TEST REPORT CONCERNING THE COMPLIANCE OF A
DCD: Part 15 Low Power Transmitter below 1705 kHz,
OPERATING on 125 kHz,
BRAND MYLAPS, MODEL X2 Prochip Decoder
WITH 47 CFR PART 15 (10-1-14 Edition).

15020602.fcc01_Rev01
August 10, 2015

FCC listed	90828
Industry Canada	2932G-2
R&TTE, LVD, EMC Notified Body	1856

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MEASUREMENT/TECHNICAL REPORT

MYLAPS
Model : X2 Prochip Decoder

FCC ID: NXYX2PROCHIPD
IC: Not applicable

This report concerns:	Original grant/certification ~~Class 2 change~~ ~~Verification~~
Equipment type:	DCD Low Power Transmitter below 1705 kHz

Report prepared by:	Name	: Richard van der Meer
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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-14 Edition) and the measurement procedures of ANSI C63.10-2009. TÜV Rheinland Nederland at Leek, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: August 10, 2015 Signature:

P. de Beer
Technical Manager TÜV Rheinland Nederland B.V.

Description of test item

Test item	:	DCD: Part 15 Low Power Transmitter below 1705 kHz
Manufacturer	:	MYLAPS BV
Brand	:	MYLAPS
Model(s)	:	X2 Prochip Decoder
Serial number(s)	:	00-04-87-06-05-78
Revision	:	--
FCC ID	:	NXYX2PROCHIPD
IC		Not Applicable
Receipt date	:	April 08, 2015

Applicant information

Applicant's representative	:	Bas van Rens
Company	:	MYLAPS
Address	:	Zuiderhoutlaan 4
Postal code	:	2012PJ
City	:	Haarlem
Country	:	Netherlands
Telephone number	:	+31 (0)23 7600100
Telefax number		--
E-mail	:	Bas.van.rens@mylaps.com

Test(s) performed

Location	:	Leek
Test(s) started	:	May 04, 2015
Test(s) completed	:	August 07, 2015
Purpose of test(s)	:	Equipment Authorization (original certification)
Test specification(s)	:	47 CFR Part 15 (10-1-14 Edition)

Test engineer(s)	:	R. van der Meer 
Report written by	:	R. van der Meer 
Report date	:	August 10, 2015

Table of contents

1 General information.

1.1 Product description.

1.1.1 Introduction.

The product tested is part of an inductive lap timing system used in various types of sports.

The content of this report and measurement results have not been changed other than the way of presenting the data.

1.2 Related submittal(s) and/or Grant(s).

1.2.1 General.

This test report supports the original certification in equipment authorization files under FCC ID: NXYX2PROCHIPD.

1.3 Test results summary

The EUT was tested in accordance with the specifications given in the table below.

Test Standard	Description	Page	Pass / Fail
47 CFR Part 15 (10-1-14 Edition)			
15.207(a)	AC power-line conducted emissions	15 – 18	Pass
15.209	Radiated emissions	11 – 14	Pass
15.215(c)	Occupied bandwidth and Bandwidth of the emission	19 - 19	Pass

Table : testspecifications

Testmethods: ANSI C63.10-2009

2 Tested system details.

Details and an overview of the system and all of its components, as it has been tested, may be found below.

EUT	:	DCD: Part 15 Low Power Transmitter below 1705 kHz
Manufacturer	:	MYLAPS BV
Brand	:	MYLAPS
Model	:	X2 Prochip Decoder
Serial number	:	00-04-87-06-05-78
Operating frequency	:	125 kHz
Modulation	:	AM
Voltage input rating	:	12 Vdc
Voltage output rating	:	n.a.
Current input rating	:	--
Antenna	:	External Loop Antenna 6m or 12m
Remarks	:	n.a.
Interface cable(s)		n.a.
Operating configuration		continuously transmitting

