TEST REPORT # EMCC-140591ABCB, 2015-04-30

This report replaces Test Report # EMCC-140591ABC, 2015-04-09

EQUIPMENT UNDER TEST:

Device:	FSC1/7
Serial Number:	021
FCC ID:	2ADM7FSC1-7
Application:	Paint thickness gauge
Manufacturer:	FI Test- und Messtechnik GmbH
Address:	Breitscheidstraße 17 39114 Magdeburg Germany
Phone:	+49 391 503894-35
Fax:	+49 391 503894-39

RELEVANT STANDARD(S): 47 CFR §15.107, §15.109

MEASUREMENT PROCEDURE:

☒ ANSI C63.10-2009 ☐ RSS-Gen Issue 3 ☐ Other

TEST REPORT PREPARED BY:

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TEST PERSONNEL:

Patrick Reusch

HEAD OF COMMERCIAL EMC AND RADIO DEPT.:

Wolfgang Döring

CONTENTS

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance as a computer device peripheral with the 47 CFR §15.107 and §15.109 requirements for the certification of licence-exempt 15B Unintentional Radiator.

1.2 Limits and Reservations

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report. 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.
Phone:	+49 9194 9016
Fax:	+49 9194 8125
E-Mail:	emc.cons@emcc.de
Web:	www.emcc.de

1.4 Manufacturer

Company Name:	FI Test- und Messtechnik GmbH
Street:	Breitscheidstraße 17
City:	39114 Magdeburg
Country:	Germany
Name for contact purposes:	Mr Maik Richter
Phone:	+49 391 503894-35
Fax:	+49 391 503894-39
E-Mail:	maik.richter@fitm.de

1.5 Dates and Test Location

Date of receipt of EUT: 2015-03-16
Test Date: CW 12/2015
Test Location: Lab IV

1.6 Ordering Information

Purchase Order and Date: E-Mail, dated 2015-02-06
Vendor Number: none

1.7 Climatic Conditions

Date	Temperature [°C]	Relative Humidity [%]	Air Pressure [hPa]	Lab	Customer attended tests
2015-03-16	22	29	981	IV	yes
2015-03-17	23	31	983	IV	yes
2015-03-18	23	29	982	IV	yes

Note: Mr Maik Richter as a representative of FI Test- und Messtechnik GmbH attended the tests.

2 PRODUCT DESCRIPTION

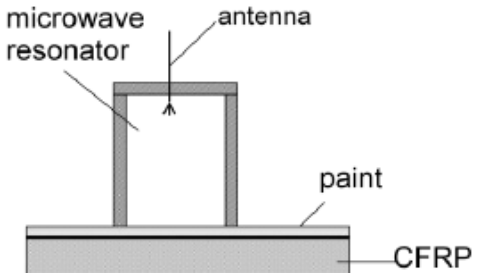
2.1 Equipment Under Test (EUT)

Trade Name:	FSC1/7
Serial Number:	021
FCC ID:	2ADM7FSC1-7
Application:	Paint thickness gauge
Transmit Frequency:	24.005 – 24.245 GHz
Modulation:	No Modulation, Sweep of CW-Signals
Power Supply:	5 VDC from USB-Connector
Ports:	USB-Connector
Antenna:	internal
Variants:	None
Remarks:	None

The following information was delivered by the customer:

The system consists of a hand-held module and a control and display module (e.g. Laptop or similar device).

The hand-held module includes the microwave components. It is intended for measuring a resonant frequency which is determined by a dielectric layer on a base substrate. The main part of the measure system, the resonator, and its application is shown in the picture below.



A cylindrical resonant cavity having a circular cylindrical wall and a plane wall on one end thereof, wherein the opposite end is open to be placed up on the dielectric layer on the substrate to form a wall of the resonant cavity on the opposite end.

- *An antenna located within said resonant cavity and adapted to excite an electromagnetic field in the resonant cavity.*

- *A reflection meter connected to said antenna and adapted to measure the resonant frequency of the resonant cavity. In this case, the reflection meter is a FMCW Transceiver. The FMCW Transceiver is driven, that only frequencies in the range from 24.005 to 24.245 GHz are adjustable.*

- *The Output-Power from the FMCW Transceiver is 10mW.*

- *A processor connected to said reflection meter and adapted to determine the resonant frequency of the resonant cavity.*

The FMCW Transceiver is on constantly whilst power is supplied.

2.2 Intended Use

The following information was delivered by the customer:

The FSC1/7 is suitable to measure the paint thickness (dielectric layer) on CFRP with and without lightning protection as well as on metal.

2.3 EUT Peripherals/Simulators

The EUT was tested being connected via USB to a notebook type Acer Aspire E15, series E5-571-32FU, model Z5WAH, S/N NXML8EG005422196VF3400.

