



TEST REPORT # EMCC-040197BPA, 2015-11-27

EQUIPMENT UNDER TEST:

Trade Name: T40HS Torquemeter
 Type Designation(s): T40HS-S0, T40HS-S1, T40HS-S0-MPZ1402023
 Serial Number: Type: T40HS-S0: 192940010
 Type: T40HS-S1: 191130008
 Type: T40HS-S0-MPZ1402023: 192540009
 Equipment Class: Low Power Transceiver
 Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Address: Im Tiefen See 45
 64293 Darmstadt
 Germany
 Phone: +49 6151 803 0
 Fax: +49 6151 803 9 100

RELEVANT STANDARD(S): 47 CFR 15.207, 15.209, RSS-210 Issue 8

MEASUREMENT PROCEDURE:

☒ ANSI C63.10-2013 ☒ RSS-Gen Issue 4 ☐ Other

TEST REPORT PREPARED BY:

Ludwig Kraft
 EMCCons DR. RAŠEK GmbH & Co. KG
 Moggast, Boelwiese 8
 91320 Ebermannstadt
 Germany
 Phone: +49 9194 9016
 Fax: +49 9194 8125
 E-Mail: l.kraft@emcc.de

TEST PERSONNEL:

HEAD OF COMMERCIAL EMC AND RADIO DEPT.:


 Manuel Zenk


 Ludwig Kraft


 Wolfgang Döring

EMCCons DR. RAŠEK
 GmbH & Co. KG
 Moggast, Boelwiese 8
 91320 Ebermannstadt
 Germany

FCC Registration # 878769
 Industry Canada Listing # 3464C

040197BPA

EMC, Radio, Safety and Environmental Testing



DAkkS

Deutsche
 Akkreditierungsstelle
 D-PL-12067-01-00

Telephone: +49 9194 9016
 Telefax: +49 9194 8125
 Mail: emc.cons@emcc.de
 Web: http://www.emcc.de

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1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR 15.207, 15.209 requirements for the certification of licence-exempt 15C Intentional Radiator.

1.2 Limits and Reservations

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Test results relate only to the items tested in the configuration as recorded. This test report shall not be reproduced except in full without the written permission of EMCCons DR. RAŠEK GmbH & Co. KG.

1.3 Test Location

Test Laboratory: EMCCons DR. RAŠEK GmbH & Co. KG

Accreditation No.: D-PL-12067-01-00

Address of Labs I, II, III
and Head Office: EMCCons DR. RAŠEK GmbH & Co. KG
Moggast, Boelwiese 8
91320 Ebermannstadt
GERMANY

Address of Labs IV and V: EMCCons DR. RAŠEK GmbH & Co. KG
Stoernhofer Berg 15
91364 Unterleinleiter
GERMANY

Laboratory: Test Laboratory IV
The 3 m & 10 m semi-anechoic chamber site has been fully described in a report submitted to the FCC and accepted in the letter dated December 24, 2013, Registration Number 878769. This 3 m & 10 m alternative test site is approved by Industry Canada under file number 3464C-1.

Phone: +49 9194 9016

Fax: +49 9194 8125

E-Mail: info@emcc.de

Web: www.emcc.de

1.4 Manufacturer

Company Name: Hottinger Baldwin Messtechnik GmbH
Street: Im Tiefen See 45
City: 64293 Darmstadt
Country: Germany

Name for contact purposes: Dr. Hans Schuster
Phone: +49 6151 803-619
Fax: +49 6151 803-400
E-Mail: hans.schuster@hbm.com

1.5 Dates and Test Location

Date of receipt of EUT: T40HS-S0, 2015-08-27
T40HS-S1, 2015-08-06
T40HS-S0-MPZ1402023, 2015-11-12
Test Date: See table below
Test Location: Lab IV

1.6 Ordering Information

Purchase Order and Date: E41-4500526084/2000 2015-07-31
D04-4500540930/2000 2015-12-08
Vendor Number: 806266

1.7 Climatic Conditions

Date	Temperature [°C]	Relative Humidity [%]	Air Pressure [hPa]	Lab	Customer attended tests
2015-08-10	28	48	973	IV	no
2015-09-15	24	46	969	IV	no
2015-09-16	25	47	962	IV	no
2015-09-17	25	49	962	IV	no
2015-11-19	23	41	975	IV	no
2015-11-20	23	41	966	IV	no

2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

Trade Name:	T40HS Torquemeter
Type Designation(s):	T40HS-S0, T40HS-S1, T40HS-S0-MPZ1402023
Serial Number(s):	Type: T40HS-S0: 192940010 Type: T40HS-S1: 191130008 Type: T40HS-S0-MPZ1402023: 192540009
FCC ID:	2ADAT-T40S0TOS1
Industry Canada Certification Number:	12438A-T40S0TOS1
Application:	Low Power Transceiver
Transmit Frequency:	522.85 kHz; 1.22 MHz
Modulation:	522.85 kHz unmodulated; 1.22 Mbps PSK
Emission Designator:	1M51G1D (1.22 MHz signal)
Power Supply:	24 VDC
Ports:	Signal and supply – 7 pole binder industrial connector
Antennas:	Integrated loop antenna
Variants:	T40HS-S0, T40HS-S1, T40HS-S0-MPZ1402023
Remarks:	.

The variants T40HS-S0 and T40HS-S1 share the same electronic in the stator with different antenna diameters. The rotors of these variants do as well share the same electronic, but have different diameters which are used for different torque levels.

The variant T40HS-S0-MPZ1402023 consists of two stators and antennas. The stator of T40HS-S0-MPZ1402023 shares the same electronic as T40HS-S0 and T40HS-S1. The rotor contains two times the same electronic in one rotor. The duplicated system is to achieve a redundancy for the measurement.

Note:

The naming of the EUTs used during the test are different to the type designation. The EUT TFHS #1 corresponds to T40HS-S1, the EUT TFHS #2 corresponds to T40HS-S0 and MPZ1402023 corresponds with T40HS-S0-MPZ1402023.

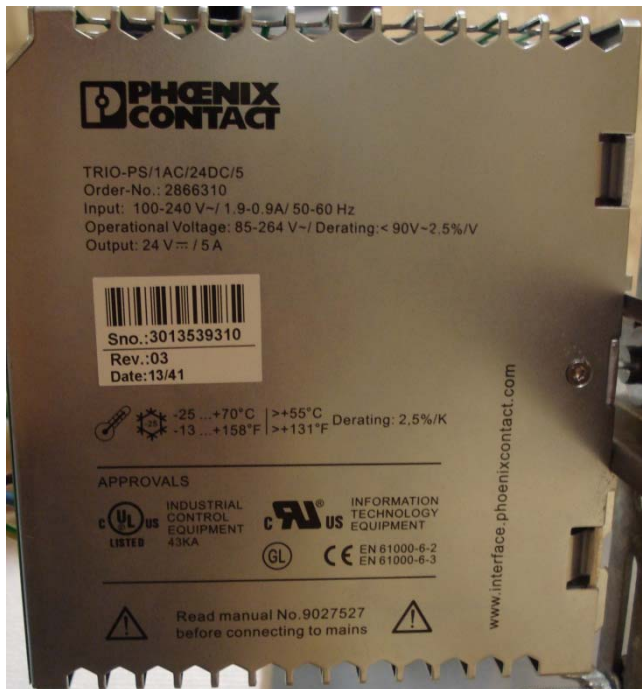
2.2 Intended Use

The EUT is a complete measuring system to measure torque on a rotating shaft. The standard use is inside a test stand.

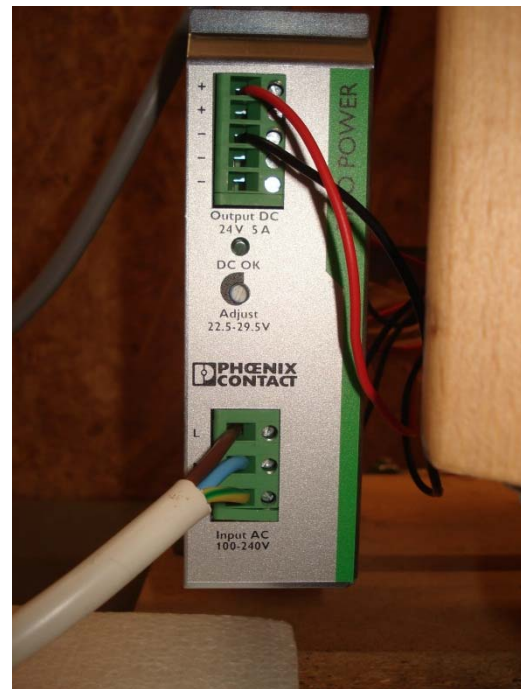
2.3 EUT Peripherals/Simulators

The EUT was tested connected with

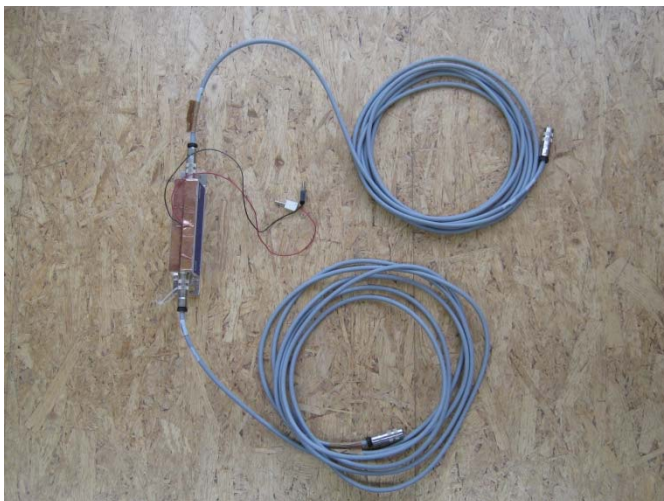
- Power supply TRIO-PS/1AC/24DC/5 (Phoenix Contact)



