

FCC TEST REPORT FCC 47 CFR Part 15C Industry Canada RSS-210 Digital transmission systems operating within the 2400 – 2483.5 MHz band	
Report Reference No.	G0M-1412-4419-TFC247ZB-V02
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	  A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Filed Test Laboratory, Reg.-No.: 96970 IC OATS Filing assigned code: 3470A
Applicant's name	MKW electronics GmbH
Address	Jutogasse 3 4675 Weibern Austria
Test specification:	
Standard	ANSI C63.10:2009 ANSI C63.4:2009 IC RSS-210 Issue 8, Amendment 1
Test scope	complete Radio compliance test
Equipment under test (EUT):	
Product description	Chirp spread spectrum based transceiver used for wireless location
Model No.	W010
Additional Model(s)	None
Brand Name(s)	Smartbow
Hardware version	BNAHOST03
Firmware / Software version	FW 2.0.7
	FCC-ID: 2ADP3W010 IC: 12561A-W010
Test result	Passed

Possible test case verdicts:

- neither assessed nor tested: N/N
- required by standard but not appl. to test object.....: N/A
- required by standard but not tested.....: N/T
- not required by standard for the test object: N/R
- test object does meet the requirement.....: P (Pass)
- test object does not meet the requirement.....: F (Fail)

Testing:

Test Lab Temperature.....: 20 – 23 °C

Test Lab Humidity: 32 – 38 %

Date of receipt of test item: 2015-01-12

Date (s) of performance of tests: 2015-01-12 – 2015-04-14

Compiled by: Wilfried Treffke

Tested by (+ signature).....: Wilfried Treffke

(Responsible for Test)

Approved by (+ signature): Toralf Jahn

Date of issue: 2015-05-28

Total number of pages: 39

W. Treff

T. Jahn

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

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Additional comments:

There are two identical transceivers inside EUT (1 per Antenna).

Pre-compliance measurements were performed to identify the antenna port with the maximum output power and this transceiver and antenna port was used for full compliance testing. Full testing was performed for antenna port 2.

Partial tests were performed for the transceiver at antenna port 1 (output power and all radiated spurious emission tests).

Only one transceiver can transmit at the same time.

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Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

Version History

Version	Issue Date	Remarks	Revised by
01	2015-05-13	Initial Release	
02	2015-05-28	Page 36: Test results were corrected.	W. Treffke

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1 Equipment (Test item) Description

Description	Chirp spread spectrum based transceiver used for wireless location	
Model	W010	
Additional Model(s)	None	
Brand Name(s)	Smartbow	
Serial number	180b52000e2f	
Hardware version	BNAHOST03	
Software / Firmware version	FW 2.0.7	
FCC-ID	2ADP3W010	
IC	12561A-W010	
Equipment type	End product	
Radio type	Transceiver	
Radio technology	IEEE 802.15.4a Chirp spread spectrum (CSS)	
Operating frequency range	2412 - 2468.5 MHz	
Assigned frequency band	2400 - 2483.5 MHz	
Main test frequencies	F _{MID}	2440 MHz
Spreading	Chirp	
Modulations	None	
Number of channels	1	
Number of antennas	2 (1 antenna per transceiver)	
Number of transceivers	2 identical transceiver inside EUT (1 per Antenna)	
Antenna 1	Type	external dedicated omnidirectional antenna
	Model	OARDSBX244
	Manufacturer	RF Elements
	Gain	4.0 dBi (manufacturer declaration)
Antenna 2	Type	external dedicated omnidirectional antenna
	Model	OARDSBX244
	Manufacturer	RF Elements
	Gain	4.0 dBi (manufacturer declaration)
Manufacturer	MKW electronics GmbH Jutogasse 3 4675 Weibern Austria	
Power supply	V _{NOM}	48 VDC (POE)
AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Output	N/A

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
None				
*Note: Use the following abbreviations: AE : Auxiliary/Associated Equipment, or SIM : Simulator (Not Subjected to Test) CABL : Connecting cables				

1.5 Test Modes

Mode #	Description	
CSS	General conditions:	EUT powered by power over Ethernet
	Radio conditions:	Mode = standalone transmit Spreading = CSS Duty cycle = 100 % (test mode) Power level = Maximum
Max Duty Cycle	General conditions:	EUT powered by power over Ethernet
	Radio conditions:	Mode = standalone transmit Spreading = CSS Duty cycle = max. duty cycle under normal operating conditions Power level = Maximum
Receive	General conditions:	EUT powered by power over Ethernet
	Radio conditions:	Mode = standalone receive Spreading = CSS
AC-Powerline	General conditions:	EUT powered by power over Ethernet
	Radio conditions:	Mode = standalone transmit Spreading = CSS Power level = Maximum

1.6 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2014.1.15

Occupied Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

6dB Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Maximum peak conducted power					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Power spectral density					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Band edge compliance					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Conducted spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2015-02	2016-02

Radiated spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	-	-
Spectrum Analyzer	R&S	FSIQ26	EF00151	2015-03	2016-03
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD Antenna	R&S	HL 223	EF00187	2014-03	2017-03
LPD Antenna	R&S	HL 025	EF00327	2013-02	2016-02

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Storkower Str. 38c, D-15526 Reichenwalde, Germany

AC power line conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
EMI Test Receiver	R&S	ESCS 30	EF00295	2014-10	2015-10

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBμV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyzer (dB}\mu\text{V)} + \text{A.F. (dB)} = \text{Net field strength (dB}\mu\text{V/m)}$$

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBμV/m). The FCC limits are given in units of μV/m. The following formula is used to convert the units of μV/m to dBμV/m:

$$\text{Limit (dB}\mu\text{V/m)} = 20 \cdot \log (\mu\text{V/m})$$

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading	+	AF	=	Net Reading	:	Net reading - FCC limit	=	Margin
21.5 dBμV	+	26 dB	=	47.5 dBμV/m	:	47.5 dBμV/m - 57.0 dBμV/m	=	-9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, IC RSS-210				
Product Specific Standard Section	Requirement – Test	Reference Method	Result	Remarks
RSS-Gen 6.6	Occupied Bandwidth	RSS-Gen 6.6	N/R	Informational only
FCC § 15.247(a)(2) IC RSS-210 § A8.2	6dB Bandwidth	ANSI C 63.10	PASS	
FCC § 15.247(b)(3) IC RSS-210 § A8.4	Maximum peak conducted power	ANSI C 63.10	PASS	
FCC § 15.247(e) IC RSS-210 § A8.2	Power spectral density	ANSI C 63.10	PASS	
47 CFR 15.207 RSS-Gen 8.8	AC power line conducted emissions	ANSI C 63.4	PASS	
FCC § 15.247(d) IC RSS-210 § A8.5	Band edge compliance	ANSI C 63.10	PASS	
FCC § 15.247(d) IC RSS-210 § A8.5	Conducted spurious emissions	ANSI C 63.10	PASS	
FCC § 15.247(d) FCC § 15.209 IC RSS-210 A8.5 IC RSS-Gen 6.13	Transmitter radiated spurious emissions	ANSI C 63.4	PASS	
IC RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C 63.4	PASS	
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – Occupied Bandwidth