Photo 2.3-1: Customer's notebook to operate EUT

Photo 2.3-2: Label of the notebook

2.4 Mode of operation during testing and test set-up

Due to the EUT's incapability to stop transmitting as declared by the manufacturer, the equipment under test (EUT) was operated during the tests under the following conditions:

Sweep mode:
the frequency was swept continuously sawtooth-shaped from the lowest to the highest settable frequency. This mode was applicable for measurements up to 18 GHz and replaced by mode Fmid for measurements above 18 GHz.

Fmid (Fixed CW frequency):
the transmitting frequency was set in the center of the operating band (24.125 GHz). This mode was used to replace the sweep-mode for measurements above 18 GHz.

2.5 Modifications required for compliance

None.

3 TEST RESULTS SUMMARY

Summary of test results for the following EUT:

Manufacturer: FI Test- und Messtechnik GmbH
Device: FSC1/7
Serial No: 021

Requirement	47 CFR Section	Report Section	Result
Conducted AC Power Line Emissions 150 kHz – 30 MHz	15.107	4	Passed
Radiated Emissions 30 MHz – 1000 MHz	15.109	5	Passed
Radiated Emissions 1 GHz – 40 GHz	15.109	6	Passed*

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

*Note: TX operating frequency at 24.125 GHz disregarded.

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 C63.10-2009. 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: Patrick Reusch
Issuance Date: 2015-04-30

4 POWER LINE CONDUCTED EMISSIONS TEST

Test Requirement: FCC 47 CFR, §15.107
Test Procedure: ANSI C63.10-2009

4.1 Regulation

FCC §15.3

(i) Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

FCC §15.107

(a) Except for Class A digital devices, for equipment 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 μH/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 band edges.

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.

4.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
EMI Test Receiver	R&S / ESU8	3846	2014-07	2015-07
V-LISN 50 Ω//(50 uH + 5 Ω)	R&S / ESH2-Z5	1901	2013-10	2015-10
Protector Limiter	R&S / ESH3-Z2	1519	2014-09	2015-09
AC Power Source	AEG / DAMK4/DAGK4	0001	n.a	n.a
Multimeter	Agilent / U1241B	3880	2014-04	2016-04

4.3 Test Procedures

The EUT was placed on a wooden table of nominal size 1 m by 1.5 m, raised 80 cm above the reference groundplane. The vertical conducting wall of the screened room was located 40 cm to the rear of the EUT.
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, reference ground plane and the vertical conducting wall of the screened room was bonded together.

4.4 Test Result

Line: N			
Freq. [MHz]	Detector	Result [dBµV]	Margin [dB]
0.165	CISPR QP	48.8	16.4
0.170	CISPR AV	34.5	20.4
0.175	CISPR QP	48.3	16.4
0.175	CISPR AV	35.2	19.5
0.220	CISPR QP	40.8	22.1
0.230	CISPR QP	41.2	21.3
0.230	CISPR AV	29.6	22.8
0.420	CISPR QP	40.7	16.7
0.430	CISPR AV	30.0	17.2
0.435	CISPR QP	38.5	18.6
0.435	CISPR AV	26.5	20.6
0.965	CISPR AV	22.8	23.2

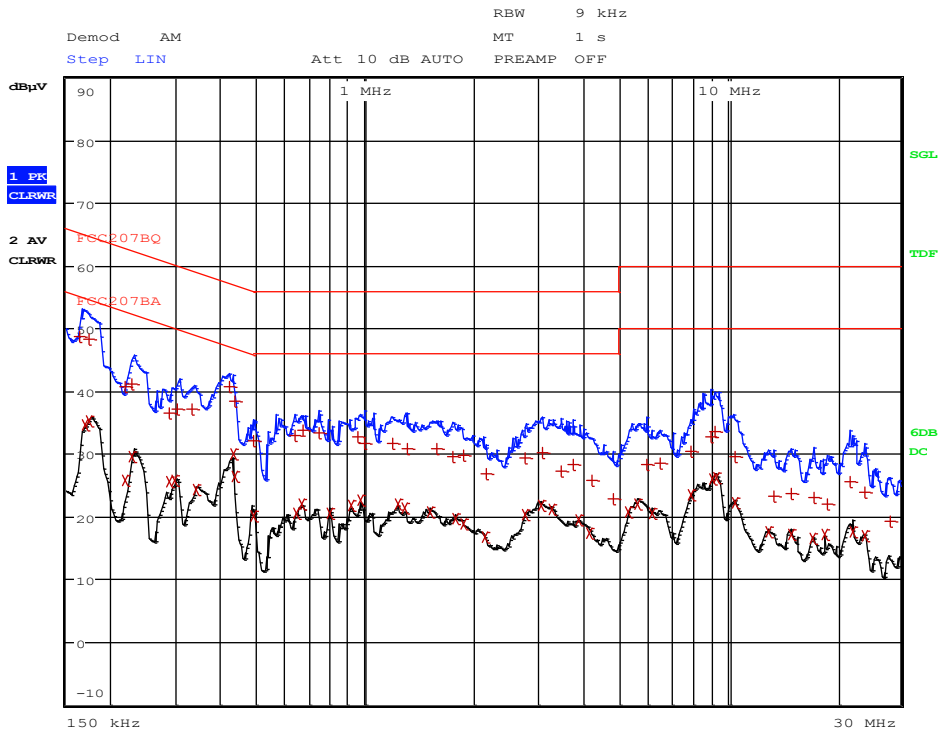
Line: L			
Freq. [MHz]	Detector	Result [dBµV]	Margin [dB]
0.150	CISPR AV	35.2	20.8
0.155	CISPR QP	45.2	20.5
0.180	CISPR QP	42.0	22.5
0.180	CISPR AV	29.5	25.0
0.225	CISPR QP	37.3	25.4
0.350	CISPR AV	27.4	21.6
0.370	CISPR QP	37.0	21.5
0.390	CISPR QP	37.8	20.3
0.395	CISPR AV	29.7	18.3
0.490	CISPR AV	23.0	23.2
0.495	CISPR QP	31.3	24.8
0.495	CISPR AV	22.7	23.4