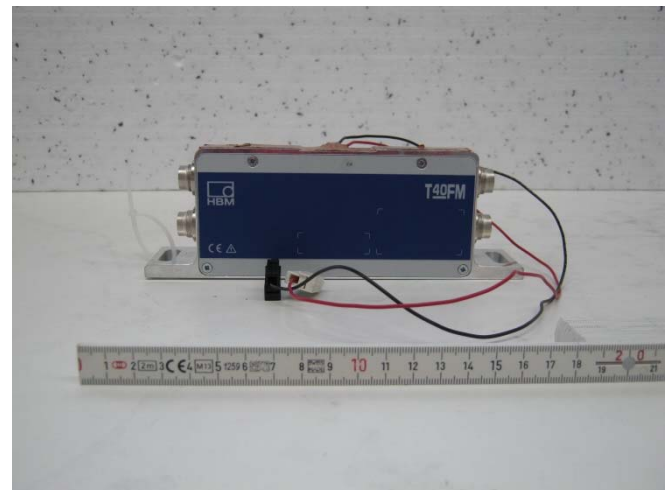
Photograph 2.3-1: Power supply TRIO-PS/1AC/24DC/5



Photograph 2.3-2: Power supply TRIO-PS/1AC/24DC/5, front view



Photograph 2.3-3: Junction box with two signal and supply cables for T40HS-S0-MPZ1402023



Photograph 2.3-4: Junction box without connection cables

2.4 Mode of Operation during Testing and Test Set-up

The equipment under test (EUT) was operated during the tests under the following conditions:

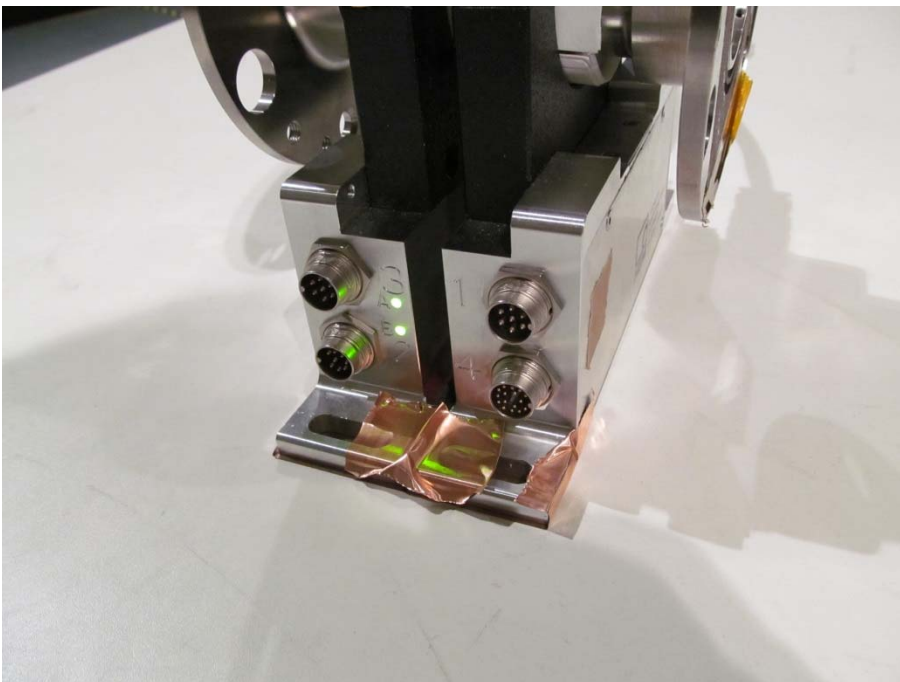
Normal operating mode:

The rotor of the EUT was fixed and there was no torque applied to the EUT.

The EUTs were powered with 24 VDC by the AC/DC supply TRIO-PS/1AC/24DC/5 delivered by the customer for the conducted power line emission tests. For all other tests the EUTs were powered with 24VDC by a laboratory power supply and connected via the junction box.

All peripheral/simulators were operated outside of the test environment.

The two stators of the EUT T40HS-S0-MPZ1402023 were bonded together by a copper tape, see picture below. During normal setup the EUT is fitted to a metal frame or chassis according to the customer. The copper tape simulated the connection of the metal plate for the tests.



Photograph 2.4-1: Stator of EUT T40HS-S0-MPZ1402023 connected with copper foil.

2.5 Modifications Required for Compliance

None.

3 TEST RESULTS SUMMARY

Summary of test results for the following EUT:

Manufacturer: Hottinger Baldwin Messtechnik GmbH
Device: T40HS Torquemeter
Type(s): T40HS-S0, T40HS-S1, T40HS-S0-MPZ1402023
Serial No(s): Type: T40HS-S0: 192940010
Type: T40HS-S1: 191130008
Type: T40HS-S0-MPZ1402023: 192540009

Requirement	RSS, Section	47 CFR Section	Report Section	Result
Antenna Requirement	RSS-Gen, 8.3	15.203	4	Passed
Occupied Bandwidth (99%)	RSS-Gen, 6.6		6	Passed
Conducted AC Power Line Emissions 150 kHz – 30 MHz	RSS-Gen, 8.8	15.207	5	Passed
Radiated Emissions 9 kHz – 30 MHz	RSS-210, A2.2 RSS-Gen, 6.13, 8.9, 8.10	15.205, 15.209	7	Passed
Radiated Emissions 30 MHz – 1000 MHz	RSS-210, A2.2 RSS-Gen, 6.13, 8.9, 8.10	15.205, 15.209	8	Passed

N.A. – not applicable; N.T. – Not tested acc. to applicant's order.

The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units and meet the requirements of the specifications referenced herein. Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the procedures described in ANSI C63.10-2013.

All requirements were found to be within the limits outlined in this report.

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report.

Test Personnel: Manuel Zenk, Ludwig Kraft

Issuance Date: 2015-11-27

4 ANTENNA REQUIREMENT

Test Requirement: 47 CFR 15.203, IC RSS-Gen Issue 4, 8.3

Test Procedure: none

4.1 Regulation

FCC 15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221.

Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

IC RSS-Gen: 8.3 Transmitter Antenna for Licence-Exempt Radio Apparatus

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level^{NOTE}. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

NOTE: Compliance is required under all operational combinations of transmitter output power and antenna gain.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

4.2 Result

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Device:	T40HS Torquemeter
Type(s):	T40HS-S0, T40HS-S1, T40HS-S0-MPZ1402023
Serial No(s):	see section 2
Test Date:	2015-11-27

The EUTs meet the requirements of this section.

5 POWER LINE CONDUCTED EMISSIONS TEST

Test Requirement: FCC 47 CFR, §15.207, IC RSS-Gen Issue 4, 8.8

Test Procedure: ANSI C63.10-2013, IC RSS-Gen

5.1 Regulation

FCC 15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5–5	56	46
0.5-30	60	50

*Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz.

In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current system containing their fundamental emission within the frequency band 535–1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 μ V within the frequency band 535–1705 kHz, as measured using a 50 μ H/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in § 15.205, § 15.209, § 15.221, § 15.223, or § 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

IC RSS-Gen: 8.8 AC Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in Table 3.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery

charger), the radio frequency voltage of emissions 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 Table 3 below. The more stringent limit applies at the frequency range boundaries.

The conducted emissions shall be measured in accordance with the reference publication mentioned in Section 3.

Table 3 – AC Power Line Conducted Emissions Limits

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average**
0.15-0.5	66 to 56*	56 to 46*
0.5–5	56	46
0.5-30	60	50

*Decreases with the logarithm of the frequency.

**A linear average detector is required.

→ The IC limits are equal to the FCC limits.

5.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
EMI Test Receiver	Rohde & Schwarz / ESU8	3846	2015-08	2016-08
V-LISN 50 Ω/(50 uH + 5 Ω)	Rohde & Schwarz / ESH2-Z5	1901	2015-09	2017-09
Protector Limiter	Rohde & Schwarz / ESH3-Z2	1519	2015-09	2017-09
AC Power Source	AEG	0001	n.a	n.a

5.3 Test Procedures

The EUT was placed on a wooden support above the reference groundplane.

The excess length of the power cord of the ac adapter to the EUT was folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

LISN housing, measuring instrument case and reference ground plane were bonded together.

5.4 Test Result Type T40HS-S0

Freq [MHz]	Line	Detector	Result [dBμV]	Limit [dBμV]	Margin
0.680	L	AV	44.4	46.0	1.6
0.370	L	AV	46.7	48.5	1.8
0.310	L	AV	47.8	50.0	2.1
0.435	L	AV	42.2	47.2	5.0
0.250	L	AV	46.3	51.8	5.4
0.185	L	AV	48.7	54.3	5.5
0.680	N	AV	42.1	46.0	3.9
0.370	N	AV	44.2	48.5	4.3
0.310	N	AV	45.0	50.0	5.0
0.435	N	AV	40.0	47.2	7.1
0.620	N	AV	37.7	46.0	8.3
0.430	N	AV	38.7	47.3	8.6

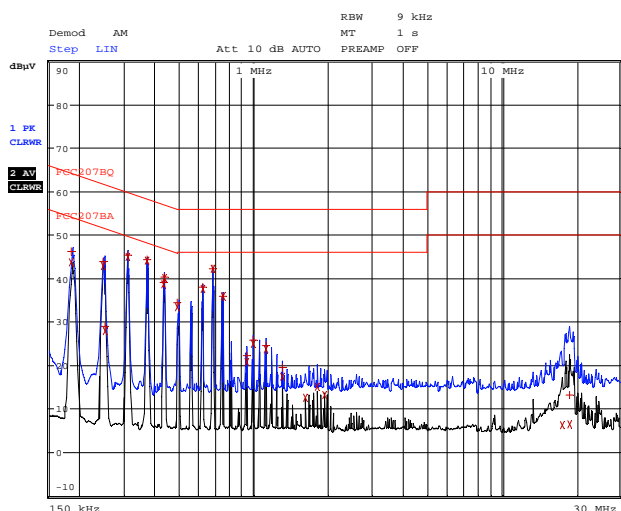
The table above contains worst-case emissions, only. For further details refer to the test plots.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S0
 Serial No(s): 192940010
 Test Date: 2015-09-16

The EUT meets the requirements of this section.