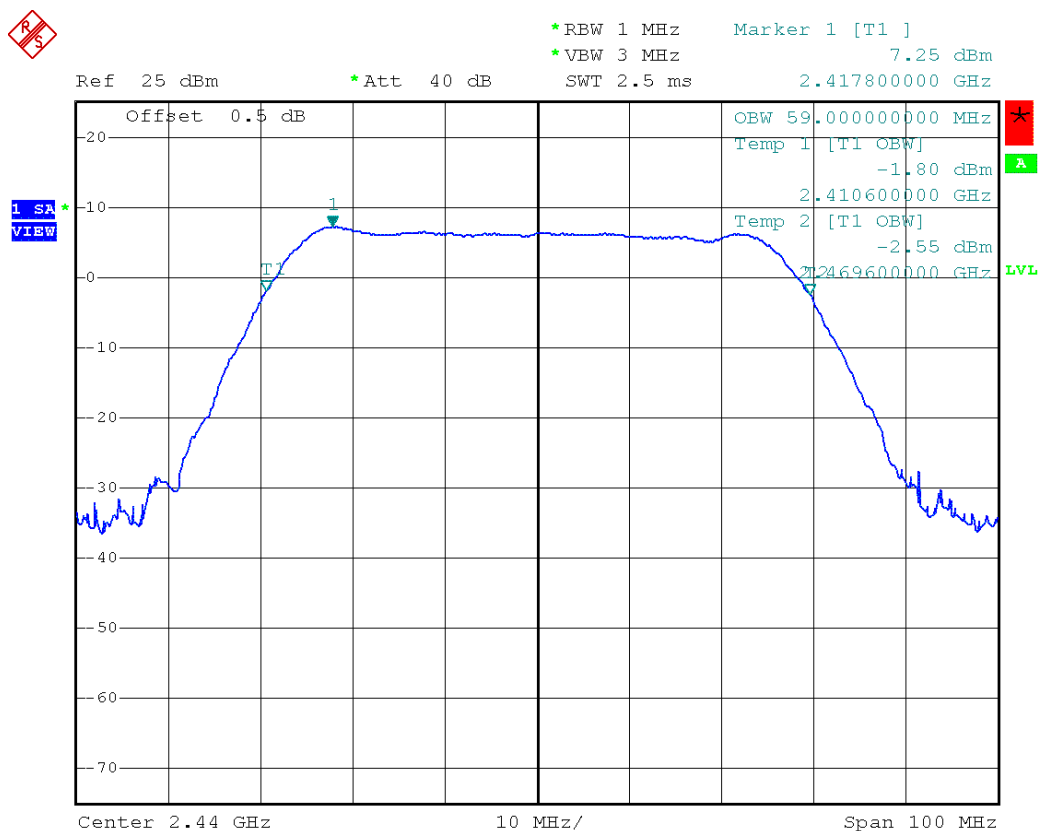
Occupied Bandwidth acc. to IC RSS-Gen				Verdict: PASS
Test according to measurement reference		Reference Method		
		RSS-Gen 6.6		
Test frequency range		Tested frequencies		
		F _{MID}		
Limits				
None (Informational only)				
Test setup				
Spectrum Analyzer EUT				
Test procedure				
1. EUT set to test mode (Communication tester is used if needed) 2. Span set to at least twice the emission spectrum 3. Resolution bandwidth set to 1 % of span 4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function				
Test results				
Channel	Frequency [MHz]	Mode	Occupied Bandwidth [MHz]	
F _{MID}	2440	CSS	59.0	
Comments:				

Occupied Bandwidth – CSS F_{MID}

Occupied Bandwidth acc. to RSS-Gen

Project Number: G0M-1412-4419

Applicant: MKW electronics GmbH
EUT Name: Shirp spread spectrum based transceiver for wireless location
Model: W010
Test Site: Eurofins Product Service GmbH
Operator: Wilfried Treffke
Test Conditions: Tnom / Vnom
Mode: Tx, CSS, 2440 MHz, Ant.2
Test Date: 2015-01-12
Verdict: PASS
Note 1: A spectrum analyzer with an integrated 99% power bandwidth function is used
Note 2: OBW = 59.000 MHz



Date: 12.JAN.2015 15:32:34

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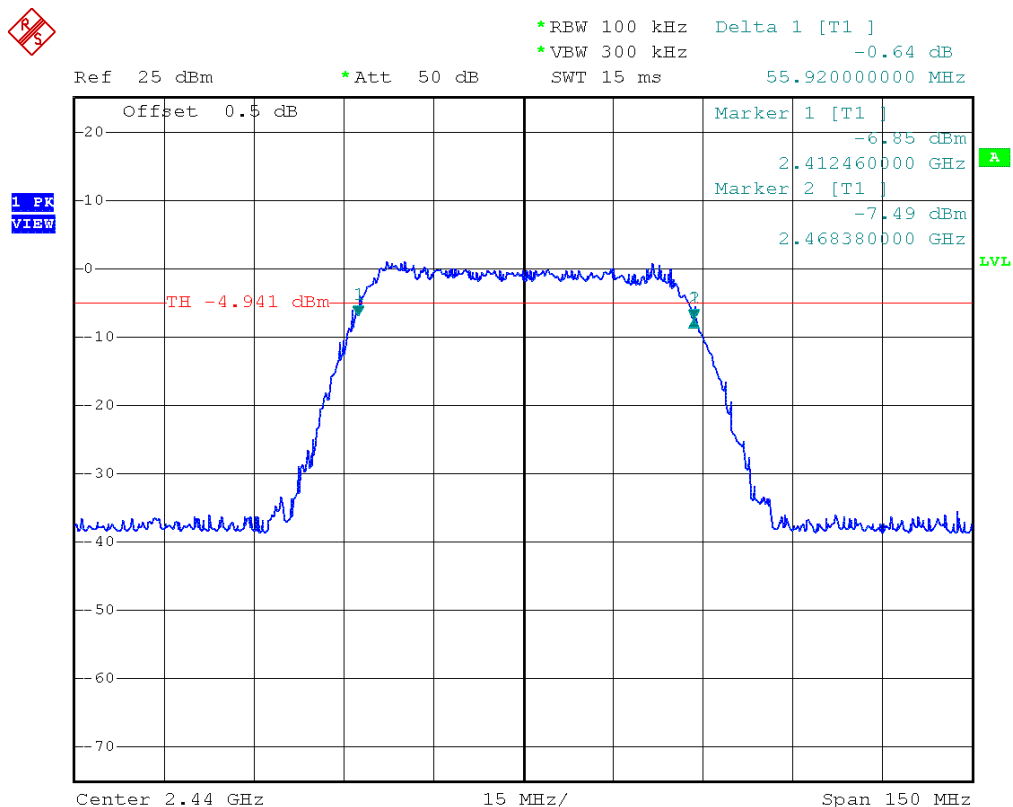
3.2 Test Conditions and Results – 6 dB Bandwidth

6dB Bandwidth acc. to FCC 15.247 / IC RSS-210				Verdict: PASS	
EUT requirement rule parts and clause		Reference			
		FCC 15.247(a)(2) / IC RSS-210 A8.2			
Test according to measurement reference		Reference Method			
		ANSI C63.10			
Test frequency range		Tested frequencies			
		F _{MID}			
Limits					
≥ 500kHz					
Test setup					
Spectrum Analyzer EUT					
Test procedure					
1. EUT set to test mode 2. Span set to at least twice the emission spectrum 3. Detector set to peak and max hold and RBW is set to 100 kHz 4. Envelope peak value of emission spectrum is selected 5. Marker on envelope of spectrum is set to level of -6 dB to the left of the peak 6. Marker on envelope of spectrum is set to level of -6 dB to the right of the peak 7. 6 dB Bandwidth is determined by marker frequency separation					
Test results					
Channel	Frequency [MHz]	Mode	6 dB Bandwidth [kHz]	Limit [kHz]	Result
F _{MID}	2440	CSS	55920	500	PASS
Comments:					

