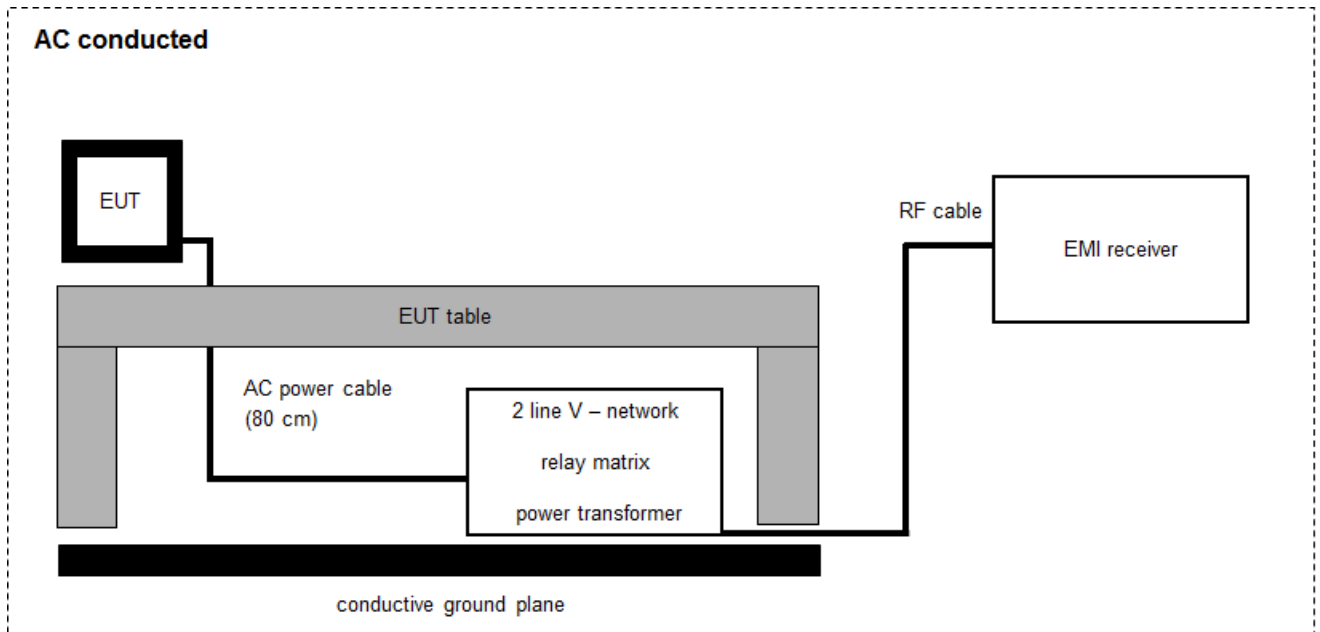
### 7.3 Frequency error



**Equipment table:**

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	ev	03.09.2015	03.09.2017
2	A	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	23.01.2015	23.01.2016
3	A	Loop Antenna		ZEG TS Steinfurt	101713	400001208	ev		
4	A	RF Cable BNC	RG58	Huber & Suhner	101713	400001209	ev		
5	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04590	300001041	Ve	20.01.2015	20.01.2018

**7.4 AC conducted**



$$FS = UR + CF + VC$$

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:

$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m)$$

**Equipment table:**

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Netznachbildung	ESH3-Z5	R&S	892475/017	300002209	k	17.06.2014	17.06.2016
2	A	EMI-Receiver	8542E	HP	3617A00170	300000568	k	28.01.2015	28.01.2016
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016

## 8 Sequence of testing

### 8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

#### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

#### Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

## 8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position  $\pm 45^\circ$  and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

**9 Measurement uncertainty**

Measurement uncertainty	
Test case	Uncertainty
Spectrum bandwidth	$\pm 21.5$ kHz absolute; $\pm 15.0$ kHz relative
Maximum output power	$\pm 1$ dB
Spurious emissions radiated below 30 MHz	$\pm 3$ dB
Spurious emissions radiated 30 MHz to 1 GHz	$\pm 3$ dB
Frequency error	$\pm 10$ Hz

## 10 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210 Issue 8 RSS Gen Issue 4	See table!	2015-11-27	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
RSS Gen Issue 4	Occupied bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.225 (a)	Field strength of the fundamental	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.209 & § 15.225 (b-d)	Field strength of the harmonics and spurious	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.109	Receiver spurious emissions and cabinet radiations	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Colocated receiver
§15.107 §15.207	Conducted limits	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.225 (a)	Frequency tolerance	Normal & extreme conditions	Normal & extreme conditions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

**Note:** C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

## 11 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

## 12 Measurement results

### 12.1 Occupied bandwidth

#### Measurement:

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

Measurement parameters	
Detector:	Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyser function:	99 % power function
Used equipment:	See chapter 7.3 A
Measurement uncertainty:	See chapter 9

#### Limit:

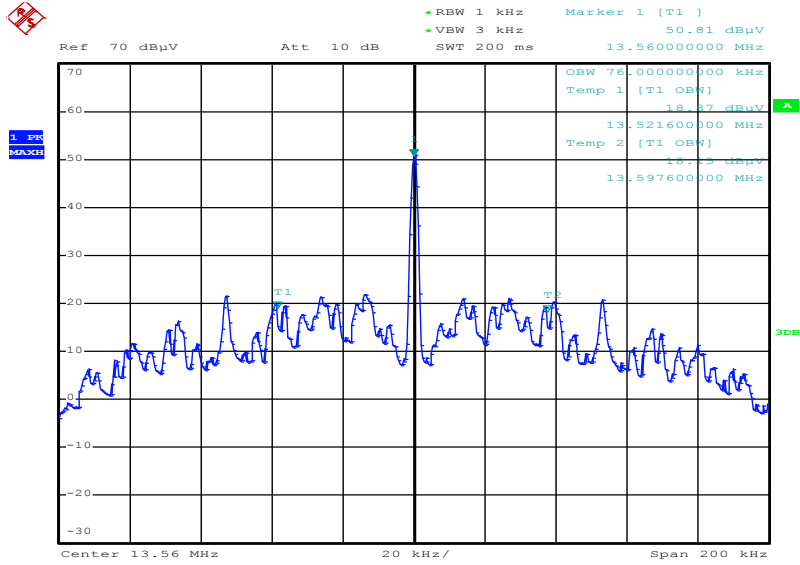
IC
for RSP-100 test report coversheet only

#### Result:

99% emission bandwidth	
DTM424	76.0 kHz
DTM426	78.8 kHz
DTM427	74.0 kHz

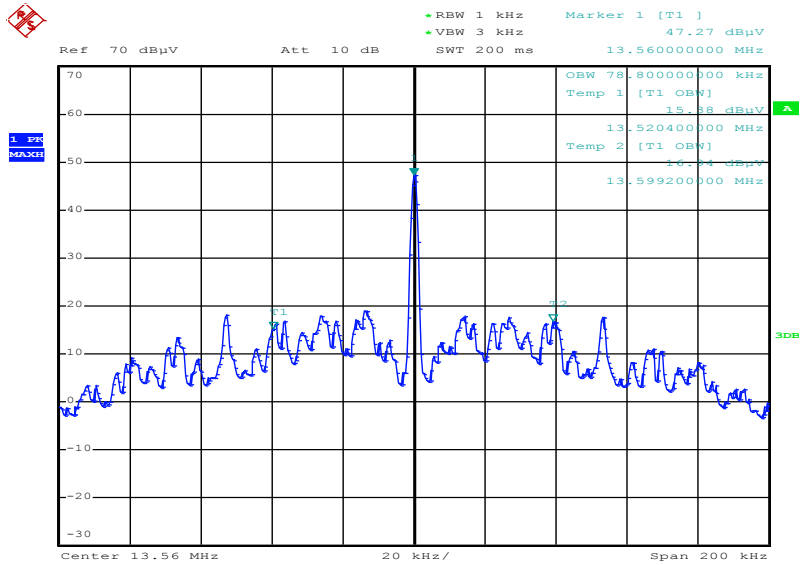
**Plot:**

**Plot 1: 99 % emission bandwidth DTM424**



Date: 20.OCT.2015 11:16:50

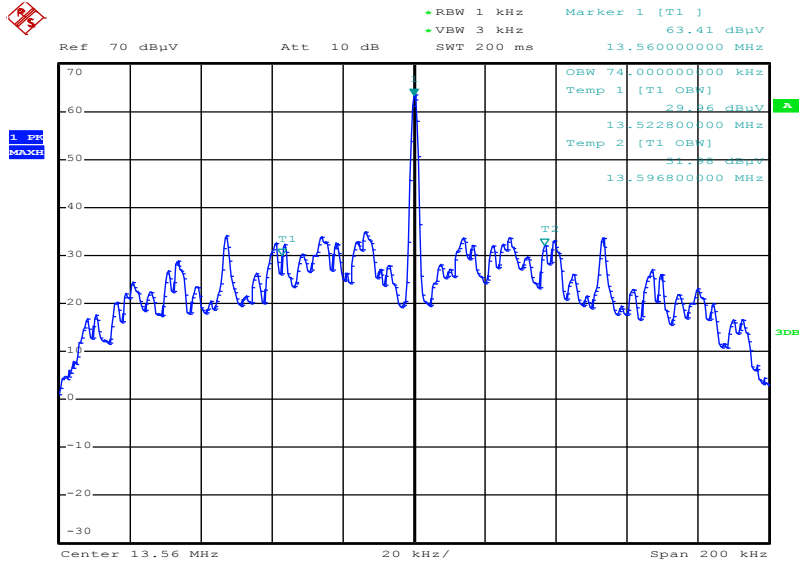
**Plot 2: 99 % emission bandwidth DTM426**



Date: 20.OCT.2015 11:16:11



Plot 3: 99 % emission bandwidth DTM427



Date: 20.OCT.2015 11:17:52

## 12.2 Field strength of the fundamental

### Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters	
Detector:	Quasi peak / peak (worst case)
Resolution bandwidth:	120 kHz
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Used equipment:	See chapter 7.2 A
Measurement uncertainty:	See chapter 9

### Limit:

FCC & IC		
Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
13.553 to 13.567	15,848 (84 dBμV/m)	30

### Recalculation:

According to ANSI C63.10		
Frequency	Formula	Correction value
13.56 MHz	$FS_{\text{limit}} = FS_{\text{max}} - 40 \log\left(\frac{d_{\text{nearfield}}}{d_{\text{measure}}}\right) - 20 \log\left(\frac{d_{\text{limit}}}{d_{\text{nearfield}}}\right)$	-21.39

According to ANSI C63.10
--------------------------

### Result:

Field strength of the fundamental			
Frequency		13.56 MHz	
Distance		@ 3 m	@ 30 m
Measured / calculated value	DTM424	44.20 dBμV/m	22.81 dBμV/m
	DTM426	44.18 dBμV/m	22.79 dBμV/m
	DTM427	53.29 dBμV/m	31.90 dBμV/m

### 12.3 Field strength of the harmonics and spurious

**Measurement:**

The maximum detected field strength for the harmonics and spurious.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz 30 MHz < F < 1 GHz: 120 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz 30 MHz < F < 1 GHz: 300 kHz
Trace mode:	Max hold
Used equipment:	See chapter 7.2 A / 7.3 A
Measurement uncertainty:	See chapter 9

**Limit:**

FCC & IC		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dBµV/m)	30
30 – 88	100 (40 dBµV/m)	3
88 – 216	150 (43.5 dBµV/m)	3
216 – 960	200 (46 dBµV/m)	3

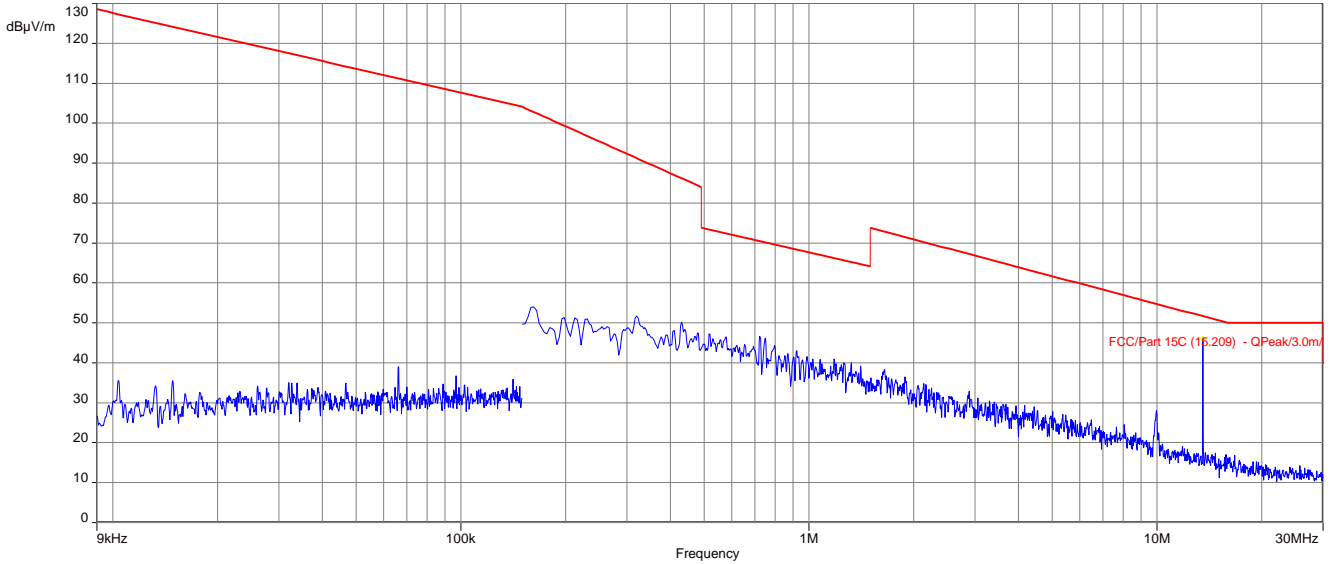
**Note:** For a reduced measurement distance, please take a look at the limit line and the ANSI C63.10-2013 sub clause 6.4 radiated emissions from unlicensed wireless devices below 30 MHz.

**Result:**

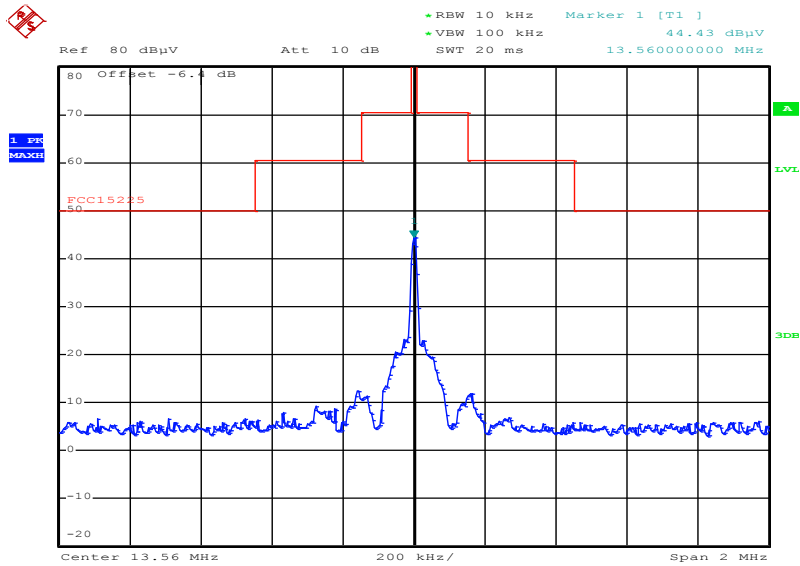
Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value
No emissions closer than 10 dB to the limit.			

