



electronic GmbH

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Prüfbericht / Test report

FCC
(Federal Communications Commission)
Test-Firm-Registration-Number: 90870

 <p>EMC-SAFETY-MULTIMEDIA pkm SINCE 1978</p> <p> TESTED IN GERMANY</p>	<p>Ohmstrasse 1 84160 Frontenhausen, Germany Tel.: + 49 (0) 8732 6381 Fax: + 49 (0) 8732 2345 E-mail: info@pkm.eu.com</p>	<p>Prüfbericht Nr./ Test report no.: 16/04-0009</p> <p>Seite 1 von 19 Seiten Page 1 of 19 pages</p>
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1. Client information:

Name: Siemens AG
Address: Gleiwitzer Str. 555, 90475 Nürnberg
Name of contact: Mr. Peter Steinmill Dipl.-Ing. (FH) / A&D AS AP SE2
Telephone: +49 (0) 911 895 5472
Fax: -/
E-mail: Peter.steinmill@siemens.com

2. Identification of the equipment under test (EUT):

Equipment: 5,8 GHz Transceiver
Model: SRIF-2002
Brand name: -/
Serial no.: -/
Manufacturer: IK Elektronik GmbH, Hammerbrücke, Friedrichsgrüner Str. 11-13, 08262 Muldenhammer
Country of origin: Germany
Rating: 5 V DC
Frequency range: 5,726.0866 MHz - 5,873.9134 MHz
Operational frequencies: Channel 01: 5,726.0866 MHz
Channel 64: 5,800.0000 MHz
Channel 127: 5,873.9134 MHz
Type of modulation: FSK
TX-cycle-time: ≥ 157 ms for long data telegram
14 ms for fast poll telegram
TX-on-time: ≤ 24.6 ms for long data telegram
3.9 ms for fast poll telegram
Class of emission: 1M40F1DXN
Antenna: Rod antenna (PSTN3-5725), 6.5 cm
Receipt of EUT: 06 April 2016
Date of test: 06 April 2016 – 07 April 2016

3. Identification of Test Laboratory

Company name: PKM electronic GmbH
Address: Ohmstrasse 1
84160 Frontenhausen, Germany
Laboratory Accreditation: DAkkS D-PL-17379-01-00
FCC Test Site registration number: 90870
Name for contact purposes: Mr. Gerhard Raitchel

4. CONCLUSIONS

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the relevant clauses of Federal Communications Commission Rules for intentional radiators 47 CFR part 15 subpart C

§ 15.207 Conducted limits.


§ 15.209 Radiated emission limits; general requirements.

§ 15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.

The EUT is already certified under FCC ID LDS-SRIF2002. With the measurements performed it is to show that with the modifications the requirements are still fulfilled.



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25.04.2016

Erstellt am/prepared on

G. Raithel Dipl.-Ing. (FH), Head of Laboratory

(Name/name / Stellung/position)



(Unterschrift/signature)

25.04.2016

Freigabe am/released on

K. Simon, Deputy Head of Laboratory

(Name/name / Stellung/position)



(Unterschrift/signature)

5. Conducted emission measurements

Test site

Measurements of conducted emission from EUT was made in the shielded chamber (Siemens DC-1 GHz).

Detector function selection and bandwidth

In conducted emissions measurement CISPR quasi-peak- and average-detector were used. The bandwidth of the detector of instrument is CISPR 9 kHz over the frequency range of 150 kHz to 30 MHz.

Frequency range to be scanned

For conducted emission measurements, the spectrum in the range of 150 kHz to 30 MHz was investigated.

Test conditions and configuration of EUT

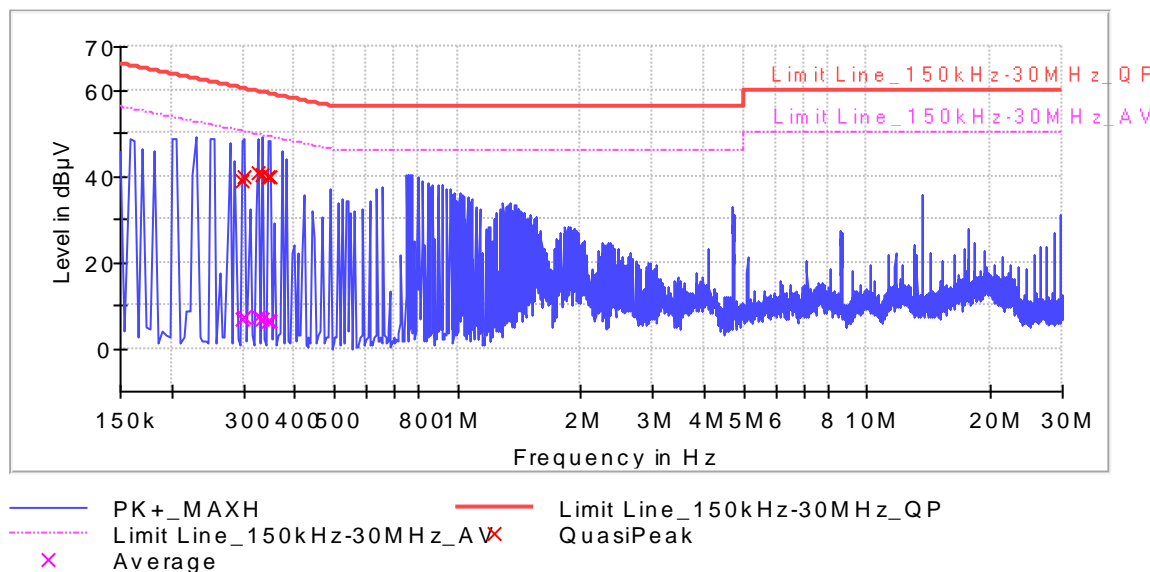
The EUT was mounted on an evaluation board powered by an AC adaptor which was connected to the LISN. The serial port of the evaluation board was connected to a Laptop to control the EUT. With a second evaluation board a RF connection was established with the EUT and a pingpong signal was sent, so that the transmitting and receiving function was active. With the second evaluation board connected to the Laptop the transmitted and received data could be monitored to ensure correct function of the EUT so as to find the maximum conducted emission generated from EUT. During test the EUT was operated with rated Power (120 V~, 60 Hz). The EUT was placed on a 80 cm high non metallic table. Measurements on neutral (N)- and live (L1)-wire had been performed.