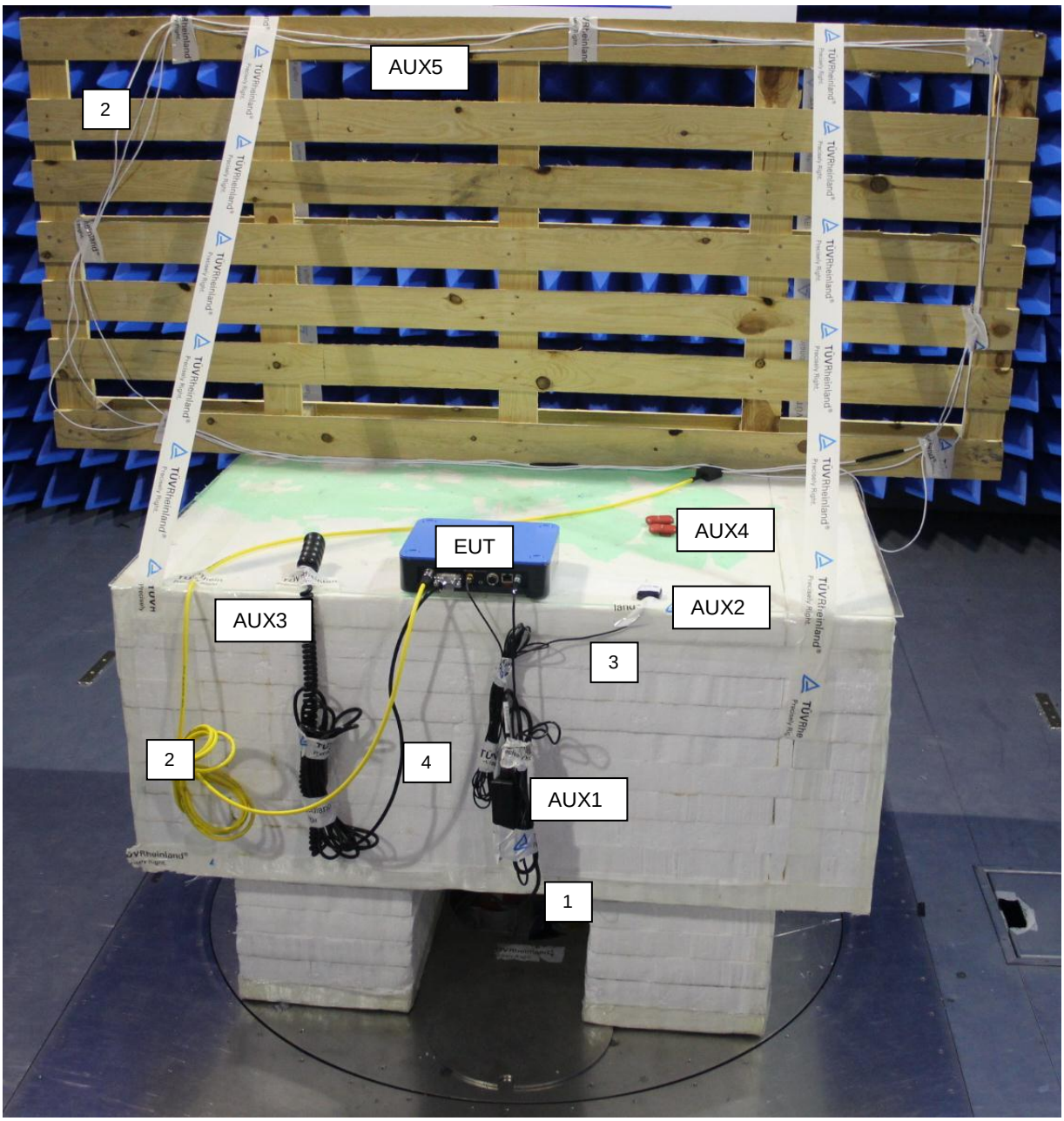
Auxiliary equipment (AUX1)	:	Power supply
Manufacturer	:	DVE
Brand	:	DVE
Model	:	DSA-42D-12 1
Serial number	:	--
Voltage input rating	:	100-240Vac
Voltage output rating	:	+12Vdc 2.7A
Remark	:	power supply for EUT

Auxiliary equipment (AUX2)	:	GPS receive antenna
Manufacturer	:	Trimble
Brand	:	Trimble
Model	:	66800-52 D
Serial number	:	01N43395
Voltage input rating	:	--
Voltage output rating	:	--.
Remark	:	--

Auxiliary equipment (AUX3)	:	Start/Stop knob
Brand	:	--
Model	:	--
Serial number	:	--
Voltage input rating	:	--
Current input rating	:	--
Remark	:	connects to Auxiliary port

Auxiliary equipment (AUX4)	:	Transponder
Brand	:	MYLAPS
Model	:	ProChip Flex
Serial number	:	NX-79558 and PL-30122
FCC ID	:	NXYPROCHIPFLEX
Remark	:	--

Auxiliary equipment (AUX5)	:	Detection Loop
Brand	:	MYLAPS
Model	:	--
Serial number	:	--
Remark	:	6m loop and 12m loop



Photograph of the system

2.1.1 Description of input and output ports.

Number	Terminal	From	To	Remarks	
1	Mains	AUX1	EUT	Cable, unshielded <3m	
2	Antenna	EUT antenna port	AUX5	Cable, shielded >3m	
3	GPS	EUT GPS port	AUX2	Cable, shielded <3m	
4	Auxiliary	EUT auxiliary port	AUX3	Cable, unshielded <3m	

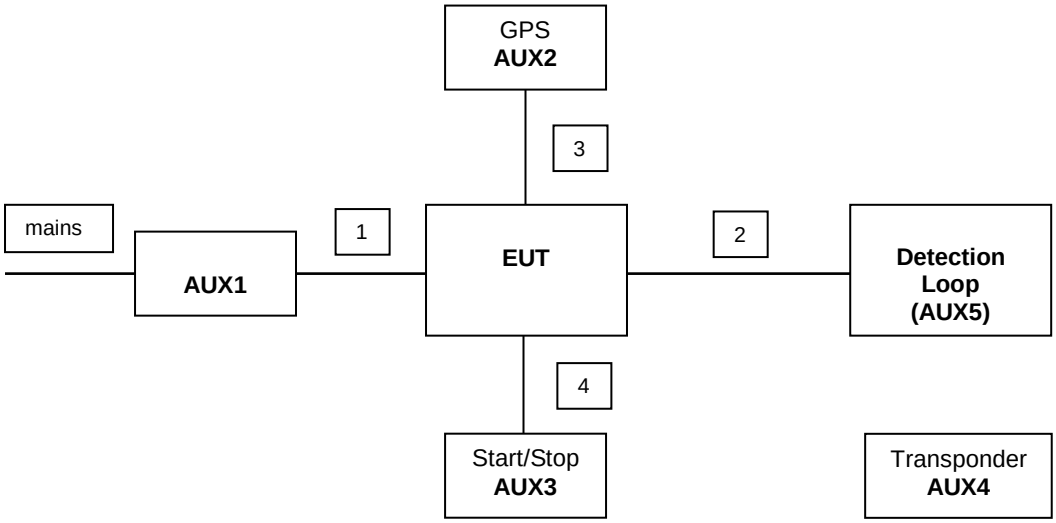


Figure 1. Basic set-up for testing

2.2 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-14 Edition), sections 15.31, 15.207, 15.209. The test methods, which have been used, are based on ANSI C63.10-2009 and KDB 174176 additionally for AC power line conducted emissions.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters.
Radiated emission tests below 30 MHz were performed at a measurement distance of 10 meters. To calculate the field strength level from these results to the appropriate distance at which the limit is specified, the appropriate extrapolation factor is used.