Note: worst case measurements listed, only.

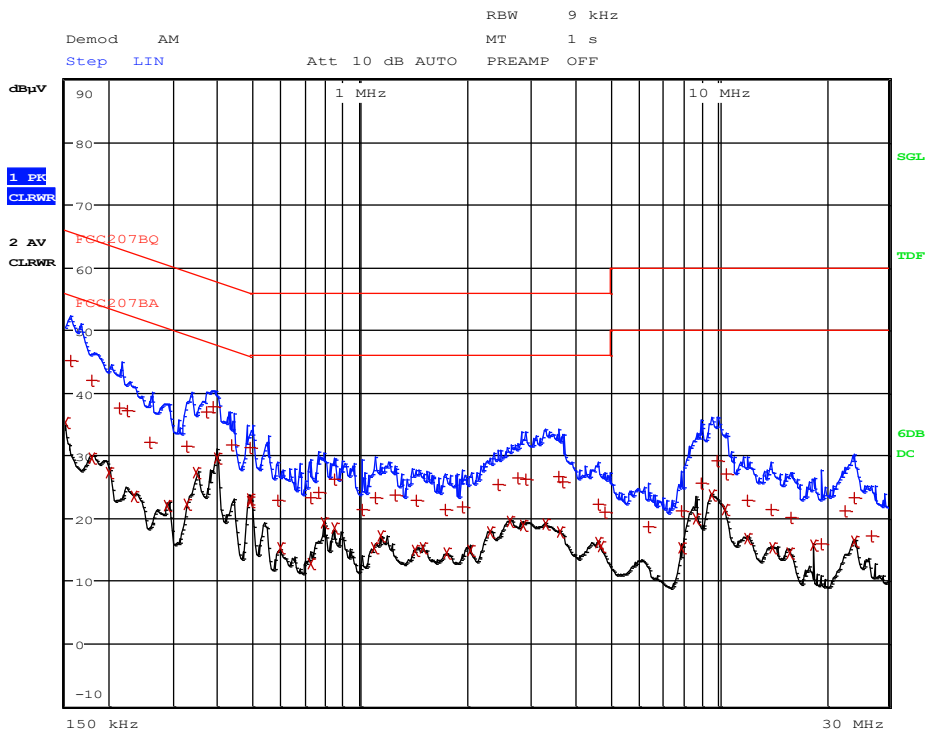
Manufacturer: FI Test- und Messtechnik GmbH
Device: FSC1/7
Serial No: 021

The EUT meets the requirements of this section.

4.5 Measurement Plots



Mode: Sweep, Line: N
Date: 17.MAR.2015



Mode: Sweep, Line: L
Date: 17.MAR.2015

5 RADIATED EMISSIONS 30 MHz – 1000 MHz

Test Requirement: FCC 47 CFR, §15.109
Test Procedure: ANSI C63.10-2009

5.1 Regulation

FCC §15.3
(i) Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

FCC §15.33
(b) For unintentional radiators:
(1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3) of this section, for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

FCC §15.35
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 §15.109

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency	Field Strength	
[MHz]	[µV/m]	[dB(µV/m)]
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

(c) In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

5.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
EMI/RFI Test Receiver	R&S / ESS	264	2014-04	2015-04
Biconilog. Antenna	EMCO / 3143	898	2014-02	2016-02
Preamplifier 0.01..1000 MHz	Miteq / AM-1431-N	343	2014-01	2016-01
DC Power Supply	Kniel / n.a.	434	n.a.	n.a.
AC Power Source	AEG / DAMK4/DAGK4	0001	n.a	n.a
Multimeter	Agilent / U1241B	3880	2014-04	2016-04

5.3 Test Procedures

The EUT was tested on a 0.8 meter high tabletop.
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. All tests performed with the EUT placed in both vertical and horizontal polarizations on the nonconductive table.

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 listed semi-anechoic room at the specified 3 m test distance.
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
Receive antenna height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

5.4 Calculation of Field Strength Limits

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

µV/m at 3 meters = 150

150 µV/m corresponds with 43.5 dBµV/m.

