

# **TEST REPORT**



Test report no.: 1-3614/17-01-02-B

## **Testing laboratory**

#### CTC advanced GmbH

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#### **Accredited Testing Laboratory:**

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS) The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

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## Manufacturer

FEIG ELECTRONIC GmbH Lange Str. 4 35781 Weilburg-Waldhausen / GERMANY

# Test standard/s

47 CFR Part 15

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

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

	Test Item	
Kind of test item:	RFID Reader	
Model name:	ID CPR44	
FCC ID:	PJMCPR44	
Frequency:	13.56 MHz	
Technology tested:	RFID	
Antenna:	External customized loop coil antenna, type VB-RTR	
Power supply:	5 V DC by external power supply	
Temperature range:	-25 °C to +70 °C	

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

## Test report authorized:

Christoph Schneider Testing Manager Radio Communications & EMC

## **Test performed:**

Tobias Wittenmeier Testing Manager Radio Communications & EMC



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## 2 General information

### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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#### This test report replaces the test report with the number 1-3614/17-01-02-A and dated 2017-02-22

### 2.2 Application details

Date of receipt of order:	2017-02-06
Date of receipt of test item:	2017-02-13
Start of test:	2017-02-14
End of test:	2017-02-15
Person(s) present during the test:	-/-

### 2.3 Test laboratories sub-contracted

None



3 Test standard/s and references						
Test standard	Date	Description				
47 CFR Part 15		Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices				
Guidance	Version	Description				
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio- noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz				
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices				

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## 4 Test environment

Temperature	:	T <sub>nom</sub> T <sub>max</sub> T <sub>min</sub>	<ul> <li>+22 °C during room temperature tests</li> <li>+70 °C during high temperature tests</li> <li>-25 °C during low temperature tests</li> </ul>
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V <sub>nom</sub> V <sub>max</sub> V <sub>min</sub>	<ul><li>5.0 V DC by external power supply</li><li>5.25 V</li><li>4.75 V</li></ul>

## 5 Test item

## 5.1 General description

Kind of test item	:	RFID Reader
Type identification	:	ID CPR44
S/N serial number	•	5733849
HW hardware status	•••	FE670
SW software status	•••	V03.95.00
Frequency band	•	13.56 MHz
Type of radio transmission Use of frequency spectrum		Modulated carrier
Type of modulation	•••	ASK
Number of channels	•••	1
Antenna	•	External customized loop coil antenna, type VB-RTR
Power supply	:	4.75 V to 5.25 V DC by external power supply
Temperature range	•	-25°C to +70°C

# 5.2 Additional information

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

Test setup- and EUT-photos are included in test report:

1-3614/17-01-01\_AnnexA 1-3614/17-01-01\_AnnexB 1-3614/17-01-01\_AnnexD



## 6 Description of the test setup

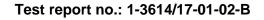
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

- k calibration / calibrated
- ne not required (k, ev, izw, zw not required)
- ev periodic self verification
- Ve long-term stability recognized
- vlkl! Attention: extended calibration interval
- NK! Attention: not calibrated

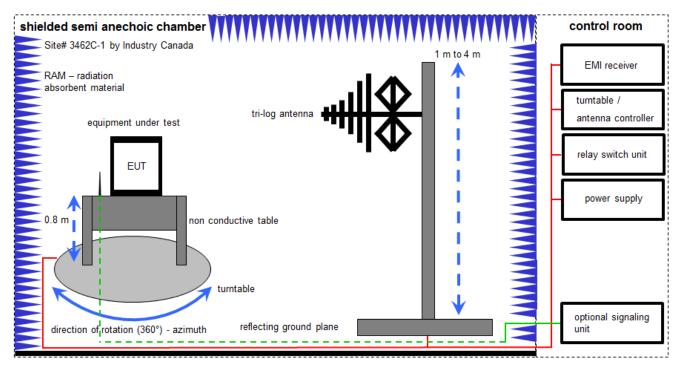
- EK limited calibration
- zw cyclical maintenance (external cyclical maintenance)
- izw internal cyclical maintenance
- g blocked for accredited testing
- \*) next calibration ordered / currently in progress





## 6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

FS = UR + CL + AF

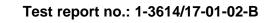
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:

 $FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$ 

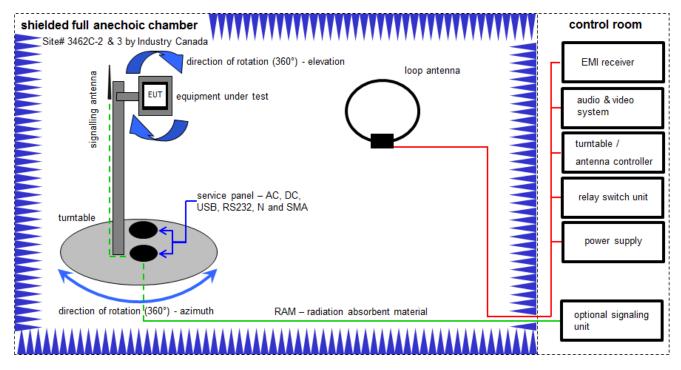
## Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	А	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	A	Meßkabine 1	HF-Absorberhalle	MWB AG 300023	2920A04466	300000551	ne	-/-	-/-
4	Α	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
5	A	Analyzer-Reference- System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
6	А	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	А	Turntable Interface- Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	А	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018





## 6.2 Shielded fully anechoic chamber



Measurement distance: loop antenna 3 meter

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

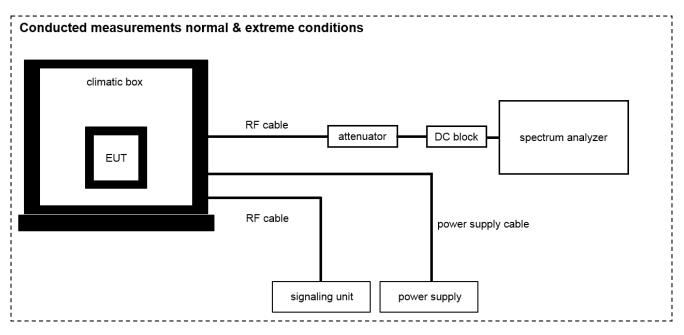
Example calculation:

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

## Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	Α	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	А	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	A	Meßkabine 1	HF-Absorberhalle	MWB AG 300023	2920A04466	300000551	ne	-/-	-/-
4	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
5	A	Analyzer-Reference- System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
6	А	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	А	Turntable Interface- Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018

## 6.3 Conducted measurements normal and extreme conditions



### OP = AV + CA

(OP-output power; AV-analyzer value; CA-loss signal path)

### Example calculation:

OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

### Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	Α	HF-Cable 1 m	BPS-1551-394-BPS	Insulated Wire	080492	300001713	g	-/-	-/-
2	А	DC Power Supply, 60V, 10A	6038A	HP	2752A04866	300001161	Ve	21.01.2015	21.01.2018
3	А	Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540	ev	03.09.2015	03.09.2017
4	А	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	27.01.2017	26.01.2018
5	Α	Loop Antenna	ESPI3	ZEG TS Steinfurt	101713	400001208	ev	-/-	-/-



## 7 Sequence of testing

### 7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) see test details.
- EUT is set into operation.

#### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

#### Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

## 7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) see test details.
- EUT is set into operation.

#### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

#### **Final measurement**

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

# 8 Measurement uncertainty

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

## 9 Summary of measurement results

$\square$	No deviations from the technical specifications were ascertained
	There were deviations from the technical specifications ascertained
	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

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CTC I advanced

TC Identifier	Description	Verdict	Date	Remark
<b>RF-Testing</b>	CFR Part 15	See table!	2017-05-05	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	С	NC	NA	NP	Remark
§ 15.225 (a)	Field strength of the fundamental	Nominal	Nominal	$\boxtimes$				-/-
§ 15.209 & § 15.225 (b-d)	Field strength of the harmonics and spurious	Nominal	Nominal	$\boxtimes$				-/-
§ 15.109	Receiver spurious emissions and cabinet radiations	Nominal	Nominal	$\boxtimes$				-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal			$\boxtimes$		-/-
§ 15.225 (a)	Frequency tolerance	Normal & extreme conditions	Normal & extreme conditions	$\boxtimes$				-/-

## Note:

C Compliant NC Not compliant

NA Not applicable

NP Not performed

## 10 Additional comments

Reference documents:	None
Special test descriptions:	None
Configuration descriptions:	None



# 11 Measurement results

# **11.1 Field strength of the fundamental**

### Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters				
Detector:	Quasi peak / peak (worst case)			
Resolution bandwidth:	120 kHz			
Video bandwidth:	≥ 3x RBW			
Trace mode:	Max hold			
Used equipment:	See chapter 7.2A			
Measurement uncertainty:	See chapter 8			