The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

2.3 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located in Leek, 9351VT Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

2.4 Test conditions.

Normal test conditions:

Temperature (*) : +15°C to +35°C
Relative humidity(*) : 20 % to 75 %
Supply voltage : 120Vac/60Hz
Air pressure : 950 – 1050 hPa

*When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

3 System test configuration.

3.1 Justification.

The system was configured for testing in a typical fashion (as a customer would normally use it). The sample as supplied by the applicant was configured with a standard BNC connector as Antenna connector, this is justified in the user manual with instructions for professional installation only. The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10: 2009.

3.2 EUT mode of operation.

The EUT has been tested while continuously transmitting. The intentional radiator tests have been performed with a complete functioning EUT.

3.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

3.4 Equipment modifications.

No modifications have been made to the equipment in order to achieve compliance.

3.5 Product Labeling

The product labeling information is available in the technical documentation package.

3.6 Block diagram of the EUT.

The block diagram is available in the technical documentation package.

3.7 Schematics of the EUT.

The schematics are available in the technical documentation package.

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4 Radiated emission data.

RESULT: PASS

Date of testing: 2015-05-04 and 2015-08-07

Frequency range: 30MHz - 1GHz

Requirements:

FCC 15.205, FCC 15.209

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a), must comply with the radiated emission limits specified in FCC 15.209(a).

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a) or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Frequency (MHz)	Field strength (µV/meter)	Field strength (dBµV/m)	Measurement distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Table of applicable limits

Test procedure:

ANSI C63.10-2009.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

Final E-field radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

Tested with 6m and 12m Detection Loop. From pre-test the emissions with EUT loop antenna of 12m in vertical position proofed to be worse case. Tested with activated and de-activated Start/stop switch (no difference in reading). The six highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit

4.1 Radiated field strength measurements H-field, frequency range of 0.009-30 MHz.

Frequency (MHz)	(a) Measurement results (dBµV)	(b) Antenna factor	(c) Cable loss	(d) Distance extrapolation factor 10m to 30m	Detector	Measurement results (calculated = a+b+c-d)	Limits
	10 m	dB	dB	dB		dBµV/m @30m	dBµV/m @30m
0.12497 fundamental	53.8	--	--	--	Pk	5.12 @300m	45.67 @300m
0.12497 fundamental	5.12	--	--	-1.6 (Duty Cycle Cor. Fact)	Av	3.52 @300m	25.67 @300m
0.25000	43.4	20.0	1	60	Pk	4.40 @300m	19.65 @300m
0.37500	43.1	20.0	1	60	Pk	4.10 @300m	16.12@300m
0.50000	18.8	20.0	1	20	Qp	19.8	33.62
0.62500	22.0	20.0	1	20	Qp	23.0	31.69
0.75000	22.1	20.0	1	20	Qp	23.1	30.10

Table 1a Radiated emissions of the EUT with 12m loop antenna.

Frequency (MHz)	(a) Measurement results (dBµV)	(b) Antenna factor	(c) Cable loss	(d) Distance extrapolation factor 10m to 30m	Detector	Measurement results (calculated = a+b+c-d)	Limits
	10 m	dB	dB	dB		dBµV/m @30m	dBµV/m @30m
0.12497 fundamental	45.3	--	--	--	Pk	-6.77 @300m	45.67 @300m
0.12497 fundamental		--	--	-1.6 (Duty Cycle Cor. Fact)	Av	-8.37 @300m	25.67 @300m
0.25000	29.4	20.0	1	60	Pk	-9.60 @300m	19.65 @300m
0.37500	30.6	20.0	1	60	Pk	-8.40 @300m	16.12@300m
0.50000	18.7	20.0	1	20	Qp	19.7	33.62
0.62500	20.5	20.0	1	20	Qp	21.5	31.69
0.75000	22.2	20.0	1	20	Qp	23.2	30.10

Table 1b Radiated emissions of the EUT with 6m loop antenna.

The results of the radiated emission tests in the frequency range 0.009 – 30 MHz, carried out in accordance with 47 CFR Part 15 section 15.209 with the EUT operating in continuous transmit mode, are depicted in Tables 1a and 1b. See notes on the next page.

Notes:

1. Calculated measurement results are obtained by using the 40 dB/decade extrapolation factor and the antenna factor and cable loss is included. For instance the corrected value for 0.250 MHz fundamental frequency is calculated as: Measurement result + Antenna Factor + Cable loss – Extrapolation Factor => 43.4 dBµV + 20.0 dB + 1 dB – 60 dB = 4.40 dBµV/m. See section 7 for the Duty cycle correction factor used to calculate the Average value.
2. A resolution bandwidth of 9kHz was used during testing
3. Field strength values of radiated emissions at frequencies in the frequency range 0.009 – 30 MHz not listed in Tables 1a and 1b are more than 20 dB below the applicable limit
4. The Detection Loop was tested in vertical orientation as per product installation guide. The reported value is the worst case found at the reported frequency.
5. The measurement distance was 10m and measured values were corrected to the applicable limit distance.
6. Measurement uncertainty is ±5.0dB

Used test equipment and ancillaries:

A01491	A00235	A00141	A00314		

The complete list of used equipment can be found in section 8 of this testreport.

