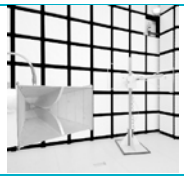
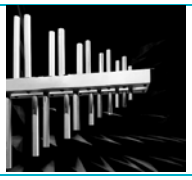
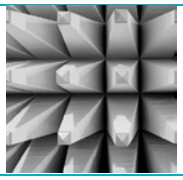

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

TEST REPORT

Test report no.: 1-5758/18-01-02-A

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com

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-12076-01-03

Applicant

Valeo Comfort and Driving Assistance
76 rue Auguste Perret - ZI Europarc
94046 CRETEIL CEDEX / FRANCE
Phone: +33 1 48 84 54 00
Fax: -/-
Contact: Jerome Hugot
e-mail: jerome.hugot@valeo.com
Phone: +33 1 48 84 57 14

Manufacturer

Valeo Comfort and Driving Assistance
76 rue Auguste Perret - ZI Europarc
94046 CRETEIL CEDEX / FRANCE

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 9	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

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

Test Item

Kind of test item:	**RKE & Smart Key**
Model name:	**ID21A**
FCC ID:	**N5F-ID21A**
IC:	**3248A-ID21A**
Frequency band	Low channel: 433.20 MHz / High channel: 434.64 MHz
Technology tested:	Proprietary RF technology with 2 different bandwidths
Antenna:	Integrated antenna
Power supply:	3.0 V DC by CR2032 battery
Temperature range:	-20°C to +65°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:

cn=Christoph Schneider, o=CTC advanced GmbH, ou=SND-161128, email=Christoph.Schneider@ctcadvanced.com, c=DE
2018.02.28 13:53:48 +01'00'

Christoph Schneider
Lab Manager
Radio Communications & EMC

Test performed:

cn=Andreas Luckenbill, o=CTC advanced GmbH, ou=LUC-180217, email=andreas.luckenbill@ctcadvanced.com, c=DE
2018.02.28 11:01:06 +01'00'

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

1 Table of contents

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

This test report replaces the test report with the number 1-5758/18-01-02 and dated 2018-02-17.

2.2 Application details

Date of receipt of order:	2018-01-08
Date of receipt of test item:	2018-01-08
Start of test:	2018-01-09
End of test:	2018-01-10
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
RSS - 210 Issue 9	August 2016	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

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

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests No tests under extreme conditions required. No tests under extreme conditions required.
Relative humidity content	:		32 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	3.0 V DC by CR2032 battery No tests under extreme conditions required. No tests under extreme conditions required.

5 Test item

5.1 General description

Kind of test item	:	RKE & Smart Key
Type identification	:	ID21A
HMN	:	-/-
PMN	:	ID Geber NG2.1
HVIN	:	BB (for Black variant) CB (for Chrome variant)
FVIN	:	-/-
S/N serial number	:	-/-
HW hardware status	:	b101050_07_e (Chrome), b101050_10_e (Black)
SW software status	:	v.9.0
Frequency band	:	Low channel: 433.20 MHz / High channel: 434.64 MHz
Type of radio transmission **Use of frequency spectrum**	: :	Modulated carrier
Type of modulation	:	FSK
Number of channels	:	2
Antenna	:	Integrated antenna
Power supply	:	3.0 V DC by CR2032 battery
Temperature	:	-20°C to +65°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: 1-5758/18-01-01_AnnexA
1-5758/18-01-01_AnnexB
1-5758/18-01-01_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).