**Plots DTM424:**

**Plot 1: 9 kHz – 30 MHz, magnetic emissions**

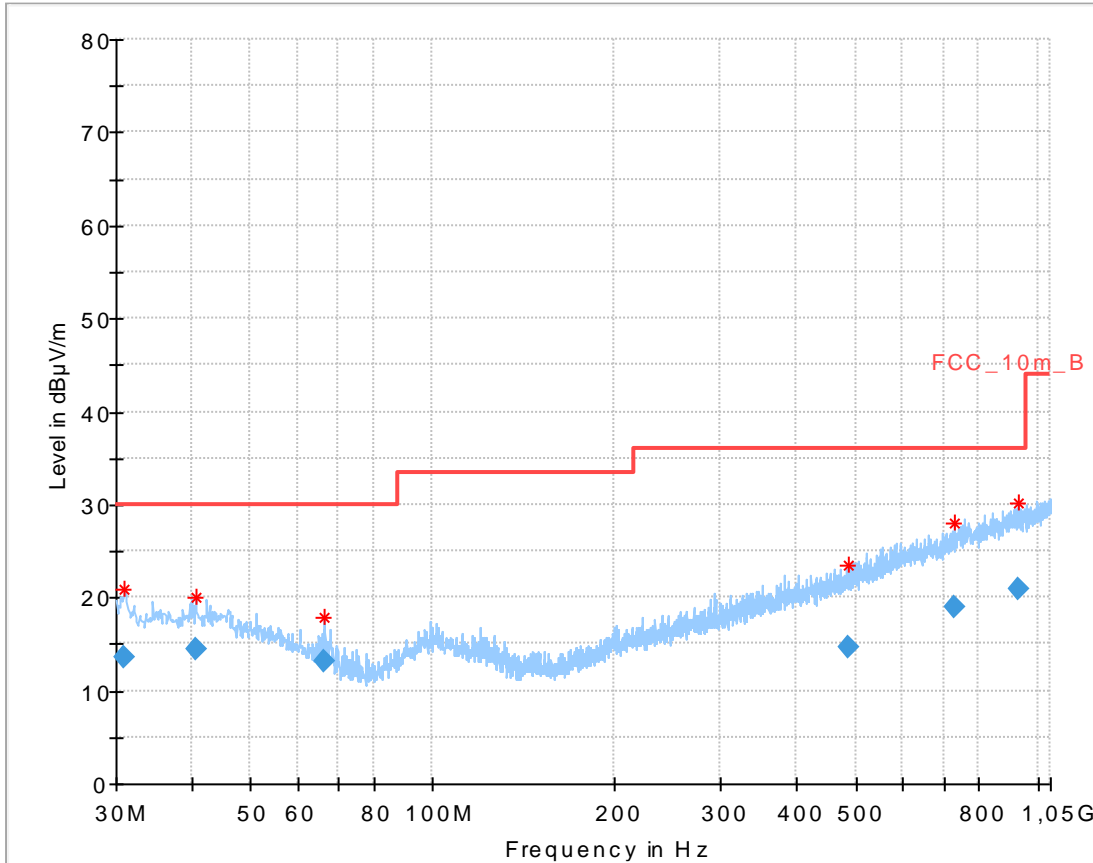


**Plot 2: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)**



Date: 20.OCT.2015 11:06:38

Plot 3: 30 MHz – 1 GHz, vertical and horizontal polarizations

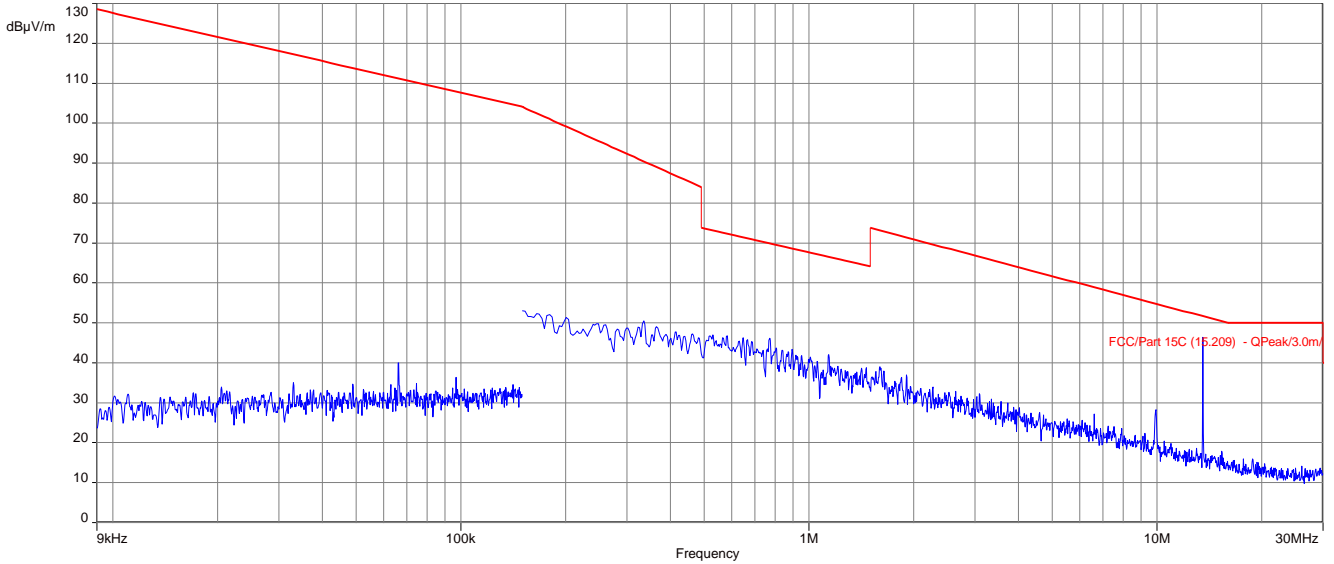


**Final Result**

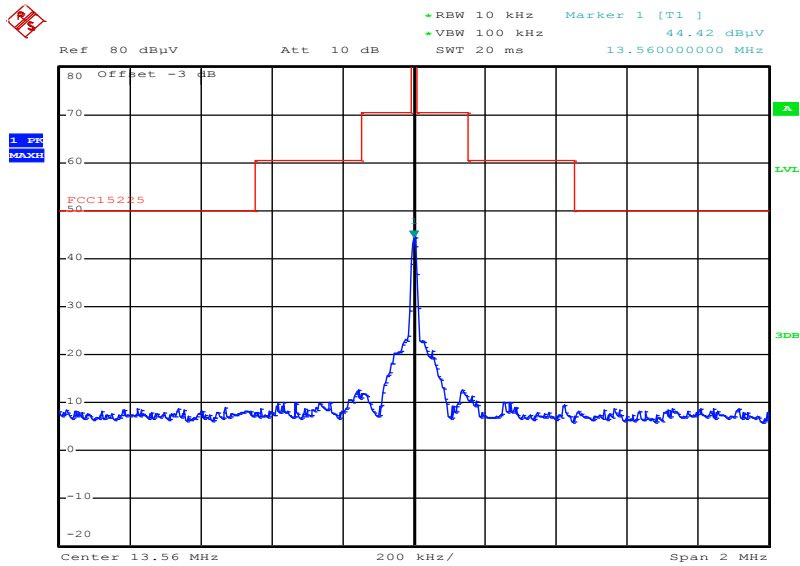
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	PoI	Azimuth (deg)	Corr. (dB)
30.814650	13.52	30.00	16.48	1000.0	120.000	101.0	V	43	13.4
40.682850	14.43	30.00	15.57	1000.0	120.000	101.0	V	254	14.0
66.080700	13.24	30.00	16.76	1000.0	120.000	101.0	V	2	9.2
486.181050	14.71	36.00	21.29	1000.0	120.000	170.0	V	128	18.4
726.828900	19.01	36.00	16.99	1000.0	120.000	170.0	H	350	22.2
929.616300	21.01	36.00	14.99	1000.0	120.000	170.0	V	2	24.2

**Plots DTM426:**

**Plot 1: 9 kHz – 30 MHz, magnetic emissions**

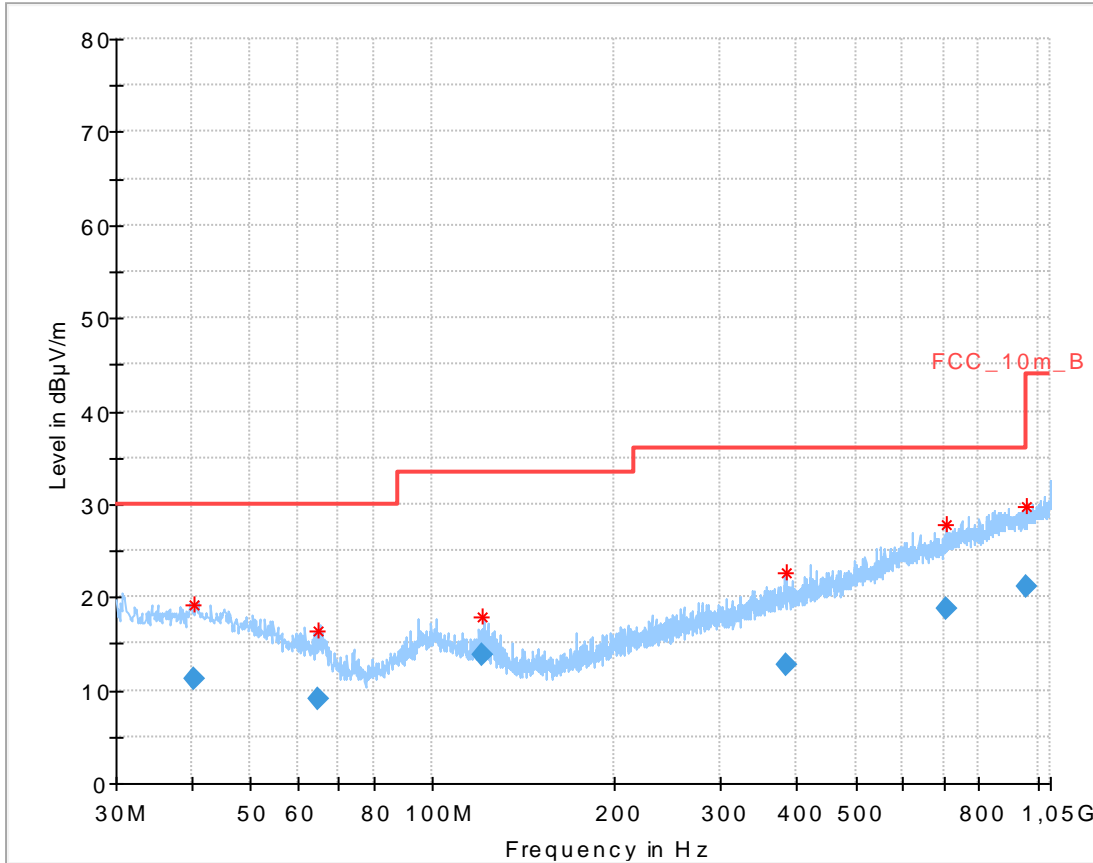


**Plot 2: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)**



Date: 20.OCT.2015 11:07:38

Plot 3: 30 MHz – 1 GHz, vertical and horizontal polarization

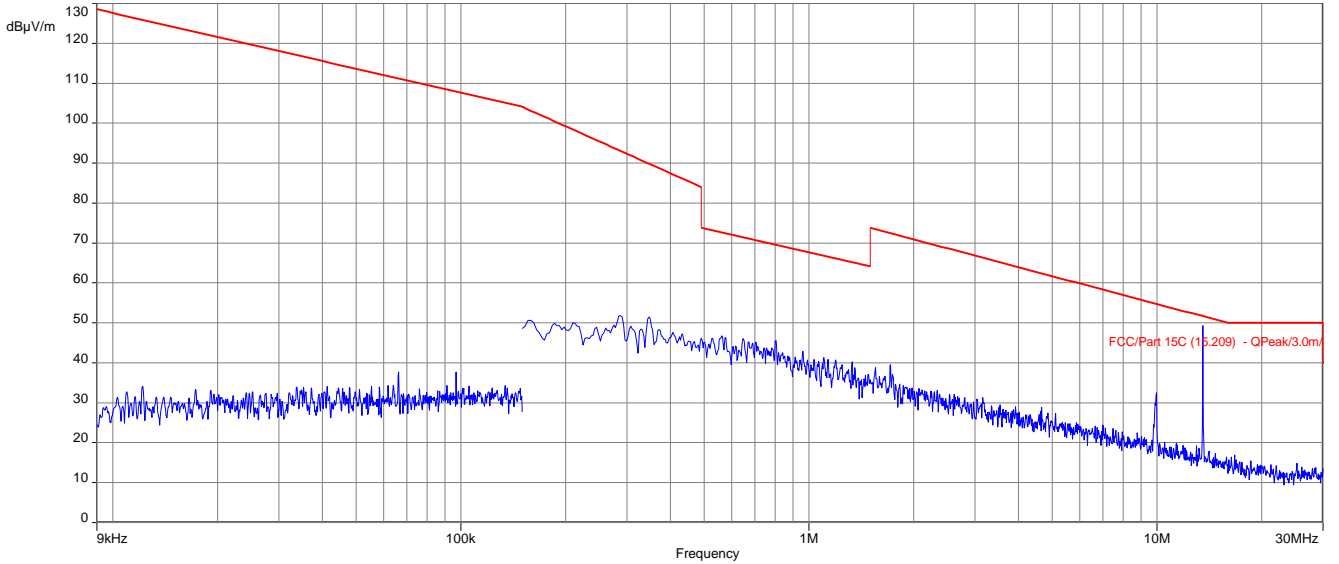


**Final Result**

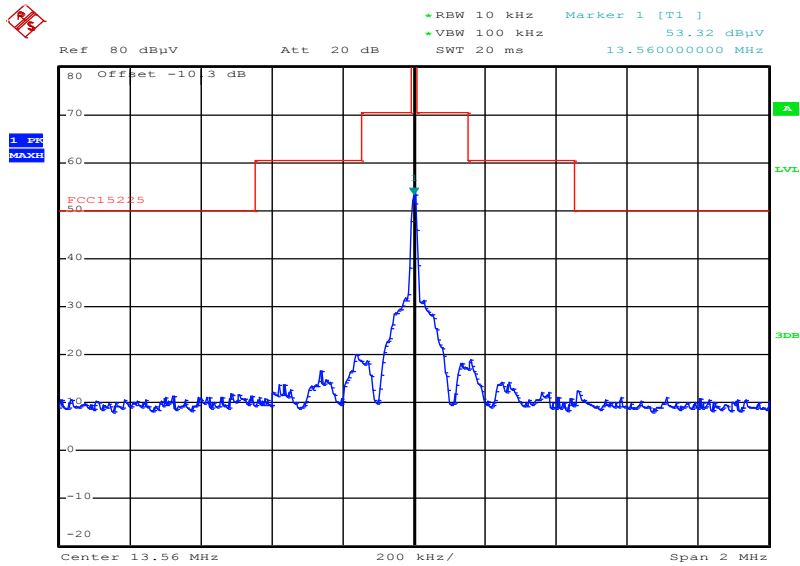
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.515150	11.14	30.00	18.86	1000.0	120.000	101.0	V	144	14.0
64.641750	9.02	30.00	20.98	1000.0	120.000	101.0	V	163	9.5
121.289100	13.72	33.50	19.78	1000.0	120.000	98.0	V	214	10.1
383.731500	12.81	36.00	23.19	1000.0	120.000	170.0	V	8	16.6
706.984950	18.66	36.00	17.34	1000.0	120.000	98.0	V	152	21.7
955.643700	21.22	36.00	14.78	1000.0	120.000	170.0	V	8	24.3

**Plots DTM427:**

**Plot 1: 9 kHz – 30 MHz, magnetic emissions**



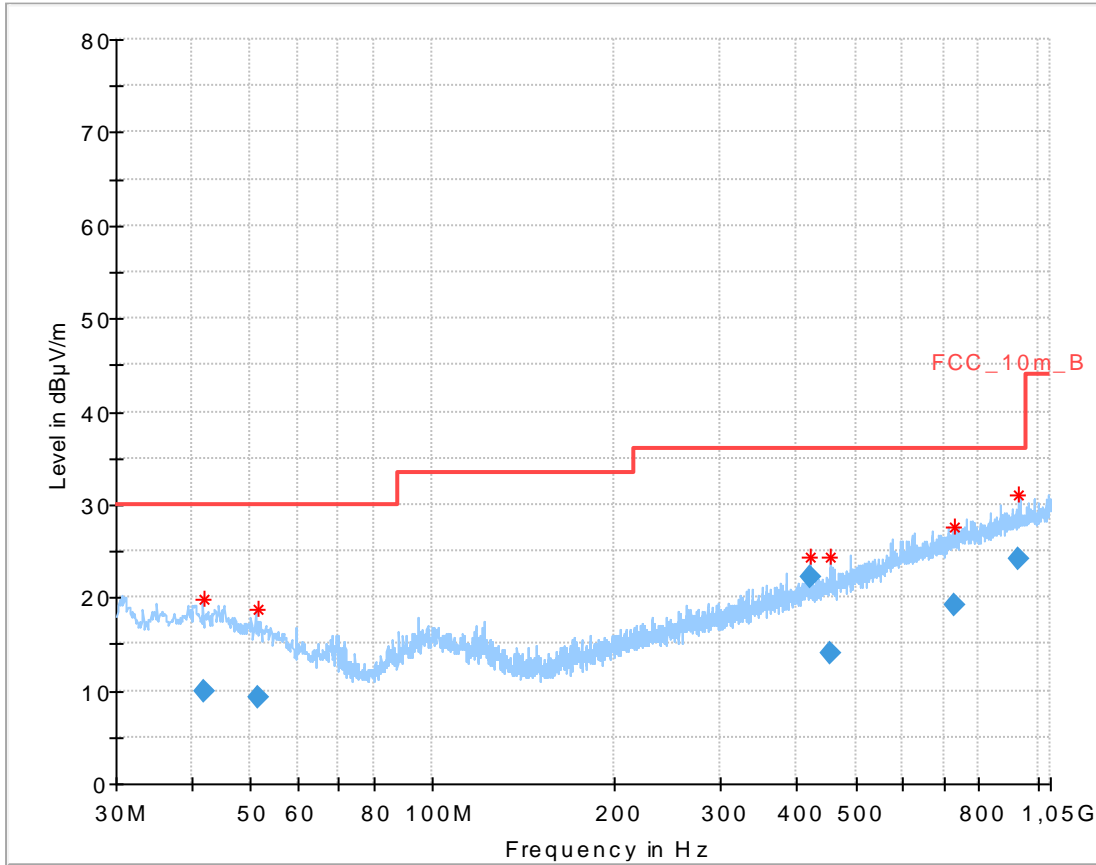
**Plot 2: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)**