#### Limit:

	FCC	
Frequency	Field strength	Measurement distance
(MHz)	(µV/m)	(m)
13.553 to 13.567	15,848 (84 dBµV/m)	30

### **Recalculation:**

According to ANSI C63.10						
Frequency	Formula	Correction value				
13.56 MHz	$\begin{split} FS_{\text{limit}} &= FS_{\text{max}} - 40\log\left(\frac{d_{\textit{leartfield}}}{d_{\textit{measure}}}\right) - 20\log(\frac{d_{\textit{limit}}}{d_{\textit{measure}}})\\ FS_{\text{limit}} & \text{is the calculation of field strength at the limit distance,}\\ expressed in dB\muV/m\\ FS_{\text{max}} & \text{is the measured field strength, expressed in dB\muV/m}\\ d_{\text{near field}} & \text{is the } \lambda 2\pi \text{ distance} \\ d_{\text{measure}} & \text{is the efference limit distance} \\ fm the efference limit distance \\ d_{\text{image}} & \text{is the efference limit distance} \\ d_{\text{measure}} & \text{is the efference limit distance} \\ fm the efference limit distance \\ fm the efference \\ fm the effect \\ fm the effec$	-21.4 from 3m to 30m				

## Result:

Field strength of the fundamental					
Frequency	13.56 MHz				
Distance	@ 3 m	@ 30 m			
Measured / calculated value	75.6 dBµV/m	54.2 dBµV/m			

# **11.2 Field strength of the harmonics and spurious**

### Measurement:

The maximum detected field strength for the harmonics and spurious.

Measurement parameters				
Detector:	Quasi peak / average or			
Delector.	peak (worst case – pre-scan)			
	F < 150 kHz: 200 Hz			
Resolution bandwidth:	150 kHz < F < 30 MHz: 9 kHz			
	30 MHz < F < 1 GHz: 120 kHz			
	F < 150 kHz: 1 kHz			
Video bandwidth:	150 kHz < F < 30 MHz: 100 kHz			
	30 MHz < F < 1 GHz: 300 kHz			
Trace mode:	Max hold			
Used equipment:	See chapter 6.1A & 6.2 A			
Measurement uncertainty:	See chapter 8			

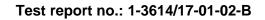
### Limit:

FCC					
Frequency	Field strength	Measurement distance			
(MHz)	(dBµV/m)	(m)			
0.009 - 0.490	2400/F(kHz)	300			
0.490 – 1.705	24000/F(kHz)	30			
1.705 – 30	30 (29.5 dBµV/m)	30			
30 - 88	100 (40 dBµV/m)	3			
88 – 216	150 (43.5 dBµV/m)	3			
216 – 960	200 (46 dBµV/m)	3			

**Note:** For a reduced measurement distance, please take a look at the limit line and the ANSI C63.10-2013 sub clause 6.4 radiated emissions from unlicensed wireless devices below 30 MHz.

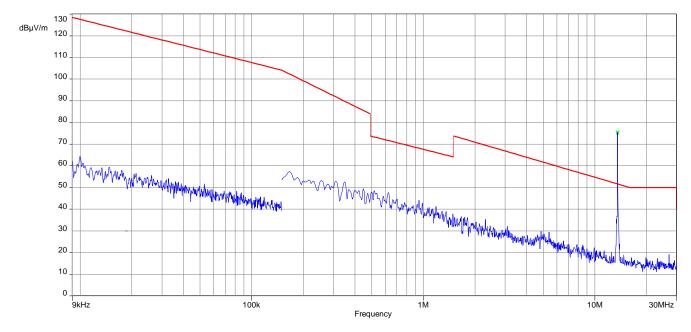
#### Result:

Detected emissions						
Frequency	Detector	Resolution bandwidth	Detected value			
(MHz)	Detector	(kHz)	(dBµV/m @ 3m)			
All emissions are more that	All emissions are more than 10 dB below the limit. For emissions between 30 MHz and 1 GHz see result table					
	below	the plot.				