6 dB Bandwidth – CSS F_{MD}
Minimum 6 dB Bandwidth acc. to FCC 15.247

Project Number: G0M-1412-4419

Applicant: MKW electronics GmbH
 EUT Name: Shirp spread spectrum based transceiver for wireless location
 Model: W010
 Test Site: Eurofins Product Service GmbH
 Operator: Wilfried Treffke
 Test Conditions: Tnom / Vnom
 Mode: Tx, CSS, 2440 MHz, modulated
 Test Date: 2015-01-12
 Verdict: PASS
 Note 1: -6 dB BW= 55.92MHz
 Note 2: Minimum 6 dB Bandwidth conducted



Comment: 6 dB bandwidth: 55920 KHz > 500 KHz; verdict: PASS
 Date: 12.JAN.2015 15:24:05

Test Report No.: G0M-1412-4419-TFC247ZB-V02

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3.3 Test Conditions and Results – Duty Cycle

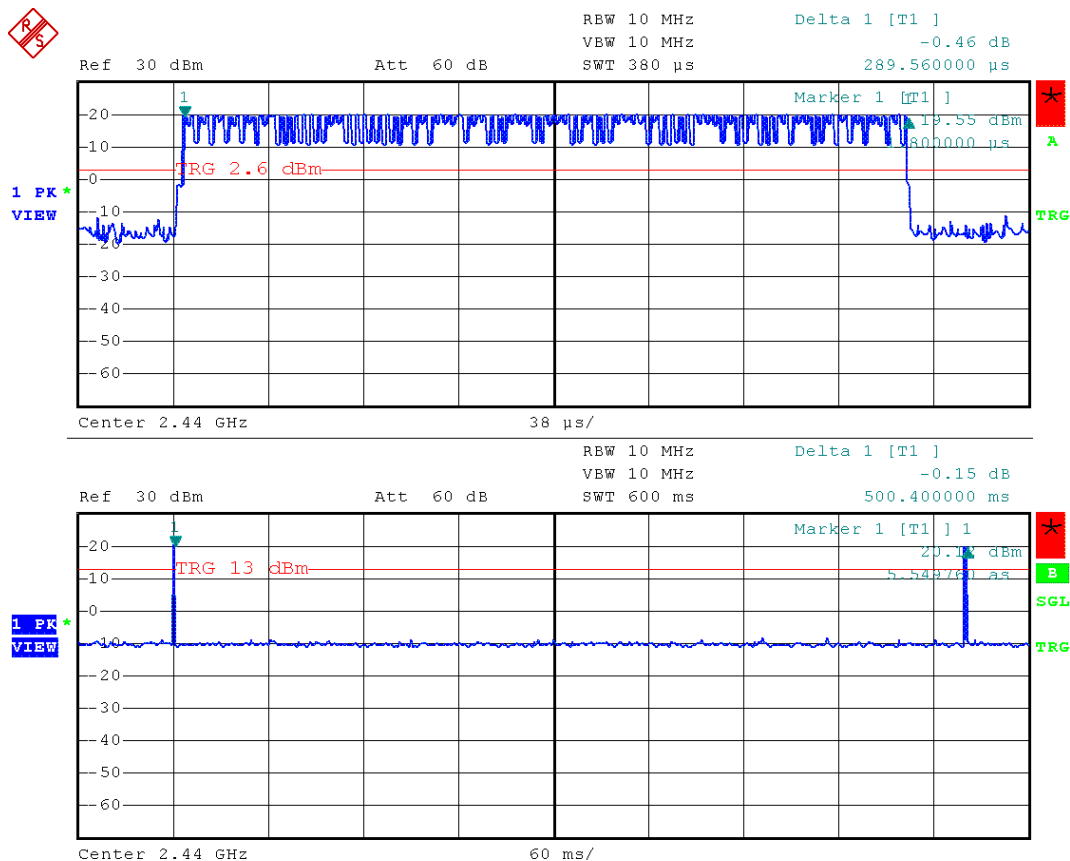
Duty cycle correction acc. to FCC 15.247			Verdict: PASS
Test according referenced standards	Reference Method		
	ANSI C63.10		
Test frequency range	Tested frequencies		
	F _{MID}		
EUT test mode	Max Duty Cycle		
Limits			
None (only for peak to average correction, 20dB max)			
Test setup			
Spectrum Analyzer EUT			
Test procedure			
1. EUT set to test mode 2. Center frequency is set to test frequency 3. Span it set to zero span 4. Resolution bandwidth is set large enough to accurately capture transmission burts 5. Total transmission time is measured			
Test results			
Channel	Frequency [MHz]	Duty Cycle [@ 100ms]	Duty Cycle correction [dB]
F _{MID}	2440	0.0029 corresponds to -50.7dB	-20 *
Comments: * maximum allowed duty cycle correction acc. to ANSI C63.10			

Duty Cycle - F_{MID}

Duty cycle info

Project Number: G0M-1412-4419

Applicant: MKW electronics GmbH
 EUT Name: Shirp spread spectrum based transceiver for wireless location
 Model: W010
 Test Site: Eurofins Product Service GmbH
 Operator: Wilfried Treffke
 Test Conditions: Tnom / Vnom
 Mode: Tx, CSS, 2440 MHz, normal signal
 Test Date: 2015-01-12
 Verdict: PASS
 Note 1: Duty cycle = 0.0029 corresponds to -50.7dB (used correction -20dB)
 Note 2: Tx on=289.56μs, Tx on+Txoff=500.4 ms (100ms for calculation)



3.4 Test Conditions and Results – Maximum peak conducted power

Maximum peak conducted power acc. to FCC 15.247 / IC RSS-210						Verdict: PASS	
EUT requirement rule parts and clause			Reference				
			FCC 15.247(b)(3) / IC RSS-210 A8.4				
Test according to measurement reference			Reference Method				
			ANSI C63.10				
Test frequency range			Tested frequencies				
			F _{MID}				
Measurement mode			Peak				
Maximum antenna gain			4 dBi ⇒ Limit correction = 0 dB				
Limits							
1 W (30 dBm)							
The conducted output power limit specified above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in the table, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.							
Test setup							
Spectrum Analyzer EUT							
Test procedure							
1. EUT set to test mode (Communication tester is used if needed) 2. Center frequency set to test channel center frequency 3. Span set to twice the 20 dB bandwidth and detector to peak and max hold 4. Resolution bandwidth is set to 3 MHz 5. Peak conducted power is determined from peak of spectrum envelope							
Test results antenna 1							
Channel	Frequency [MHz]	Voltage [VDC]	Mode	Peak power [dbm]	Peak power [W]	Limit [dBm]	Margin [dB]
F _{MID}	2440	V _{NOM} = 48	CSS	19.2	0.08318	30	-10.80
Test results antenna 2							
Channel	Frequency [MHz]	Voltage [VDC]	Mode	Peak power [dbm]	Peak power [W]	Limit [dBm]	Margin [dB]
F _{MID}	2440	V _{NOM} = 48	CSS	19.6	0.0912	30	-10.40
Comments:							