Date: 20.OCT.2015 11:08:39



Plot 3: 30 MHz – 1 GHz, vertical and horizontal polarization



**Final Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	PoI	Azimuth (deg)	Corr. (dB)
41.871600	9.96	30.00	20.04	1000.0	120.000	170.0	H	258	14.0
51.621000	9.26	30.00	20.74	1000.0	120.000	101.0	V	25	12.4
420.353100	22.30	36.00	13.70	1000.0	120.000	98.0	V	286	17.2
454.795500	13.99	36.00	22.01	1000.0	120.000	170.0	V	192	17.7
728.438700	19.12	36.00	16.88	1000.0	120.000	170.0	H	45	22.2
927.341400	24.19	36.00	11.81	1000.0	120.000	98.0	H	293	24.2

## 12.4 Conducted limits

### Measurement:

Measurement of the conducted spurious emissions for an intentional radiator that is designed to be connected to the public utility (AC) power line.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Trace mode:	Max hold
Used equipment:	See chapter 7.4 A
Measurement uncertainty:	See chapter 9

### Limit:

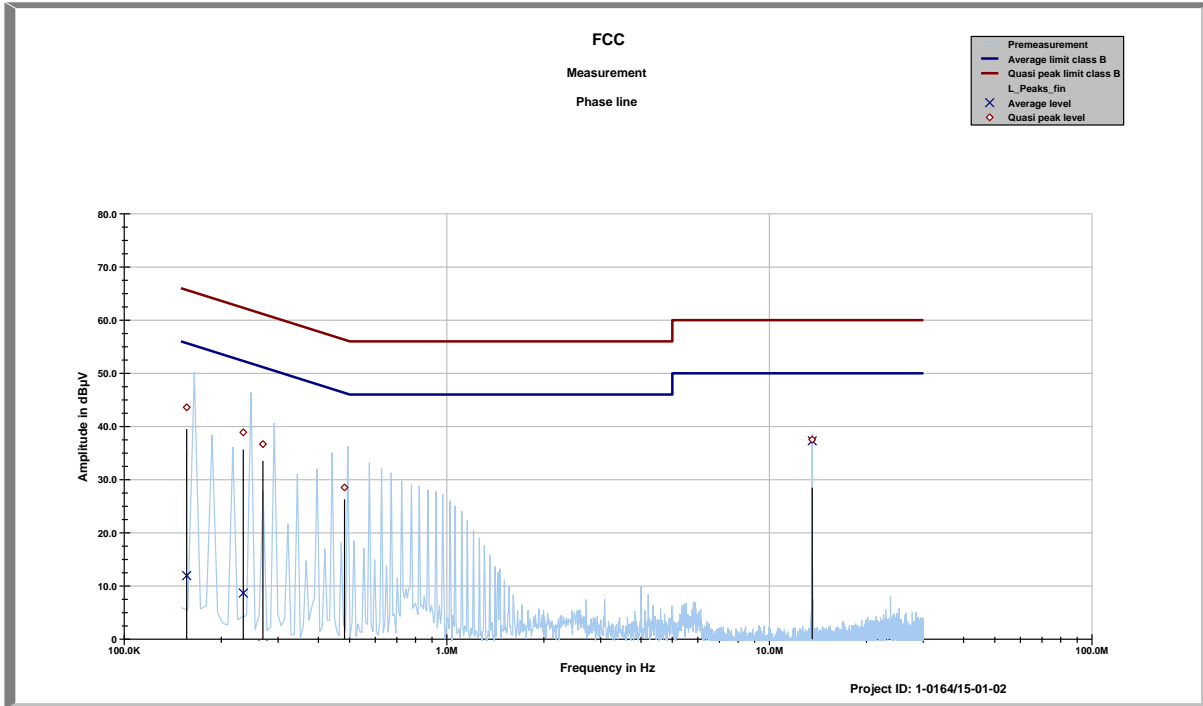
FCC & IC		
Frequency (MHz)	Quasi-peak (dB $\mu$ V/m)	Average (dB $\mu$ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

### Result:

Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value

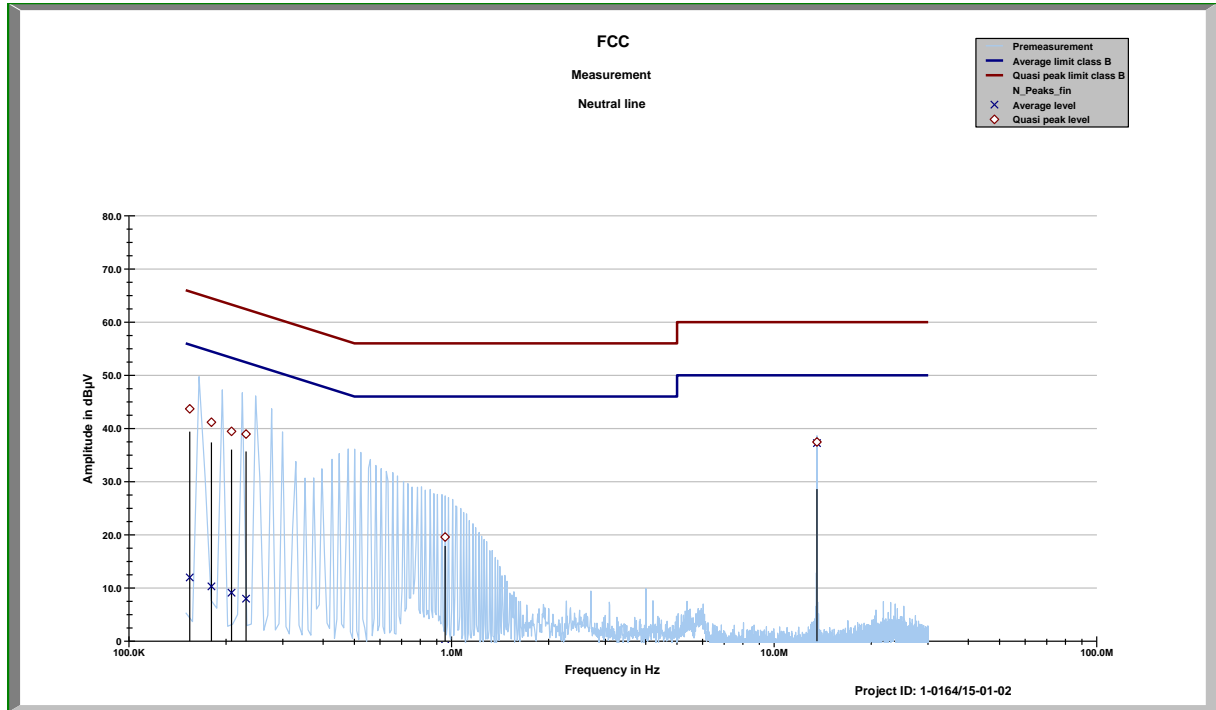
**Plots DTM424:**

**Plot 1: 150 kHz to 30 MHz, phase line**



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.15624	43.61	22.05	11.95	43.87
0.234	38.90	23.41	8.67	44.93
0.26908	36.68	24.47	-1.06	53.66
0.48176	28.53	27.78	-3.63	50.15
13.562	37.53	22.47	37.30	12.70

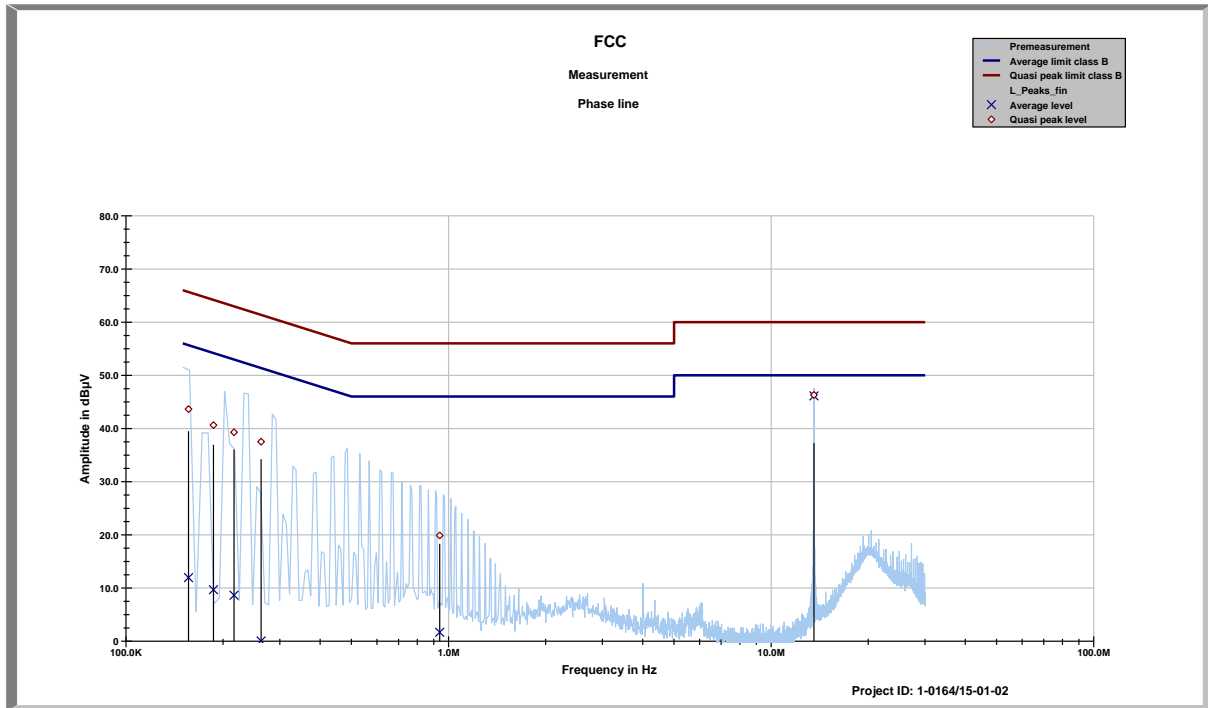
Plot 2: 150 kHz to 30 MHz, neutral line



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.15434	43.70	22.07	11.99	43.89
0.18014	41.18	23.30	10.30	44.84
0.20792	39.45	23.84	9.11	45.24
0.23073	38.96	23.47	7.99	45.71
0.95504	19.58	36.42	-0.86	46.86
13.562	37.47	22.53	37.25	12.75

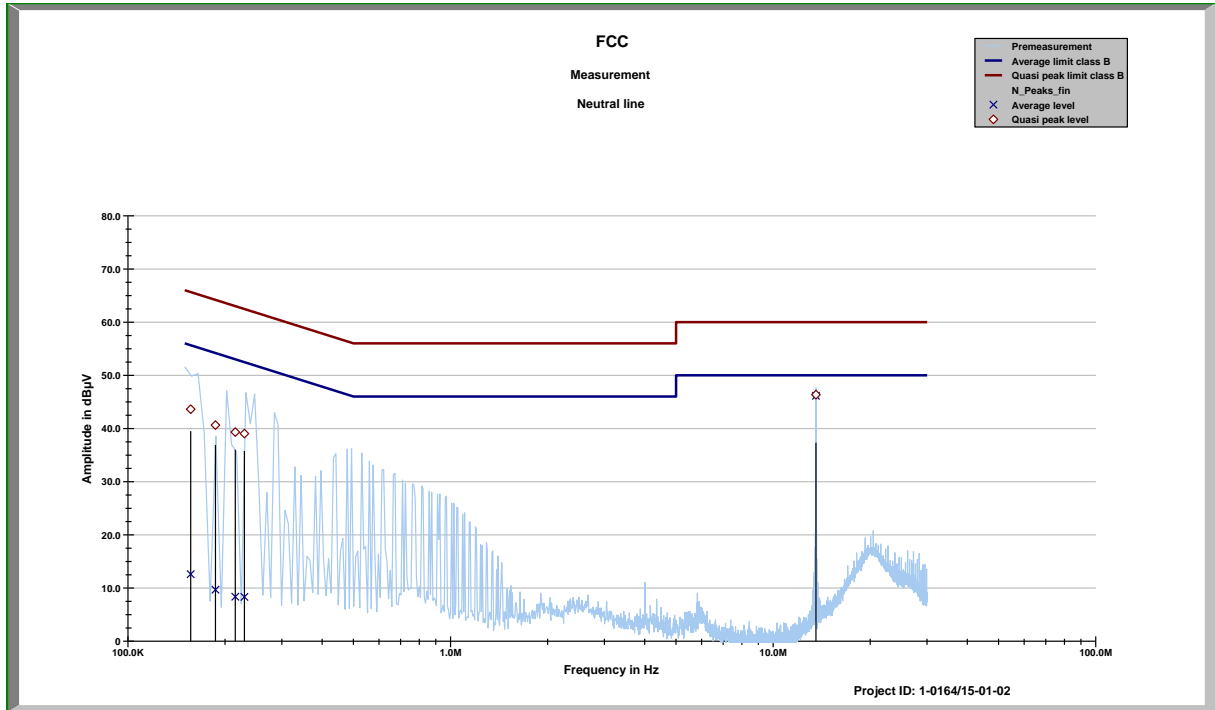
**Plots DTM426:**

**Plot 1: 150 kHz to 30 MHz, phase line**



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.15627	43.64	22.02	11.95	43.87
0.18673	40.63	23.55	9.68	45.27
0.21631	39.28	23.68	8.63	45.47
0.26242	37.51	23.85	0.04	52.75
0.93856	19.89	36.11	1.67	44.33
13.562	46.31	13.69	46.12	3.88

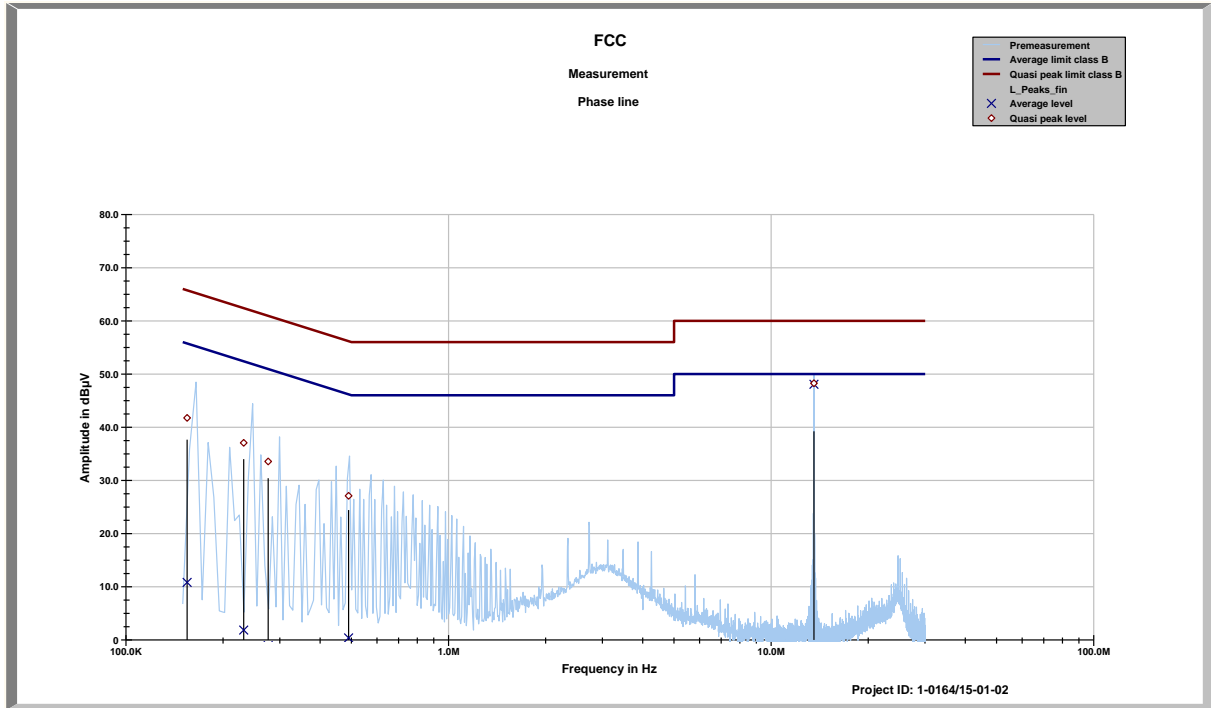
Plot 2: 150 kHz to 30 MHz, neutral line



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.15651	43.62	22.02	12.60	43.21
0.18681	40.63	23.55	9.68	45.27
0.21519	39.32	23.68	8.37	45.77
0.22969	39.04	23.42	8.33	45.39
13.562	46.36	13.64	46.15	3.85

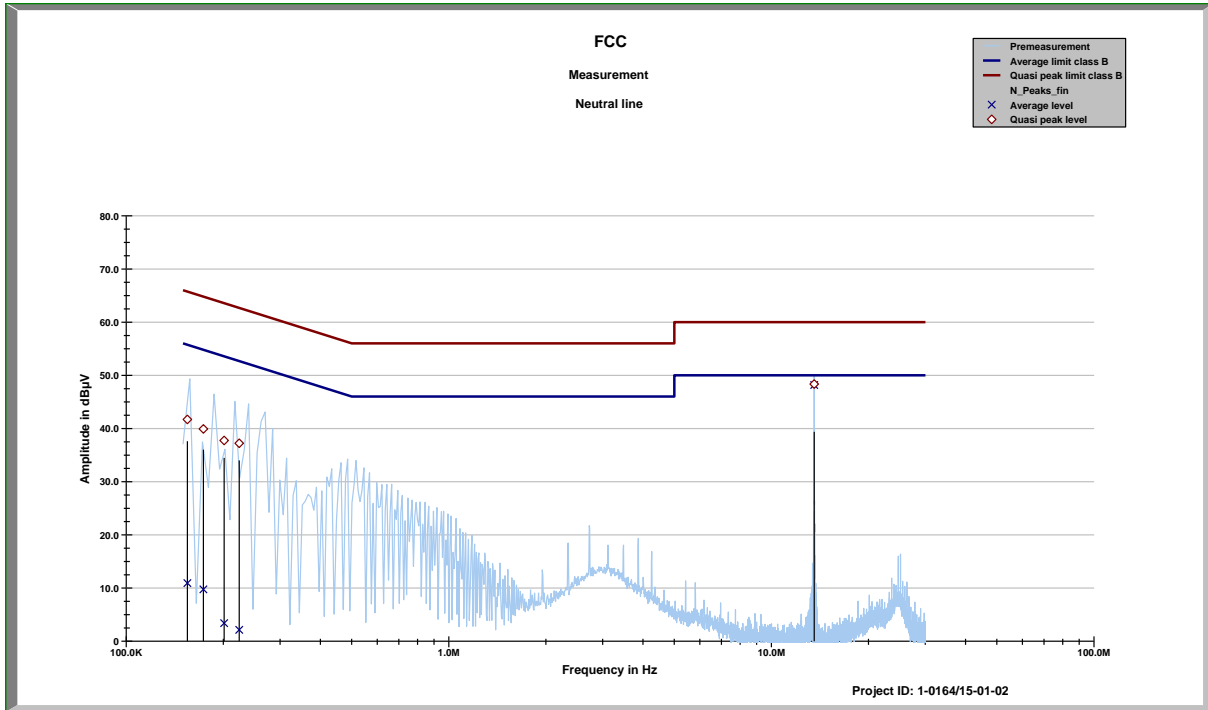
**Plots DTM427:**

**Plot 1: 150 kHz to 30 MHz, phase line**



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.15478	41.76	23.98	10.81	45.05
0.23178	37.06	25.32	1.84	51.82
0.27602	33.55	27.39	-1.07	53.47
0.49007	27.10	29.06	0.38	45.90
13.562	48.27	11.73	48.07	1.93

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.1548	41.70	24.04	10.92	44.95
0.17345	39.90	24.89	9.74	45.59
0.20123	37.75	25.81	3.38	51.15
0.22405	37.22	25.44	2.13	51.76
13.562	48.36	11.64	48.18	1.82



## 12.5 Frequency error

### Measurement:

The maximum detected field strength for the spurious.