Test engineer

Signature : 

Name : R. van der Meer
Date : August 07, 2015

4.2 Radiated field strength measurements (30 MHz – 1 GHz, E-field)

Frequency [MHz]	Antenna Orientation	Detector/ Bandwidth	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
51.340	Horizontal	Qp / 120 kHz	21.5	40.0	Pass
70.740	Horizontal	Qp / 120 kHz	29.2	40.0	Pass
71.000	Vertical	Qp / 120 kHz	33.0	40.0	Pass
80.440	Vertical	Qp / 120 kHz	24.3	40.0	Pass
782.72	Vertical	Qp / 120 kHz	39.6	46.0	Pass
916.58	Horizontal	Qp / 120 kHz	42.9	46.0	Pass
982.54^{R}	Horizontal	Qp / 120 kHz	42.7	46.0	Pass

Table 2 Radiated emissions of the EUT.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209 are depicted in Table 2.

Notes:

1. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is ±5.0dB
3. The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in three positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. ^{R} refers to a frequency in a restricted band.

Used test equipment and ancillaries:

A00257	A00314	A00444	A00447	A00450	A00466		

Test engineer

Signature :

Name : Richard van der Meer

Date : May 04, 2015

5 AC Power Line Conducted Emission Data.

5.1 Requirements

For an intentional radiator that is designed to be connected the public utility AC power line, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the following table. The tighter limit applies at the frequency range boundaries.

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

*Decreases with the logarithm of the frequency.

Test procedure:

ANSI C63.10-2009.

Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50 µH / 50 Ω LISN. The frequency range from 150kHz to 30MHz was searched.
The six highest EUT emissions relative to the limit were noted for three supply voltages.
In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane.

5.2 Testresults, AC Power Line Conducted Emission data of the EUT

Frequency (MHz)	Measurement results (dBµV) Neutral/L2		Measurement results (dBµV) Line 1		Limits (dBµV)		Result
	QP	AV	QP	AV	QP	AV	
0.15781	45.7	*1	44.3	*1	65.5	55.5	PASS
0.17734	43.0	*1	41.9	*1	64.5	54.5	PASS
0.19297	38.6	*1	37.3	*1	64.0	54.0	PASS
0.20469	38.6	*1	34.6	*1	63.6	53.6	PASS
0.47031	42.5	*1	42.0	*1	56.5	46.5	PASS
13.35703	35.1	*1	34.4	*1	60.0	50.0	PASS

Table 2

The results of the AC Power line conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207(a) section 7.2.4, at the 120 Volts/ 60 Hz AC mains connection terminals of AUX1 that connects to the EUT, are depicted in Table 2 above. The system is tested as in whole, so with all equipment as shown in Figure 1 in place and functioning except a 50 Ohm load has been used instead of the Detection Loop.

Notes:

1. Measurement uncertainty is ±3.5dB
2. The resolution bandwidth used was 9 kHz
3. The EUT was tested with a GPS receive antenna connected and a Start/Stop switch connected to AUX port. Worst case values noted.
4. The loop antenna was replaced by a 50 Ohm load as per KDB 174176.
5. Values of conducted emissions at frequencies not listed in Table 2 are more than 20 dB below the applicable limit.
6. Qp values were already within Av limits, therefor Av not tested.
7. See plots on page 16 and 17.