Applied standards

47 CFR part 15 subpart C, § 15.207 Conducted limits.

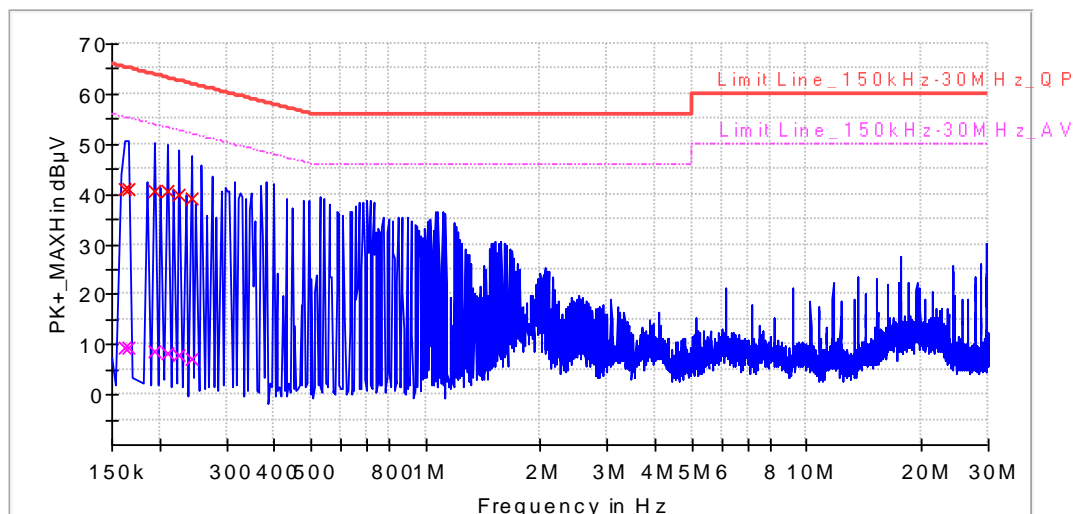
Measurements

Tested on N (RX and TX mode)



Frequency (MHz)	MaxPeak (dBµV)	QuasiPeak (dBµV)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Margin - AVG (dB)	Limit - AVG (dBµV)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.298000	48.2	38.7	6.6	1000.0	9.000	43.7	50.3	21.6	60.3
0.302000	48.7	39.6	7.1	1000.0	9.000	43.1	50.2	20.6	60.2
0.326000	48.8	40.5	7.0	1000.0	9.000	42.5	49.6	19.0	59.6
0.334000	49.0	40.3	6.7	1000.0	9.000	42.6	49.4	19.1	59.4
0.346000	48.2	39.7	6.3	1000.0	9.000	42.8	49.1	19.4	59.1
0.350000	48.2	39.6	6.2	1000.0	9.000	42.8	49.0	19.4	59.0

Tested on L1 (RX and TX mode)



Frequency (MHz)	MaxPeak (dBµV)	QuasiPeak (dBµV)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Margin - AVG (dB)	Limit - AVG (dBµV)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.162000	50.7	41.1	9.4	1000.0	9.000	45.9	55.4	24.2	65.4
0.166000	50.6	41.0	9.3	1000.0	9.000	45.9	55.2	24.1	65.2
0.194000	50.3	40.7	8.8	1000.0	9.000	45.1	53.9	23.2	63.9
0.210000	49.7	40.4	8.3	1000.0	9.000	44.9	53.2	22.8	63.2
0.226000	49.0	39.9	7.9	1000.0	9.000	44.7	52.6	22.7	62.6
0.242000	47.6	39.1	7.1	1000.0	9.000	45.0	52.0	22.9	62.0

Results

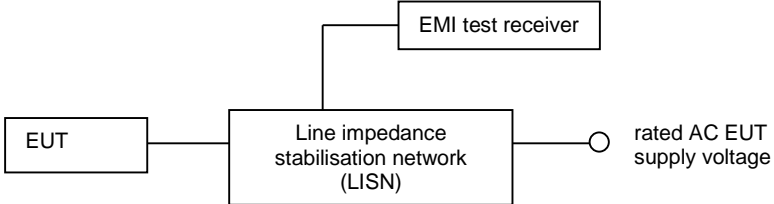
From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the conducted emission measurements according to 47 CFR part 15 subpart C, § 15.207.

Test equipment used:

Bezeichnung/ Kind of equipment	Hersteller/ Manufacturer	Typ/ Type	PKM-Ident-Nr./ PKM-ident no.	Calibrated till
EMI-Test-Receiver	Rohde & Schwarz	ESR7	11505	March 2017
Line impedance stabilisation network	Rohde&Schwarz	ESH2-Z5	10139	August 2017
Shielded room	Siemens	(3,7 x 3,4 x 2,1) m (l x w x h) DC – 1 GHz	10111	-/- (verified)

All measurements were made with measuring instruments, including any accessories that may affect test results, calibrated according to the requests of ISO/IEC 17025 according to which the test site is accredited from DAkkS. Measurement of conducted emissions was made with instruments conforming to American National Standard Specification, ANSI C63.4-2009.

Block diagram Conducted emissions



Measurement uncertainty

Parameter	PKM measurement uncertainty
Emissions conducted	±3.2 dB
Temperature	±0.72 °C
Humidity	±2.54 %
DC and low frequency voltages	±0.76 % (DC up to 40 V) ±1.74 % (AC 50 Hz/60 Hz up to 400 V)

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above mentioned way.

The measurements uncertainty was calculated in accordance with CISPR 16-4-2, NAMAS NIS 81: "The treatment of uncertainty in EMC measurement" and "Guide to the Expression of Uncertainty in Measurement (GUM)".

The measurement uncertainty was given with a confidence of 95 % (k = 2).

Photo(s) of test setup



6. Radiated spurious emission measurement.

Test site

Measurement of radiated emissions from EUT was made in the semi-anechoic chamber that has been found in compliance with Federal Communications Commissions (FCC) requirements of 47CFR 2.948 according to ANSI C63.4-2009 on March 11, 2015.

Detector function selection and bandwidth

In radiated emissions measurement, a field strength meter that have CISPR quasi-peak was used. The bandwidth of the detector of instrument is CISPR 9 kHz over the frequency range of 150 kHz to 30 MHz and CISPR 120 kHz over the frequency range of 30 to 1000 MHz, emissions to be measured are detected in CISPR quasi peak mode. In the frequency range above 1 GHz the used bandwidth was 1000 kHz and emissions to be measured are detected in peak and average mode using a spectrum analyser.

Antennas

Measurements were made using a calibrated loop antenna in the frequency range of 150 kHz to 30 MHz, a calibrated bilog antenna in the range of 30 to 1000 MHz to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization.