Measurement parameters	
Detector:	Peak detector
Resolution bandwidth:	10 Hz / 100 Hz
Video bandwidth:	> RBW
Trace mode:	Max hold
Used equipment:	See chapter 7.3 A
Measurement uncertainty:	See chapter 9

### Limit:

FCC
The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. ( $\pm 1.356$ kHz)

### Result: Temperature variation

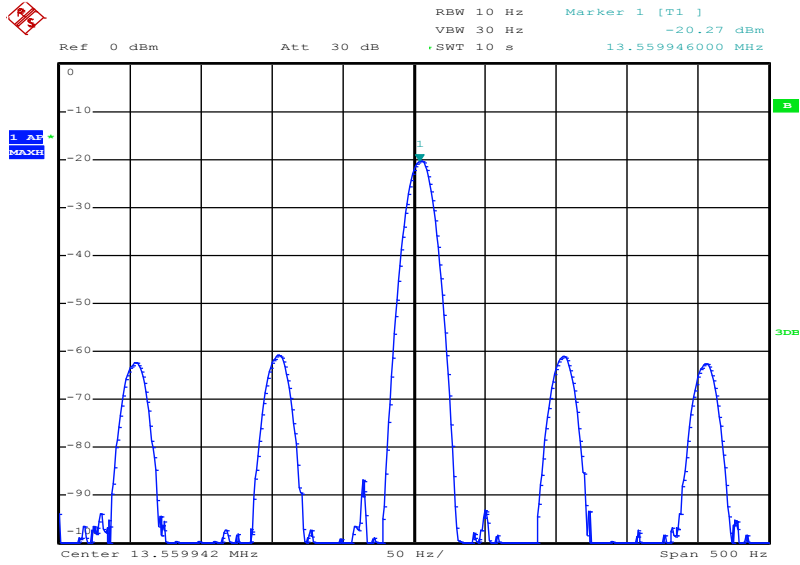
Frequency tolerance				
Measured frequency (MHz)			Conditions	Result
DTM424	DTM426	DTM427		
13.560191	13.560188	13.560259	-40 °C & 100% voltage	compliant
13.560301	13.560274	13.560284	-30 °C & 100% voltage	compliant
13.560328	13.560323	13.560351	-20 °C & 100% voltage	compliant
13.560312	13.560308	13.560339	-10 °C & 100% voltage	compliant
13.560267	13.560251	13.560310	0 °C & 100% voltage	compliant
13.560252	13.560102	13.560277	+10 °C & 100% voltage	compliant
13.560125	13.560164	13.560169	+20 °C & 100% voltage	compliant
13.560058	13.560166	13.560143	+30 °C & 100% voltage	compliant
13.560035	13.560108	13.560159	+40 °C & 100% voltage	compliant
13.559998	13.560036	13.560075	+50 °C & 100% voltage	compliant
13.559948	13.560001	13.560041	+60 °C & 100% voltage	compliant
13.559938	13.559970	13.559998	+70 °C & 100% voltage	compliant
13.559936	13.559979	13.560008	+80 °C & 100% voltage	compliant
13.559546	13.560000	13.560037	+85 °C & 100% voltage	compliant

**Result:** Voltage variation

Frequency tolerance				
Measured frequency (MHz)			Temperature	Result
DTM424	DTM426	DTM427		
13.560098	13.560133	13.560171	+20 °C & 85% voltage	compliant
13.560125	13.560164	13.560169	+20 °C & 100% voltage	compliant
13.560097	13.560139	13.560164	+20 °C & 115% voltage	compliant