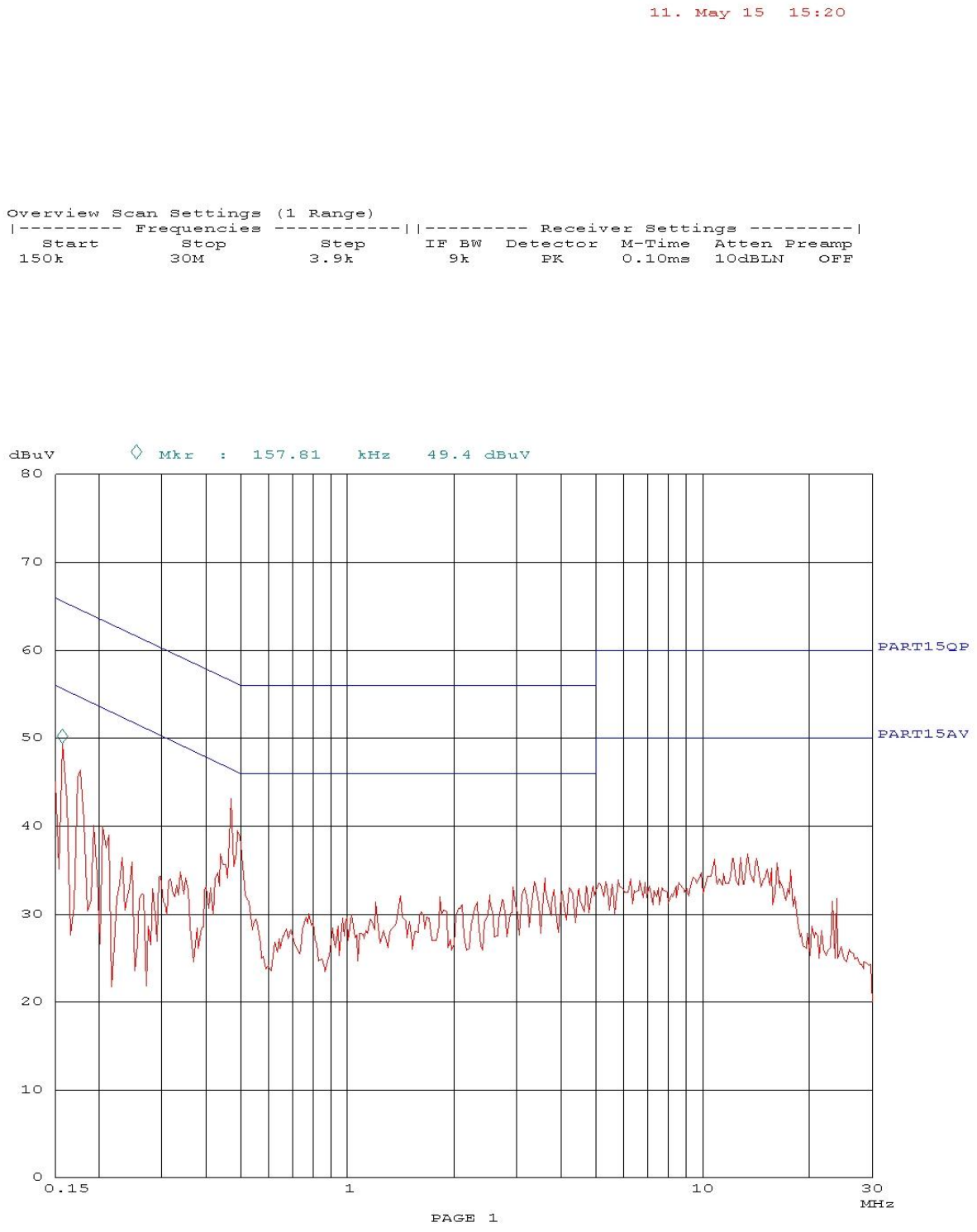
Used test equipment and ancillaries:

A00022	A00051	A00171	A00437	A00444	A00726		

Test engineer

Signature : 

