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

TEST REPORT

Test report no.: 1-2177/16-01-03-A

Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH

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Internet: <http://www.cetecom.com>e-mail: ict@cetecom.com**Accredited Testing Laboratory:**

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Applicant

Mettler-Toledo GmbH

Im Langacher 44

8606 Greifensee / SWITZERLAND

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Manufacturer

Mettler-Toledo GmbH

Im Langacher 44

8606 Greifensee / SWITZERLAND

Test standard/s

47 CFR Part 15

Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

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

Test Item

Kind of test item: RF-ID Reader 125 kHz**Model name:** MULTI-RFID-SWITCH 5x**FCC ID:** THVMULTIRFID5X

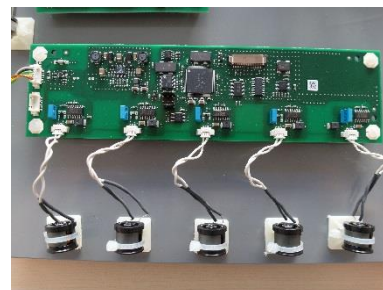
Frequency: 125 kHz

Technology tested: RFID

Antenna: Integrated antenna

Power supply: 10.8 V to 13.2 V by PHIHONG switching power supply

Temperature range: 0°C to +55°C



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

Test report authorized:

p.o.

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:

Benedikt Gerber
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.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.

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This test report replaces the test report with the number 1-2177/16-01-03 and dated 2016-08-11.

2.2 Application details

Date of receipt of order:	2016-07-07
Date of receipt of test item:	2016-07-26
Start of test:	2016-07-29
End of test:	2016-08-03
Person(s) present during the test:	-/-

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15		Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

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

4 Test environment

Temperature :	T _{nom} T _{max} T _{min}	+22 °C during room temperature tests No tests under extreme conditions No tests under extreme conditions
Relative humidity content :		55 %
Barometric pressure :		not relevant for this kind of testing
Power supply :	V _{nom} V _{max} V _{min}	12 V by PHIHONG switching power supply No tests under extreme conditions No tests under extreme conditions

5 Test item

5.1 General description

Kind of test item :	RF-ID Reader 125 kHz
Type identification :	MULTI-RFID-SWITCH 5x
S/N serial number :	see table below
HW hardware status :	see table below
SW software status :	see table below
Frequency band :	125 kHz
Type of radio transmission :	RFID
Use of frequency spectrum :	
Type of modulation :	ASK
Number of channels :	1
Antenna :	Integrated antenna
Power supply :	10.8 V to 13.2 V by PHIHONG switching power supply
Temperature range :	0°C to +55°C

Equipment under test:						
Name	Part	BL TMS SW	TMS SW	BL LPC SW	LPC SW	Note
Back Bone	30006323 C	30006193 D	30095459 A	30006192 C	30006178 8 (V1.28)	
Powder Dosing Controller Board	30005413 F	30006193 D	30006190 (V1.3)			
MULTI-RFID-SWITCH 5x	30008471 B	30006193 D	30095040 (V0.92)			DUT
CAN/POWER CONN. BOARD	30034244 B					
Power mains	MT 11107909					
RS(m)-RS(f) cable	MT 11101051					
CAN cable L=65 mm	MT 30005904					
RFID-Tag	MT 11141451					
Gender Changer f/f	Distrelec 671410					
Null Modem m/f	Distrelec 675596					

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-2177/16-01-01_AnnexA
1-2177/16-01-01_AnnexB