5.5 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 dBµV/m
RA = Receiver Amplitude in dBµV
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB
Assume a receiver reading of 23.5 dBµV 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 dBµV/m. The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 = 32 [dBµV/m]

Level in µV/m = Common Antilogarithm (32/20) = 39.8

5.6 Final Test Results

Frequency [MHz]	Reading [dB(µV)]	Ant. factor [dB(1/m)]	Result [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]	Polarisation h / v
41.86	11.1	10.3	21.4	40	18.6	v
96.01	14.7	9.4	24.1	43.5	19.4	v
108.04	8.0	9.0	17.0	43.5	26.5	v
168.00	12.5	11.4	23.9	43.5	19.6	h
473.63	7.7	21.5	29.2	46	16.8	v
480.00	16.7	21.7	38.4	46	7.6	h

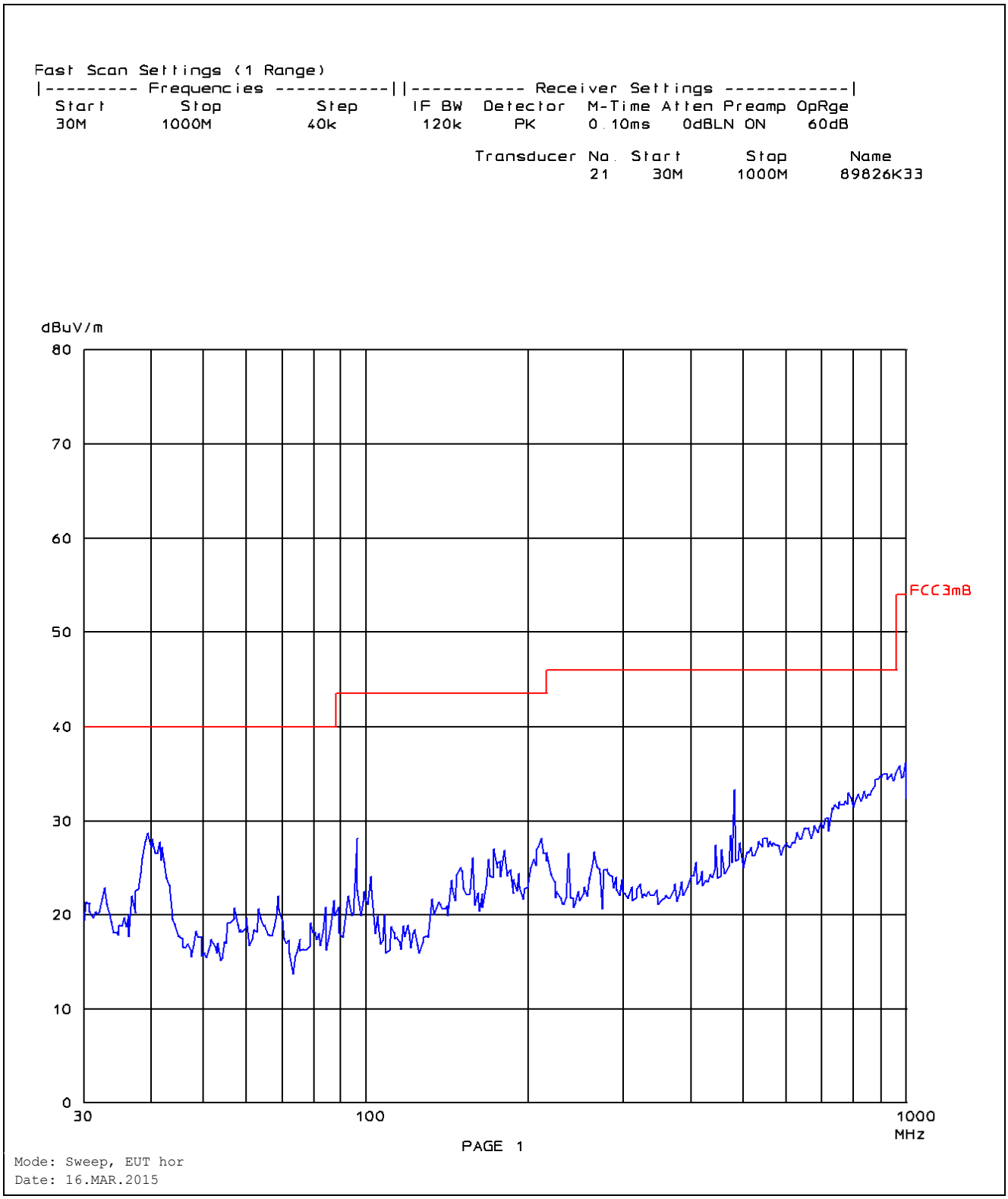
All tests performed at 3 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plots.

Manufacturer: FI Test- und Messtechnik GmbH
Device: FSC1/7
Serial No: 021

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

The EUT meets the requirements of this section.