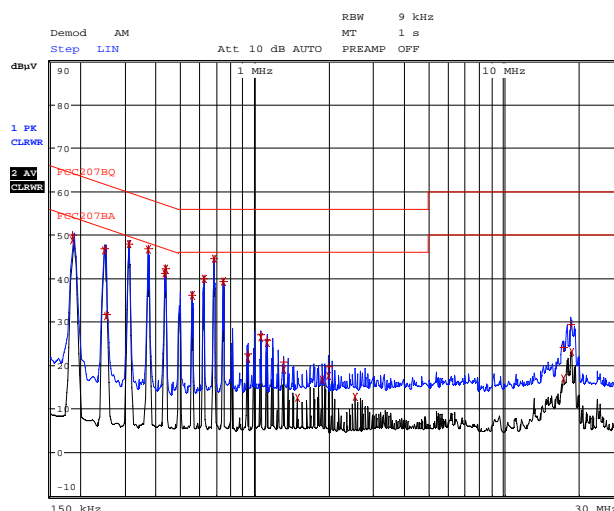
5.5 Measurement Plots Type T40HS-S0

Test on line N:



Manufacturer: HBM, EUT: TFHS #02, normal operation, Power: 1
 15Vac / 60 Hz, Line: N
 Date: 16.SEP.2015 17:11:47

Test on line L:



Manufacturer: HBM, EUT: TFHS #02, normal operation, Power: 1
 15Vac / 60 Hz, Line: L
 Date: 16.SEP.2015 17:17:02

5.6 Test Result Type T40HS-S1

Freq [MHz]	Line	Detector	Result [dBμV]	Limit [dBμV]	Margin
0.680	L	AV	45.3	46.0	0.7
0.370	L	AV	47.7	48.5	0.8
0.310	L	AV	48.3	50.0	1.7
0.435	L	AV	43.8	47.2	3.4
0.430	L	AV	43.2	47.3	4.1
0.245	L	AV	46.9	51.9	5.0
0.680	N	AV	43.3	46.0	2.7
0.370	N	AV	45.7	48.5	2.8
0.310	N	AV	45.8	50.0	4.1
0.435	N	AV	42.0	47.2	5.2
0.430	N	AV	41.3	47.3	5.9
0.740	N	AV	38.2	46.0	7.8

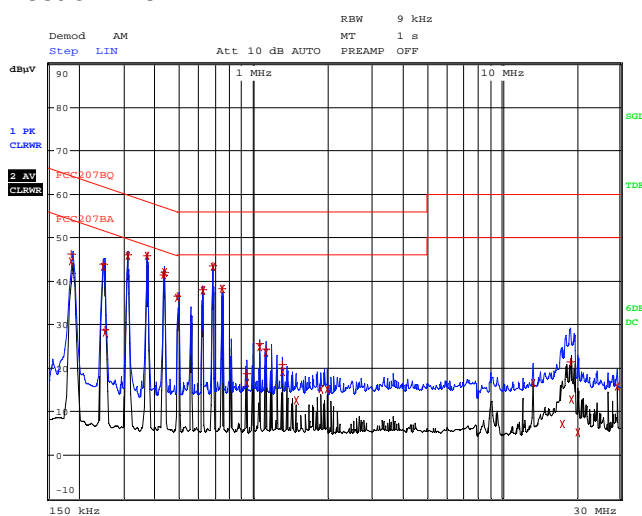
The table above contains worst-case emissions, only. For further details refer to the test plots.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S1
 Serial No(s): 191130008
 Test Date: 2015-08-10

The EUT meets the requirements of this section.

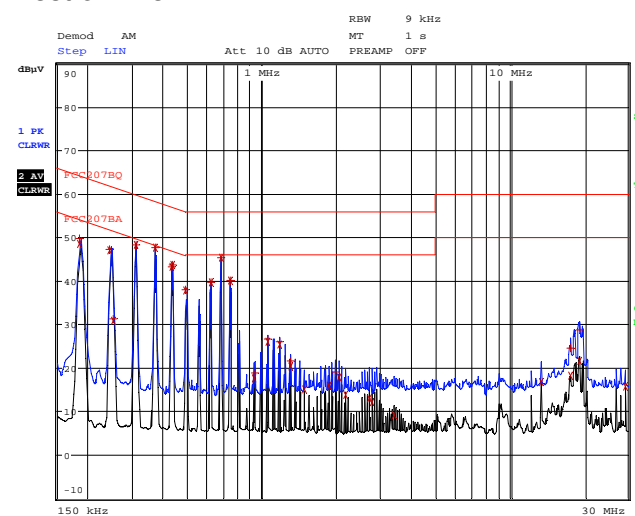
5.7 Measurement Plots Type T40HS-S1

Test on line N:



Manufacturer: HBM, EUT: TFHS #1, normal operation, Power: 11
 5Vac / 60 Hz, Line: N
 Date: 10.AUG.2015 14:29:10

Test on line L:



Manufacturer: HBM, EUT: TFHS #1, normal operation, Power: 11
 5Vac / 60 Hz, Line: L
 Date: 10.AUG.2015 14:36:22

5.8 Test Result Type T40HS-S0-MPZ1402023

Freq [MHz]	Line	Detector	Result [dBμV]	Limit [dBμV]	Margin
0.185	L	AV	51.0	54.3	3.3
0.680	L	AV	42.1	46.0	3.9
0.495	L	AV	41.6	46.1	4.5
0.245	L	AV	46.8	51.9	5.1
0.310	L	AV	44.6	50.0	5.3
0.435	L	AV	40.8	47.2	6.4
0.680	N	AV	40.6	46.0	5.4
0.495	N	AV	40.0	46.1	6.1
0.185	N	AV	47.7	54.3	6.6
0.310	N	AV	42.8	50.0	7.2
0.250	N	AV	44.1	51.8	7.6
0.435	N	AV	39.0	47.2	8.2

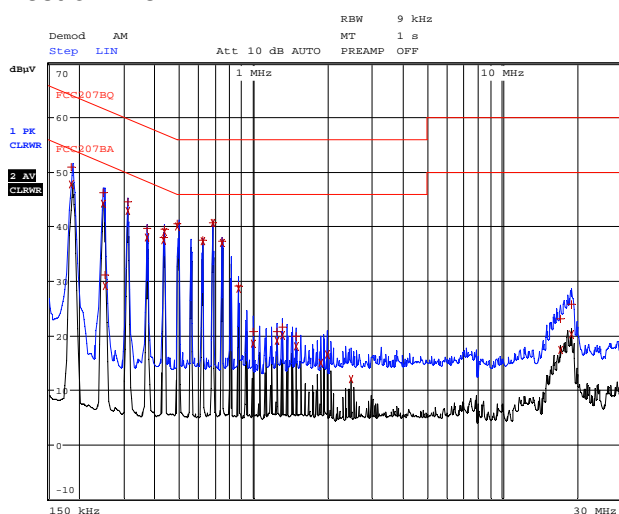
The table above contains worst-case emissions, only. For further details refer to the test plots.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S0-MPZ1402023
 Serial No(s): 192540009
 Test Date: 2015-11-20

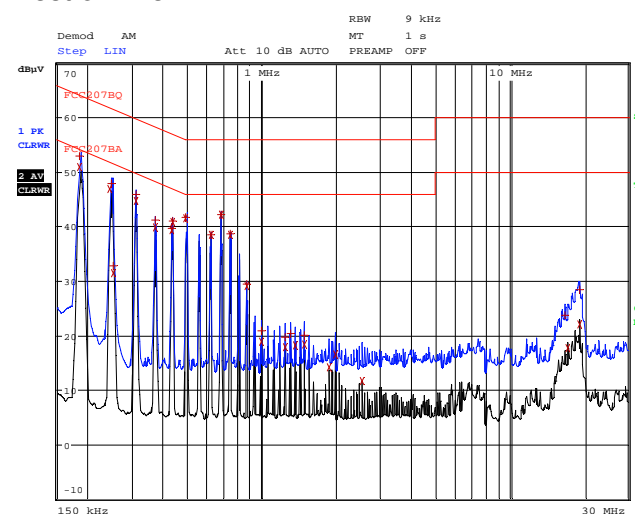
The EUT meets the requirements of this section.

5.9 Measurement Plots Type T40HS-S0-MPZ1402023

Test on line N:



Test on line L:



EUT: MPZ1402023, normal operation, Power: 115Vac / 60 Hz, Li
 ne: N
 Date: 20.NOV.2015 11:14:03

EUT: MPZ1402023, normal operation, Power: 115Vac / 60 Hz, Li
 ne: L
 Date: 20.NOV.2015 11:09:35

6 OCCUPIED BANDWIDTH (99%)

Test requirement: IC RSS-Gen Issue 4, 6.6

Test procedure: IC RSS-Gen Issue 4, 6.6

6.1 Regulation

IC RSS-Gen 6.6 Occupied Bandwidth

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. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth

6.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
Spectrum Analyzer	Rohde & Schwarz / ESU	3846	2015-08	2016-08
Antenna (9 kHz – 30 MHz)	Rohde & Schwarz HFH-Z2	374	2014-06	2016-06

6.3 Test Procedures

6.3.1 Test Procedure 523 kHz Carrier for Energy Transfer

Measurement was performed in a semi-anechoic room. The EUT was tested on a 0.8 meter high tabletop and was connected to its associated peripherals. The antenna was positioned with its plane vertical at about 3 m distance from the EUT. The analyzer was setup at the nominal centre frequency of the EUT. For the 522.88 kHz carrier the span was 200 Hz/ 10kHz, the resolution bandwidth 10 Hz /1 kHz and the video bandwidth 30 Hz / 3 kHz. A max peak hold was used to measure the occupied bandwidth. There was no torque applied to the EUT during the test.