6 Test laboratories sub-contracted

None

7 Description of the test setup

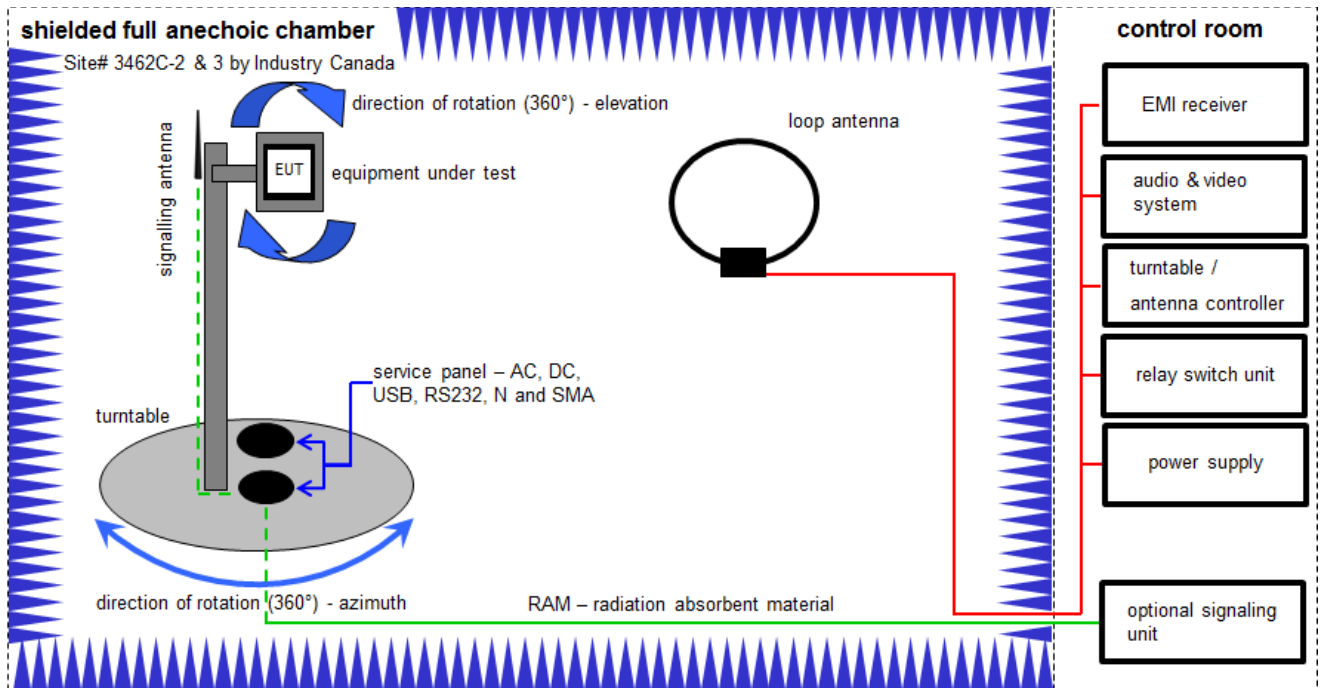
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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 fully anechoic chamber



Measurement distance: loop antenna 3 meter

$$FS = UR + CA + AF$$

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

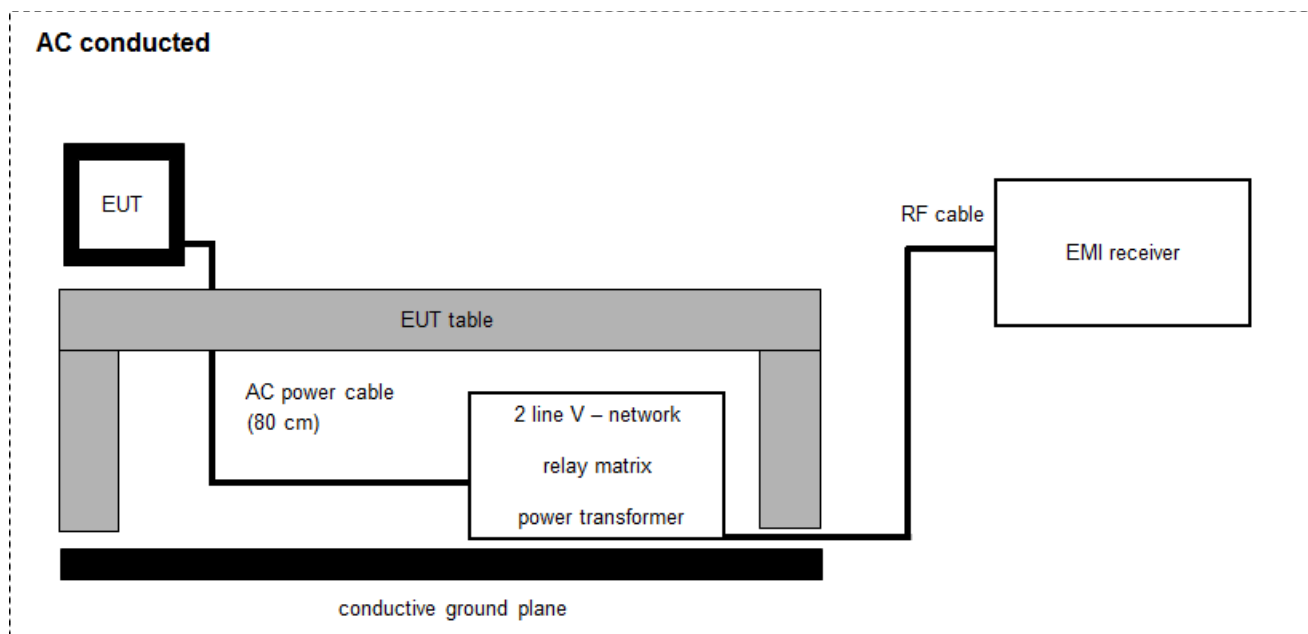
Example calculation:

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A,B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
2	A,B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
3	A,B	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
4	A,B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
5	A	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	04.09.2015	04.09.2016
6	B	PXA Spectrum Analyzer 3Hz to 50GHz	N9030A PXA Signal Analyzer	Agilent Technologies	US51350267	300004338	k	09.02.2016	09.02.2017

7.2 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	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	893045/004	300000584	k	02.02.2016	02.02.2017
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	k	27.11.2006	-/-
3	A	EM-Injection Clamp	FCC-203i	emv	232	300000626	ev	18.05.2001	-/-
4	A	Magnetfeldantenne	MS 100	EM-Test	----	300002659	ev	24.04.2000	-/-
5	A	AC-Spannungsquelle variabel	MV2616-V	EM-Test	0397-12	300003259	k	11.12.2015	11.12.2017
6	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
7	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	08.04.2008	-/-
8	A	Power Supply	NGSM 32/10	R&S	3939	400000192	vIKI	22.01.2015	22.01.2017
9	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	04.02.2016	04.02.2017

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.

9 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Occupied bandwidth	± used RBW
Field strength of the fundamental	± 3 dB
Field strength of the harmonics and spurious	± 3 dB
Receiver spurious emissions and cabinet radiations	± 3 dB
Conducted limits	± 2.6 dB

10 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	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	See table!	2016-10-07	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
for information only	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209	Field strength of the fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 RSS Gen Issue 4 (6.13)	Field strength of the harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal	☒	☐	☐	☐	-/-

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

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:	Positive Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyzer function:	99 % power function
Used test setup:	See sub clause 7.1 - B
Measurement uncertainty:	See sub clause 9

Limit:

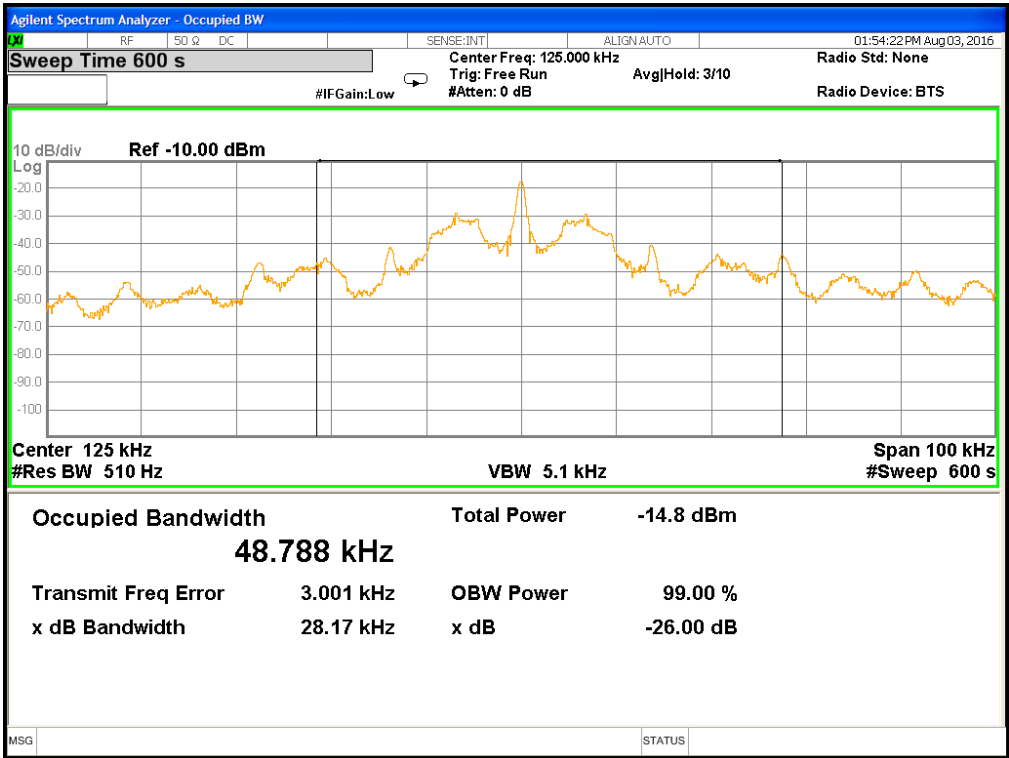
IC
for information only

Result:

99% emission bandwidth
49 kHz

Plots:

Plot 1: occupied bandwidth, multi RFID switch



12.2 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters	
Detector:	Quasi peak
Resolution bandwidth:	9 kHz
Video bandwidth:	$\geq 3 \times \text{RBW}$
Trace mode:	Max hold
Used test setup	See sub clause 7.1 - A
Measurement uncertainty:	See sub clause 9

Limit:

FCC & IC		
Frequency (kHz)	Field strength (dB μ V/m)	Measurement distance (m)
125	25.7	300
	105.7*	3

*see also remark on recalculation below

Recalculation:

According to ANSI C63.10, chapter 6.4 a correction factor of -80 dB is used.

Result:

Field strength of the fundamental		
Frequency	125 kHz	
Distance	@ 3 m	@ 300 m
EIRP	71 dB μ V/m	-9 dB μ V/m

12.3 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious.

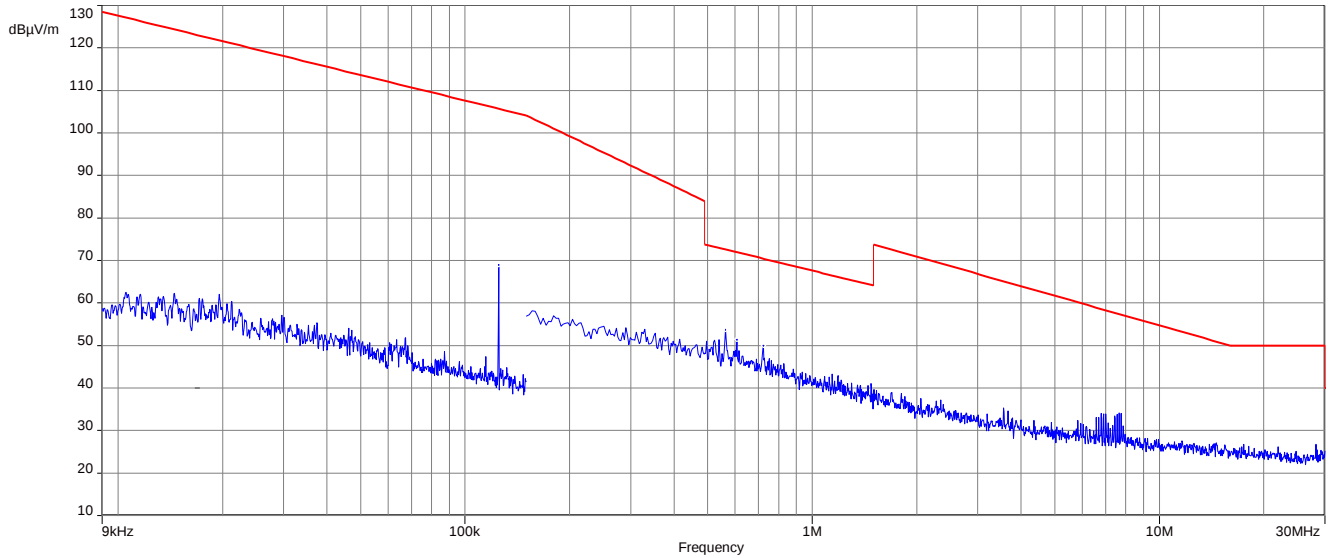
Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz
Trace mode:	Max hold
Used test setup:	9 kHz to 30 MHz: see sub clause 7.1 - A
Measurement uncertainty:	See sub clause 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

Result:

Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value
All detected emissions are more than 20 dB below the limit			

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

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.