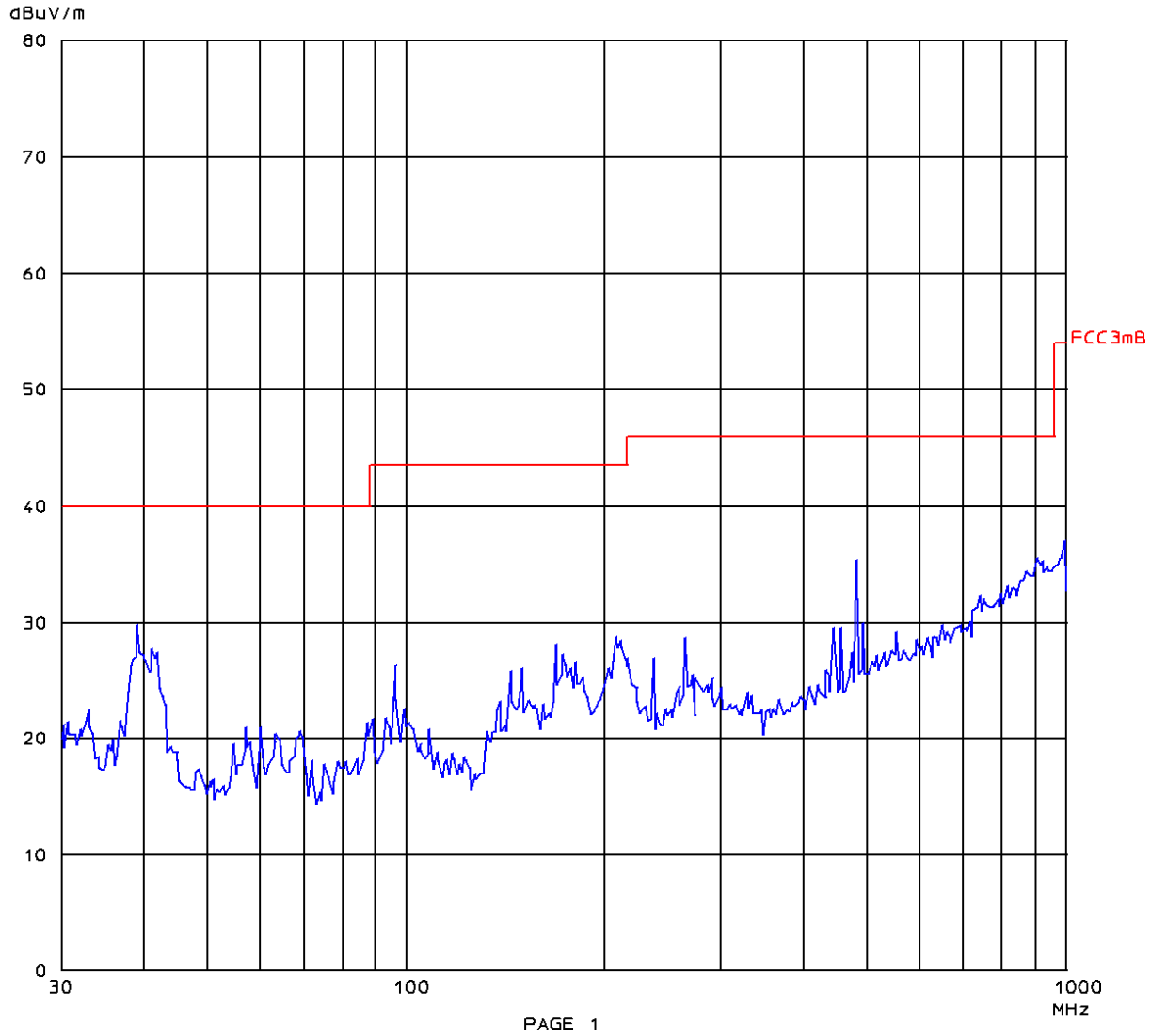
5.7 Measurement Prescan-Plots



Fast Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	1000M	40k	120k	PK	0.10ms	0dBLN	ON	60dB

Transducer No	Start	Stop	Name
21	30M	1000M	89826K33



Mode: Sweep, EUT ver
Date: 16.MAR.2015

6 RADIATED EMISSIONS 1 GHz – 40 GHz

Test Requirement: FCC 47 CFR, §15.109
Test Procedure: ANSI C63.10-2009

6.1 Regulation

FCC §15.3
(i) Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

FCC §15.33

(b) For unintentional radiators:
(1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3) of this section, for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

FCC §15.35
The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part:
(b) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

FCC §15.109

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency	Field Strength	
[MHz]	[µV/m]	[dB(µV/m)]
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