The horizontal distance between the receiving antenna and the EUT was 3 meters.

In the range above 1 GHz measurements were made using a calibrated horn antennas to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization.

The horizontal distance between the receiving antenna and the EUT was 3 meters.

Frequency range to be scanned

For radiated emissions measurements, the spectrum in the range of 9 kHz to 29.4 GHz (5th harmonic) was investigated as the highest frequency generated is 5.8739134 GHz.

Test conditions and configuration of EUT

The EUT was mounted on an evaluation board powered by an AC adaptor. The serial port of the evaluation board was connected to a Laptop to control the EUT. With a second evaluation board a RF connection was established with the EUT and a pingpong signal was sent, so that the transmitting and receiving function was active. With the second evaluation board connected to the Laptop the transmitted and receipt data could be monitored to ensure correct function of the EUT so as to find the maximum conducted emission generated from EUT.

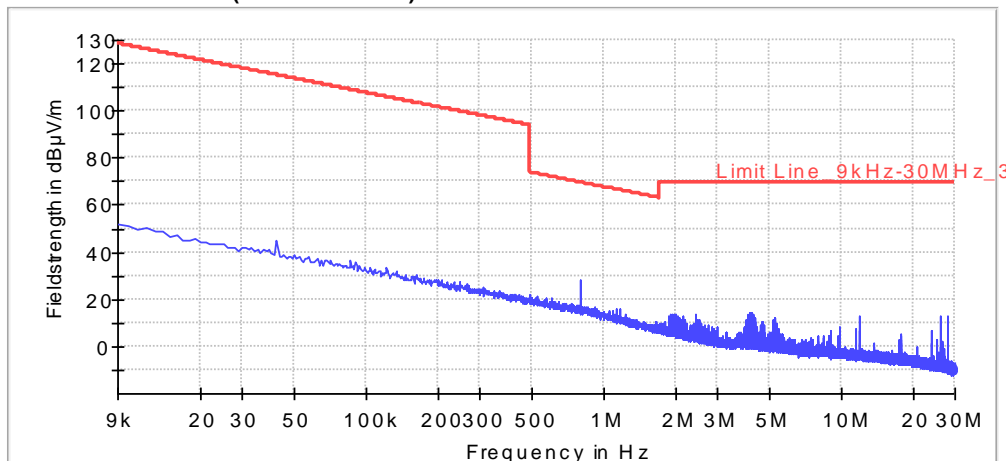
During test the EUT was operated with rated Power (120 V~, 60 Hz). The EUT was placed on a 80 cm high non metallic table. The EUT was placed on a 80 cm high non metallic 1 m diameter turntable. The EUT was rotated and the antenna height was varied between 1 m to 4 m to find the maximum RF energy generated from EUT. All measurements had been performed in all three axis of the EUT.

Applied standards

47 CFR part 15 subpart C, § 15.209 Radiated emission limits; general requirements.

Measurements

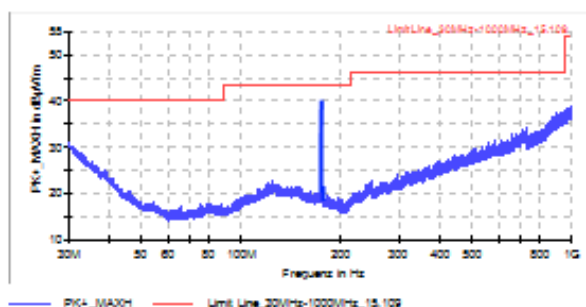
Radiated 9kHz-30MHz (RX and TX mode)



— Limit — PK+_MAXH-PK+

Frequency (MHz)	MaxPeak at 3 m (dBµV/m)	MaxPeak corrected (dBµV/m)	AVG (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Distance (m)
0.009-0.490	<80	<0	--	1000.0	9.000	--	67.6 – 20 x log(f [kHz])	300
0.490-1.705	<50	<10	--	1000.0	9.000	--	87.6 – 20 x log(f [kHz])	30
1.705-30	<50	<10	--	1000.0	9.000	--	29.5	30

Horizontal Radiated 30 MHz – 1000 MHz (RX and TX mode)



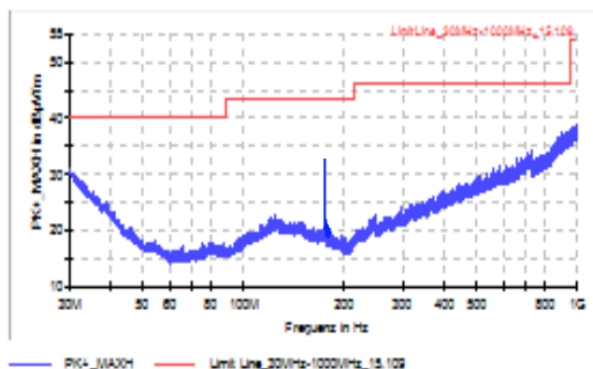
Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Distance (m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30-88	<34	--	1000.0	120.000	H	3	--	40.0
176.96	39.1	38.1	1000.0	120.000	H	3	5.4	43.5
216-960	<40	--	1000.0	120.000	H	3	--	46.0
960-1000	<40	--	1000.0	120.000	H	3	--	54.0

No significant emission found above the noise threshold, all peak emissions at least or more than 6 dB below the Quasipeak limit.

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Pol	Distance (m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
>1000	<45.0	--	1000	V	3	--	54.0

No significant emission found above the noise threshold, all peak emissions at least or more than 6 dB below the average limit.

Vertical Radiated 30 MHz – 1000 MHz (RX and TX mode)



Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Distance (m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30-88	<34	--	1000.0	120.000	V	3	--	40.0
176.96	32.7	30.9	1000.0	120.000	V	3	12.6	43.5
216-960	<40	--	1000.0	120.000	V	3	--	46.0
960-1000	<40	--	1000.0	120.000	V	3	--	54.0

No significant emission found above the noise threshold, all peak emissions at least or more than 6 dB below the Quasipeak limit.

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Pol	Distance (m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
>1000	<45.0	--	1000	V	3	--	54.0

No significant emission found above the noise threshold, all peak emissions at least or more than 6 dB below the average limit.