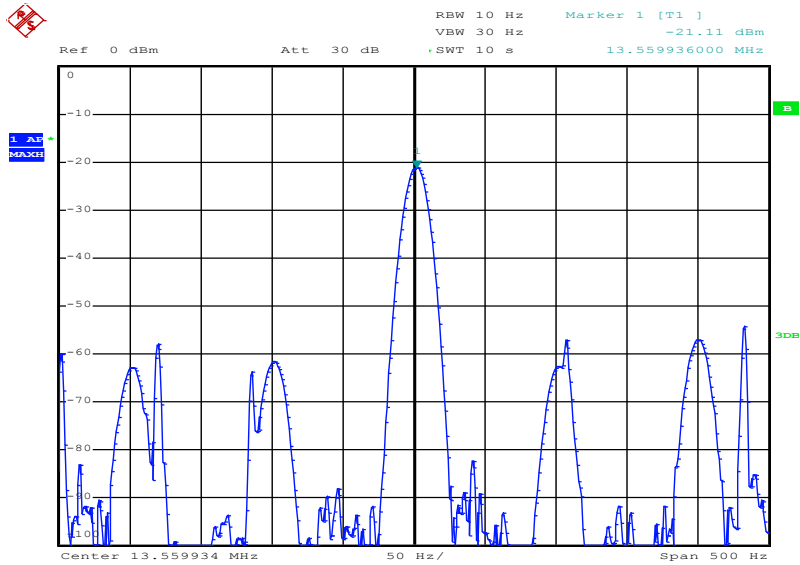
**Plots DTM424:**

**Plot 1: 100% voltage; 85°C**



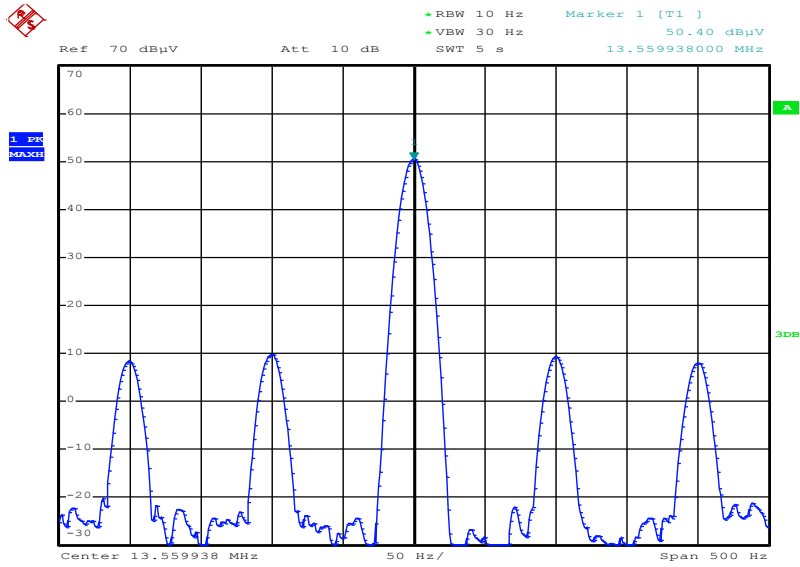
Date: 19.OCT.2015 15:41:09

**Plot 2: 100% voltage; 80°C**



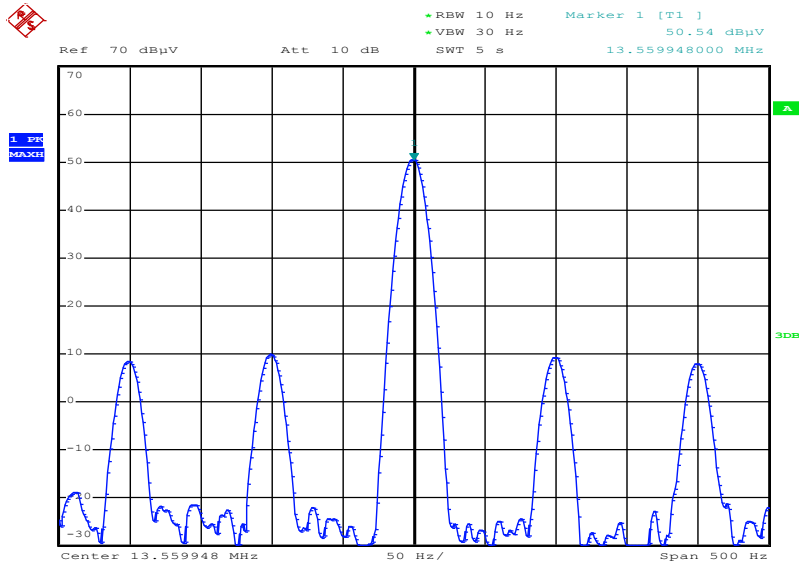
Date: 19.OCT.2015 15:25:35

Plot 3: 100% voltage; 70°C



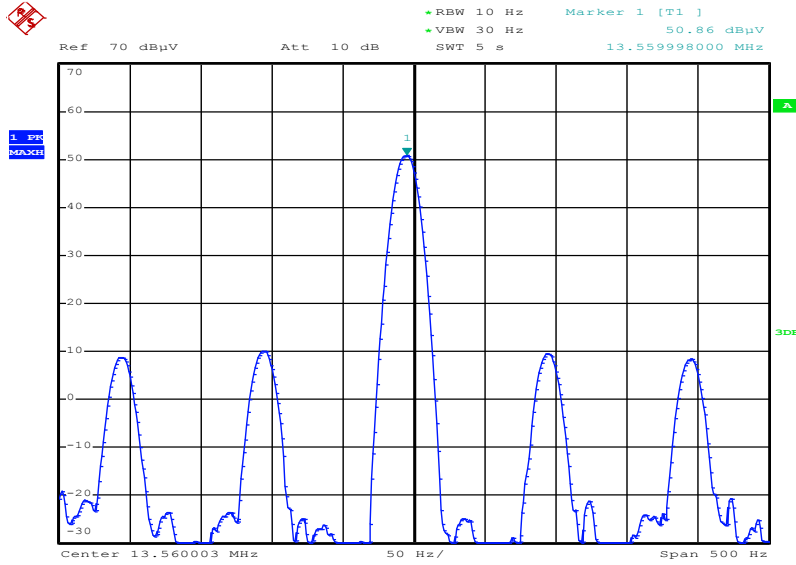
Date: 20.OCT.2015 15:49:21

Plot 4: 100% voltage; 60°C



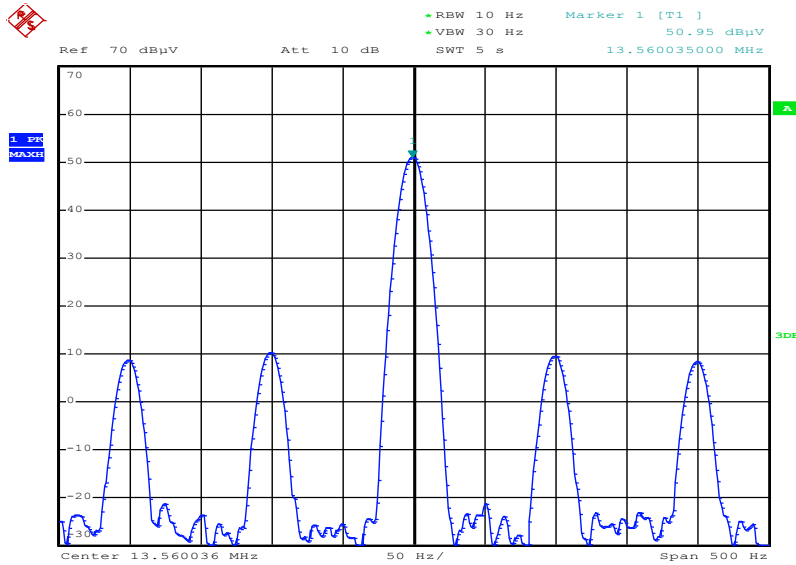
Date: 20.OCT.2015 15:43:39

Plot 5: 100% voltage; 50°C



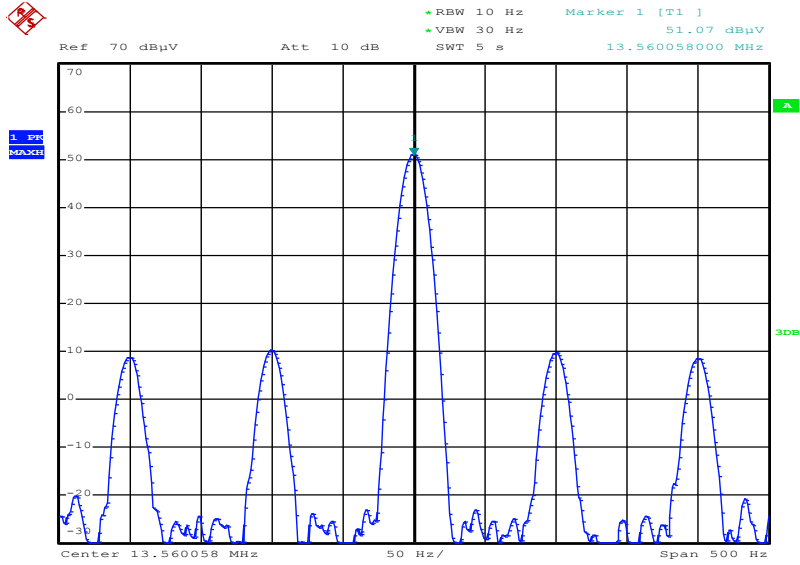
Date: 20.OCT.2015 15:29:11

Plot 6: 100% voltage; 40°C



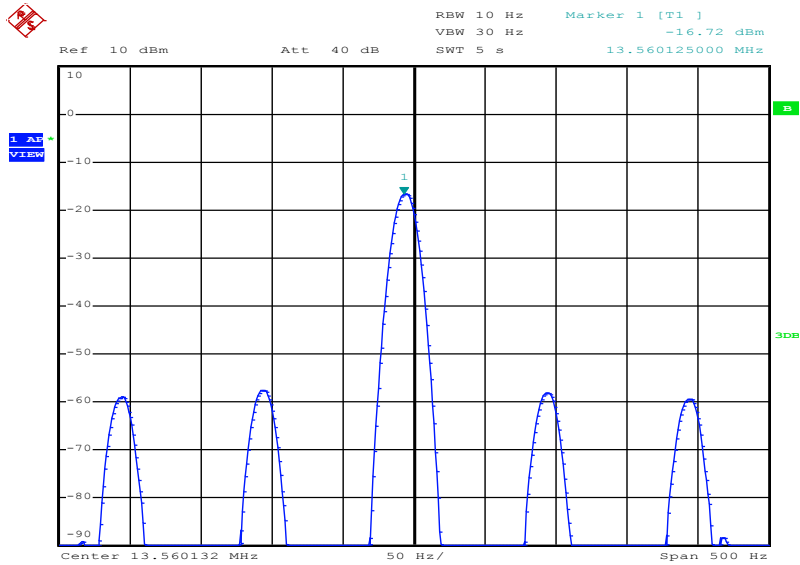
Date: 20.OCT.2015 15:21:20

Plot 7: 100 % voltage; 30°C



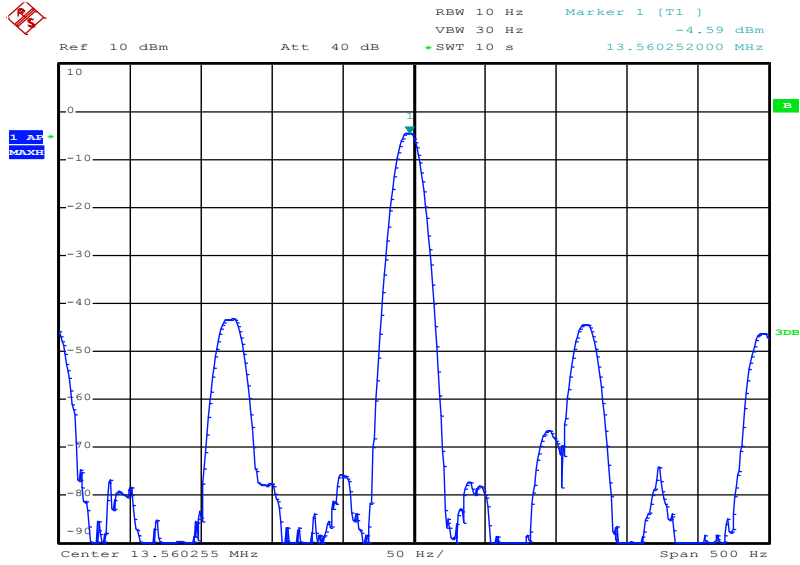
Date: 20.OCT.2015 15:12:20

Plot 8: 100 % voltage; 20°C



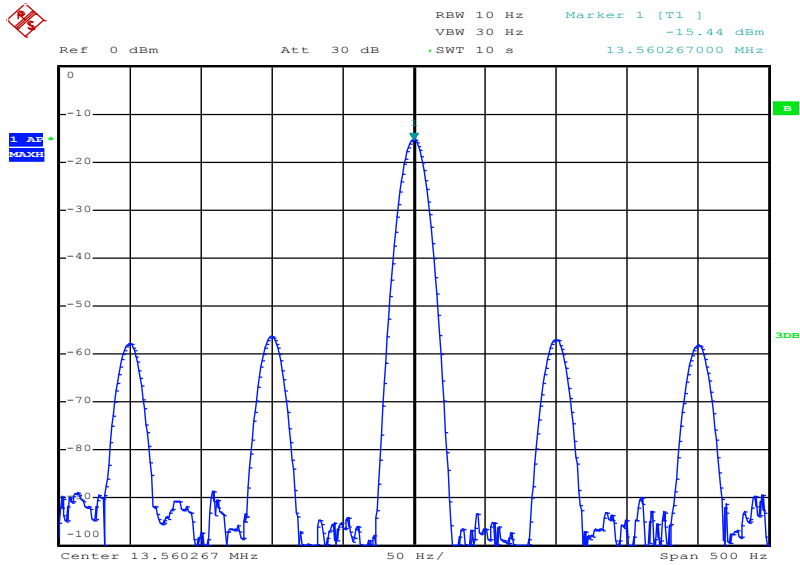
Date: 19.OCT.2015 08:51:49

Plot 9: 100 % voltage; 10°C



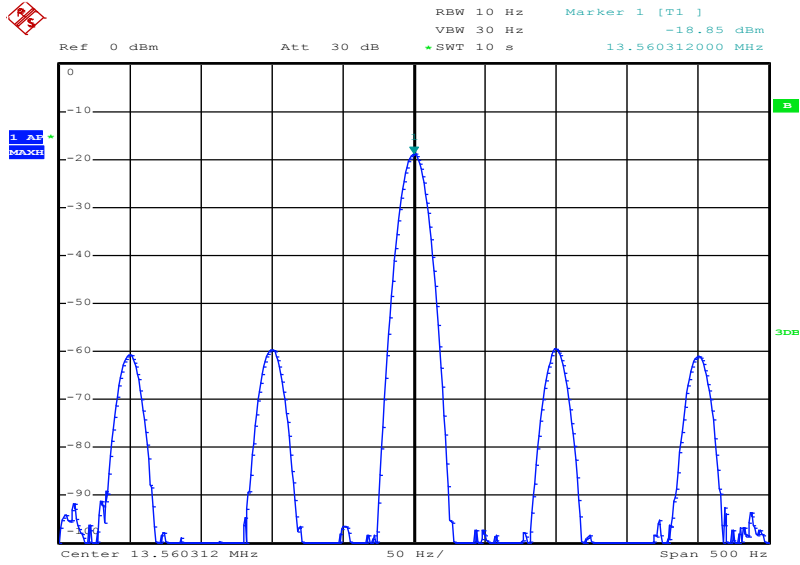
Date: 19.OCT.2015 13:48:57

Plot 10: 100 % voltage; 0°C



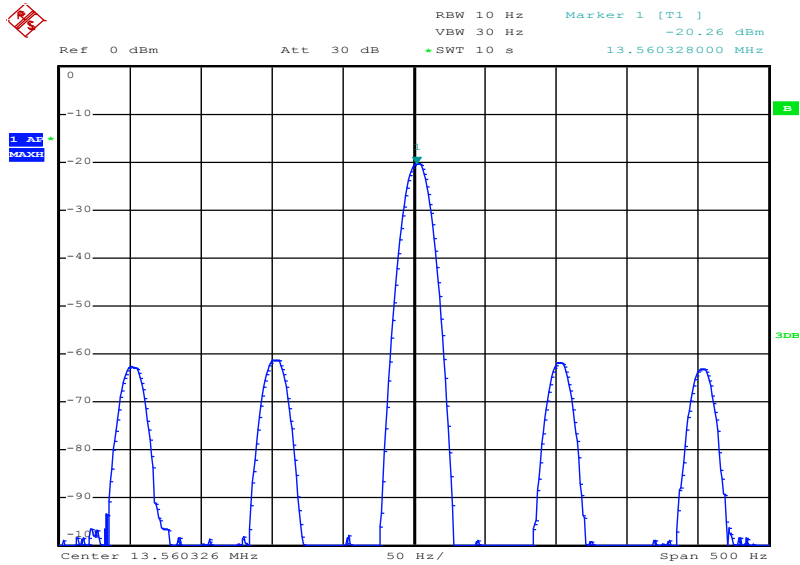
Date: 19.OCT.2015 13:25:47

Plot 11: 100 % voltage; -10°C



Date: 19.OCT.2015 12:57:40

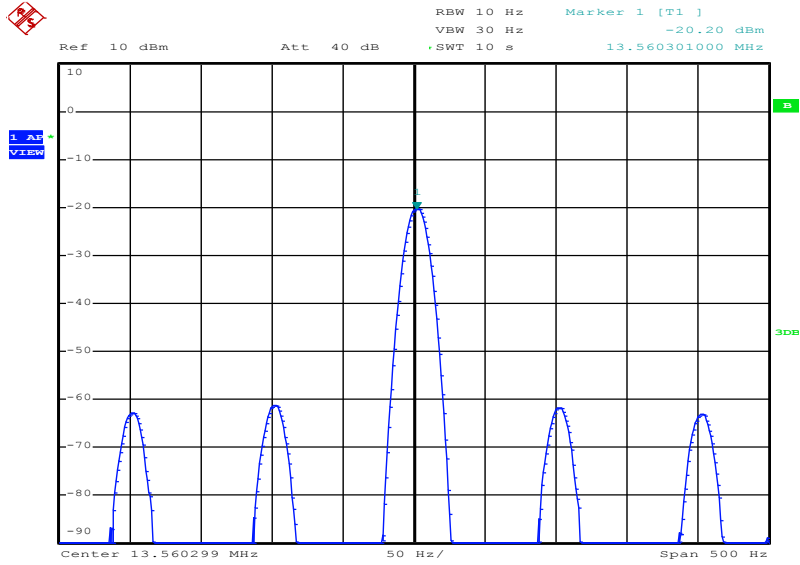
Plot 12: 100 % voltage; -20°C



Date: 19.OCT.2015 12:03:58

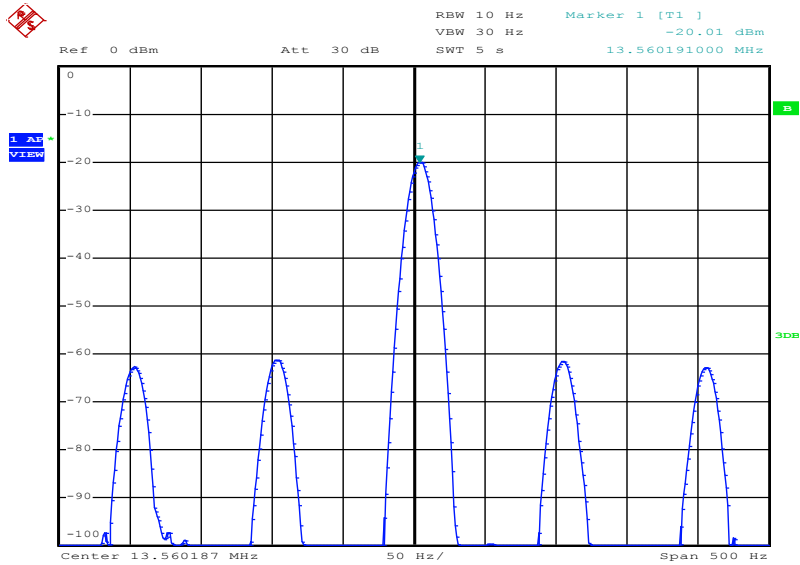


Plot 13: 100 % voltage; -30°C



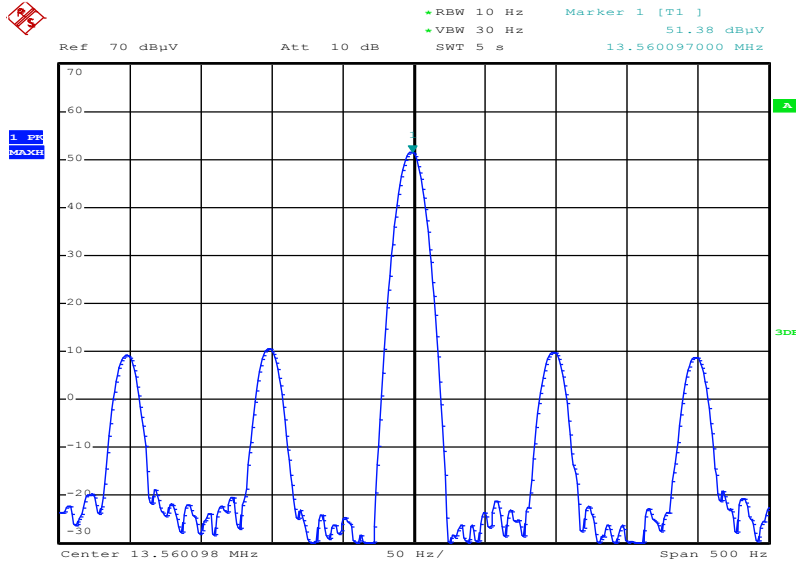
Date: 19.OCT.2015 11:39:01

Plot 14: 100 % voltage; -40°C



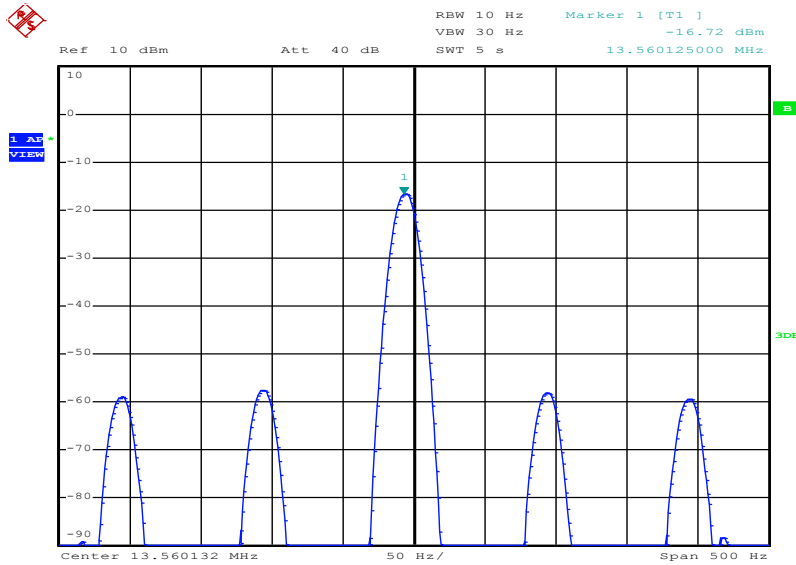
Date: 19.OCT.2015 11:11:21

Plot 15: 115 % voltage; 20°C



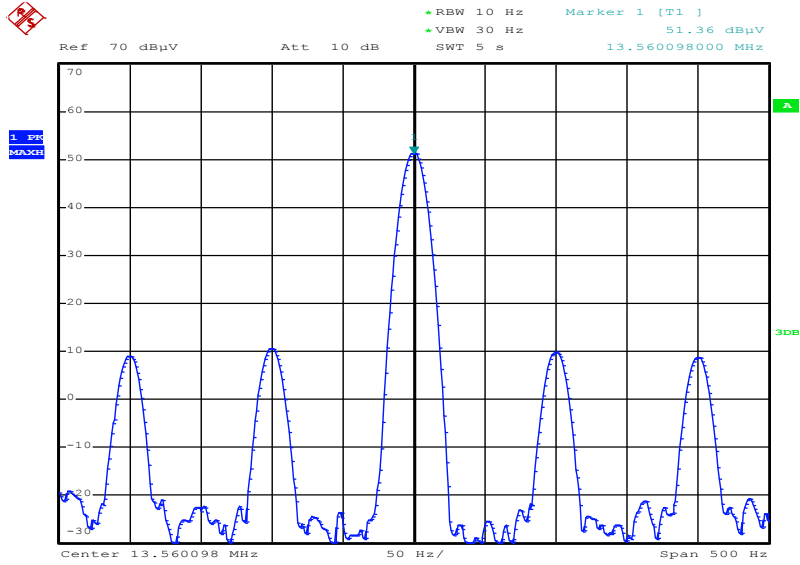
Date: 20.OCT.2015 14:49:17

Plot 16: 100 % voltage; 20°C



Date: 19.OCT.2015 08:51:49

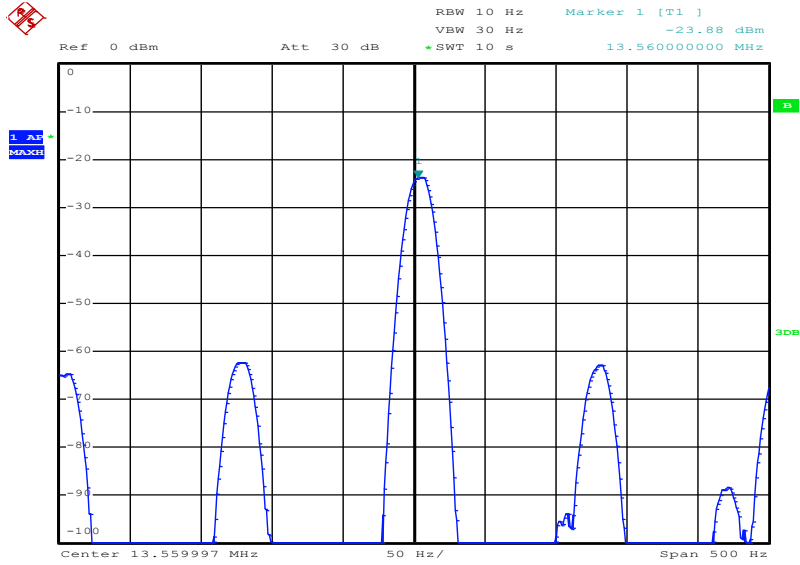
Plot 17: 85 % voltage; 20°C



Date: 20.OCT.2015 14:48:46

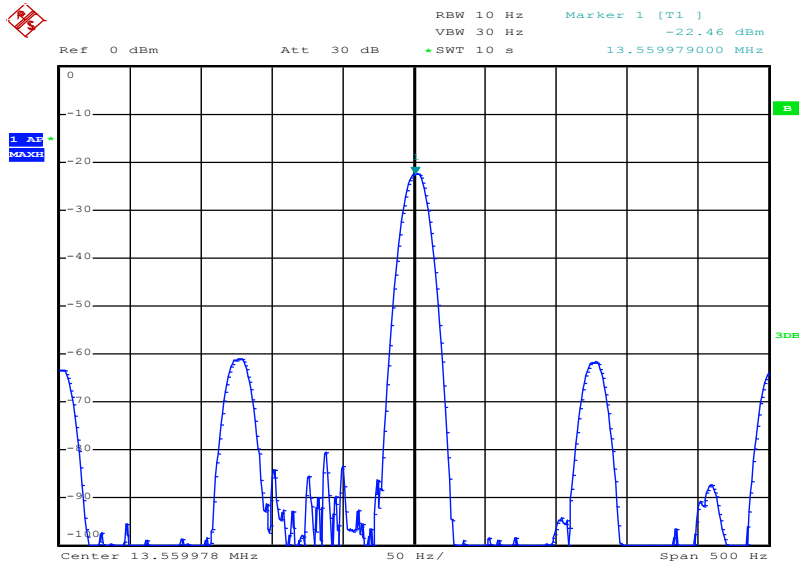