(c) In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

6.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
AC Power Source	AEG / DAMK4/DAGK4	0001	n.a	n.a
Standard Gain Horn Ant.	Mid Century / MC22/31B	1229	2014-07	2016-07
Semi-Flex-Cable	IW / KPS-1501-354-KPS	1229	2014-12	2015-12
Standard Gain Horn Ant.	Mid Century / MC 20/31B	1300	2014-07	2016-07
Standard Gain Horn Ant.	FMI/Pro NOVA / 2424-25	1333	n.a.	n.a.
K-Cable K/50	IW / KPS-1501-600-KPS	3061	2014-12	2015-12
Double Ridged Guide Ant.	Schwarzb. / BBHA 9120D	3236	2013-06	2015-06
Spectrum Analyzer	R&S / FSU50	3831	2014-06	2015-06
Multimeter	Agilent / U1241B	3880	2014-04	2016-04
HF-Cable	IW / NPS-2801N-2756-NPS	4391	2014-07	2014-07

6.3 Test Procedures

ANSI C63.10-2009: 6.6.4 Radiated emissions tests

Radiated emission tests shall be performed on a test site per 5.2, with the exception of the test table as described in 6.6.2.

The EUT should be setup in its typical configuration and arrangement, and operated in its various modes as shown in Figure 5 of this standard. An antenna shall be connected to the EUT. If the EUT is equipped with or uses an adjustable antenna, the EUT antenna shall be manipulated through typical positions and lengths during exploratory testing to maximize emission levels.

For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for representative setups and cable manipulation for typical use. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.

For each required mode of operation to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 m and 4 m [note: not useful due to antenna's small beam and the short measuring distance], antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified in Clause 6 and 6.3) shall be explored to produce the emission that has the highest amplitude relative to the limit.

The frequencies of emission from the EUT should first be detected. Then the amplitudes of the emissions are measured at the specified test distance using the required antenna height, orientation, polarization, and detector characteristics.

The EUT was tested on a 0.8 meter high tabletop for measurements up to 18 GHz and a 1.0 meter high tabletop for measurements above 18 GHz.

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. All tests performed with the EUT placed in both vertical and horizontal polarizations on the nonconductive table.

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 listed semi-anechoic room at the specified 3 m test distance. Worst case emissions are listed under chapter: test results.

Radiated Emissions Test Characteristics	
Frequency range	1 GHz – 40 GHz
Test distance	3 m*
Test instrumentation resolution bandwidth	1 MHz **
Receive antenna height	0.8 – 1.5 m (for 1 GHz – 18 GHz) 1 m (for 18 GHz – 40 GHz)
Receive antenna polarization	Vertical/Horizontal

* Test distance was reduced in order to fulfil the limit requirements, refer to final measurement table for details.

** Test instrumentation resolution bandwidth was reduced in order to fulfil the limit requirements, refer to final measurement table for details.

6.4 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for frequencies above 960 MHz:

µV/m at 3 meters = 500

500 µV/m corresponds with 54 dBµV/m.

6.5 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 dBµV/m
RA = Receiver Amplitude in dBµV
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB
Assume a receiver reading of 23.5 dBµV 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 dBµV/m. The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 = 32 [dBµV/m]

Level in µV/m = Common Antilogarithm (32/20) = 39.8

For a test distance other than what is specified, but fulfilling the requirements of Section 15.21 (f)(1) the field strength is calculated by adding additionally an extrapolation factor of 20 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 dBµV/m
FST = Field Strength at test distance on dBµV/m
DF = Distance Extrapolation Factor in dB
where DF = 20 log (Dtest/Dspec) where Dtest = Test Distance and Dspec = Specified Distance

Assume the tests performed at a reduced distance of 1.0 m instead of the Specified Distance if 3.0 m giving a Distance Extrapolation Factor of DF = 20 log (1.0 m / 3.0 m) = -9.5 dB.

6.6 Final Test Results

Freq. [GHz]	Dtest [m]	BW [kHz]	Reading [dBm]	Mixer or Cable Loss [dB]	Antenna Factor [dB]	Field Strength at 3m [dBµV/m]	AV Limit at 3m [dBµV/m]	Margin [dB]
6.008	1	1000	-92.4	2.7	33.9	41.6	54	12.4
12.050	1	1000	-97.4	4	39.6	43.7	54	10.3
18.094	3	1	-104.7	2.8	35.4	40.5	54	13.5
24.125	3	1	-69.2	3.3	37.9	79.0	54 *	-25.0 *
30.156	3	0.2	-113.5	3.9	39.8	37.3	54	16.7
36.187	3	0.2	-116.5	4.3	41.4	36.2	54	17.8

All tests performed at the denoted distance with the denoted resolution bandwidth. The table above contains worst-case emissions, only. For further details refer to the pre-scan and final measurement test plots.