3.5 Test Conditions and Results – Power spectral density

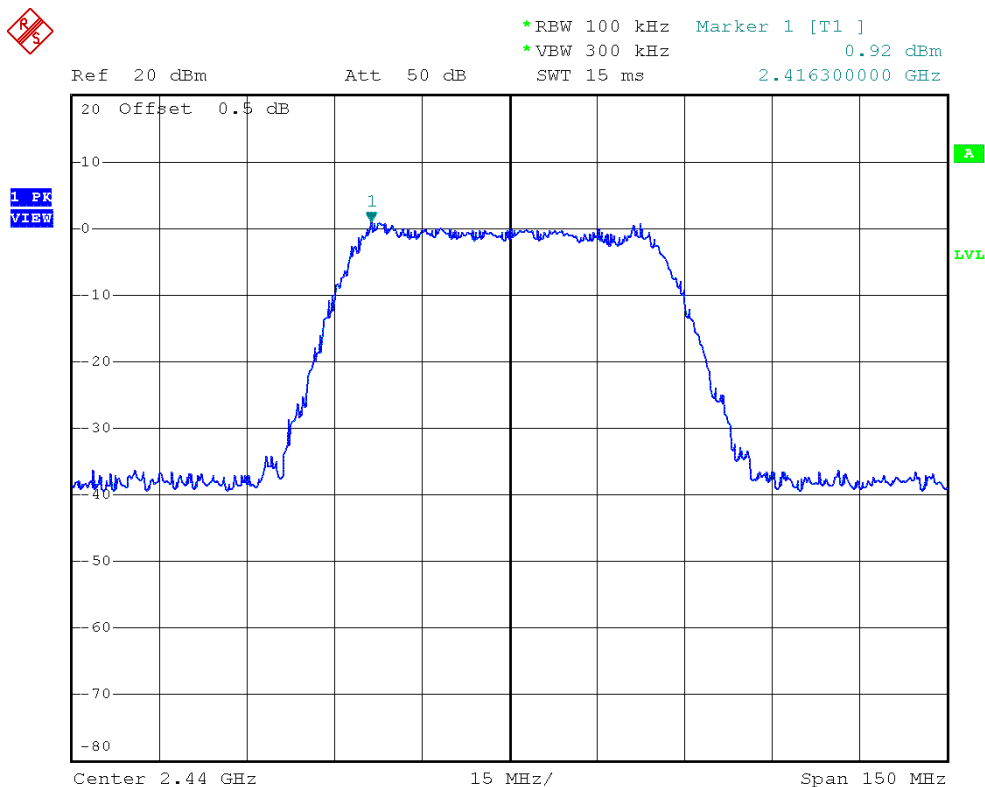
Power spectral density acc. to FCC 15.247 / IC RSS-210						Verdict: PASS
EUT requirement rule parts and clause			Reference			
			FCC 15.247(e) / IC RSS-210 A8.2			
Test according to measurement reference			Reference Method			
			ANSI C63.10			
Test frequency range			Tested frequencies			
			F _{MID}			
Measurement mode			Peak			
Limits						
8 dBm / 3 kHz						
Test setup						
Spectrum Analyzer EUT						
Test procedure						
1. EUT set to test mode (Communication tester is used if needed) 2. Center frequency set to test channel center frequency 3. Span is set large enough to capture maximum emissions in passband, RBW is set to 3kHz 4. Peak power density is determined from peak emission of envelope						
Test results						
Channel	Frequency [MHz]	Test mode	Peak frequency [MHz]	Peak power density [dBm/100kHz]	Limit [dBm/3kHz]	Margin [dB]
F _{MID}	2440	CSS	2416.30	0.92	8.0	-07.08
Comments: measurement with RBW=100kHz						

Power spectral density

Power spectral density acc. to FCC 15.247

Project Number: G0M-1412-4419

Applicant: MKW electronics GmbH
 EUT Name: Shirp spread spectrum based transceiver for wireless location
 Model: W010
 Test Site: Eurofins Product Service GmbH
 Operator: Wilfried Treffke
 Test Conditions: Tnom / Vnom
 Mode: Tx, CSS, 2440 MHz, ant. 2
 Test Date: 2015-01-12
 Verdict: PASS
 Note 1: PSD=0.9dBm
 Note 2: Power spectral density conducted



Comment: Maximum Power Spectral Density=0.92dBm
 Comment: f=2.4163GHz RBW= 100kHz , Limit <8dBm/3kHz
 Date: 12.JAN.2015 15:36:56

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 Storkower Str. 38c, D-15526 Reichenwalde, Germany

3.6 Test Conditions and Results – AC power line conducted emissions

Power line conducted emissions acc. to FCC 47 CFR 15.207 / IC RSS-Gen				Verdict: PASS	
Test according referenced standards		Reference Method			
		ANSI C63.4			
Fully configured sample scanned over the following frequency range		Frequency range			
		0.15 MHz to 30 MHz			
Points of Application		Application Interface			
AC Mains		LISN			
EUT test mode		AC-Powerline			
Limits and results					
Frequency [MHz]	Quasi-Peak [dBμV]	Result	Average [dBμV]	Result	
0.15 to 5	66 to 56*	PASS	56 to 46*	PASS	
0.5 to 5	56	PASS	46	PASS	
5 to 30	60	PASS	50	PASS	
Comments:					
* Limit decreases linearly with the logarithm of the frequency.					