**Plots DTM426:**

**Plot 1: 100% voltage; 85°C**



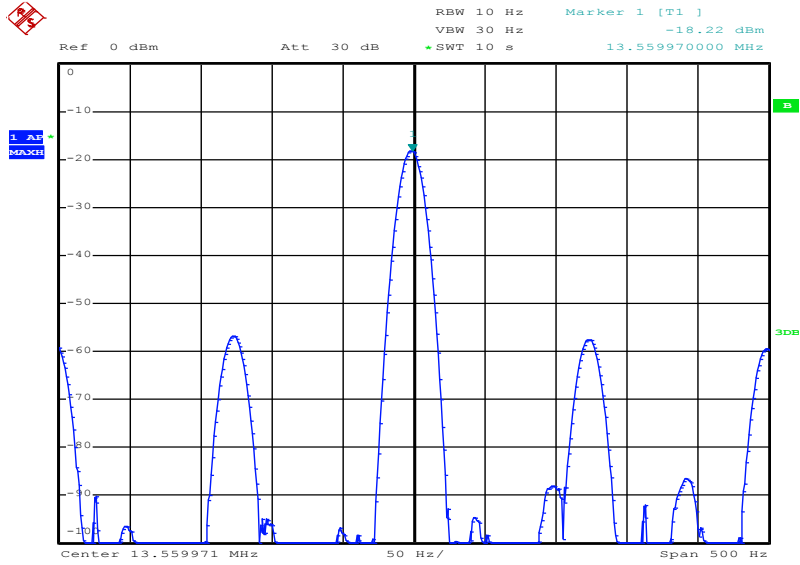
Date: 19.OCT.2015 15:41:58

**Plot 2: 100% voltage; 80°C**



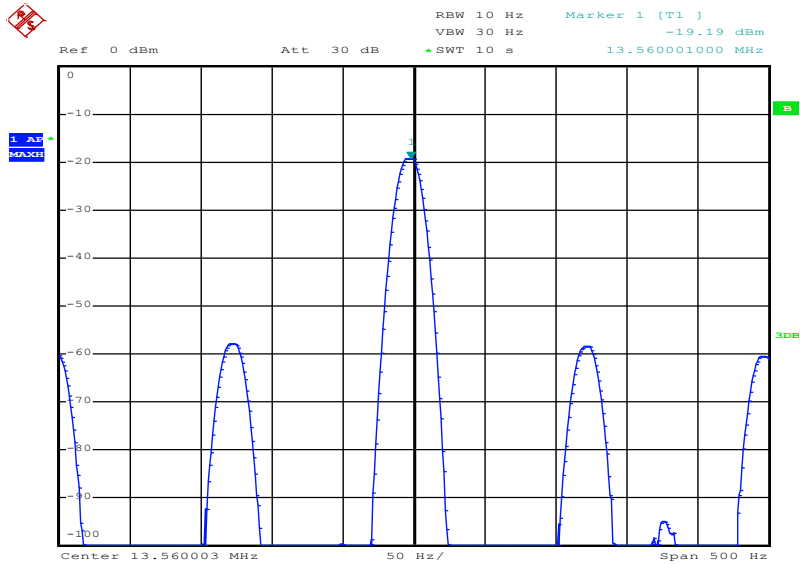
Date: 19.OCT.2015 15:26:26

Plot 3: 100% voltage; 70°C



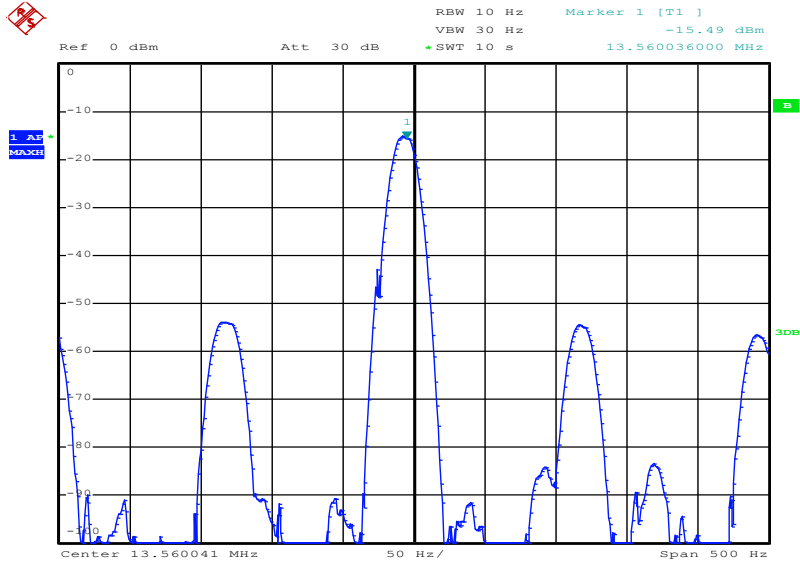
Date: 19.OCT.2015 15:09:30

Plot 4: 100% voltage; 60°C



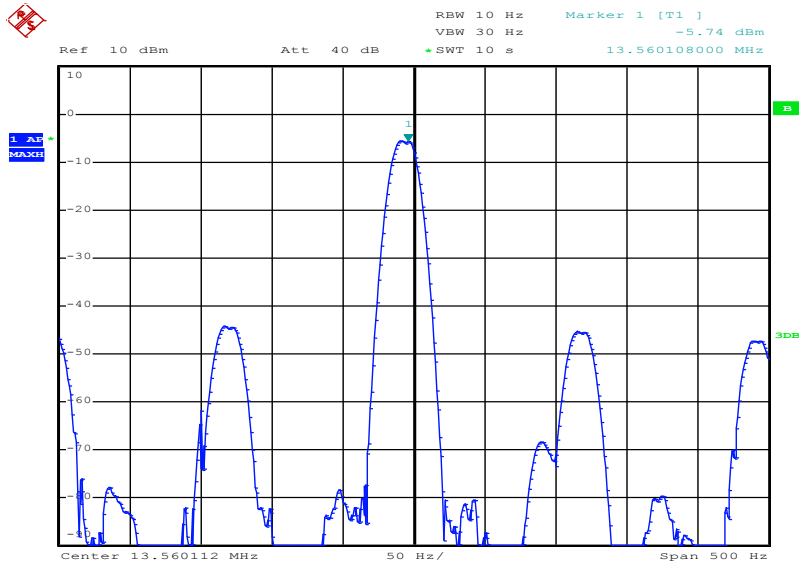
Date: 19.OCT.2015 14:52:29

Plot 5: 100% voltage; 50°C



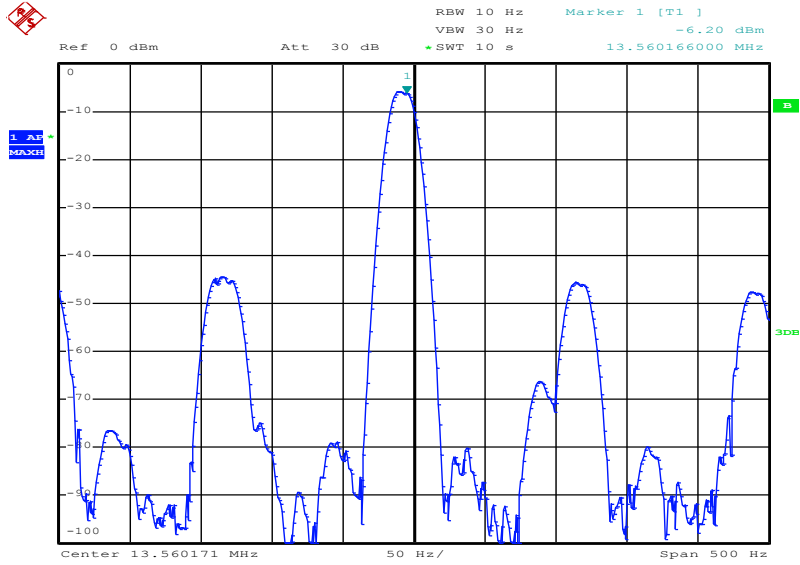
Date: 19.OCT.2015 14:41:03

Plot 6: 100% voltage; 40°C



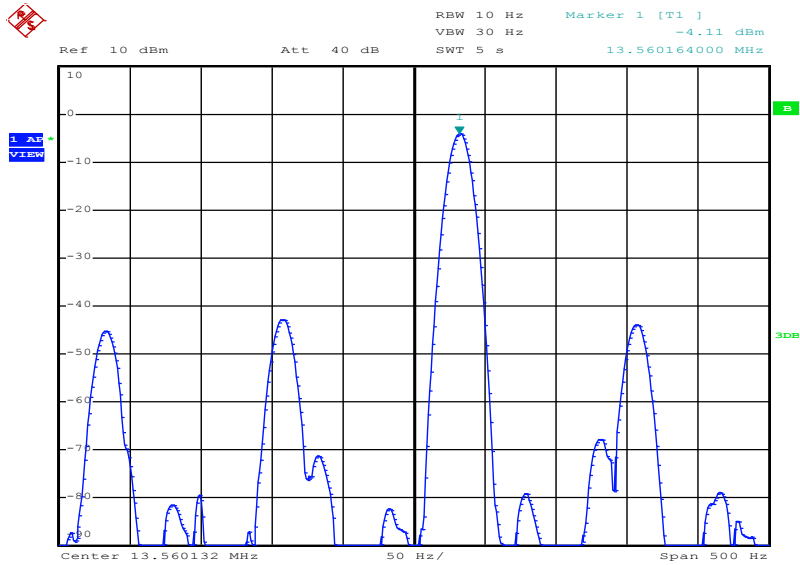
Date: 19.OCT.2015 14:12:06

Plot 7: 100 % voltage; 30°C



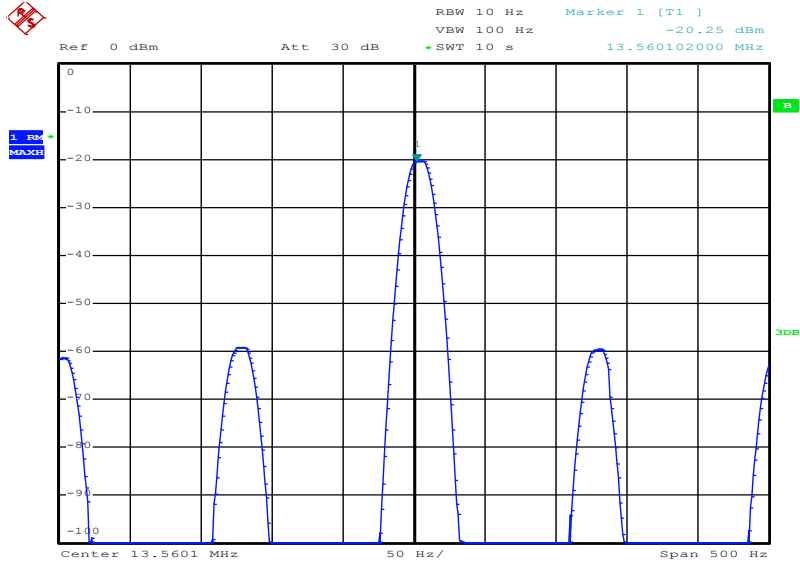
Date: 19.OCT.2015 14:03:33

Plot 8: 100 % voltage; 20°C



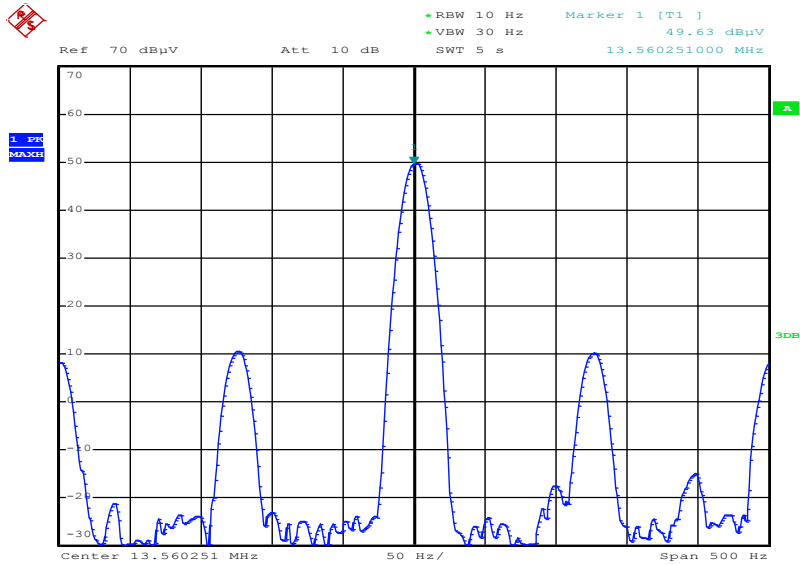
Date: 19.OCT.2015 08:52:31

Plot 9: 100 % voltage; 10°C



Date: 19.OCT.2015 16:18:30

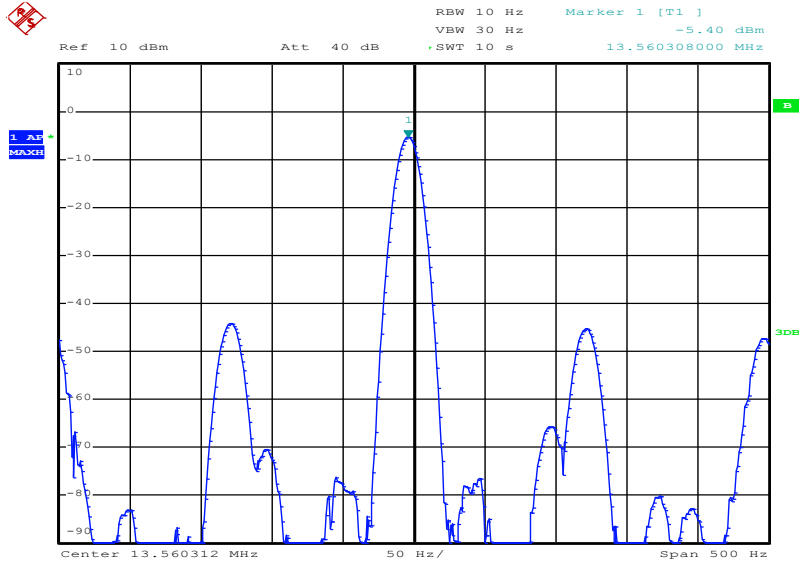
Plot 10: 100 % voltage; 0°C



Date: 20.OCT.2015 14:21:10

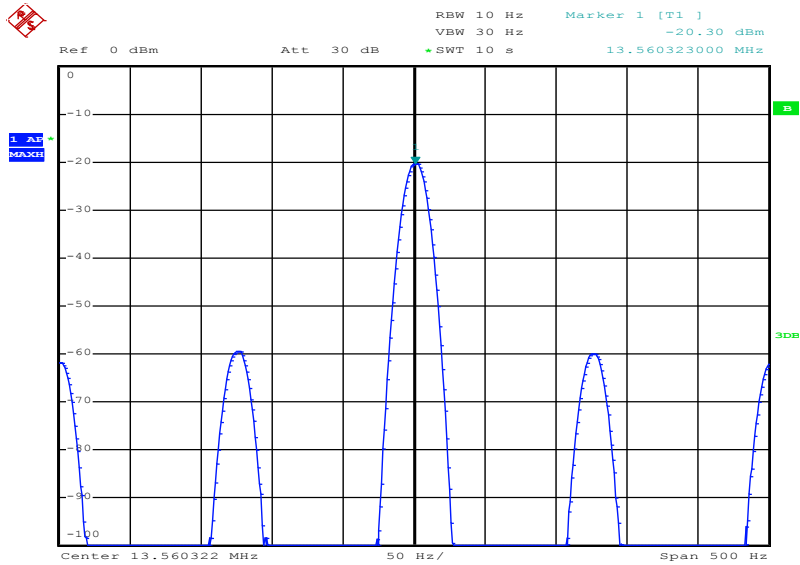


Plot 11: 100 % voltage; -10°C



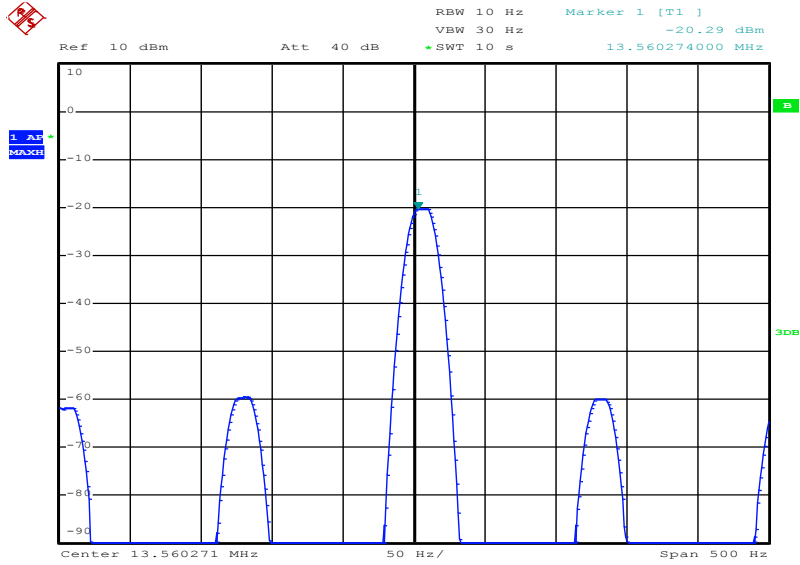
Date: 19.OCT.2015 12:58:31

Plot 12: 100 % voltage; -20°C



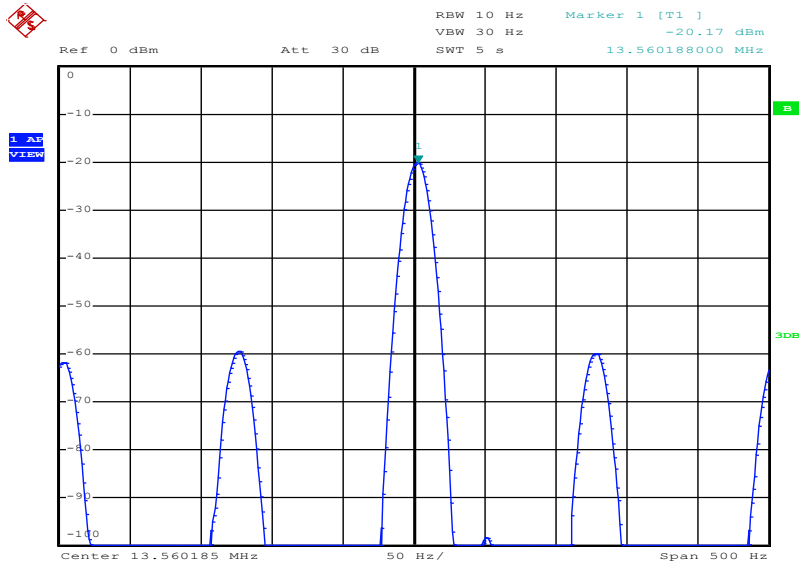
Date: 19.OCT.2015 12:03:11

Plot 13: 100 % voltage; -30°C



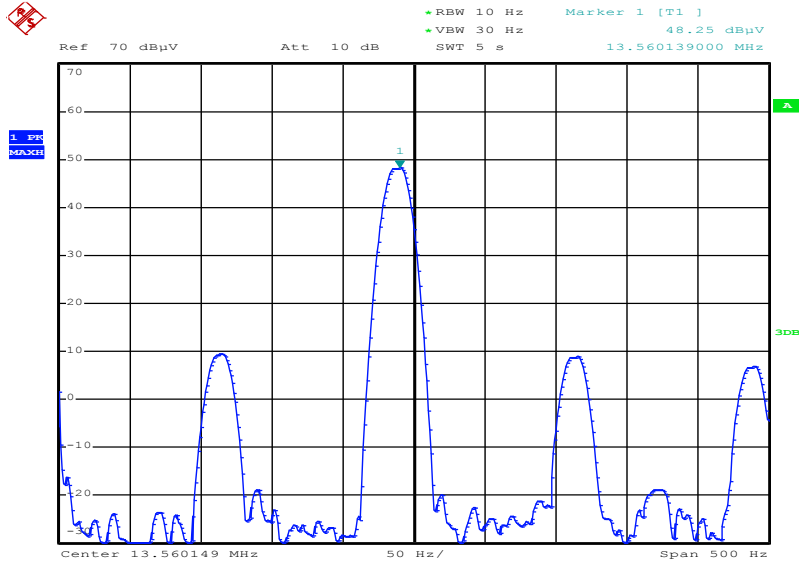
Date: 19.OCT.2015 11:39:56

Plot 14: 100 % voltage; -40°C



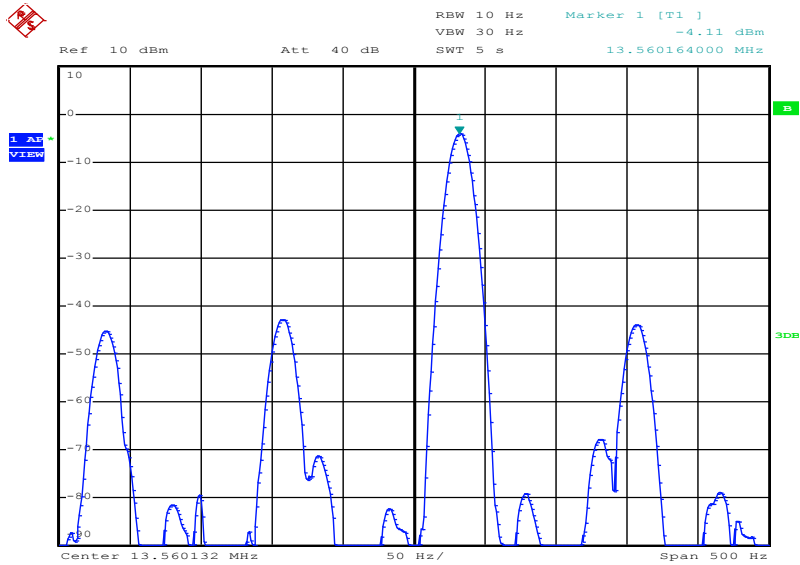
Date: 19.OCT.2015 11:10:28

Plot 15: 115 % voltage; 20°C



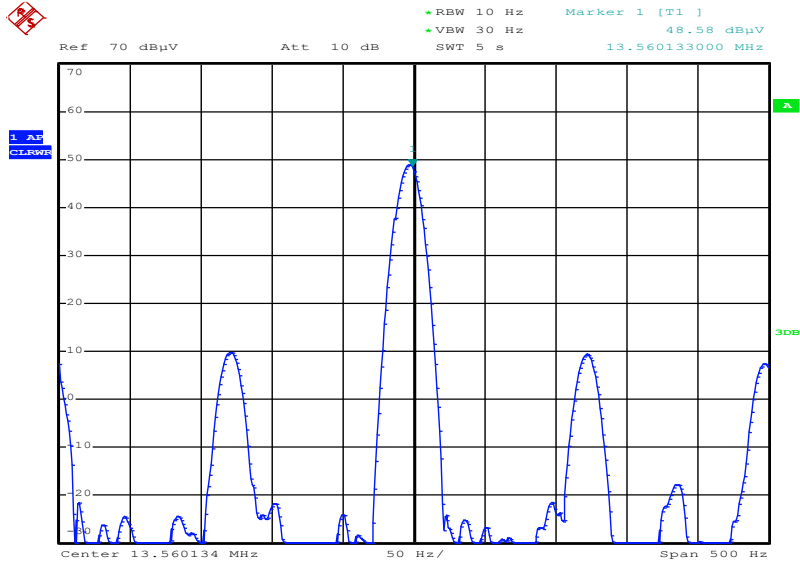
Date: 20.OCT.2015 14:50:14

Plot 16: 100 % voltage; 20°C



Date: 19.OCT.2015 08:52:31

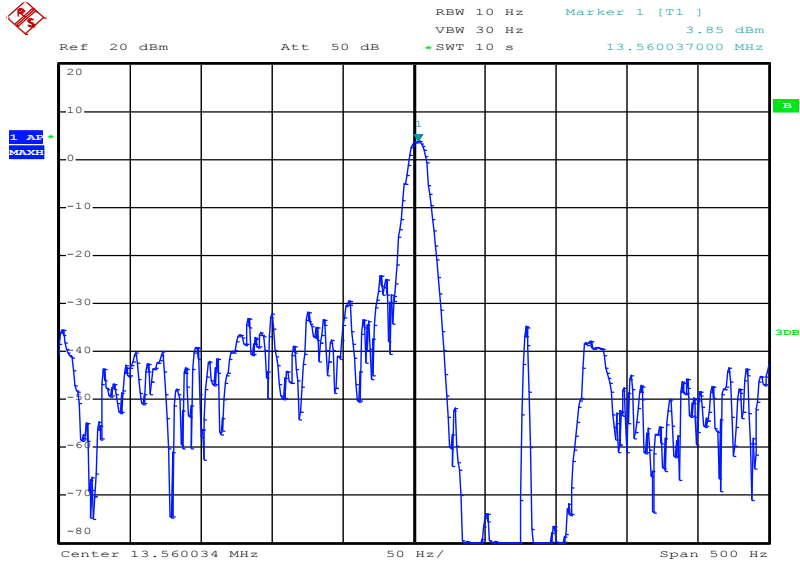
Plot 17: 85 % voltage; 20°C



Date: 20.OCT.2015 14:50:47

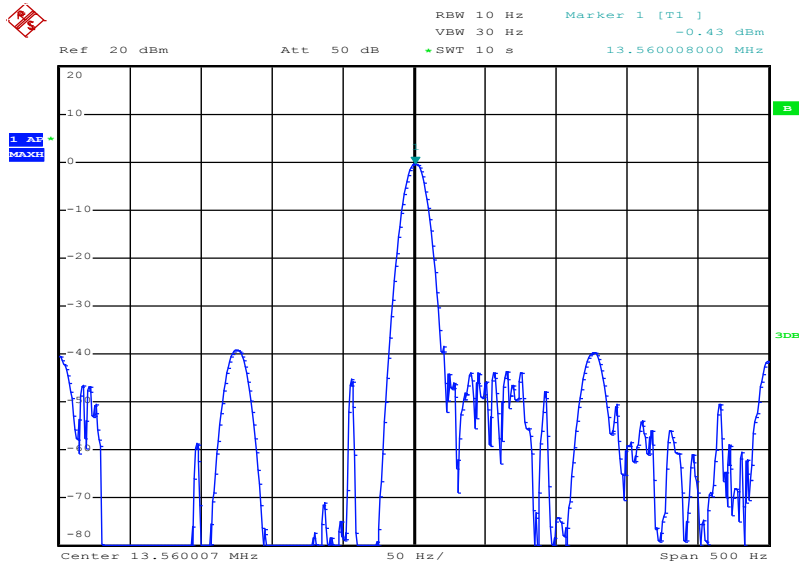
**Plots DTM427:**

**Plot 1: 100% voltage; 85°C**



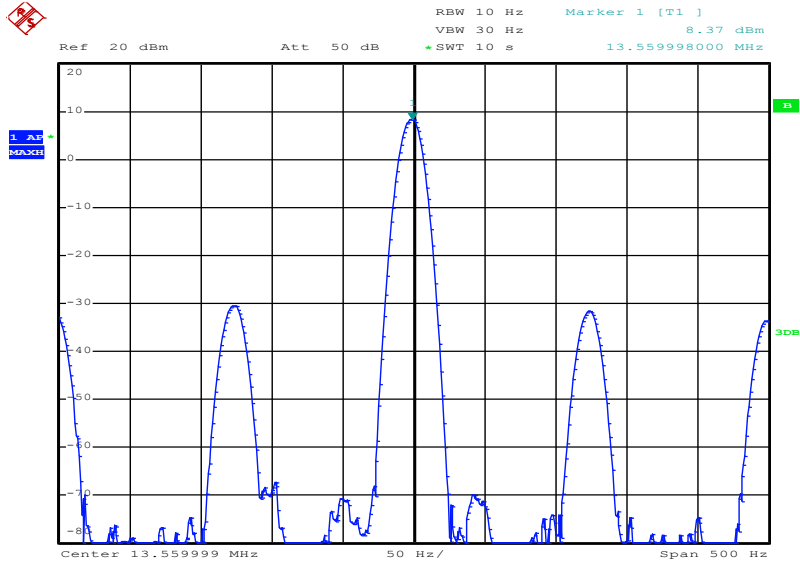