Name : R. van der Meer
Date : May 11, 2015

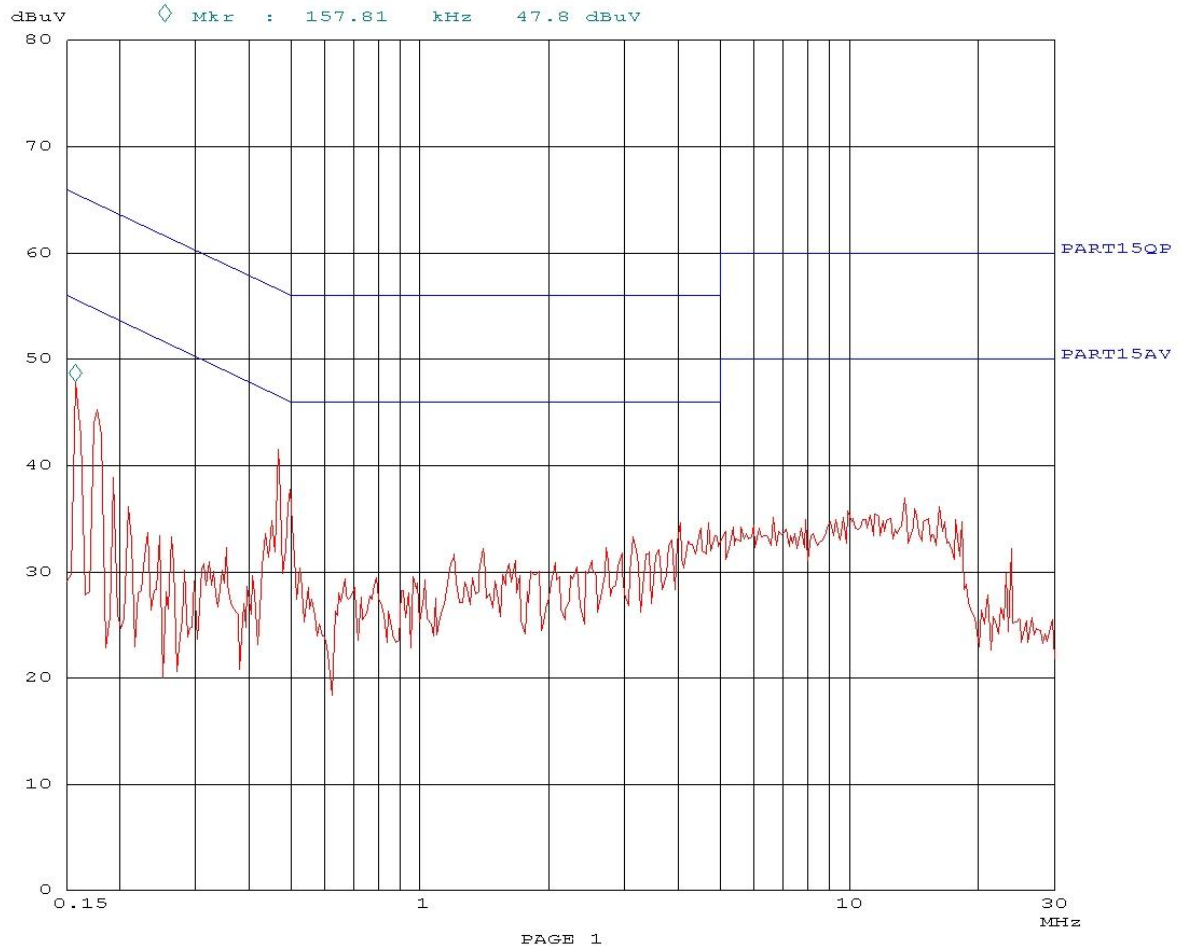


Plot 1a: AC Power line conducted emissions on L1

11. May 15 15:27

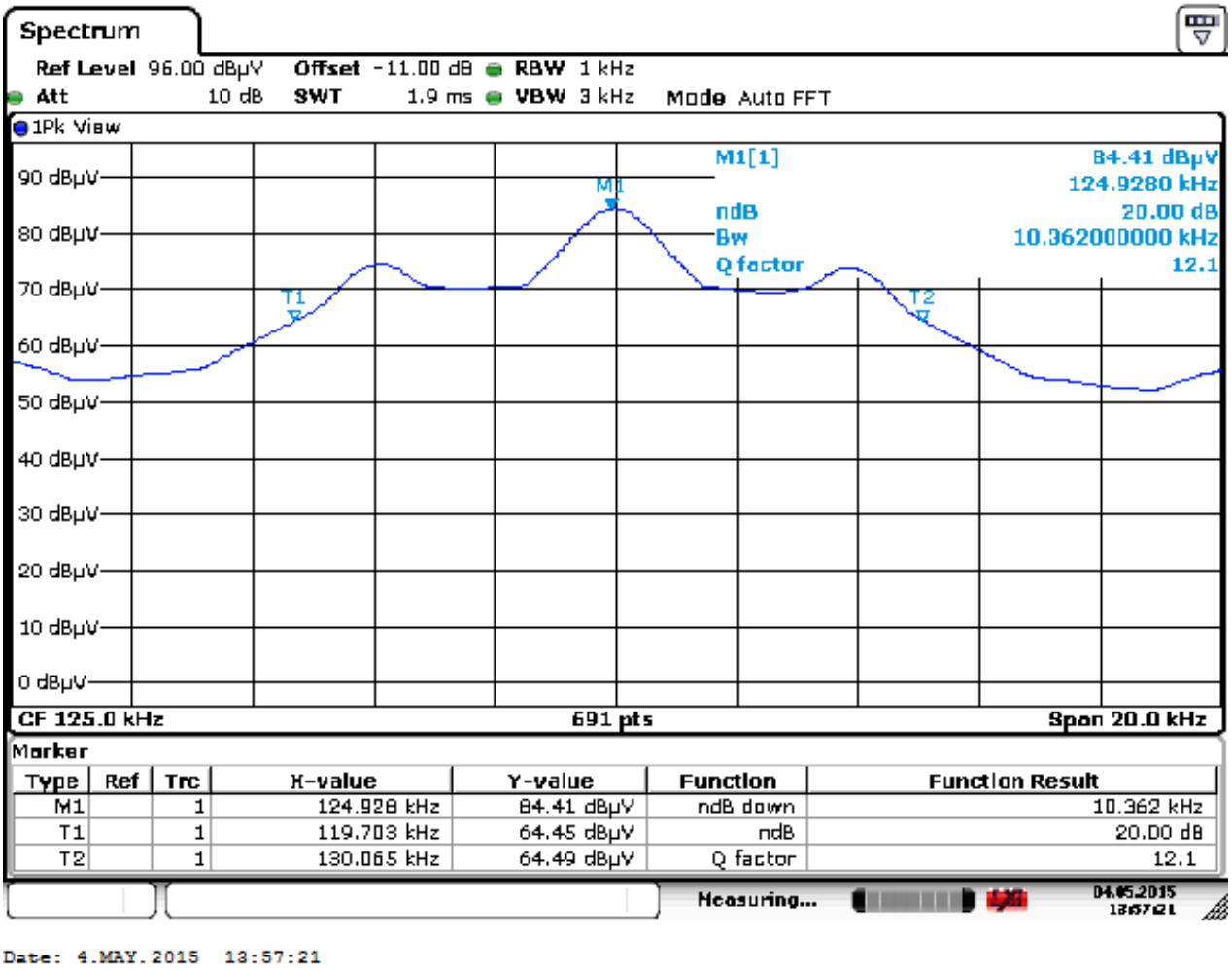
Overview Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	3.9k	9k	PK	0.10ms	10dBLN	OFF