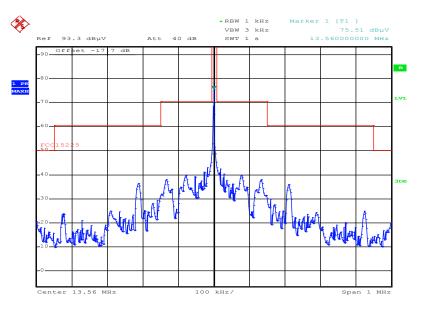


## Plots:



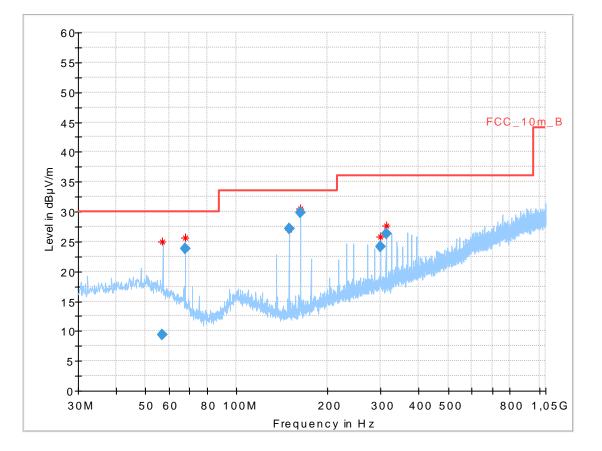
Plot 1: 9 kHz - 30 MHz, magnetic emissions

Plot 2: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



Date: 15.FEB.2017 10:09:17





### Plot 3: 30 MHz – 1 GHz, vertical and horizontal polarisation

### Final\_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
56.928450	9.40	30.00	20.60	1000.0	120.000	103.0	V	95.0	12.6
67.799700	23.77	30.00	6.23	1000.0	120.000	203.0	V	359.0	10.2
149.164050	27.19	33.50	6.31	1000.0	120.000	100.0	V	240.0	9.2
162.714900	29.86	33.50	3.64	1000.0	120.000	100.0	V	358.0	9.8
298.297800	24.14	36.00	11.86	1000.0	120.000	270.0	Н	264.0	14.4
311.863200	26.37	36.00	9.63	1000.0	120.000	98.0	V	-27.0	14.8



## **11.3 Frequency error**

#### Measurement:

The maximum detected field strength for the spurious.

Measurement parameters				
Detector:	Peak detector			
Resolution bandwidth:	10 Hz			
Video bandwidth:	> RBW			
Trace mode:	Max hold			
Used equipment:	See chapter 6.3A			
Measurement uncertainty:	See chapter 8			

### Limit:

FCC The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. (±1.356 kHz)

### Result: Temperature variation

Frequency tolerance						
Measured frequency (MHz)	Frequency error (kHz)	Conditions	Result			
13.55977	-0.2	-25 °C & 100% voltage	compliant			
13.55979	-0.2	-20 °C & 100% voltage	compliant			
13.55981	-0.2	-10 °C & 100% voltage	compliant			
13.55981	-0.2	0 °C & 100% voltage	compliant			
13.55998	-0.3	+10 °C & 100% voltage	compliant			
13.55974	-0.3	+20 °C & 100% voltage	compliant			
13.55970	-0.3	+30 °C & 100% voltage	compliant			
13.55968	-0.3	+40 °C & 100% voltage	compliant			
13.55967	-0.3	+50 °C & 100% voltage	compliant			
13.55969	-0.3	+60 °C & 100% voltage	compliant			
13.55973	-0.3	+70 °C & 100% voltage	compliant			

#### Result: Voltage variation

Frequency tolerance					
Measured frequency (MHz)	Frequency error (kHz)	Conditions	Result		
13.55972	-0.3	+20 °C & 85% voltage	compliant		
13.55972	-0.3	+20 °C & 100% voltage	compliant		
13.55972	-0.3	+20 °C & 115% voltage	compliant		



# 12 Observations

No observations except those reported with the single test cases have been made.



# Annex A Document history

Version	Applied changes	Date of release
	Initial release	2017-02-22
-A	Editorial corrections	2017-05-05
-В	Change picture	2017-05-05

# Annex B Further information

### <u>Glossary</u>

AVG	-	Average
DUT	-	
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN	-	Product marketing name
HMN	-	Host marketing name
HVIN	-	Hardware version identification number
FVIN	-	Firmware version identification number
OBW		Occupied Bandwidth
OC		Operating Channel
OCW		Operating Channel Bandwidth
OOB		Out Of Band



# Annex C Accreditation Certificate

first page	last page
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#### Note:

The current certificate including annex can be received on request.