Date: 19.OCT.2015 15:45:02

**Plot 2: 100% voltage; 80°C**



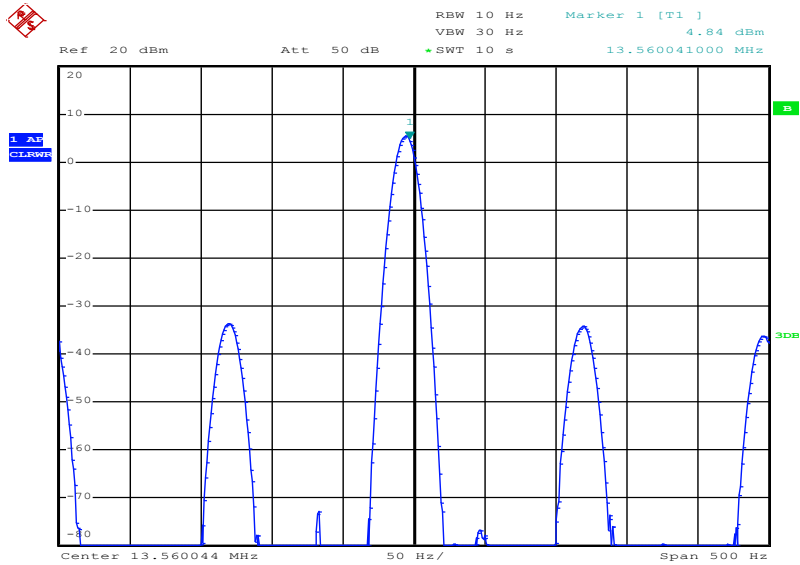
Date: 19.OCT.2015 15:28:07

Plot 3: 100% voltage; 70°C



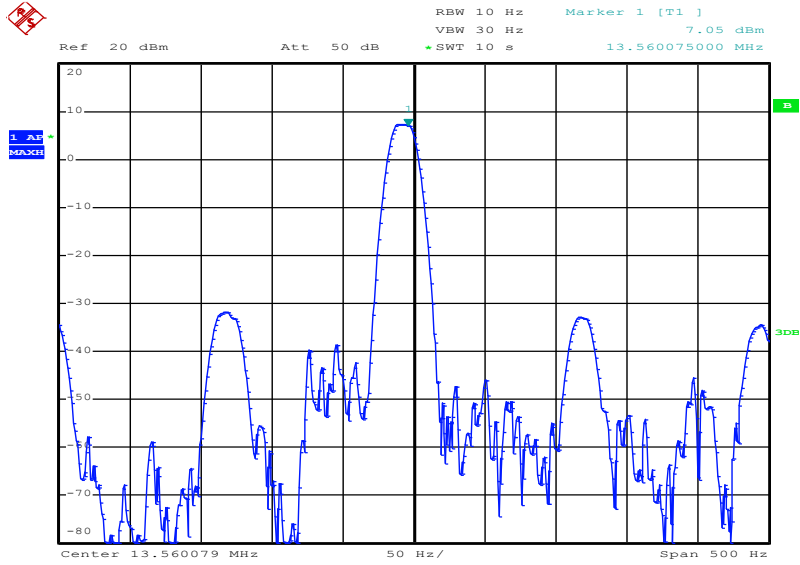
Date: 19.OCT.2015 15:10:43

Plot 4: 100% voltage; 60°C



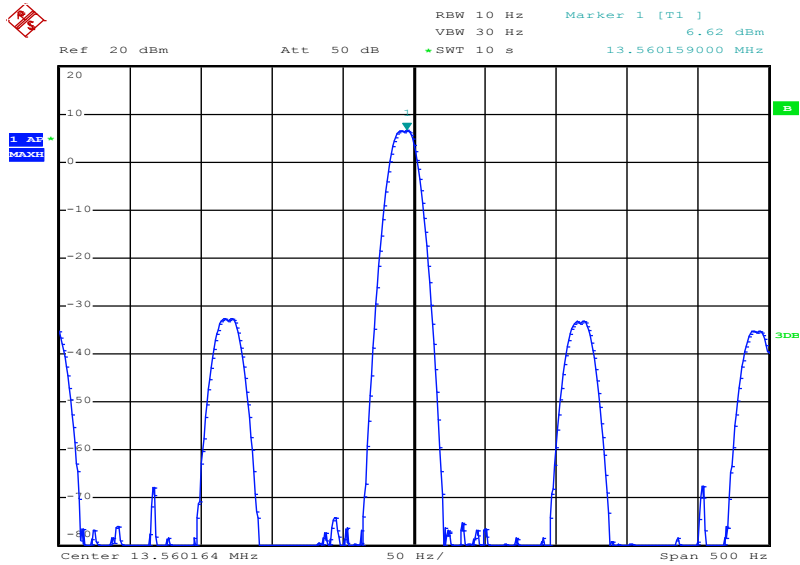
Date: 19.OCT.2015 14:53:08

Plot 5: 100% voltage; 50°C



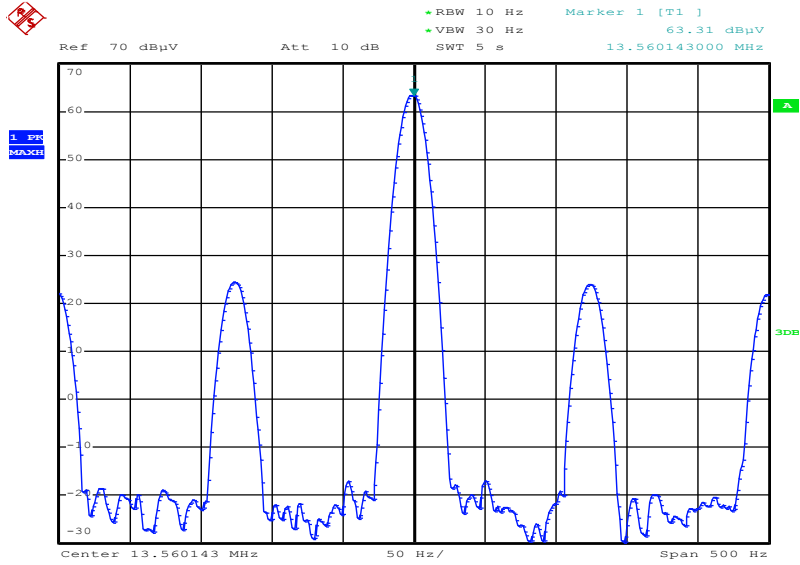
Date: 19.OCT.2015 14:40:20

Plot 6: 100% voltage; 40°C



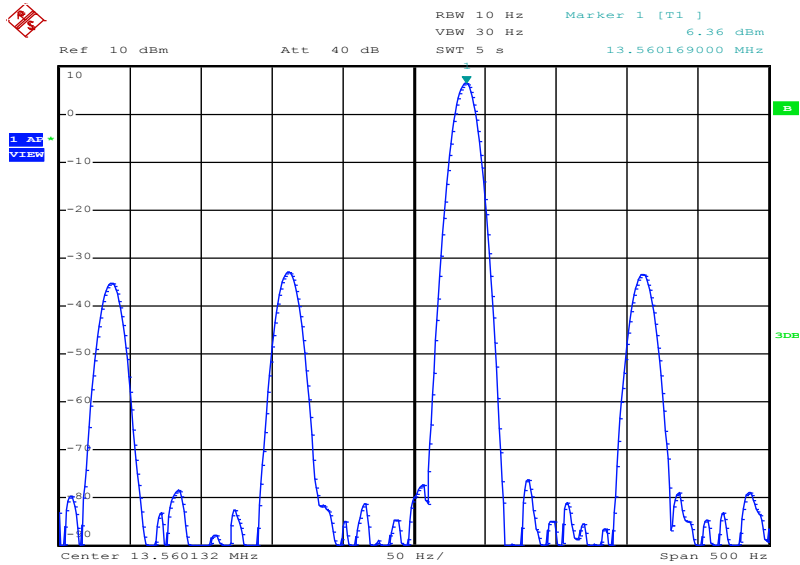
Date: 19.OCT.2015 14:12:48

Plot 7: 100 % voltage; 30°C



Date: 20.OCT.2015 14:38:07

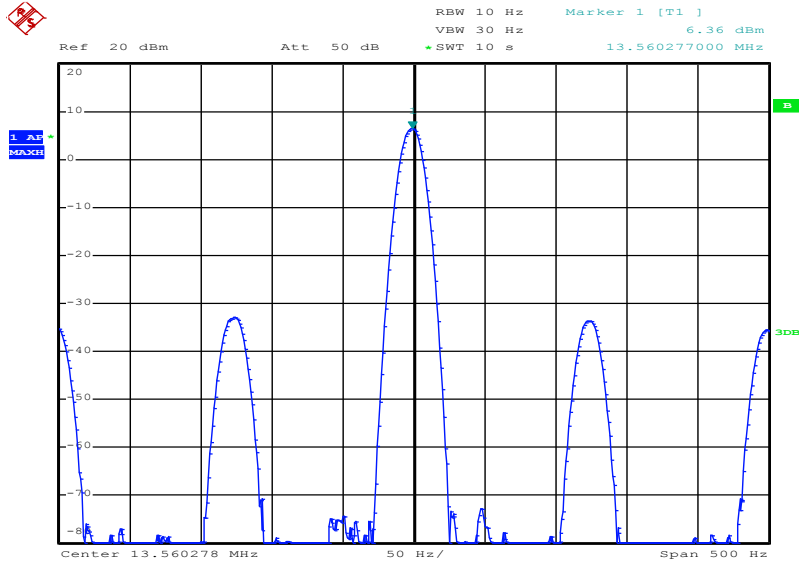
Plot 8: 100 % voltage; 20°C



Date: 19.OCT.2015 08:53:26

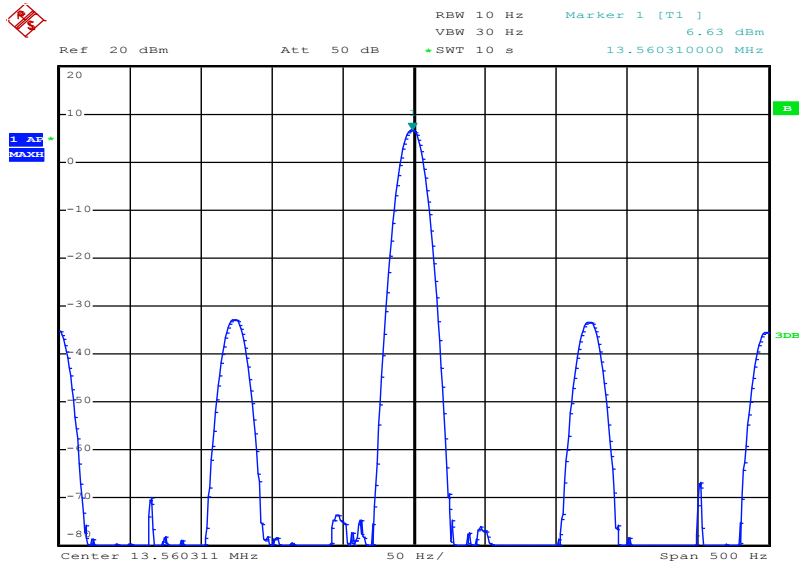


Plot 9: 100 % voltage; 10°C



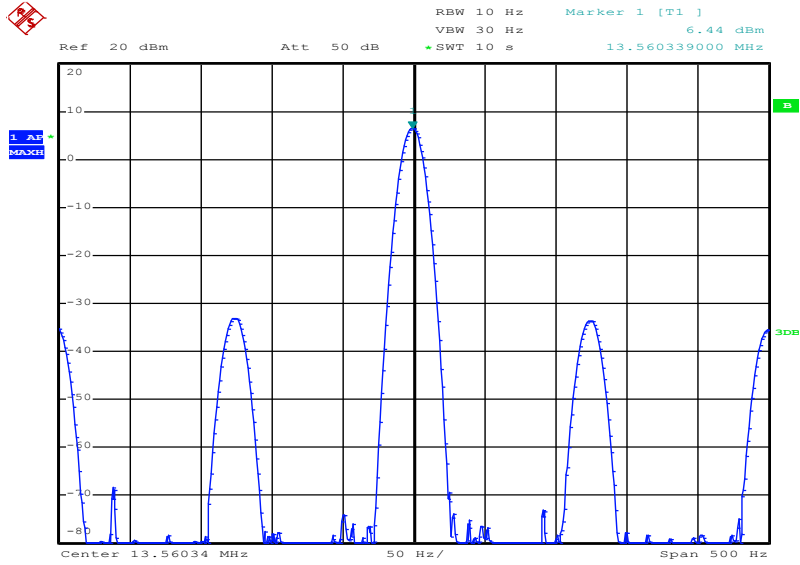
Date: 19.OCT.2015 13:47:13

Plot 10: 100 % voltage; 0°C



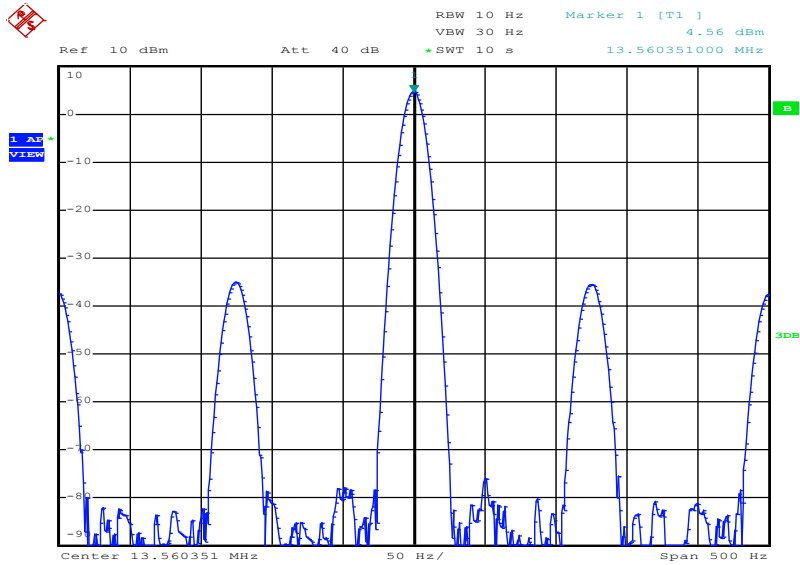
Date: 19.OCT.2015 13:27:32

Plot 11: 100 % voltage; -10°C



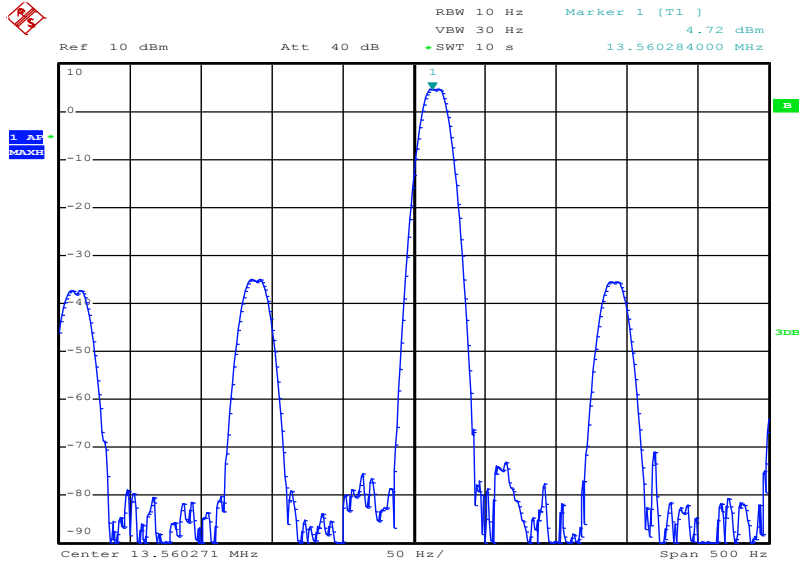
Date: 19.OCT.2015 12:59:24

Plot 12: 100 % voltage; -20°C



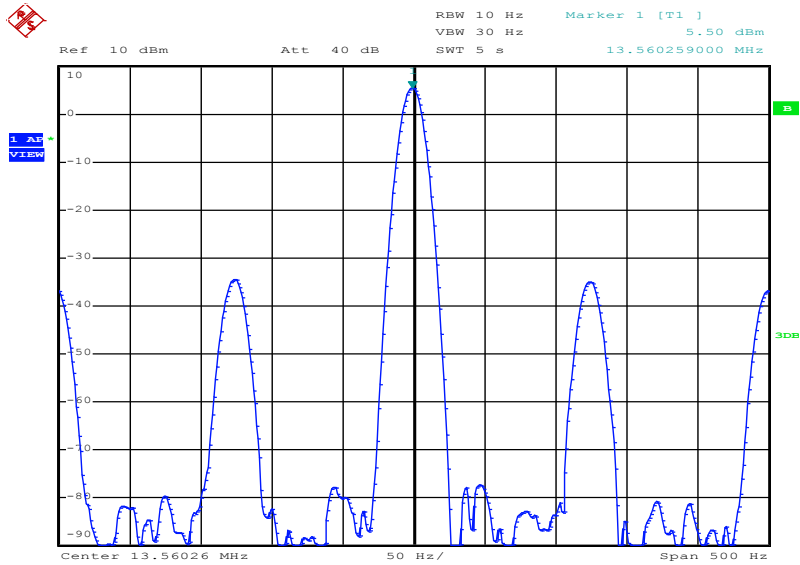
Date: 19.OCT.2015 12:02:18

Plot 13: 100 % voltage; -30°C



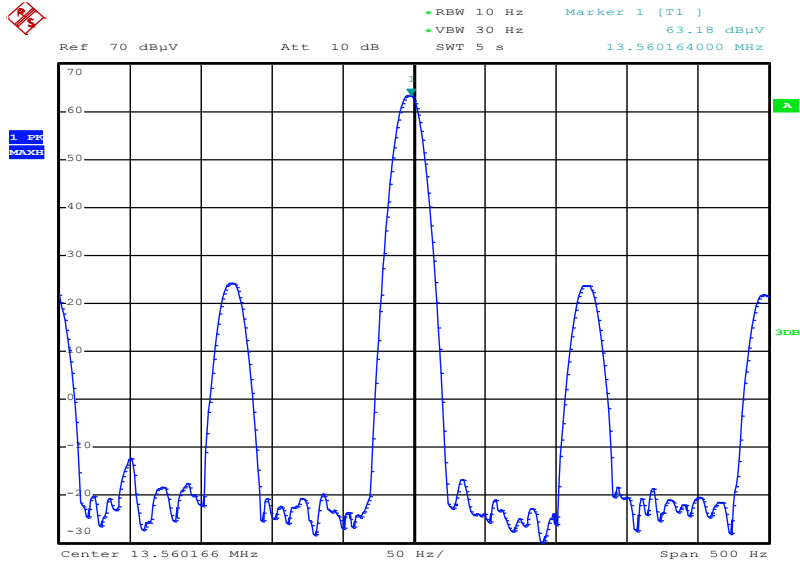
Date: 19.OCT.2015 11:40:49

Plot 14: 100 % voltage; -40°C



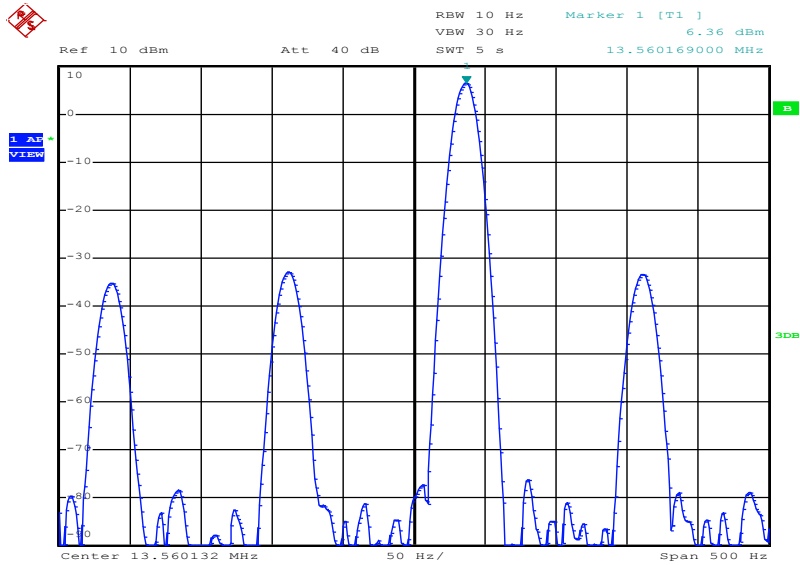
Date: 19.OCT.2015 11:08:07

Plot 15: 115 % voltage; 20°C



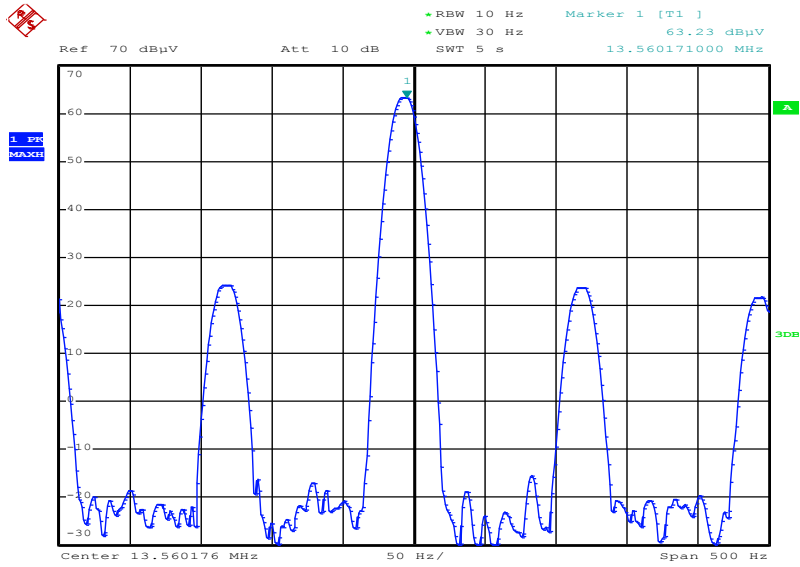
Date: 20.OCT.2015 14:52:11

Plot 16: 100 % voltage; 20°C



Date: 19.OCT.2015 08:53:26

Plot 17: 85 % voltage; 20°C



Date: 20.OCT.2015 14:51:37

### 13 Observations

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

**Annex A Document history**

Version	Applied changes	Date of release
	Initial release	2015-11-02
A	Updated HMN and FVIN	2015-11-27