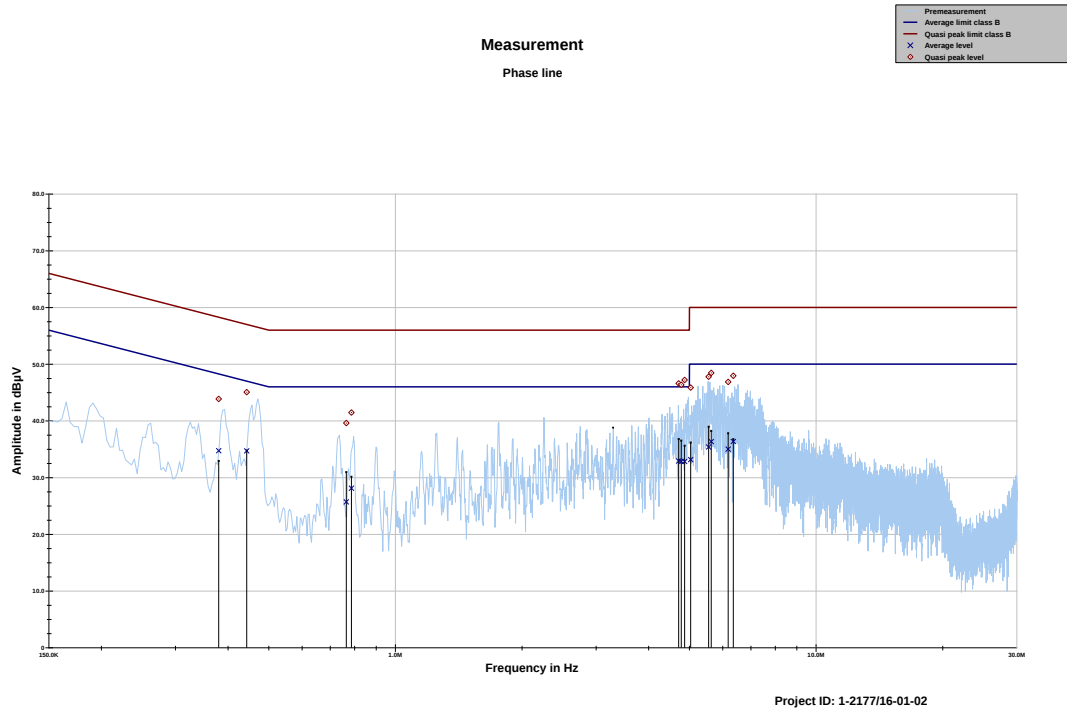
Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Trace mode:	Max hold
Used test setup	See sub clause 7.2 - A
Measurement uncertainty:	See sub clause 9

Limit:

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

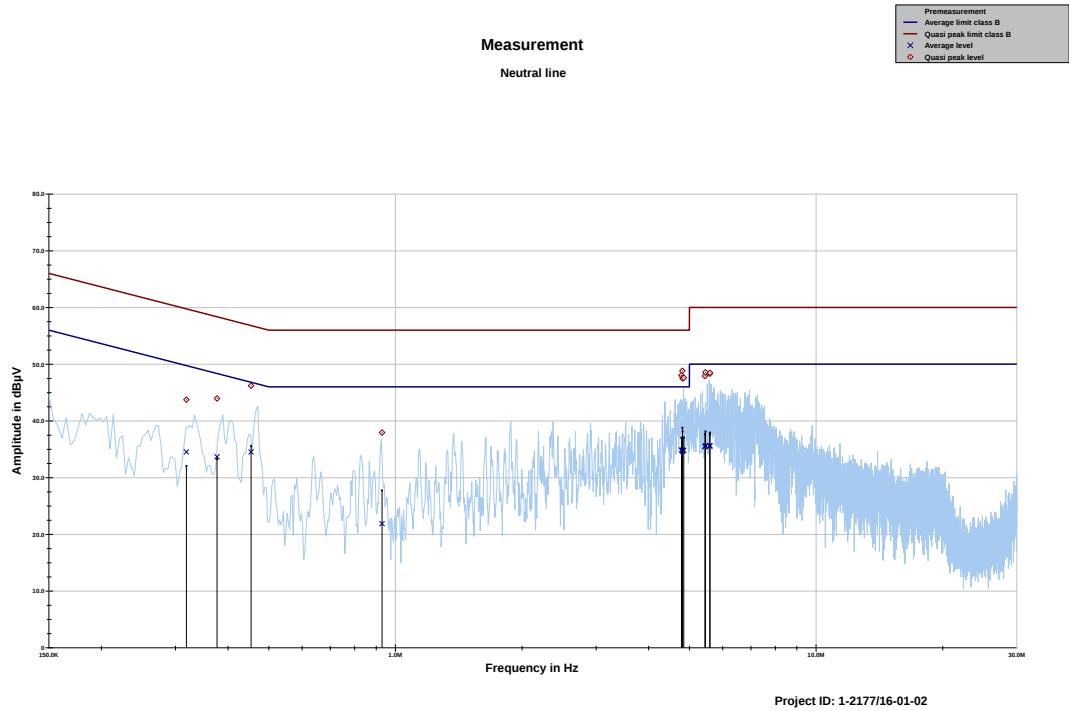
Result:

See plots 1 and 2.

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

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.380101	43.87	14.41	58.277	34.74	14.69	49.426
0.443161	45.07	11.93	57.002	34.71	12.91	47.624
0.764547	39.61	16.39	56.000	25.71	20.29	46.000
0.786272	41.47	14.53	56.000	28.13	17.87	46.000
4.713507	46.61	9.39	56.000	32.92	13.08	46.000
4.781544	46.37	9.63	56.000	32.85	13.15	46.000
4.871356	47.21	8.79	56.000	32.85	13.15	46.000
5.035067	45.87	14.13	60.000	33.16	16.84	50.000
5.554745	47.78	12.22	60.000	35.39	14.61	50.000
5.633361	48.45	11.55	60.000	36.34	13.66	50.000
6.181803	46.87	13.13	60.000	35.02	14.98	50.000
6.359143	47.95	12.05	60.000	36.36	13.64	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.318499	43.74	16.01	59.746	34.52	16.66	51.186
0.376678	43.95	14.41	58.352	33.67	15.85	49.523
0.454032	46.19	10.61	56.801	34.52	12.79	47.313
0.929686	37.94	18.06	56.000	21.88	24.12	46.000
4.787946	48.01	7.99	56.000	34.84	11.16	46.000
4.811254	48.82	7.18	56.000	34.86	11.14	46.000
4.816492	47.47	8.53	56.000	34.65	11.35	46.000
4.848083	47.62	8.38	56.000	34.80	11.20	46.000
5.442039	47.93	12.07	60.000	35.45	14.55	50.000
5.459751	48.56	11.44	60.000	35.62	14.38	50.000
5.591606	48.33	11.67	60.000	35.52	14.48	50.000
5.595397	48.46	11.54	60.000	35.66	14.34	50.000

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	2016-08-11
-A	FCC ID corrected (THVQCB → THVMULTIRFID5X)	2016-10-07

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



Deutsche Akkreditierungsstelle GmbH

Befehle 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:

Funk
Mobilfunk (GSM / DCS) + OTA
Elektromagnetische Verträglichkeit (EMV)
Produktsicherheit
SAR / EMF
Umwelt
Smart Card Technology
Bluetooth®
Automotive
Wi-Fi-Services
Kanadische Anforderungen
US-Anforderungen
Akustik
Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 04.05.2016 mit der
Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt,
der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

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

Frankfurt, 04.05.2016

Siehe Hinweise auf der Rückseite

Im Auftrag Dir.-Ing. (FH) Ralf Egner
Abteilungsleiter

Back side of certificate

Deutsche Akkreditierungsstelle GmbH

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10117 Berlin

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Europa-Allee 52
60327 Frankfurt am Main

Standort Braunschweig
Bundesallee 100
38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen
Zustimmung der Deutschen Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate
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Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom
31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments
und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung
im Zusammenhang mit der Vermarktung von Produkten (Abt. L 218 vom 9. Juli 2008, S. 30).
Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der
European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und
der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen
erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:

EA: www.european-accreditation.orgILAC: www.ilac.orgIAF: www.iaf.nu**Note:****The current certificate including annex can be received from CETECOM ICT Services GmbH on request.**