Plot 1b: AC power line conducted emissions on L2

6 Plot of the carrier bandwidth

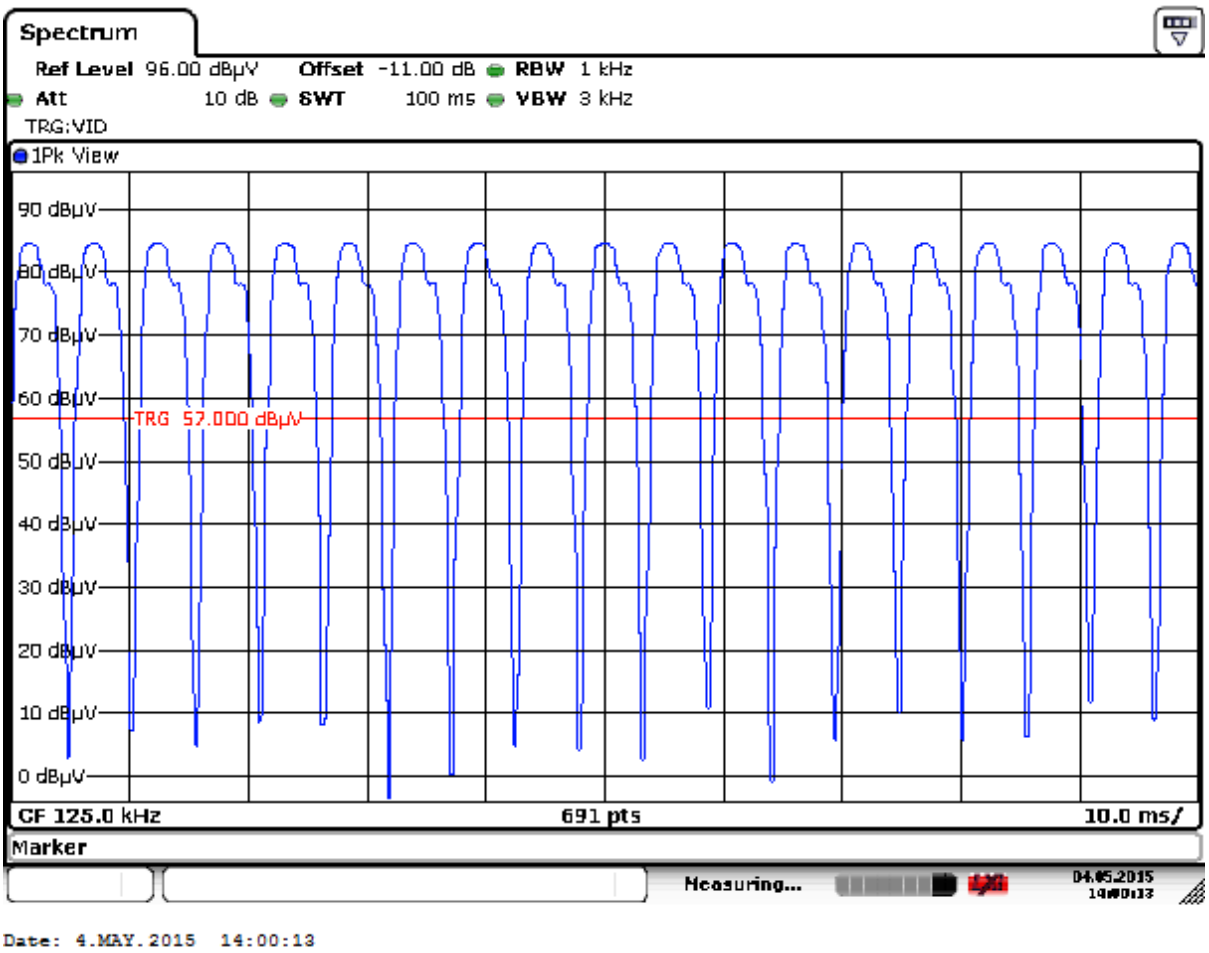


Plot 2: 20 dB bandwidth of the carrier, actual bandwidth is 10.36 kHz as measured on a spectrum analyzer