**Radiated 1GHz – 29.4 GHz
Horizontal/vertical
channel 01 (RX and TX mode)**

Frequency (MHz)	Detector	Pol	Reading (dBµV)	correction factor (dB/m)	Duty Cycle correction (dB)	Test Distance (m)	Field-strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5400.24	peak	H	19.0	33.7	-	3	52.7	74	21.3
5400.24	average	H	19.0	33.7	-11.1	3	41.6	54	12.4
10800.50	peak	H	0.9	38.2	-	3	39.1	74	34.9
10800.50	average	H	0.9	38.2	-11.1	3	28.0	54	26.0
16200.74	peak	H	<2.0	38.2	-	3	<40.2	74	>34.0
16200.74	average	H	<2.0	38.2	-11.1	3	<29.1	54	>25.1

channel 64 (RX and TX mode)

Frequency (MHz)	Detector	Pol	Reading (dBµV)	correction factor (dB/m)	Duty Cycle correction (dB)	Test Distance (m)	Field-strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5474.28	peak	H	18.1	33.8	-	3	51.9	74	22.1
5474.28	average	H	18.1	33.8	-11.1	3	40.8	54	13.2
10948,56	peak	H	0.5	38.4	-	3	38.9	74	36.1
10948,56	average	H	0.5	38.4	-11.1	3	27.8	54	26.2
16422,84	peak	H	<2.0	38.7	-	3	<40.7	74	>33.3
16422,84	average	H	<2.0	38.7	-11.1	3	<29.6	54	>24.4

channel 127 (RX and TX mode)

Frequency (MHz)	Detector	Pol	Reading (dBµV)	correction factor (dB/m)	Duty Cycle correction (dB)	Test Distance (m)	Field-strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5548.07	peak	H	18.7	33.9	-	3	52.6	74	21.6
5548.07	average	H	18.7	33.9	-11.1	3	41.5	54	12.5
1109.614	peak	H	-0.4	38.5	-	3	38.1	74	35.9
1109.614	average	H	-0.4	38.5	-11.1	3	27.0	54	27.0
16644.21	peak	H	<2.0	39.5	-	3	<41.5	74	>32.5
16644.21	average	H	<2.0	39.5	-11.1	3	<30.4	54	>23.6

The duty cycle is declared by client with $\leq 28\%$ (-11.1 dB)

Results

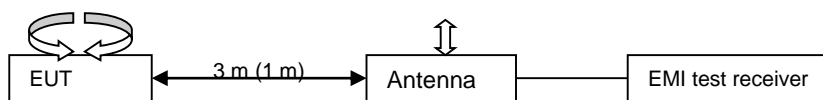
From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the radiated emission measurements.

Test equipment used:

Bezeichnung/ Kind of equipment	Hersteller/ Manufacturer	Typ/ Type	PKM-Ident-Nr./ PKM-ident no.	Calibrated till
EMI-Test-Receiver	Rohde & Schwarz	ESR7	11505	March 2017
Signal Spectrum Analyzer 2Hz - 26,5 GHz	Rohde & Schwarz	FSW 26	11571	August 2016
Harmonic Mixer 26.5 GHz – 40 GHz	Rohde & Schwarz	FS-Z30	10779	March 2017
Antenna	EMCO	6502	10546	October 2016
Antenna	Schaffner	CBL6111C	10977	June 2016
Antenna	Electro Metric	RGA50/60	10273	October 2016
Breitband Hornantenne 15 - 40 GHz	Schaffner	BBHA 9170	11580	December 2016

All measurements were made with measuring instruments, including any accessories that may affect test results, calibrated according to the requests of ISO/IEC 17025 according to which the test site is accredited from DAkkS. Measurement of radiated emissions was made with instruments conforming to American National Standard Specification, ANSI C63.4-2009.

Block diagram Radiated emissions



Measurement uncertainty

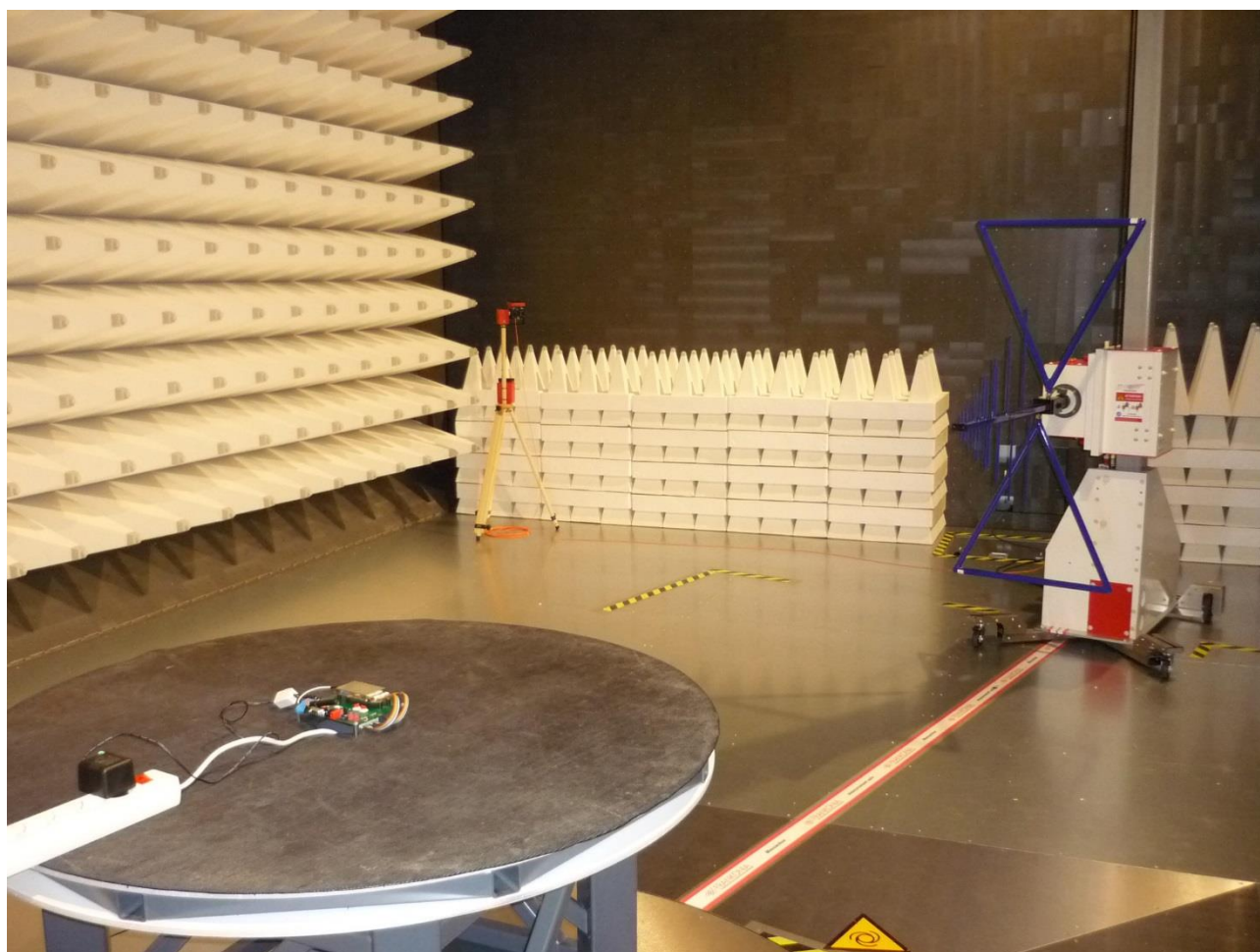
Parameter	PKM measurement uncertainty
Emissions radiated	±4.2 dB
Temperature	±0.72 °C
Humidity	±2.54 %
DC and low frequency voltages	±0.76 % (DC up to 40 V) ±1.74 % (AC 50 Hz/60 Hz up to 400 V)