6.3.2 Test Procedure 1.22 MHz kHz Carrier for Data Transmission

The occupied bandwidth of the data transfer carrier (1.22 MHz) was calculated according to TRC-43, Issue 3, November 2012. The measured signal level was too low for a measurement with sufficient signal to noise distance.

$$\text{Formula for PSK: } B_n = \frac{2 \times R \times K}{\log_2 S}$$

$$R = 1.2 \text{ Mbps}^1$$

$$K = 1$$

$$S = 3^1$$

$$B_n = 1.514 \text{ MHz}$$

Note ¹: Information provided by customer

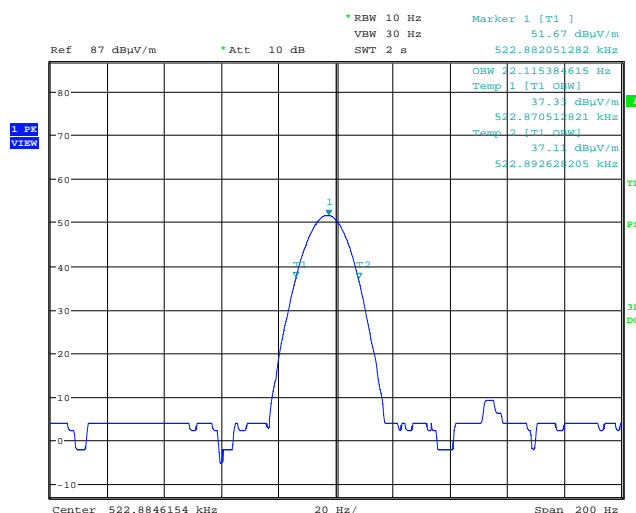
6.4 Test Result Type T40HS-S0

Occupied Bandwidth (99%), 523 kHz carrier	[Hz]	22.1
Occupied Bandwidth (99%), 1.22 MHz carrier	[MHz]	1.514

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S0
 Serial No(s): 192940010
 Test Date: 2015-09-16

The EUT meets the requirements of this section.

6.4.1 Measurement Plot Type T40HS-S0 (523 kHz carrier)



Manufacturer: HBM, EUT: TFHS #2, EUT axis horizontal, max H-Field
 Date: 16.SEP.2015 09:59:42

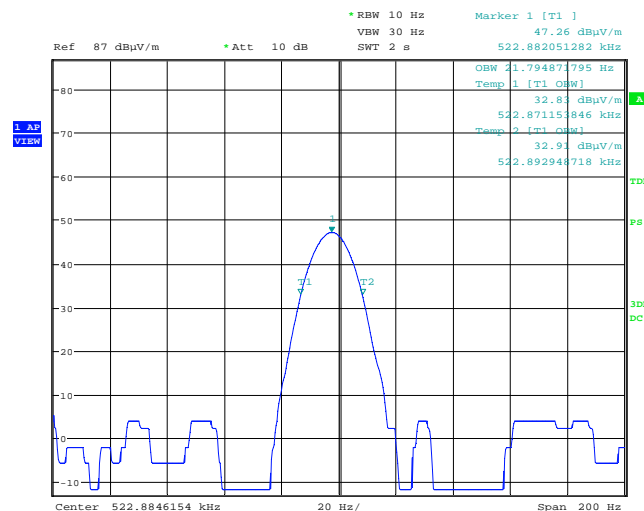
6.5 Test Result Type T40HS-S1

Occupied Bandwidth (99%), 523 kHz carrier	[Hz]	21.8
Occupied Bandwidth (99%), 1.22 MHz carrier	[MHz]	1.514

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S1
 Serial No(s): 191130008
 Test Date: 2015-08-10

The EUT meets the requirements of this section.

6.5.1 Measurement Plot Type T40HS-S1 (523 kHz carrier)



Manufacturer: HBM, EUT: TFHS #1, EUT axis horizontal, max H-Field
 Date: 10.AUG.2015 10:56:59

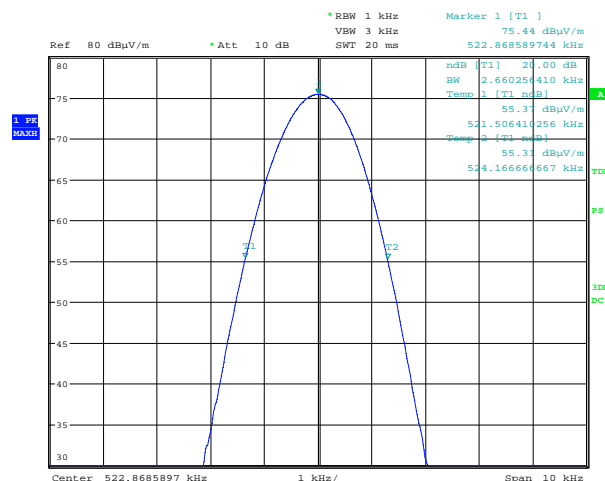
6.6 Test Result Type T40HS-S0-MPZ1402023

Occupied Bandwidth (99%), 523 kHz carrier	[kHz]	2.66
Occupied Bandwidth (99%), 1.22 MHz carrier	[MHz]	1.514

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S0-MPZ1402023
 Serial No(s): 192540009
 Test Date: 2015-11-20

The EUT meets the requirements of this section.

6.6.1 Measurement Plot Type T40HS-S0-MPZ1402023 (523 kHz carrier)



EUT: MPZ1402023
 Date: 20.NOV.2015 09:01:33

7 RADIATED EMISSIONS 9 kHz – 30 MHz

Test requirement: FCC 47 CFR, §15.205, 15.209
IC RSS-Gen Issue 4, 6.13, 8.9, 8.10, RSS-210 Issue 8 A2.2
Test procedure: ANSI C63.10-2013, RSS-Gen

7.1 Regulation

FCC 15.33 Frequency range of radiated measurements:

(a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz [...]

FCC 15.35 Measurement detector functions and bandwidths.

The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part:

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified.

(c) Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

FCC 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength		Measurement distance
[MHz]	[$\mu\text{V/m}$]	[dB($\mu\text{V/m}$)]	[m]
0.009–0.490	2400/F[kHz]	67.6 – 20 logF[kHz]	300
0.490–1.705	24000/F[kHz]	87.6 – 20 logF[kHz]	30
1.705–30.0	30	29.5	30

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

RSS-210 A2.2 Band 510-1705 kHz

Devices using this band shall comply with one of the following limits:

- (a) The total input power to the final radio frequency stage shall not exceed 100 milliwatts, and the total length of transmission line, antenna and ground lead (if used) shall not exceed 3 metres; or
- (b) The field strength of radiated emissions shall not exceed 250 microvolts/m measured at 30 metres.
- (c) Transmitters that employ a leaky coaxial cable as a radiating antenna may meet the field strength limit of 15 microvolts/m, as measured at a distance of $47715/(\text{frequency in kHz})$ metres (equivalent to wavelength/(2π)) from the coaxial cable.
- (d) Emissions outside of this band shall be attenuated by at least 20 dB below the mean transmitter output power, or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

IC RSS-Gen 6.13 Transmitter Unwanted Emissions

The measurement method shall be described in the test report. When the applicable unwanted emissions limits are defined in relative terms, the same parameter, peak power or average power, used for the transmitter's output power measurement shall also be used for the unwanted emission measurements.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given below:

- (a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency, as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

When limits are expressed in absolute terms, compliance with the emission limits below 1000 MHz shall be demonstrated using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limits can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.

Above 1000 MHz, compliance with the emission limits shall be demonstrated using an average detector with a minimum resolution bandwidth of 1 MHz.

IC RSS-Gen 8.9 Transmitter Emission Limits for Licence-Exempt Radio Apparatus

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 - General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Below 30 MHz

Frequency	Electric Field Strength (µV/m)	Magnetic Field Strength (H-Field) (µA/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1,705-30 MHz	30	N/A	30

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector. Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the relevant RSS

IC RSS-Gen 8.10 Restricted Frequency Bands

[...]

(b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and

(c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

7.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
Antenna (9 kHz – 30 MHz)	Rohde & Schwarz HFH-Z2	374	2014-06	2016-06
Receiver (20 Hz - 8 GHz)	Rohde & Schwarz ESU8	3846	2015-08	2016-08

7.3 Test Procedures

The measurement was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.10 clause 4.5.1 was positioned with its plane vertical at the test distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop antenna was 1 m above the ground.

The EUT was tested on a wooden support on the groundplane, the axis was horizontal.

The EUT was connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter.

In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.

Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode.

Worst case emissions are listed under chapter: Final test results.

Radiated Emissions Test Characteristics	
Frequency range	9 kHz - 30 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	200 Hz (9 kHz - 150 kHz)
	10 kHz (150 kHz - 30 MHz)
Receive antenna height	1 m
Receive antenna polarization	Vertical

* According to Section 15.31 (f)(2): At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The 40 dB/decade factor was used.

7.4 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the band 1.705–30.0 MHz:

$\mu\text{V/m}$ at 30 meters = 30

30 $\mu\text{V/m}$ corresponds with 29.5 dB $\mu\text{V/m}$.

7.5 Field Strength Calculation

All emission measurements performed using the test receiver's transducer factor setting capability, i.e. the field strength value measured directly without the necessity of additional correction factors.

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f)(2) the field strength is calculated by adding additionally an extrapolation factor of 40 dB/decade (inverse linear-distance for field strength measurements). The basic equation with a sample calculation is as follows:

$$FS = FST + DF$$

where

FS = Field Strength in dB $\mu\text{V/m}$

FST = Field Strength at test distance in dB $\mu\text{V/m}$

DF = Distance Extrapolation Factor in dB,

where $DF = 40 \log (D_{\text{test}}/D_{\text{spec}})$ where D_{test} = Test Distance and D_{spec} = Specified Distance

Assume the tests performed at a reduced Test Distance of 3 m instead of the Specified Distance of 30 m giving a Distance Extrapolation Factor of $DF = 40 \log (3 \text{ m}/30 \text{ m}) = -40 \text{ dB}$.