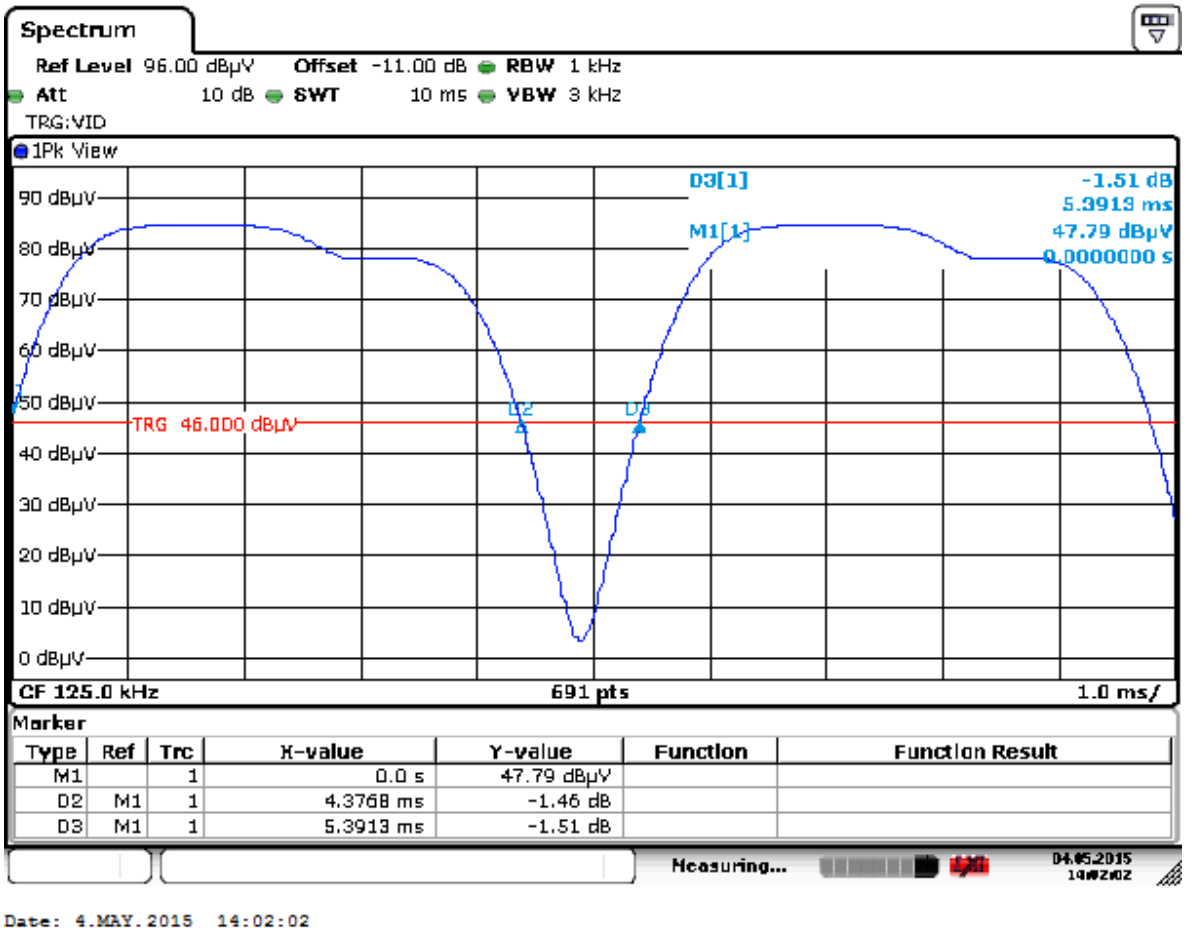
7 Duty cycle

19 peaks were observed in a 100 ms interval. Each peak was measured to have a duration of 4.38 ms.
This yields a total on-time of 83.22 ms in a 100 ms interval. Using the formula
Average factor (dB) = 20*LOG(83.22ms /100ms), the duty cycle average factor is therefore -1.6 dB.

Plot 3a and 3b below show the RF On/Off characteristics of the EUT's emissions. From these characteristics a correction factor is calculated that is required to derive Average values from the measured peak values of the emissions. Measured on a spectrum analyzer (A00207) and small detection loop antenna (A00309).



Plot 3a: number of pulses in a 100msec period is 19.



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Plot 3b: Pulse width is 4.38ms and Pulse repetition rate is 5.39ms

8 List of utilized test equipment.

Inventory number	Description	Brand	Model	Serial number	Last cal.	Next cal.
A00022	LISN	EMCO	3725/2	8812/2027	01/2014	01/2016
A00051	Pulse limiter	R&S	ESH3-Z2	357.8810.52	01/2015	01/2016
A00141	Tripod for A001491	Chase	--	--	NA	NA
A01491	Loop antenna	Chase	HLA6120	1107	05-25/2014	05-25/2015
A00165	Variac 250V 6A	RFT	LTS006	510947	NA	NA
A00466	Biconilog Testantenna	Teseq	CBL 6111D	35555	06/2014	06/2015
A00314	Measuring receiver	R&S	ESCI	100872/1166 .5950.0	03/2015	03/2016
--	50 Ohm load resistor	R&S	R404051000 50 9141	--	10-15/2012	10-15/2013
A00450	Controller	Maturo	SCU/088/80908 11	--	NA	NA
A00207	Spectrum analyzer	R&S	FSP40	100007	05/2013	05/2014
A00444/ A00446/	Temperature-Humiditymeter	Extech	SD500	--	03/2015	03/2016
A00235	Test site	Comtest	FCC listed: 90828	--	04/2014	04/2017
A00437	Shielded room for Conducted emissions	Euroshield	RFD-100 359	--	NA	NA
A00258	Antenna mast	EMCS	AP-4702C	--	NA	NA
A00447	Cable S-AR	Gigalink	APG0500	--	01/2014	01/2015
A00309	Loop antenna, 6cm	NA	7405-901	--	09/2014	09/2015
A00726	Measurement receiver	R&S	ESCS30	100313	09/2014	09/2015

NA= Not Applicable

Appendix 1

Calculated measurements results radiated field strength, H-Field

The rules of Part 15 section 15.31 allow scaling of the measured values or limits when measurements are made at distances other than those specified. The extrapolation factor for frequencies below 30 MHz are 40 dB/decade which means that for a distance change of 10 to 1 (a decade), the limit, or measured value, may be recalculated by adding(moving closer) or subtracting (moving away) 40 dB, respectively.

It is also possible to make radiated-emission measurements at two different distances and extrapolate to a third distance. The calculation method described below, should then be followed.

General Formula:

d_1 = short distance

d_2 = long distance

So:
$(d_1/d_2)^n = H_{d2}/H_{d1}$

$n \log(d_1/d_2) = \log(H_{d2}/H_{d1})$

Calculation of n:

$n = \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$

Calculation of field strength at other distance (10m --> 300m):

$H_{d2} = H_{d1} (d_1/d_2)^n$

Example

For the fundamental frequency of 125 kHz the level at a distance of 300m would be calculated as follows:

d1= 3m
d2= 10m

EUT in combination with Loop antenna 12m
Calculation for n: $n= \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$ > n=log(53.8 / 78.5)/ log(3m/10m) > n=2.362
$H_{d2} = H_{d1} (d_1/d_2)^n$ > $H_{d2} = 78.5 (3/10)^{2.362}$ = 5.12 dB(µV)/m.

EUT in combination with Loop antenna 6m
Calculation for n: $n= \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$ > n=log(45.3 / 71.2)/ log(3m/10m) > n=2.477
$H_{d2} = H_{d1} (d_1/d_2)^n$ > $H_{d2} = 71.2 (3/10)^{2.477}$ = -6.77 dB(µV)/m.