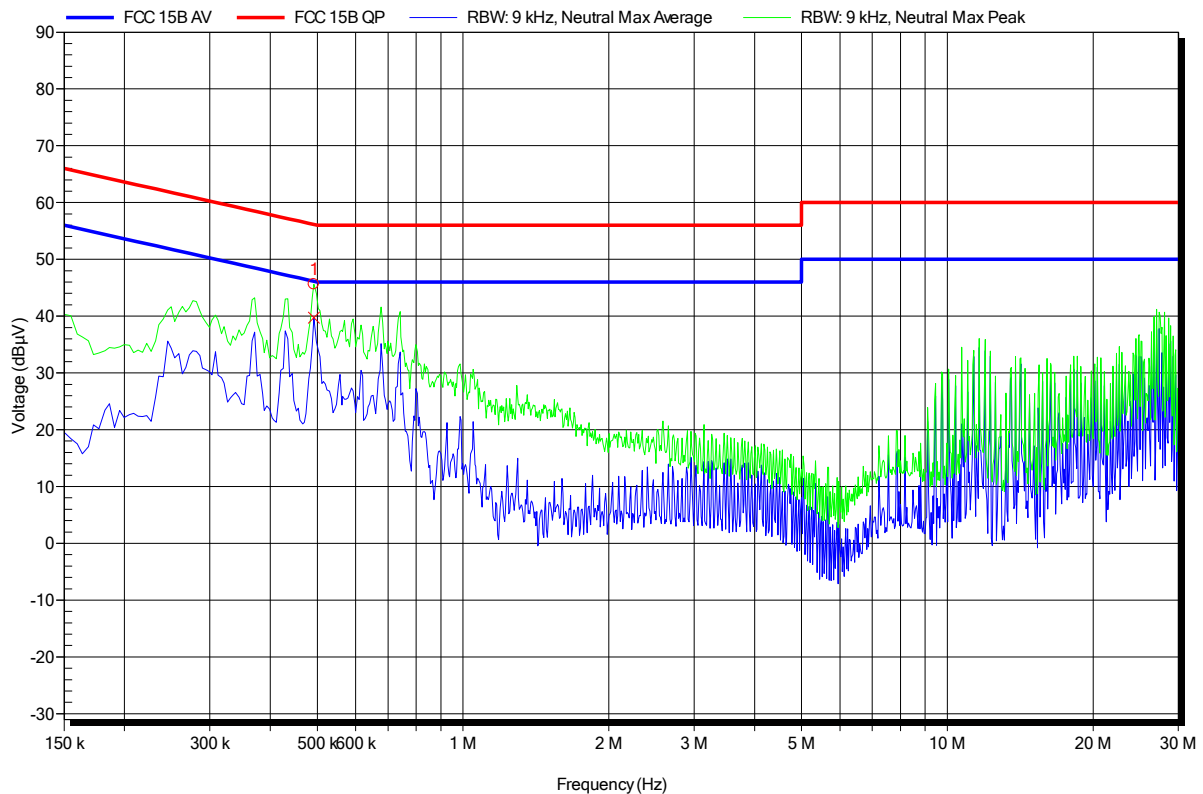
Conducted Emissions

EMI voltage test in the ac-mains according to FCC Part 15b

Project number: GOM-1412-4419

Applicant: Nanotron Technologies GmbH
 EUT Name: Chirp spread spectrum based transceiver used for wireless location
 Model: W010
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Zunke
 Test Conditions: Tnom: 23°C, Unom: 48VDC via PoE feeding
 LISN: ESH2-Z5 N
 Mode: power via POE, WLAN active
 Test Date: 2015-04-23
 Note:

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Frequency	Average	Average Limit	Average Difference	Average Status
492 kHz	39.71 dBµV	46.13 dBµV	-6.42 dB	Pass

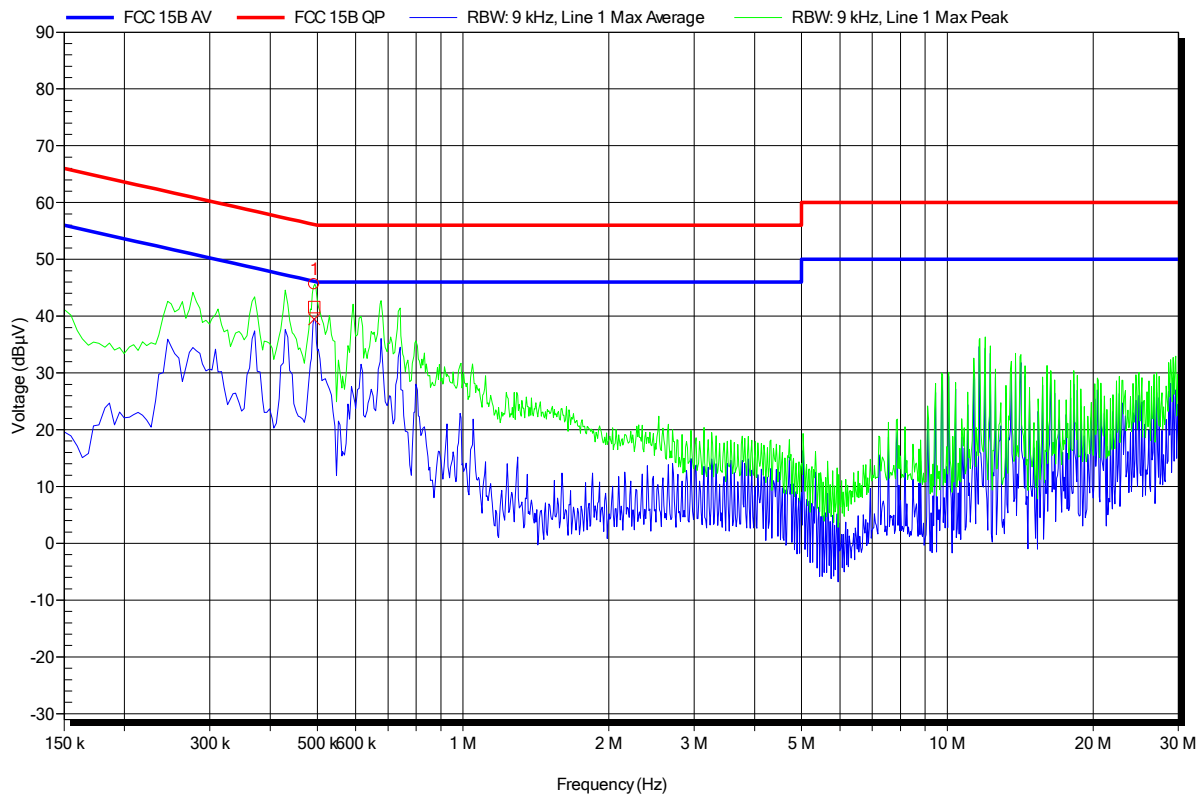
Conducted Emissions

EMI voltage test in the ac-mains according to FCC Part 15b

Project number: GOM-1412-4419

Applicant: Nanotron Technologies GmbH
 EUT Name: Chirp spread spectrum based transceiver used for wireless location
 Model: W010
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Zunke
 Test Conditions: Tnom: 23°C, Unom: 48VDC via PoE feeding
 LISN: ESH2-Z5 L
 Mode: power via POE, WLAN active
 Test Date: 2015-04-23
 Note:

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Frequency 492.9 kHz	Quasi-Peak 41.61 dBµV	Quasi-Peak Limit 56.12 dBµV	Quasi-Peak Difference -14.51 dB	Quasi-Peak Status Pass
Frequency 492.9 kHz	Average 39.47 dBµV	Average Limit 46.12 dBµV	Average Difference -6.65 dB	Average Status Pass

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3.7 Test Conditions and Results – Band edge compliance