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above mentioned way.

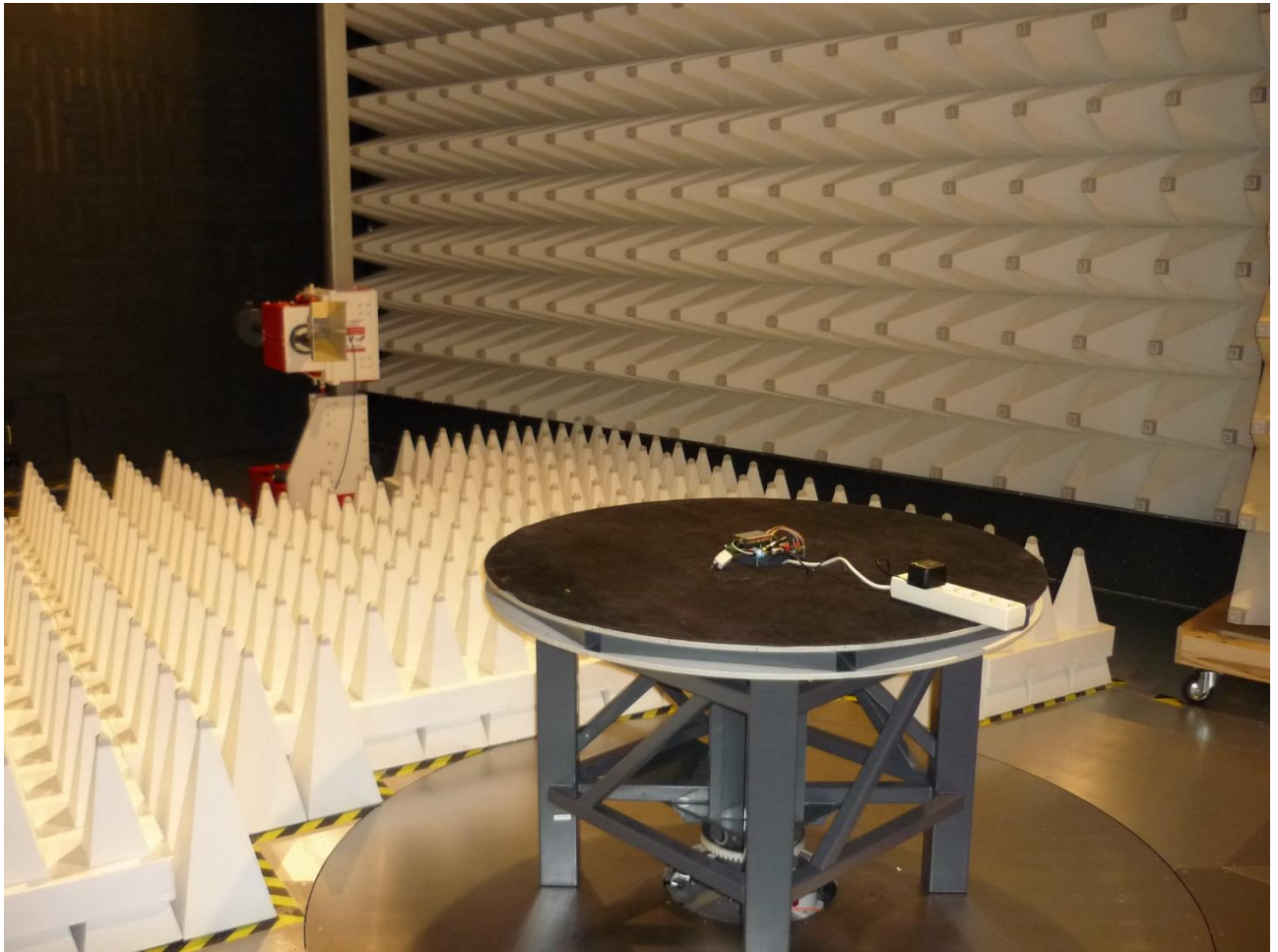
The measurements uncertainty was calculated in accordance with CISPR 16-4-2, NAMAS NIS 81: "The treatment of uncertainty in EMC measurement" and "Guide to the Expression of Uncertainty in Measurement (GUM)".

The measurement uncertainty was given with a confidence of 95 % (k = 2).

Photo(s) of test setup



tested frequency range 30 MHz – 1000 MHz



tested frequency range >1 GHz

7. Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.

Test site

Measurement of radiated emissions from EUT was made in the semi-anechoic chamber that has been found in compliance with Federal Communications Commissions (FCC) requirements of 47CFR 2.948 according to ANSI C63.4-2009 on March 11, 2015.

Detector function selection and bandwidth

In the frequency range above 1 GHz the used bandwidth was 100 kHz and emissions to be measured are detected in peak and average mode using a spectrum analyser.

Antennas

In the range above 1 GHz measurements were made using a calibrated horn antennas to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization. The horizontal distance between the receiving antenna and the EUT was 3 meters.

Frequency range to be scanned

For radiated emissions measurements, the spectrum in the range of 1 GHz to 29.4 GHz (5th harmonic) was investigated as the highest frequency generated is 5.8739134 GHz.

Test conditions and configuration of EUT

The EUT was mounted on an evaluation board powered by an AC adaptor. The serial port of the evaluation board was connected to a Laptop to control the EUT. With a second evaluation board a RF connection was established with the EUT and a pingpong signal was sent, so that the transmitting and receiving function was active. With the second evaluation board connected to the Laptop the transmitted and receipt data could be monitored to ensure correct function of the EUT so as to find the maximum radiated emission generated from EUT.