**Annex B Further information****Glossary**

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN		Product marketing name
HMN		Host marketing name
HVIN		Hardware version identification number
FVIN		Firmware version identification number

**Annex C Accreditation Certificate**

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Befähigung gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV  
 Unterzeichnerin der Multilateralen Abkommen  
 von EA, ILAC und IAF zur gegenseitigen Anerkennung

**Akkreditierung**



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

**CETECOM ICT Services GmbH**  
 Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

- Drahtgebundene Kommunikation einschließlich xDSL
- VoIP und DECT
- Akustik
- Funk einschließlich WLAN
- Short Range Devices (SRD)
- RFID
- WiFiMax und Richtfunk
- Mobilfunk (GSM / GPRS / UTRAN / LTE) Performance
- Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
- Produktsicherheit
- SAR und Hearing Aid Compatibility (HAC)
- Umweltsimulation
- Smart Card Terminals
- Bluetooth
- Wi-Fi Services

Die Akkreditierungskunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-00

Frankfurt am Main, 07.03.2014  
 Leiter des Referats

*(Signature)*  
 im Auftrag D-PL-12076-01-00  
 Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Standort Berlin Spittelmarkt 10 10117 Berlin	Standort Frankfurt am Main Gartenstraße 8 60594 Frankfurt am Main	Standort Braunschweig Bundesallee 100 38115 Braunschweig
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 ILAC: [www.ilac.org](http://www.ilac.org)  
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**Note:**

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

<https://www.cetecom.com/en/cetecom-group/europe/germany-saarbruecken/accreditations.html>