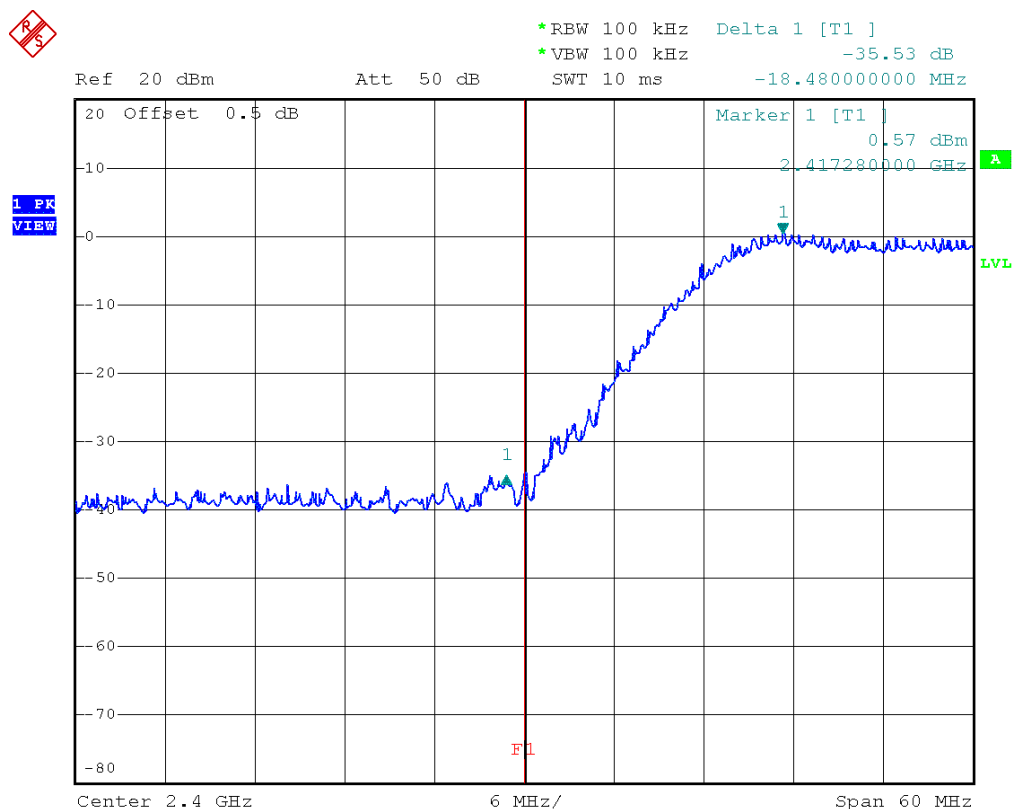
Band-edge compliance acc. to FCC 15.247 / IC RSS-210					Verdict: PASS
EUT requirement rule parts and clause			Reference		
			FCC 15.247(d) / IC RSS-210 A8.5		
Test according to measurement reference			Reference Method		
			ANSI C63.10		
Test frequency range			Tested frequencies		
			F _{MID}		
Measurement mode			Peak		
Limits					
Limit			Condition		
≤ -20 dB / 100 kHz			Peak power measurement detector = Peak		
≤ -30 dB / 100 kHz			Peak power measurement detector = RMS		
Test setup					
Spectrum Analyzer EUT					
Test procedure					
1. EUT set to test mode (Communication tester is used if needed) 2. Span set around lower band edge and detector is set to peak and max hold 3. Resolution bandwidth is set to 100 kHz 4. Markers are set to peak emission levels within frequency band and outside frequency band 5. Band edge attenuation is determined from level difference					
Test results					
Band egge	Frequency [MHz]	Mode	Level [dBc]	Limit [dBc]	Margin [dB]
F _{LOW}	2440	CSS	-35.5	-20	-15.50
F _{HIGH}	2440	CSS	-36.8	-20	-16.80
Comments:					

Band-edge compliance – CSS F_{LOW}

Band-edge compliance acc. to FCC 15.247

Project Number: G0M-1412-4419

Applicant:	MKW electronics GmbH
EUT Name:	Shirp spread spectrum based transceiver for wireless location
Model:	W010
Test Site:	Eurofins Product Service GmbH
Operator:	Wilfried Treffke
Test Conditions:	Tnom / Vnom
Mode:	Tx, CSS, 2440 MHz, modulated
Test Date:	2015-01-12
Verdict:	PASS
Note 1:	Delta marker: -35.53 dB
Note 2:	lower Band-edge, conducted measurement



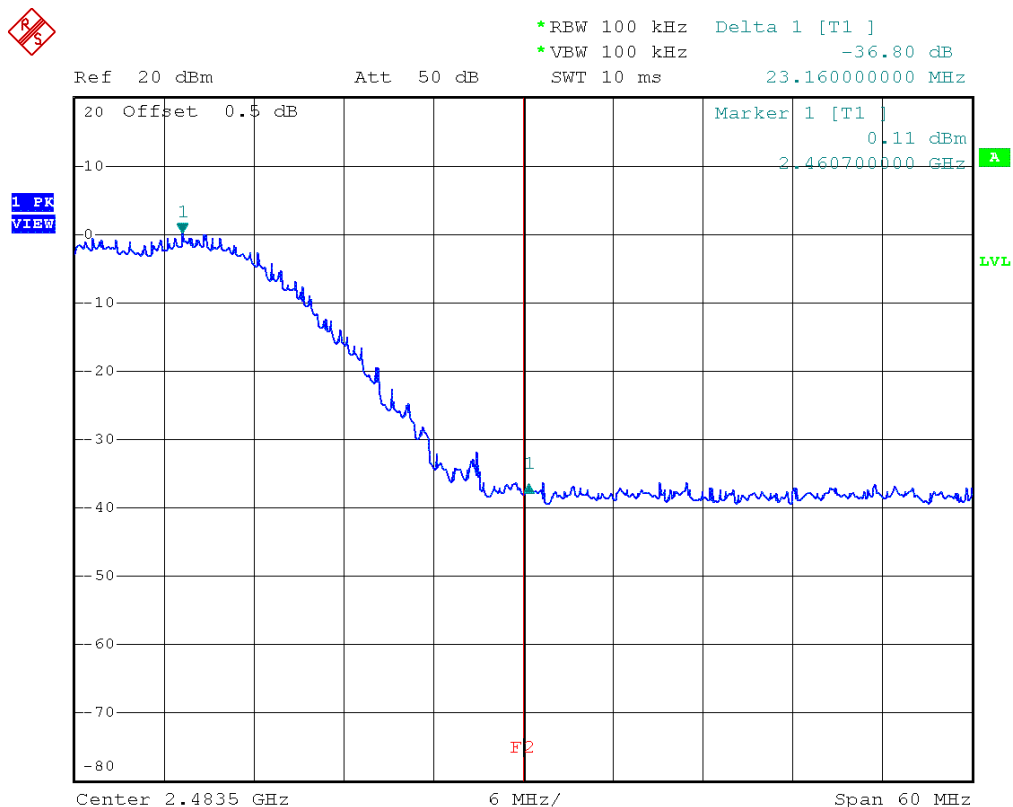
Comment: Limit: Marker Delta value >20 dB; Result: PASS
Date: 12.JAN.2015 16:07:36

Band-edge compliance – CSS F_{HIGH}

Band-edge compliance acc. to FCC 15.247

Project Number: G0M-1412-4419

Applicant: MKW electronics GmbH
 EUT Name: Shirp spread spectrum based transceiver for wireless location
 Model: W010
 Test Site: Eurofins Product Service GmbH
 Operator: Wilfried Treffke
 Test Conditions: Tnom / Vnom
 Mode: Tx, CSS, 2440 MHz, modulated
 Test Date: 2015-01-12
 Verdict: PASS
 Note 1: Delta marker: -36.80 dB
 Note 2: upper Band-edge, conducted measurement



Comment: Limit: Marker Delta value >20 dB; Result: PASS
 Date: 12.JAN.2015 16:10:56