During test the EUT was operated with rated Power (120 V~, 60 Hz). The EUT was placed on a 80 cm high non metallic 1 m diameter turntable. The EUT was rotated and the antenna height was varied between 1 m to 4 m to find the maximum RF energy generated from EUT.

Applied standards

47 CFR part 15 subpart C, § 15.249 Radiated emission limits; general requirements.

Measurements

Radiated 1 GHz – 29.4 GHz Horizontal/vertical

TX mode channel 01

Frequency (MHz)	Detector	Pol	Reading (dBµV)	correction factor (dB/m)	Duty Cycle correction (dB)	Test Distance (m)	Field-strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5726.087	peak	V	69.3	33.8	-	3	103.1	114	10.9
5726.087	average	V	69.3	33.8	-11.1	3	92.0	94	2.0
11452.173	peak	H	9.8	38.6	-	3	48.4	74	25.6
11452.173	average	H	9.8	38.6	-11.1	3	37.3	54	16.7
17178.259	peak	H	4.7	42.4	-	3	47.1	74	26.9
17178.259	average	H	4.7	42.4	-11.1	3	36.0	54	18.0

TX mode channel 64

Frequency (MHz)	Detector	Pol	Reading (dBµV)	correction factor (dB/m)	Duty Cycle correction (dB)	Test Distance (m)	Field-strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5800.000	peak	V	68.8	33.9	-	3	102.7	114	11.3
5800.000	average	V	68.8	33.9	-11.1	3	91.6	94	2.4
11600.000	peak	H	9.1	38.7	-	3	47.8	74	26.2
11600.000	average	H	9.1	38.7	-11.1	3	36.7	54	17.3
17400.000	peak	H	3.2	43.9	-	3	47.1	74	26.9
17400.000	average	H	3.2	43.9	-11.1	3	36.0	54	18.0

TX mode channel 127

Frequency (MHz)	Detector	PoI	Reading (dBµV)	correction factor (dB/m)	Duty Cycle correction (dB)	Test Distance (m)	Field-strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5873.913	peak	V	70.4	33.9	-	3	104.3	114	9.7
5873.913	average	V	70.4	33.9	-11.1	3	93.2	94	0.8
11747.826	peak	H	13.4	38.9	-	3	52.3	74	21.7
11747.826	average	H	13.4	38.9	-11.1	3	41.2	54	12.8
17621.739	peak	H	2.1	45.8	-	3	47.9	74	24.1
17621.739	average	H	2.1	45.8	-11.1	3	36.8	54	17.2

The duty cycle is declared by client with $\leq 28\%$ (-11.1 dB)

Results

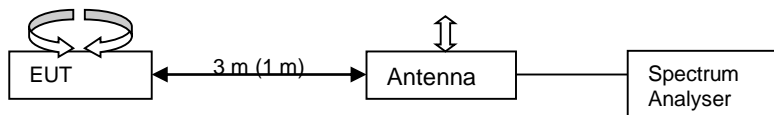
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Block diagram Radiated emissions



Measurement uncertainty

Parameter	PKM measurement uncertainty
Emissions radiated	± 4.2 dB
Temperature	± 0.72 °C
Humidity	± 2.54 %
DC and low frequency voltages	± 0.76 % (DC up to 40 V) ± 1.74 % (AC 50 Hz/60 Hz up to 400 V)

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above mentioned way.

The measurements uncertainty was calculated in accordance with CISPR 16-4-2, NAMAS NIS 81: "The treatment of uncertainty in EMC measurement" and "Guide to the Expression of Uncertainty in Measurement (GUM)".

The measurement uncertainty was given with a confidence of 95 % ($k = 2$).

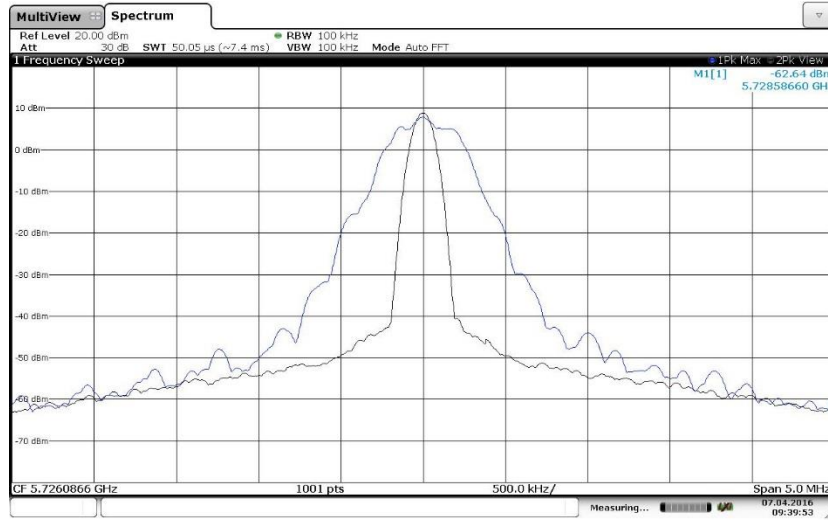
Photo(s) of test setup





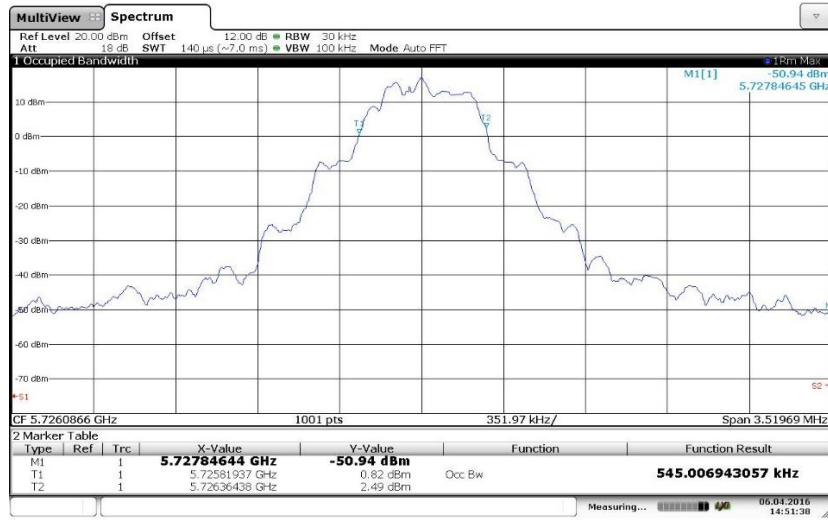
8. Additional graphs of EUT measurement (conducted)