Assuming a measured field strength level of 58.8 dB $\mu\text{V/m}$ is obtained. The Distance Factor of -40 dB is added, giving a field strength of 18.8 dB $\mu\text{V/m}$. The 18.8 dB $\mu\text{V/m}$ value can be mathematically converted to its corresponding level in $\mu\text{V/m}$.

$$FS = 58.8 - 40 = 18.8 \text{ [dB}\mu\text{V/m]}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } (18.8/20) = 8.7$$

7.6 Final Test Type T40HS-S0

Frequency	Detector	3m_Result	Distance Correction	30m_Result	30m_Limit	300m_Result	300m_Limit	Margin
[MHz]		[dB(μV/m)]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]
0.5229	QP	52.1	-40	12.1	33.2			21.1

The table above contains worst-case emissions, only. For further details refer to the measurement plot. Measurements with more than 25dB margin have not been reported.

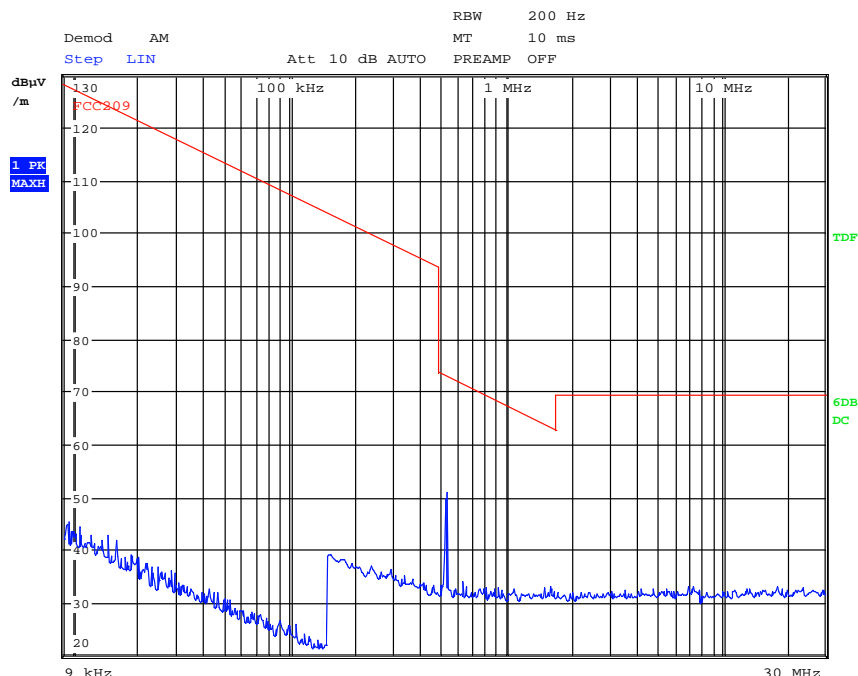
Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S0
 Serial No(s): 192940010
 Test Date: 2015-09-15

All emissions in the range 9 kHz to 30 MHz are below the specified limits.

The EUT meets the requirements of this section.

7.7 Measurement Plot Type T40HS-S0

Test distance d = 3 m



Manufacturer: HBM, EUT: TFHS #2, EUT axis horizontal, H-ante
 nna 2 directions, EUT 4 directions
 Date: 16.SEP.2015 09:40:47

7.8 Final Test Type T40HS-S1

Frequency [MHz]	Detector	3m_Result [dB(μV/m)]	Distance Correction [dB]	30m_Resul t [dB(μV/m)]	30m_Limit [dB(μV/m)]	300m_Res ult [dB(μV/m)]	300m_Limi t [dB(μV/m)]	Margin [dB]
0.523	QP	47.5	-40	7.5	33.2			25.7

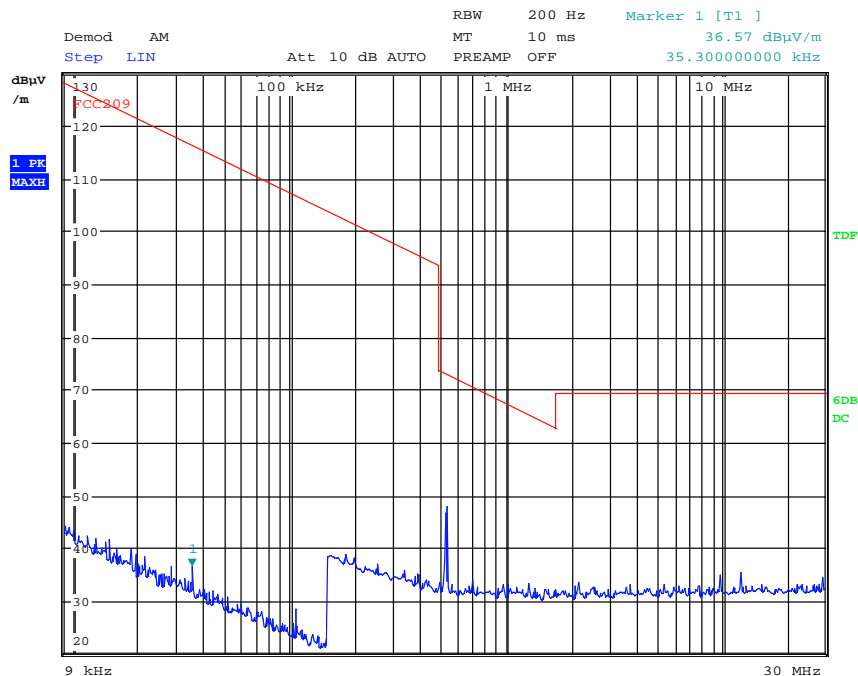
The table above contains worst-case emissions, only. For further details refer to the measurement plot. Measurements with more than 25dB margin have not been reported, beside the 523 kHz carrier.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S1
 Serial No(s): 191130008
 Test Date: 2015-08-10

All emissions in the range 9 kHz to 30 MHz are below the specified limits.

The EUT meets the requirements of this section.

7.9 Measurement Plot Type T40HS-S1



Manufacturer: HBM, EUT: TFHS #1, EUT axis horizontal, H-ante
 nna 2 directions, EUT 4 directions
 Date: 10.AUG.2015 10:33:08

7.10 Final Test Type T40HS-S0-MPZ1402023

Frequency [MHz]	Detector	3m_Result [dB(μV/m)]	Distance Correction [dB]	30m_Resul t [dB(μV/m)]	30m_Limit [dB(μV/m)]	300m_Res ult [dB(μV/m)]	300m_Limi t [dB(μV/m)]	Margin [dB]
0.523	QP	47.5	-40	7.5	33.2			25.7

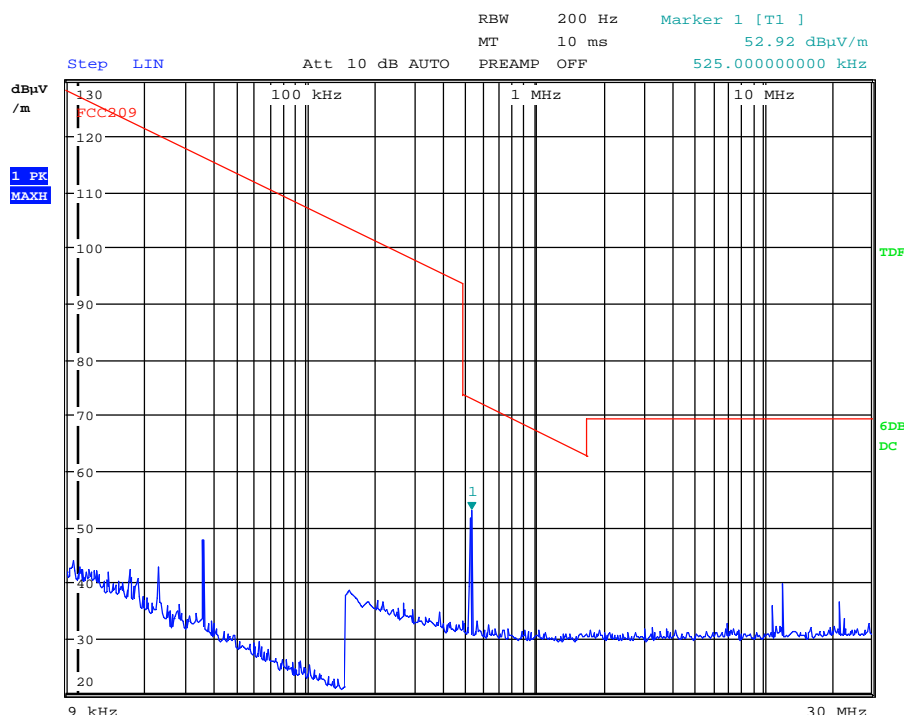
The table above contains worst-case emissions, only. For further details refer to the measurement plot. Measurements with more than 25dB margin have not been reported, beside the 523 kHz carrier.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
 Device: T40HS Torquemeter
 Type(s): T40HS-S0-MPZ14020231
 Serial No(s): 192540009
 Test Date: 2015-11-20

All emissions in the range 9 kHz to 30 MHz are below the specified limits.

The EUT meets the requirements of this section.

7.11 Measurement Plot Type T40HS-S0-MPZ1402023



EUT: MPZ1402023, H-antenna 2 directions, EUT 4 directions

Date: 20.NOV.2015 14:25:32

8 RADIATED EMISSIONS 30 MHz – 1000 MHz

Test Requirement: FCC 47 CFR, §15.205, 15.209
IC RSS-Gen Issue 4, 6.13, 8.9, 8.10, RSS-210 Issue 8 A2.2
Test Procedure: ANSI C63.10-2013, IC RSS-Gen

8.1 Regulation

FCC 15.33 Frequency range of radiated measurements:

(a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1)-(a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this Section, whichever is the higher frequency range of investigation.