Test Report No.: G0M-1412-4419-TFC247ZB-V02

Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

3.8 Test Conditions and Results – Conducted spurious emissions

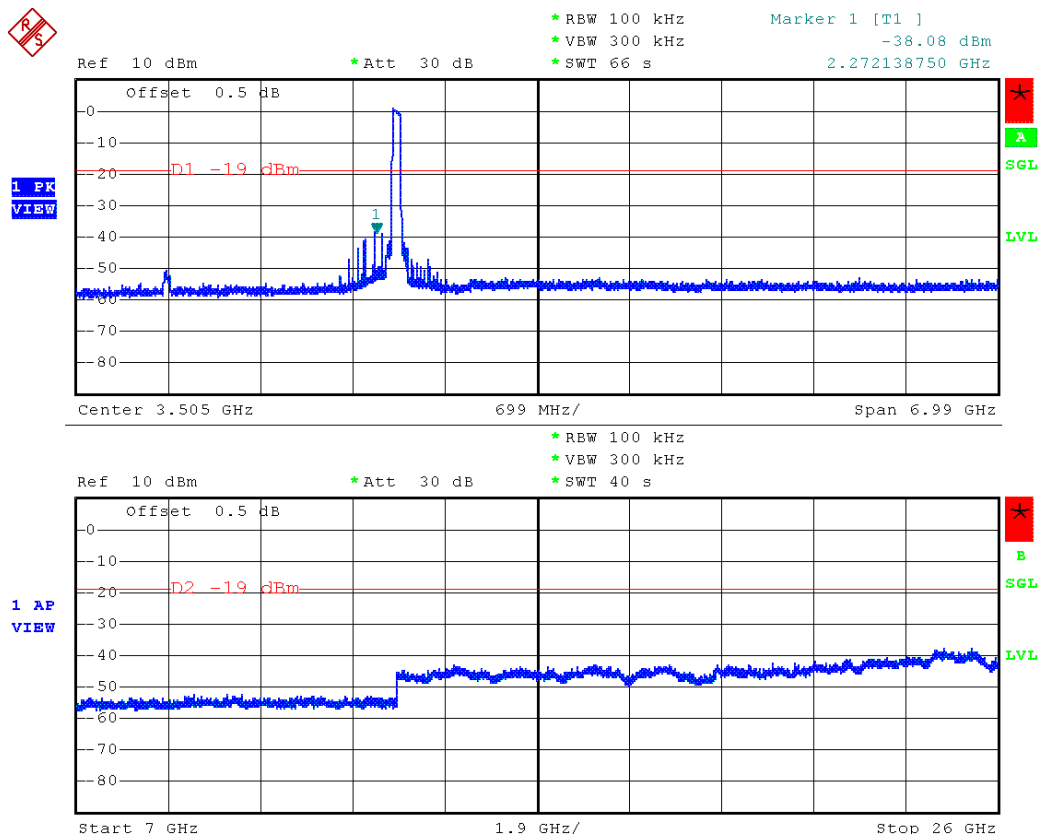
Conducted spurious emissions acc. to FCC 15.247 / IC RSS-210						Verdict: PASS	
EUT requirement rule parts and clause			Reference				
			FCC 15.247(d) / IC RSS-210 A8.5				
Test according to measurement reference			Reference Method				
			ANSI C63.10				
Test frequency range			Tested frequencies				
			10 MHz – 10 th Harmonic				
Measurement mode			Peak				
Limits							
Limit				Condition			
≤ -20 dB / 100 kHz				Peak power measurement detector = Peak			
≤ -30 dB /100 kHz				Peak power measurement detector = RMS			
Test setup							
Spectrum Analyzer EUT							
Test procedure							
1. EUT set to test mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth is set to 100 kHz and detector to peak and max hold 4. Markers are set to peak emission levels within frequency band 5. Emission level is determined by second marker on emission peak 6. Attenuation is determined from level difference							
Test results							
Channel	Frequency [MHz]	Mode	Emission [MHz]	Emission Level [dbm]	Peak power [dBm]	Limit [dBm]	Margin [dB]
F _{MID}	2440	CSS	2272.14	-38.08	1	-19.0	-19.08
Comments:							

Conducted spurious emissions – CSS F_{MID}

Spurious Emissions acc. to FCC 15.247

Project Number: G0M-1412-4419

Applicant: MKW electronics GmbH
EUT Name: Shirp spread spectrum based transceiver for wireless location
Model: W010
Test Site: Eurofins Product Service GmbH
Operator: Wilfried Treffke
Test Conditions: Tnom / Vnom
Mode: Tx, CSS, 2440 MHz, Ant.2
Test Date: 2015-01-12
Verdict: PASS
Note 1: Spurious in non-restricted frequency bands
Note 2: conducted measurement

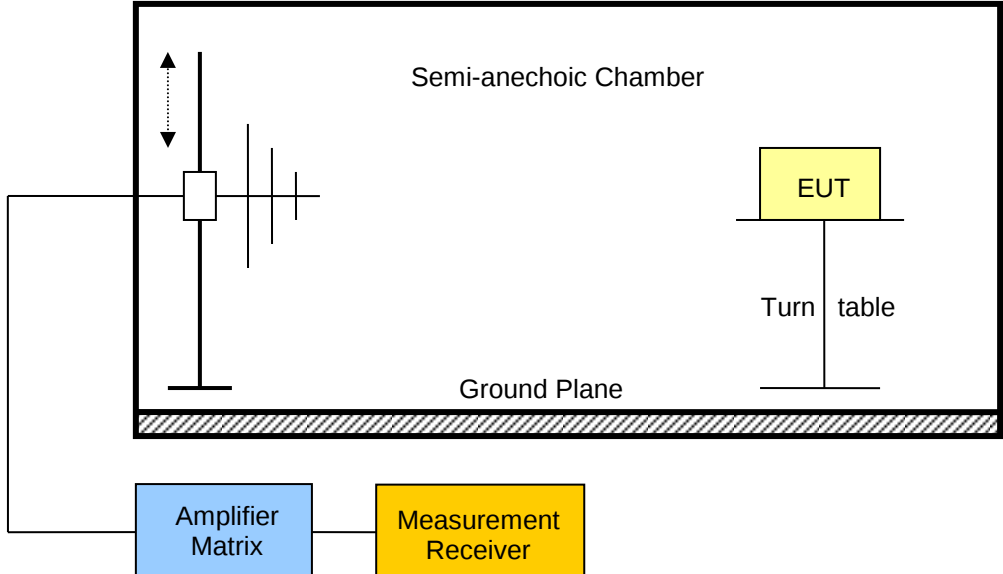


Date: 12.JAN.2015 16:00:43

Test Report No.: G0M-1412-4419-TFC247ZB-V02

Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

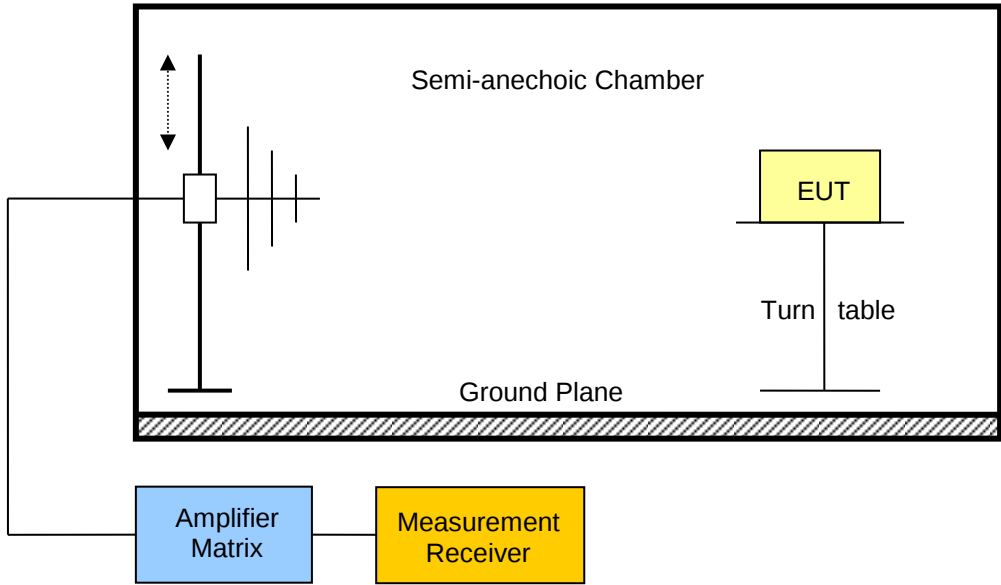
3.9 Test Conditions and Results – Transmitter radiated emissions