Channel 1 modulated/unmodulated



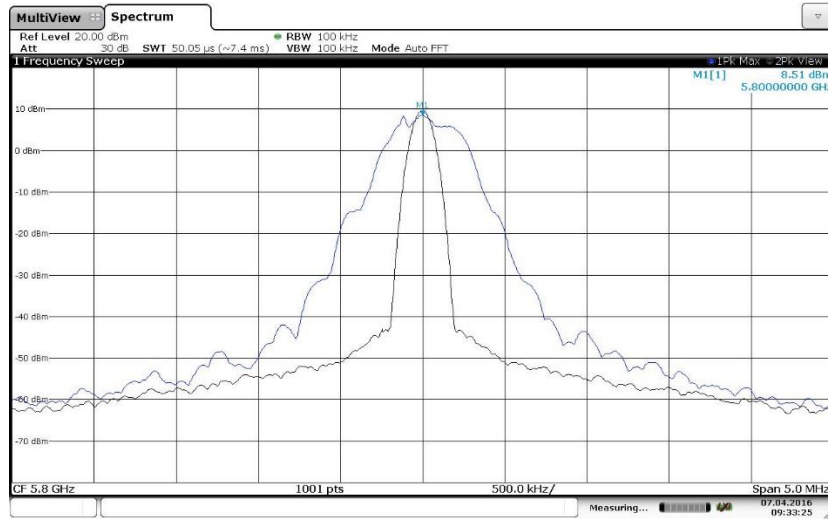
Date: 7 APR 2016 09:39:53

Channel 1 modulated - bandwidth



Date: 6 APR 2016 14:51:38

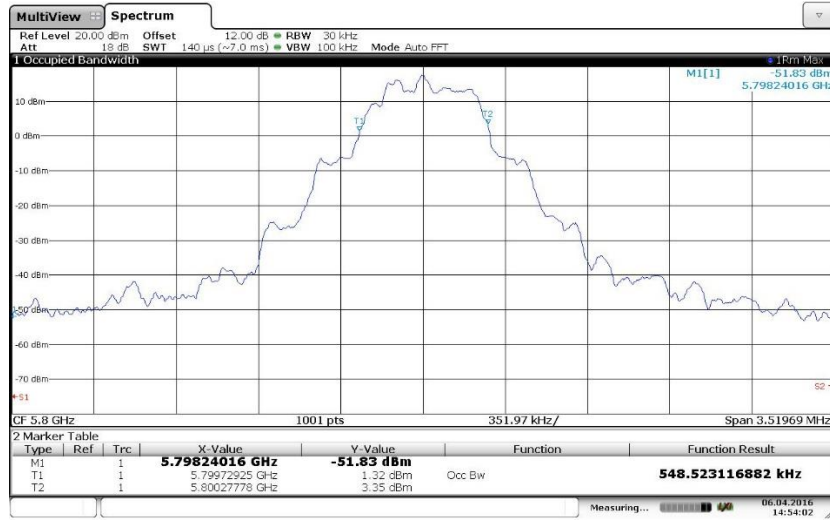
Channel 64 modulated/unmodulated



Date: 7 APR 2016 09:33:25

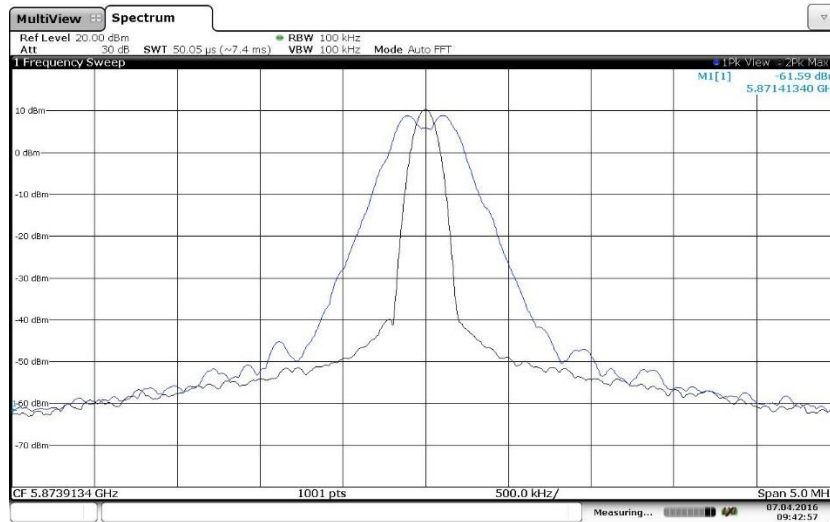


Channel 64 modulated - bandwidth