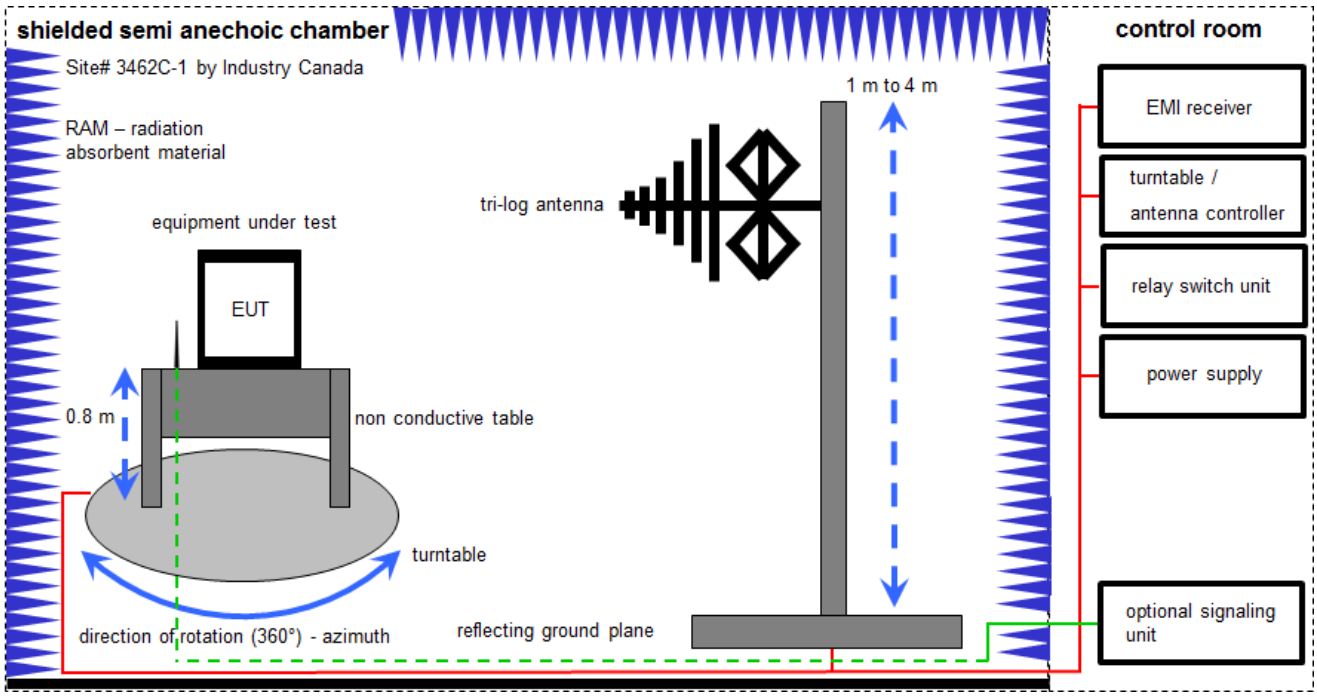
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	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 confirmed with 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

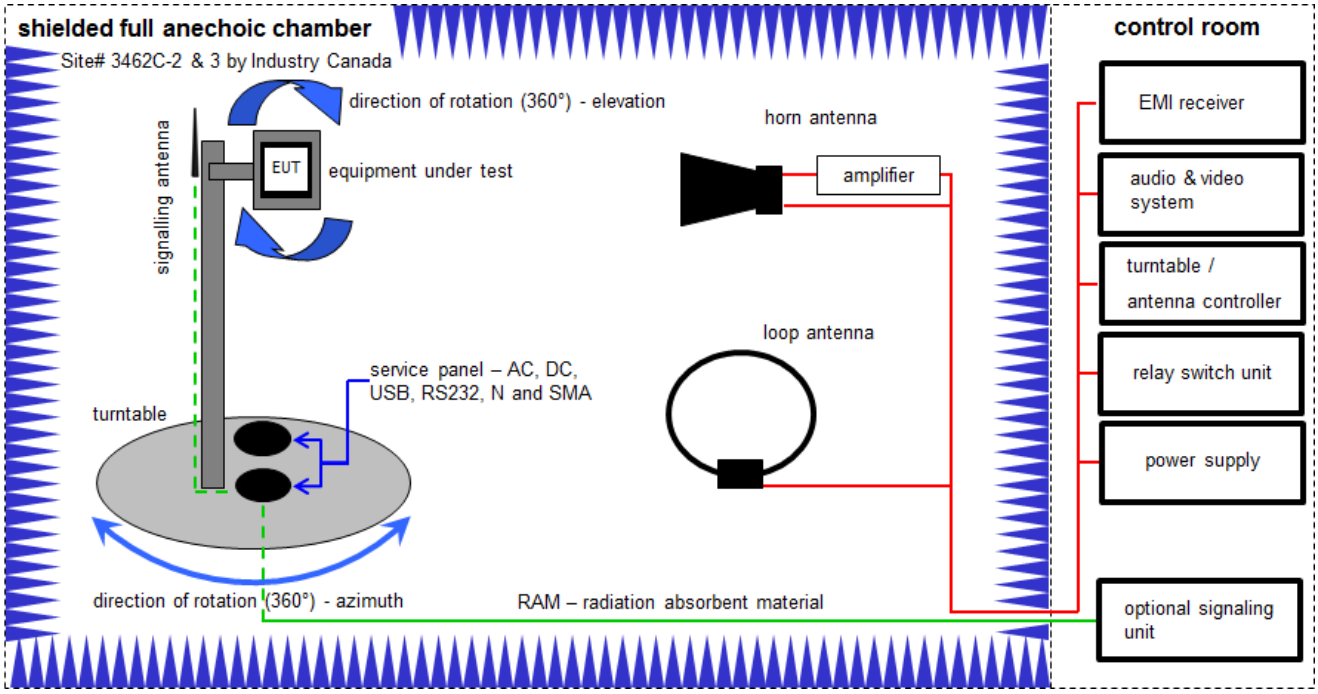
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	Meßkabine 1	HF-Absorberhalle	MWB AG 300023		300000551	ne	-/-	-/-
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	15.12.2017	14.12.2018
4	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-