Transmitter radiated emissions acc. to FCC 47 CFR 15.247 / IC RSS-210				Verdict: PASS
Test according referenced standards	Reference Method			
	FCC 15.247(d) / IC RSS-210 A8.5			
Test according to measurement reference	Reference Method			
	ANSI C63.10 / ANSI C63.4			
Test frequency range	Tested frequencies			
	30 MHz – 10 th Harmonic			
Limits				
Frequency range [MHz]	Detector	Limit [μV/m]	Limit [dBμV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). When average radiated emission measurements are specified, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.				
Test setup				
				

Test procedure									
1. EUT set to test mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to peak emission levels within restricted bands									
Test results – Antenna 1									
Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Limit dist. [m]	Margin [dB]
F _{MID}	2440	CSS	249.6	35.47	pk	ver	46.00	3	-10.53
F _{MID}	2440	CSS	250.004	41.88	qpk	hor	46.00	3	-04.12
F _{MID}	2440	CSS	336	39.85	pk	ver	74.00	3	-34.15
F _{MID}	2440	CSS	2271.5	58.92	pk	ver	74.00	3	-15.08
F _{MID}	2440	CSS	2271.5	38.92*	av	ver	54.00	3	-15.08
F _{MID}	2440	CSS	2374	72.58	pk	ver	74.00	3	-01.42
F _{MID}	2440	CSS	2374	52.58*	av	ver	54.00	3	-01.42
F _{MID}	2440	CSS	2383	69.20	pk	ver	74.00	3	-04.80
F _{MID}	2440	CSS	2383	49.20*	av	ver	54.00	3	-04.80
F _{MID}	2440	CSS	2388	71.65	pk	ver	74.00	3	-02.35
F _{MID}	2440	CSS	2388	51.65*	av	ver	54.00	3	-02.35
F _{MID}	2440	CSS	2484.4	71.67	pk	ver	74.00	3	-02.33
F _{MID}	2440	CSS	2484.4	51.67*	av	ver	54.00	3	-02.33
F _{MID}	2440	CSS	2486.4	72.53	pk	ver	74.00	3	-01.47
F _{MID}	2440	CSS	2486.4	52.53*	pk	ver	54.00	3	-01.47
F _{MID}	2440	CSS	2496.7	70.76	pk	ver	74.00	3	-03.24
F _{MID}	2440	CSS	2496.7	50.76*	pk	ver	54.00	3	-03.24
F _{MID}	2440	CSS	2500	66.21	pk	ver	74.00	3	-07.80
F _{MID}	2440	CSS	2500	46.21*	pk	ver	54.00	3	-07.80
F _{MID}	2440	CSS	4878	38.50	pk	ver	74.00	1	-35.50
F _{MID}	2440	CSS	4886	39.12	pk	hor	74.00	1	-34.88
Comments: * calculated from peak value by duty cycle correction of -20dB									

Test results – Antenna 2									
Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dbμV/m]	Det.	Pol.	Limit [dbμV/m]	Limit dist. [m]	Margin [dB]
F _{MID}	2440	CSS	249.6	36.91	pk	ver	46.00	3	-09.09
F _{MID}	2440	CSS	250.004	41.88	qpk	hor	46.00	3	-04.12
F _{MID}	2440	CSS	2271.5	59.00	pk	ver	74.00	3	-15.00
F _{MID}	2440	CSS	2271.5	39.00*	av	ver	54.00	3	-15.00
F _{MID}	2440	CSS	2336	65.20	pk	ver	74.00	3	-08.80
F _{MID}	2440	CSS	2336	45.20*	av	ver	54.00	3	-08.80
F _{MID}	2440	CSS	2387	67.67	pk	ver	74.00	3	-06.33
F _{MID}	2440	CSS	2387	47.67*	av	ver	54.00	3	-06.33
F _{MID}	2440	CSS	2483.9	70.39	pk	ver	74.00	3	-03.61
F _{MID}	2440	CSS	2483.9	50.39*	av	ver	54.00	3	-03.61
F _{MID}	2440	CSS	2495.9	67.84	pk	ver	74.00	3	-06.16
F _{MID}	2440	CSS	2495.9	47.84*	pk	ver	54.00	3	-06.16
F _{MID}	2440	CSS	2503	65.62	pk	ver	95.00	3	-29.38
F _{MID}	2440	CSS	4871	41.77	pk	hor	74.00	3	-32.23
F _{MID}	2440	CSS	4876	41.62	pk	ver	74.00	3	-32.38
F _{MID}	2440	CSS	7314	43.26	pk	ver	74.00	3	-30.74
Comments: * calculated from peak value by duty cycle correction -20dB									

3.10 Test Conditions and Results – Receiver radiated emissions

Receiver radiated emissions acc. to IC RSS-210				Verdict: PASS
Test according referenced standards	Reference Method			
	IC RSS-210 A8.5			
Test according to measurement reference	Reference Method			
	ANSI C63.4			
Test frequency range	Tested frequencies			
	30 MHz – 3 th Harmonic			
EUT test mode	Receive			
Limits				
Frequency range [MHz]	Detector	Limit [μV/m]	Limit [dBμV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Test setup				
				

Test procedure							
1. EUT set to receive mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to peak emission levels							
Test results							
Channel	Frequency [MHz]	Emission [MHz]	Emission Level [dB μ V/m]	Pol.	Det.	Limit [dB μ V/m]	Margin [dB]
F _{MID}	Scan	149.68	35.26	ver	pk	43.50	-08.24
F _{MID}	Scan	200	31.86	hor	pk	43.50	-11.64
F _{MID}	Scan	249.6	39.80	hor	pk	46.00	-06.20
F _{MID}	Scan	249.6	36.88	ver	pk	46.00	-09.12
F _{MID}	Scan	304	34.63	ver	pk	46.00	-11.37
F _{MID}	Scan	348.8	32.91	hor	pk	46.00	-13.09
F _{MID}	Scan	499.2	34.42	hor	pk	46.00	-11.58
F _{MID}	Scan	499.2	33.05	ver	pk	46.00	-12.95
F _{MID}	Scan	748.8	34.00	hor	pk	46.00	-12.00
F _{MID}	Scan	748.8	33.82	ver	pk	46.00	-12.18
F _{MID}	Scan	873.6	34.43	ver	pk	46.00	-11.57
F _{MID}	Scan	2194	45.42	hor	pk	53.98	-08.56
F _{MID}	Scan	2332	45.04	hor	pk	53.98	-08.94
F _{MID}	Scan	2434	45.30	hor	pk	53.98	-08.68
F _{MID}	Scan	5672	41.83	ver	pk	53.98	-12.15
F _{MID}	Scan	7432	45.43	ver	pk	53.98	-08.55
F _{MID}	Scan	7736	46.41	hor	pk	53.98	-07.57
Comments: * Physical distance between EUT and measurement antenna.							