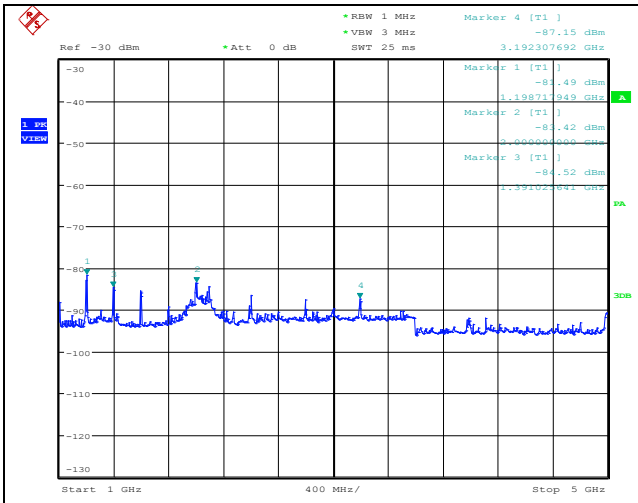
** Note: TX operating frequency at 24.125 GHz disregarded, due to the EUT being unable to switch off the transmitter.*

Manufacturer: FI Test- und Messtechnik GmbH
Device: FSC1/7
Serial No: 021

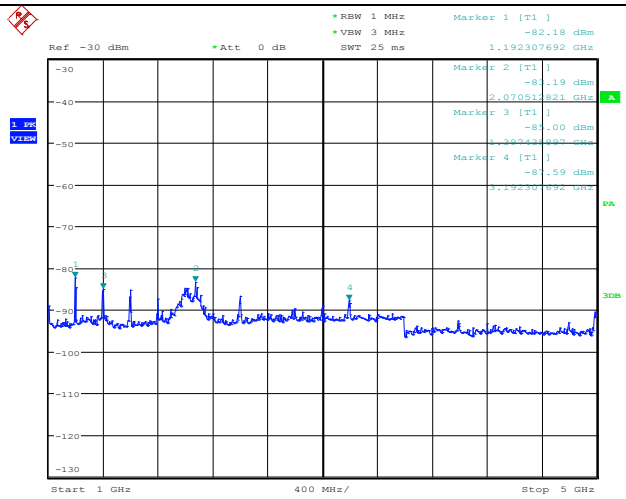
All emissions in the range 1 GHz to 40 GHz (TX operating frequency at 24.125 GHz disregarded) are below the specified limits.

The EUT meets the requirements of this section.

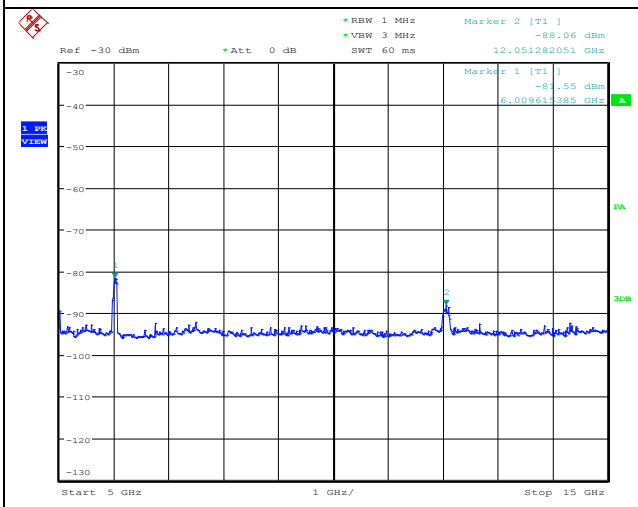
6.7 Measurement Prescan-Plots



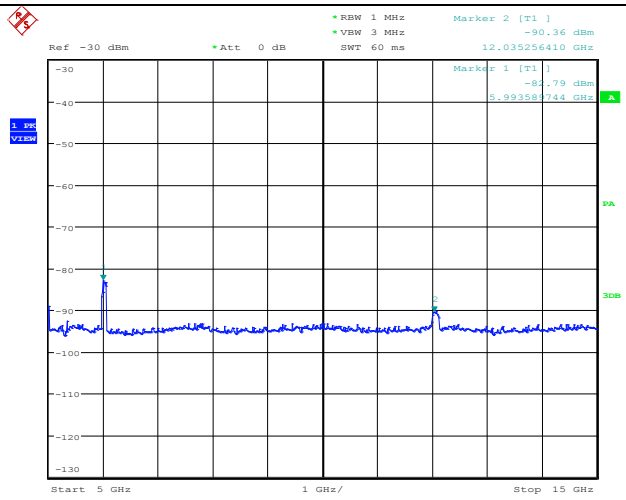
Mode: Sweep, EUT hor, Prescan 1 - 5 GHz, distance 3m
Date: 17.MAR.2015