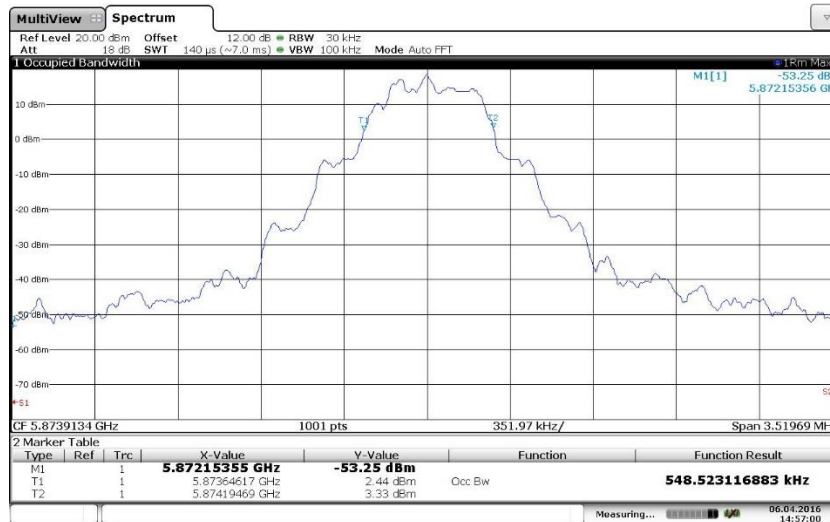
Date: 6 APR 2016 14:54:02

Channel 127 modulated/unmodulated



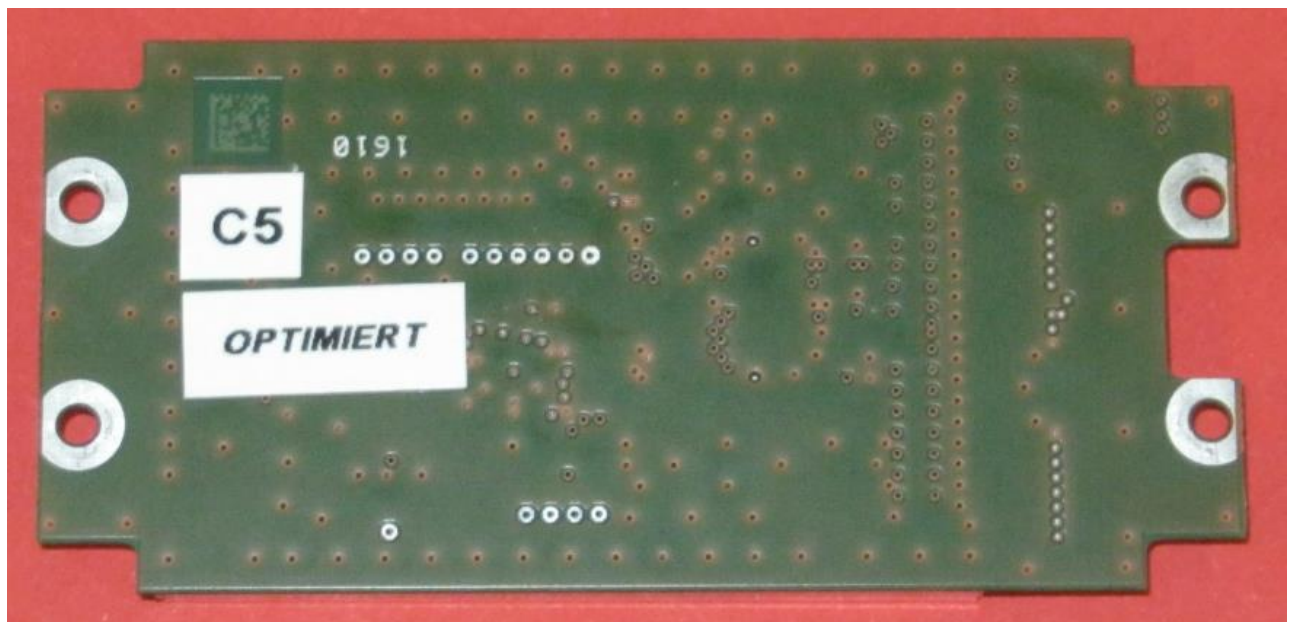
Date: 7 APR 2016 09:42:58

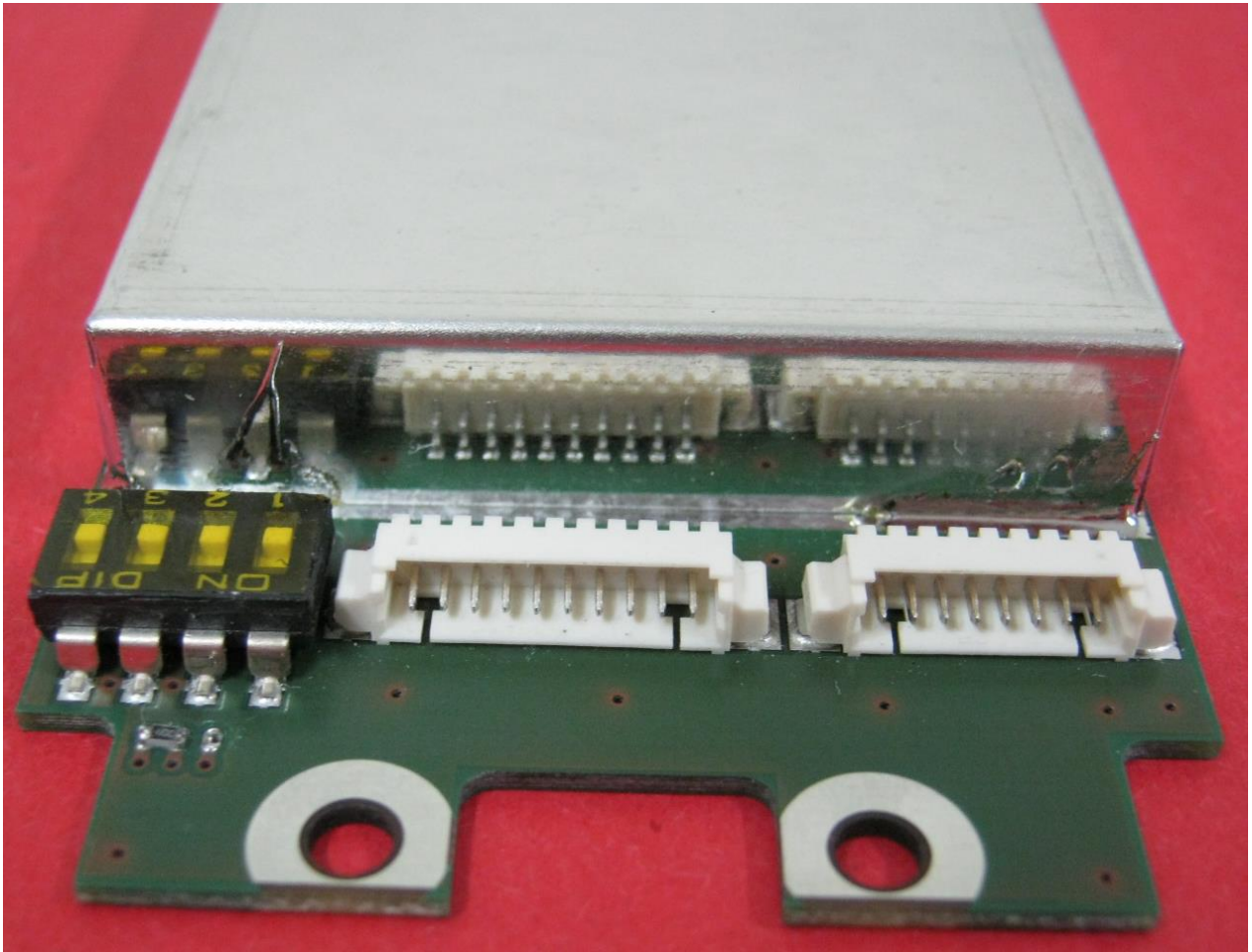
Channel 127 modulated - bandwidth



Date: 8 APR 2016 14:57:00

7. Photos of sample





End of test report