FCC 15.35 Measurement detector functions and bandwidths.

The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part:

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

Note: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

FCC 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency [MHz]	Field Strength		Measurement Distance
	[μ V/m]	[dB(μ V/m)]	[m]
30–88	100	40.0	3
88–216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

RSS-210 A2.2 Band 510-1705 kHz

Devices using this band shall comply with one of the following limits:

- (a) The total input power to the final radio frequency stage shall not exceed 100 milliwatts, and the total length of transmission line, antenna and ground lead (if used) shall not exceed 3 metres; or
- (b) The field strength of radiated emissions shall not exceed 250 microvolts/m measured at 30 metres.
- (c) Transmitters that employ a leaky coaxial cable as a radiating antenna may meet the field strength limit of 15 microvolts/m, as measured at a distance of $47715/(\text{frequency in kHz})$ metres (equivalent to $\text{wavelength}/(2\pi)$) from the coaxial cable.
- (d) Emissions outside of this band shall be attenuated by at least 20 dB below the mean transmitter output power, or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

IC RSS-Gen 6.13

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given below:

- (a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

IC RSS-Gen 8.9

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission

Table 4 - General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

IC RSS-Gen 8.10 Restricted Frequency Bands

[...]

(b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and

(c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

8.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
Antenna (30 MHz – 300 MHz)	Schwarzbeck VHA 9103	899	2015-05	2017-05
Antenna (200 MHz – 2000 MHz)	Schwarzbeck VUSLP 9111B	3203	2015-05	2017.05
Receiver (9 kHz - 1 GHz)	Rohde & Schwarz ESS	303	2015-03	2016-03

8.3 Test Procedures

The EUT was tested on a wooden support on the groundplane, the axis was horizontal.

In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.

With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions *[Remark: Not applicable]*.

Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode.

Final measurement performed up to the tenth harmonic of the carrier according to FCC Section 15.33.

Worst case emissions are listed under chapter: Test Results.

Radiated Emissions Test Characteristics	
Frequency range	30 MHz - 1000 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. (...) When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

8.4 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the restricted band 108-121.94 MHz:

$\mu\text{V/m}$ at 3 meters = 150

150 $\mu\text{V/m}$ corresponds with 43.5 dB $\mu\text{V/m}$.

8.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where

FS = Field Strength in dB $\mu\text{V/m}$

RA = Receiver Amplitude in dB μV

AF = Antenna Factor in dB(1/m)

CF = Cable Attenuation Factor in dB

Assume a receiver reading of 23.5 dB μV is obtained. The Antenna Factor of 7.4 dB(1/m) and a Cable Factor of 1.1 dB are added, giving a field strength of 32 dB $\mu\text{V/m}$. The 32 dB $\mu\text{V/m}$ value can be mathematically converted to its corresponding level in $\mu\text{V/m}$.

$$FS = 23.5 + 7.4 + 1.1 = 32 \text{ [dB}\mu\text{V/m]}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } (32/20) = 39.8$$

8.6 Final Test Results T40HS-S0

Frequency	Reading	Antenna factor	Result	Limit	Margin	Polarisation
[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	h / v
30.54	10.5	19.2	29.6	40	10.4	v
31.72	11.0	18.7	29.7	40	10.3	v
41.48	9.9	15.0	24.9	40	15.1	v
50.02	8.2	12.4	20.6	40	19.4	v
210.00	6.8	19.5	26.3	43.5	17.2	h

All tests performed at 3 m distance. The table above contains worst-case emissions for the normal mode, only. For further details refer to the pre-scan test plots. Measurements with more than 25dB Margin have not been reported.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
Device: T40HS Torquemeter
Type(s): T40HS-S0
Serial No(s): 192940010
Test Date: 2015-09-16

All emissions in the range 30 MHz to 1000 MHz are below the specified limits.

The EUT meets the requirements of this section.

8.7 Pre-scan Plot Type T40HS-S0

Prescan 30 -300 MHz:

EMCC DR. RAŠEK

16. Sep 15 10:12

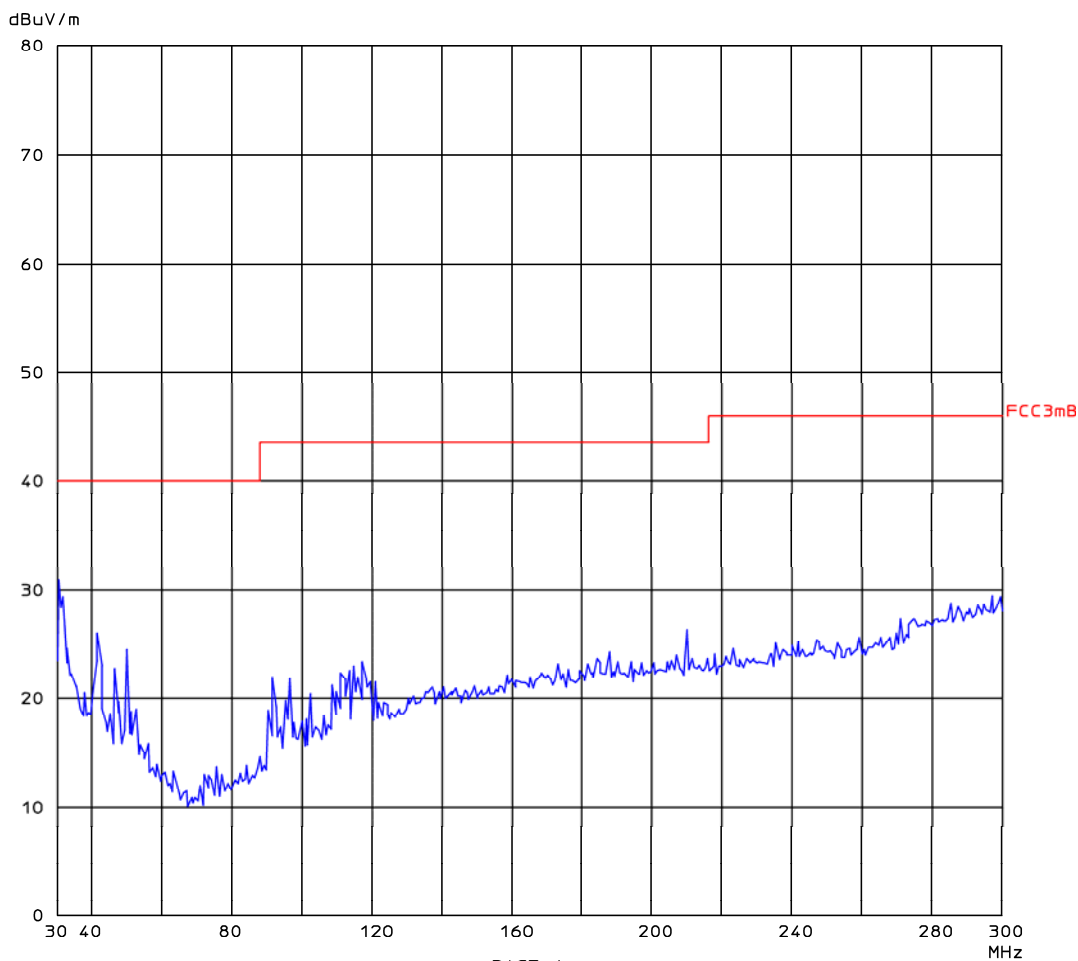
Radiated Emissions Prescan in SAR, d=3m

EUT: TFHS #2
 Manuf: HBM
 Op Cond: Normal Operation
 Operator: L. Kraft
 Test Spec: FCC 15.209
 Comment: 4 sides, ant. pol. hor + vert, 3.4 heights

Fast Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	300M	40k	120k	PK	0.10ms	0dBLN	ON	60dB

Transducer	No.	Start	Stop	Name
	21	30M	350M	899K26



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Prescan 300 -1000 MHz:

EMCC DR. RAŠEK

16. Sep 15 13:57

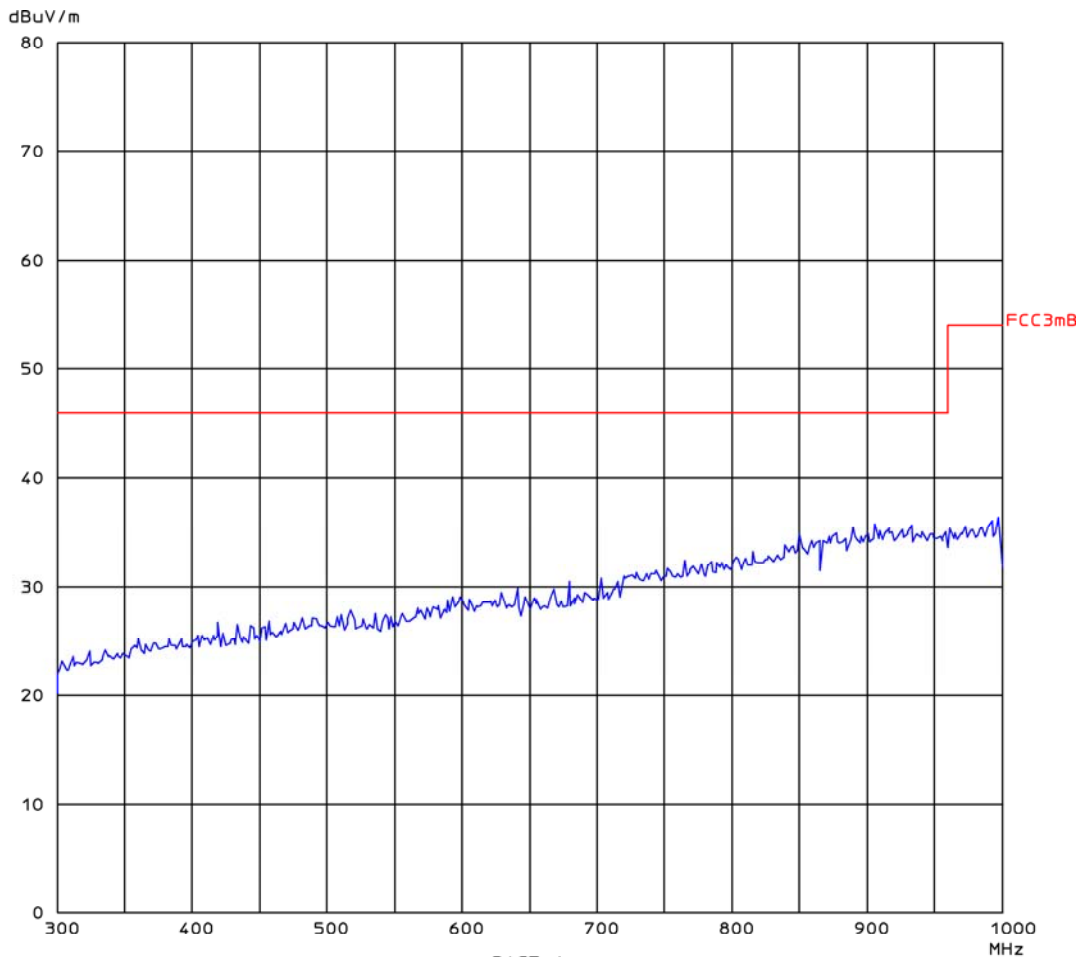
Radiated Emissions Prescan in SAR, d=3m

EUT: TFHS #2
 Manuf: HBM
 Op Cond: Normal Operation
 Operator: L. Kraft
 Test Spec: FCC 15.209
 Comment: 4 sides, ant. pol. hor & ver, 3,4 heights

Fast Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
300M	1000M	40k	120k	PK	0.10ms	0dB	LN ON	60dB

Transducer	No.	Start	Stop	Name
	22	150M	1000M	3201K26



12.png

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8.8 Final Test Results T40HS-S1

Frequency	Reading	Antenna factor	Result	Limit	Margin	Polarisation
[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	h / v
30.50	18.0	19.2	37.2	40	2.8	v
41.48	13.6	15.0	28.5	40	11.5	v
50.02	11.9	12.4	24.3	40	15.7	v
104.93	12.0	13.0	25.0	43.5	18.5	h
117.13	12.3	14.3	26.6	43.5	16.9	h
184.24	10.8	19.0	29.8	43.5	13.7	h

All tests performed at 3 m distance. The table above contains worst-case emissions for the normal mode, only. For further details refer to the pre-scan test plots. Measurements with more than 25dB Margin have not been reported.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
Device: T40HS Torquemeter
Type(s): T40HS-S0
Serial No(s): 192940010
Test Date: 2015-09-16/17

All emissions in the range 30 MHz to 1000 MHz are below the specified limits.

The EUT meets the requirements of this section.

8.9 Pre-scan Plot Type T40HS-S1

Prescan 30 - 300 MHz

EMCC DR. RASEK

16. Sep 15 15:19

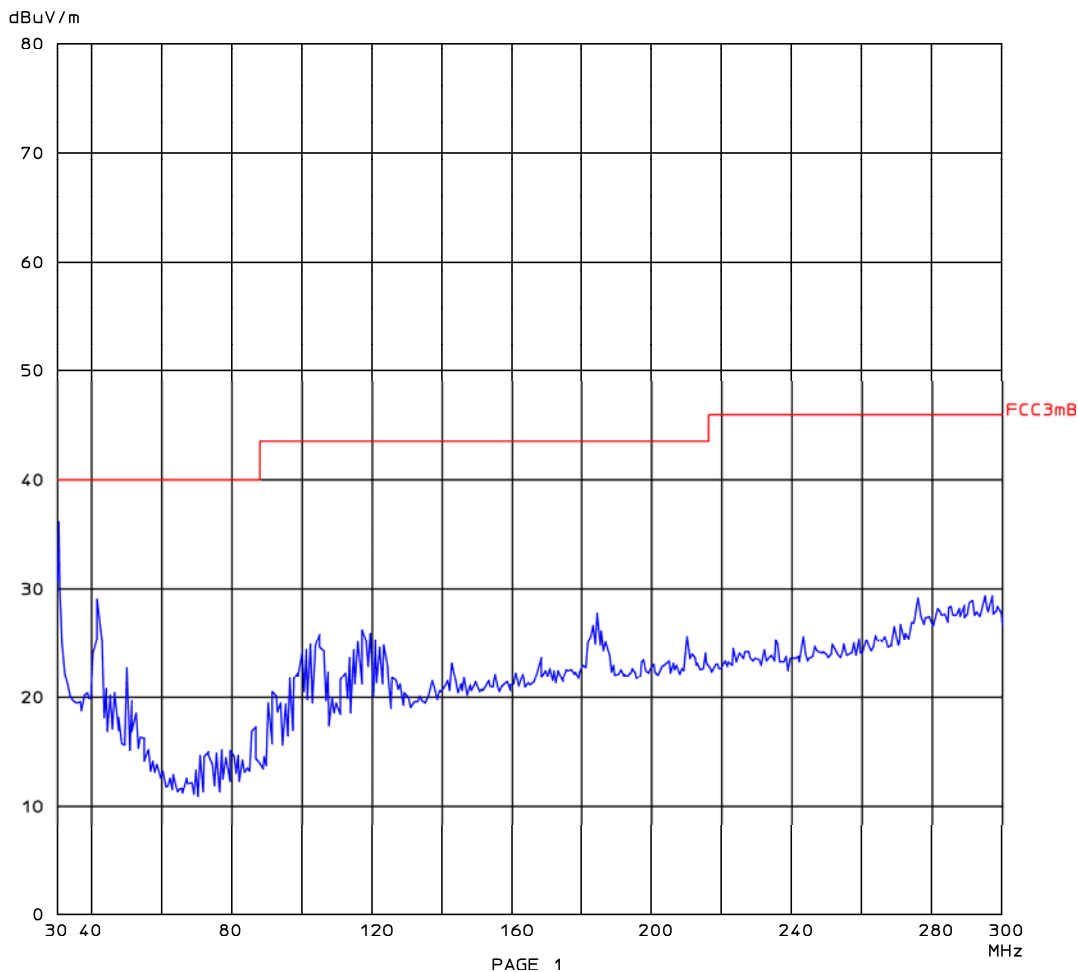
Radiated Emissions Prescan in SAR, d=3m

EUT: TFHS #1
 Manuf: HBM
 Op Cond: Normal Operation
 Operator: L. Kraft
 Test Spec: FCC 15.209
 Comment: 4 sides, ant. pol. hor + vert, 3,4 heights

Fast Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	300M	40k	120k	PK	0.10ms	0dBLN	ON	60dB

Transducer	No.	Start	Stop	Name
	21	30M	350M	899K26



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Prescan 30 - 300 MHz

EMCC DR. RAŠEK

16. Sep 15 14:28

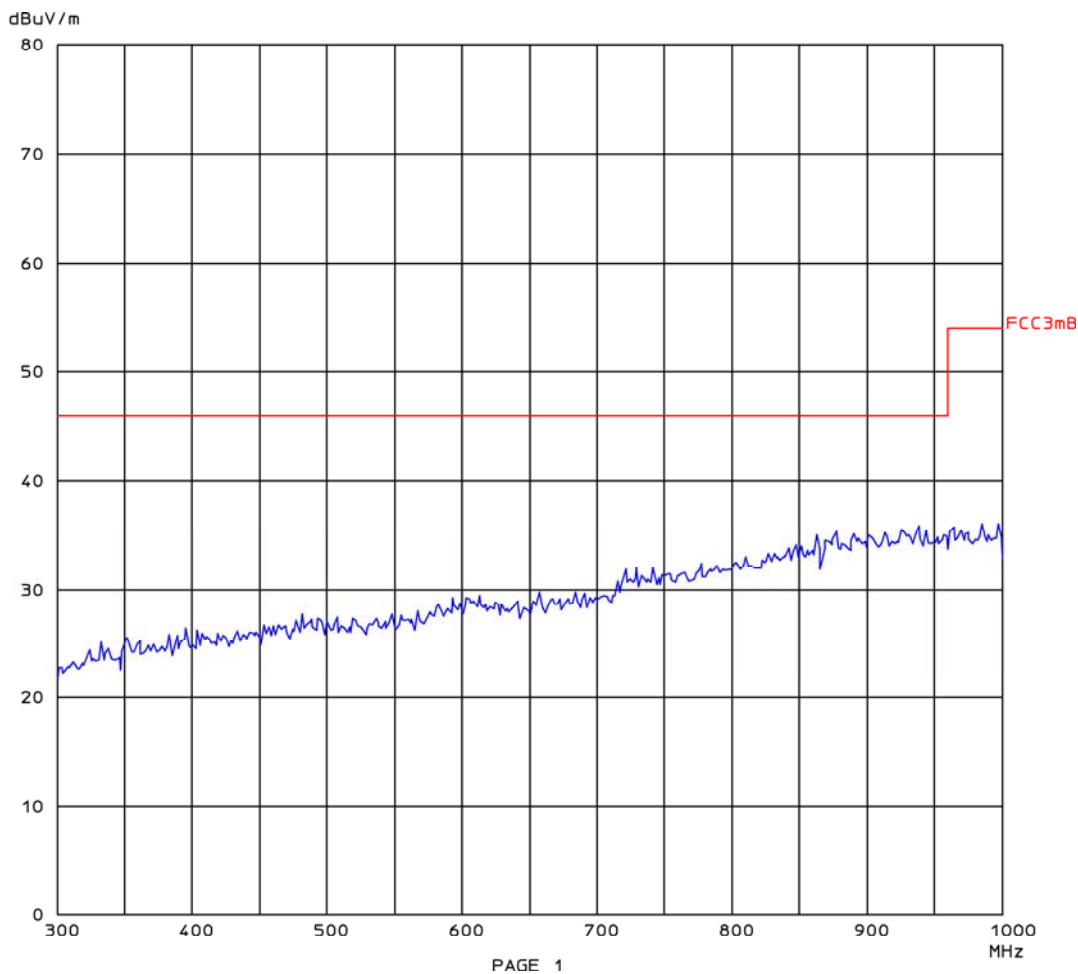
Radiated Emissions Prescan in SAR, d=3m

EUT: TFHS #1
 Manuf: HBM
 Op Cond: Normal Operation
 Operator: L. Kraft
 Test Spec: FCC 15.209
 Comment: 4 sides, ant. pol. hor & ver, 3,4 heights