6.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter

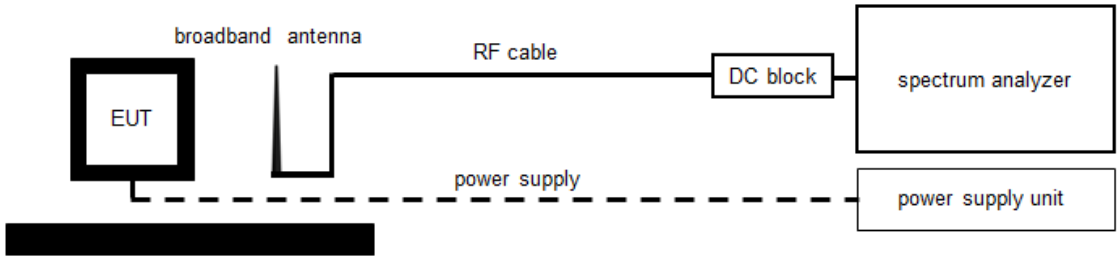
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	07.07.2017	06.07.2019
2	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	k	07.07.2017	06.07.2019
3	B	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne	-/-	-/-
4	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
5	A, B	Computer	Intel Core i3 3220/3,3 GHz, Prozessor		2V2403033A5421	300004591	ne	-/-	-/-
6	A, B	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
7	A, B	Anechoic chamber		TDK		300003726	ne	-/-	-/-

6.3 Test setup for normalized measurement configurations



OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	MXA Signal Analyzer 20 Hz - 26.5 GHz	N9020A MXA Signal Analyzer	Agilent Technologies	US46220229	300003805	vlKl!	14.12.2017	13.12.2019
2	A	HF-Cable 1 m	BPS-1551-394-BPS	Insulated Wire	080492	300001713	g	-/-	-/-

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, it is placed on a table with 0.8 m height.
- 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 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 pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- 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.

*)Note: The sequence will be repeated three times with different EUT orientations.

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.

7.3 Sequence of testing radiated spurious 1 GHz to 6 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 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 is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector 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 maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, 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**
Signal bandwidth	± RBW
Maximum output field strength	± 3 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB

9 Summary of measurement results

☒	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.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210, Issue 9, Annex A	See table!	2018-02-28	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	C	NC	NA	NP	Remark
§ 15.35 (c) RSS-GEN	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal					
§ 15.231 (a) (1) RSS-210 Issue 9	Switch off time	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.231 (b) (3) (c) RSS-210 Issue 9	Emission bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.231 (b) RSS-210 Issue 9	Field strength of Fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 RSS-210 Issue 9	Field strength of harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 RSS-GEN	Receiver spurious emissions (radiated)	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

9.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: The device has two different types of transmission.
RKE – small signal bandwidth, used for pushed button method
CA – wide signal bandwidth, enabled by the car if the key is detected

10 Measurement results

10.1 Timing of the transmitter

Measurement:

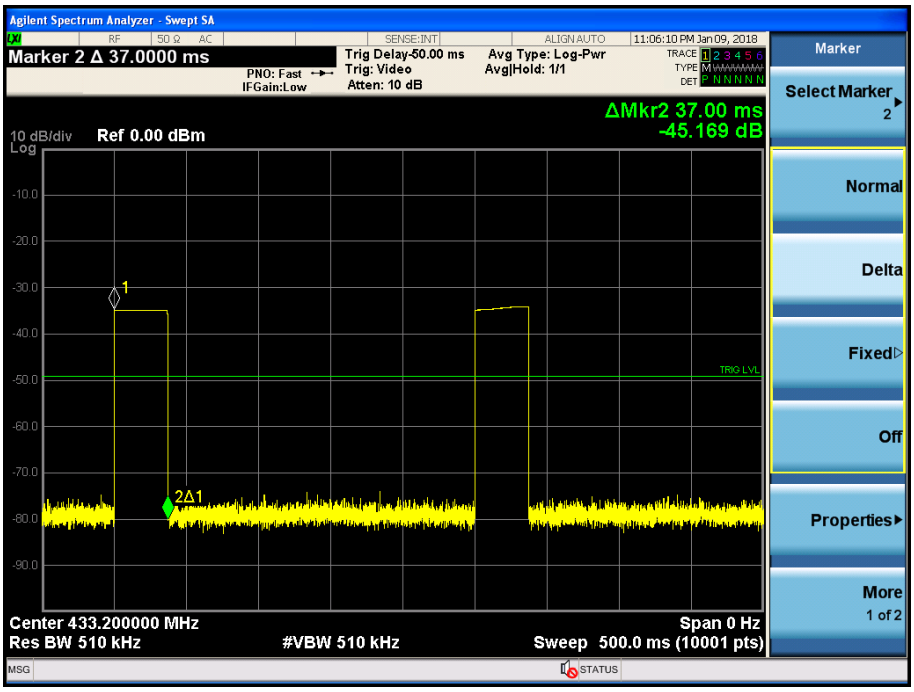
Measurement parameter	
Detector:	Peak
Sweep time:	See plots
Resolution bandwidth:	510 kHz
Video bandwidth:	510 kHz
Span:	Zero
Trace-Mode:	Single sweep
Test setup:	See chapter 6.3 A

Limits:

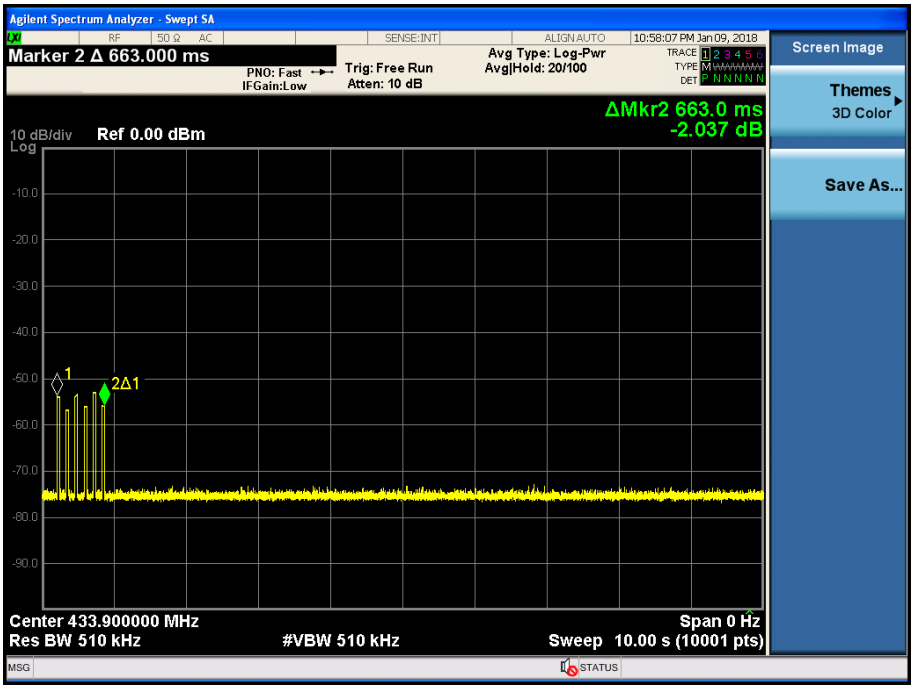
FCC	IC
(c) Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking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

Result:

Plot 1: Transmit burst



Plot 2: Timing of the transmitter



The different power levels results from the different frequencies which are used alternating by the device

Transmit time (Tx on)	=	37.0 ms	(Plot 1)
Tx on + Tx off	=	100 ms (1 burst per 100 ms)	(Plot 2)

The peak-to-average correction factor is calculated with 20 x Log [Tx on/(Tx on + Tx off)].
Hereby the peak-to-average correction factor is -8.64 dB.