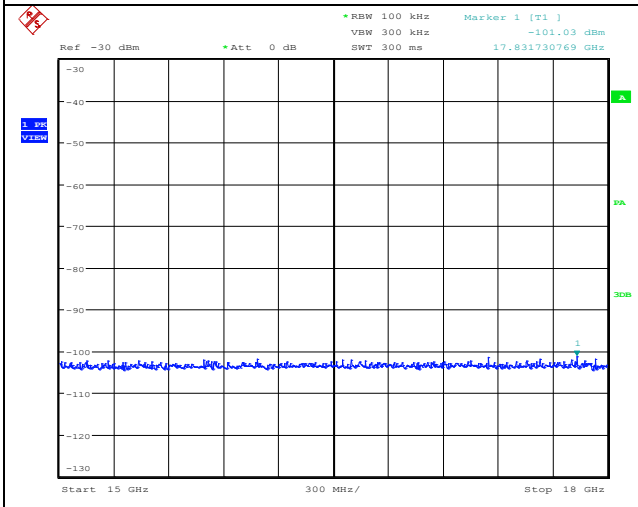
Mode: Sweep, EUT ver, Prescan 1 - 5 GHz, distance 3m
Date: 17.MAR.2015



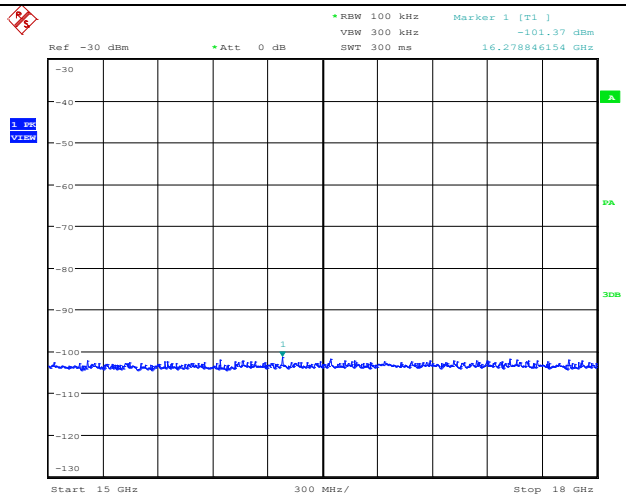
Mode: Sweep, EUT hor, Prescan 5 - 15 GHz, distance 1m
Date: 17.MAR.2015



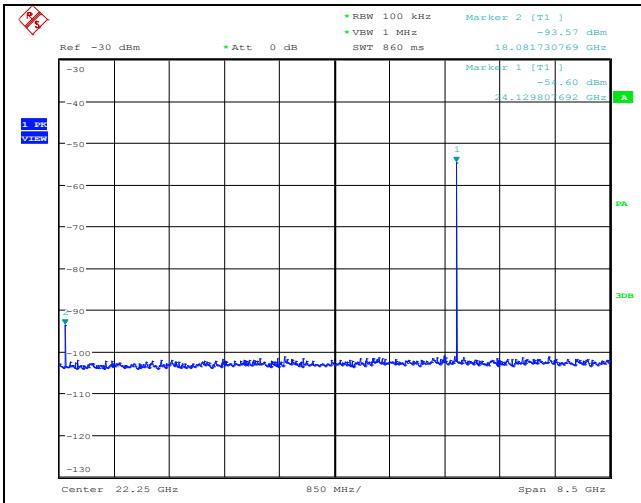
Mode: Sweep, EUT ver, Prescan 5 - 15 GHz, distance 1m
Date: 17.MAR.2015



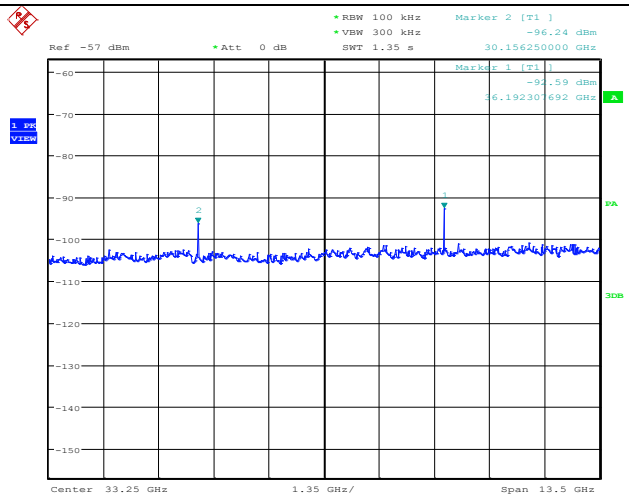
Mode: Sweep, EUT hor, Prescan 15 - 18 GHz, distance 1m
Date: 17.MAR.2015



Mode: Sweep, EUT ver, Prescan 15 - 18 GHz, distance 1m
Date: 17.MAR.2015



Mode: Fmid, Prescan 18 - 26.5 GHz, distance 0.1m
Date: 18.MAR.2015



Mode: Fmid, Prescan 26.5 - 40 GHz, distance 0.1m
Date: 18.MAR.2015

Note: Prescan measurements performed at reported distance with no additional correction factors, therefore the plots are just showing the measurement receiver's reading.

7 LIST OF ANNEXES

Following annexes are separated parts from this test report.

Description	Pages
Annex 1: Photographs of test set-up	4
Annex 2: External photographs of equipment under test (EUT)	4
Annex 3: Internal photographs of equipment under test (EUT)	3