Fast Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
300M	1000M	40k	120k	PK	0.10ms	0dBLN	ON	60dB

Transducer	No.	Start	Stop	Name
	22	150M	1000M	3201K26



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8.10 Final Test Results T40HS-S0-MPZ1402023

Frequency	Reading	Antenna factor	Result	Limit	Margin	Polarisation
[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	h / v
30.50	13.9	19.4	33.3	40	6.8	v
32.90	6.1	18.4	24.5	40	15.5	v
61.00	10.9	9.3	20.2	40	19.8	v
102.50	13.5	12.6	26.1	43.5	17.4	h
211.00	6.0	19.3	25.3	43.5	18.2	h
336.20	14.0	18.5	32.5	46	13.5	h

All tests performed at 3 m distance. The table above contains worst-case emissions for the normal mode, only. For further details refer to the pre-scan test plots. Measurements with more than 25dB Margin have not been reported.

Manufacturer: Hottinger Baldwin Messtechnik GmbH
Device: T40HS Torquemeter
Type(s): T40HS-S0-MPZ1402023
Serial No(s): 192540009
Test Date: 2015-11-19

All emissions in the range 30 MHz to 1000 MHz are below the specified limits.

The EUT meets the requirements of this section.

8.11 Pre-scan Plot Type T40HS-S0-MPZ1402023

Prescan 30 -300 MHz

EMCC DR. RAŠEK

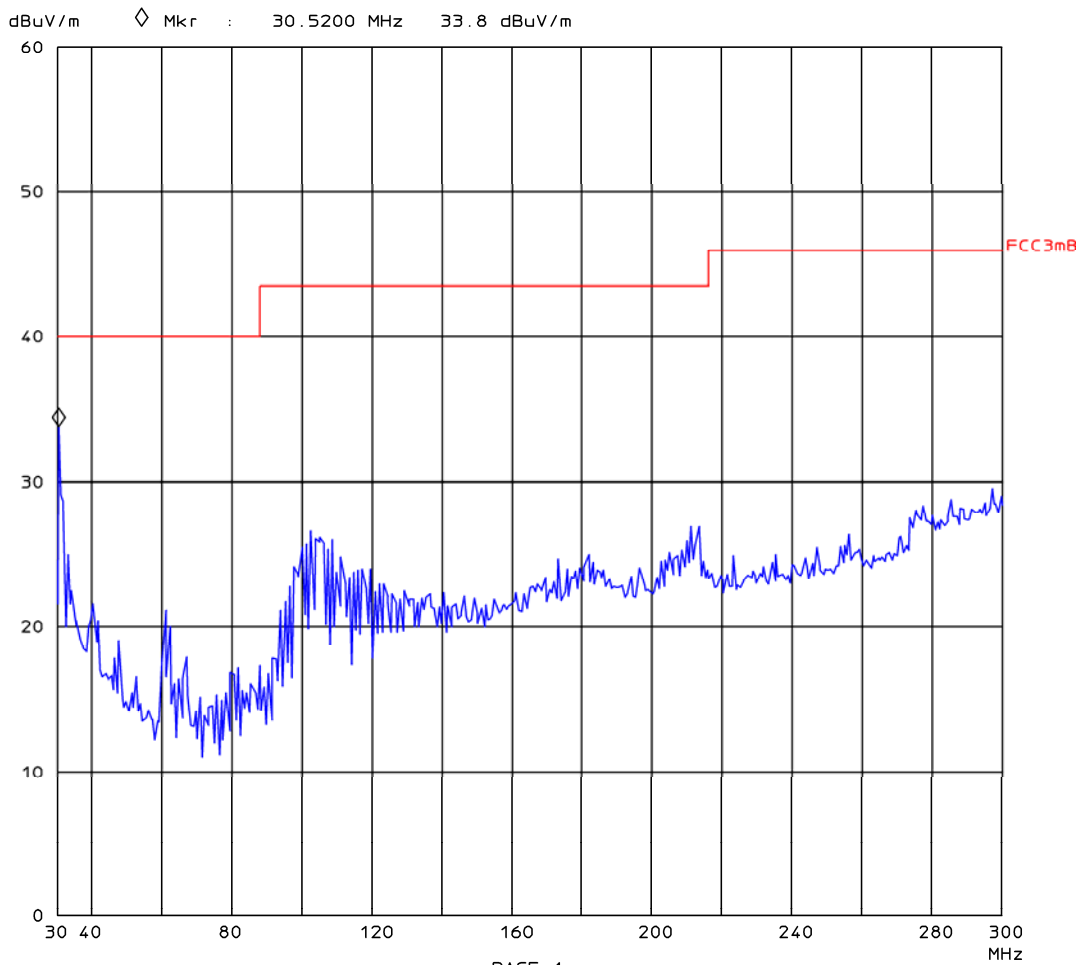
19. Nov 15 11:43

Radiated Emissions Prescan in SAR, d=3m

EUT: MPZ1402023
 Manuf: HBM
 Op Cond: normal operation
 Operator: Zenk

Fast Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	300M	40k	120k	PK	0.10ms	0dB	LN ON	60dB
			Transducer	No.	Start	Stop	Name	
				21	30M	300M	89926k3	



Prescan 30 -300 MHz

EMCC DR. RAŠEK

19. Nov 15 14:28

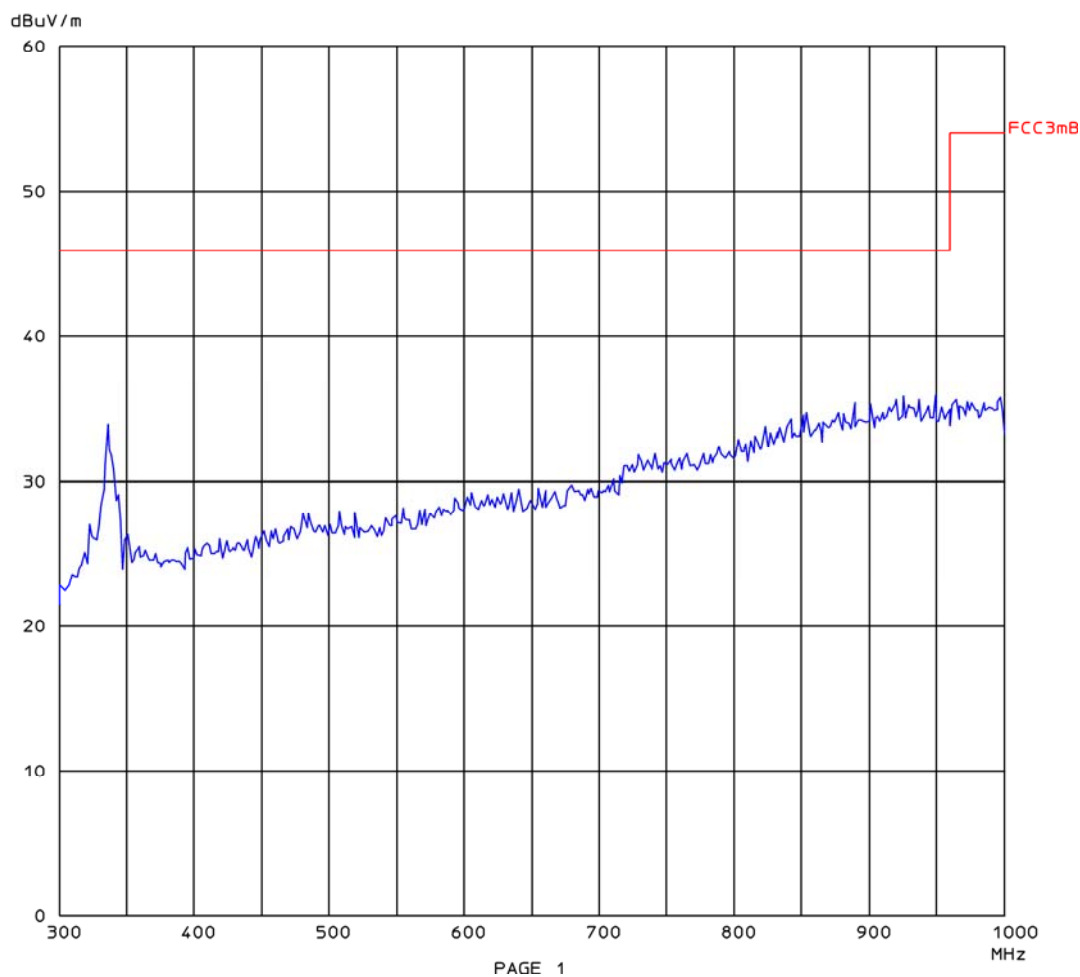
Radiated Emissions Prescan in SAR, d=3m

EUT: MPZ1402023
 Manuf: HBM
 Op Cond: Normal Operation
 Operator: Zenk

Fast Scan Settings (1 Range)

Fast Scan Settings (1 Range)			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
300M	1000M	40k	120k	PK	0.10ms	0dB	ON	60dB

Transducer	No.	Start	Stop	Name
	22	150M	1000M	3201K26



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9 LIST OF ANNEXES

Following annexes are separated parts from this test report.

Description	Pages
Annex 1: Photographs of test set-up	2
Annex 2: Photographs of equipment under test (EUT)	2