10.2 Switch off time

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	10 s
Resolution bandwidth:	510 kHz
Video bandwidth:	510 kHz
Span:	Zero
Trace-Mode:	Single sweep
Test setup:	See chapter 6.3 A

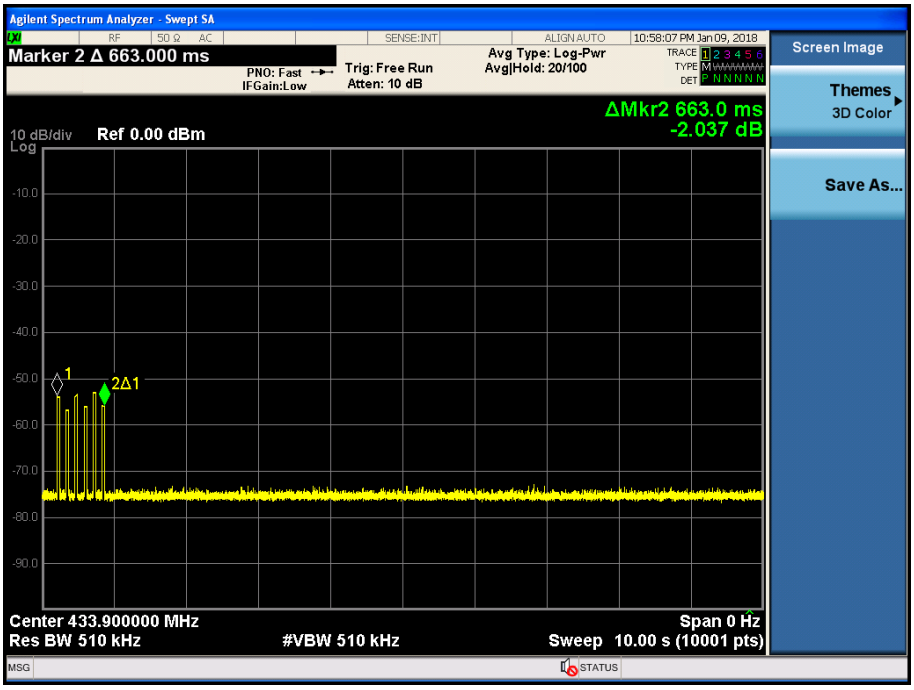
Limits:

FCC	IC
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	

Results:

Plot 1: TX on time

The EUT automatically ceases transmission within 663 ms after releasing the switch (worst case).



10.3 Emission bandwidth

Measurement:

Measurement of the 99 % bandwidth of the modulated signal

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	2 kHz
Video bandwidth:	10 kHz
Span:	500 kHz
Trace-Mode:	Max. hold
Test setup:	See chapter 6.3 A
Measurement uncertainty:	See chapter 8

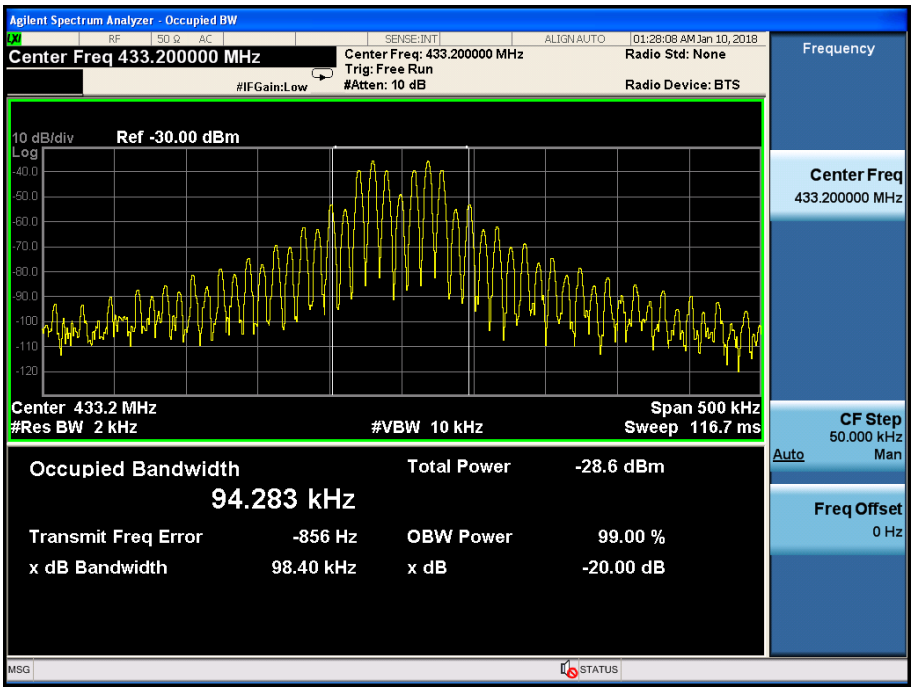
Limits:

FCC	IC
433.20 MHz: The OBW shall not be wider than 0.25 % of the center frequency, here maximum 1.0830 MHz.	
434.64 MHz: The OBW shall not be wider than 0.25 % of the center frequency, here maximum 1.0866 MHz.	

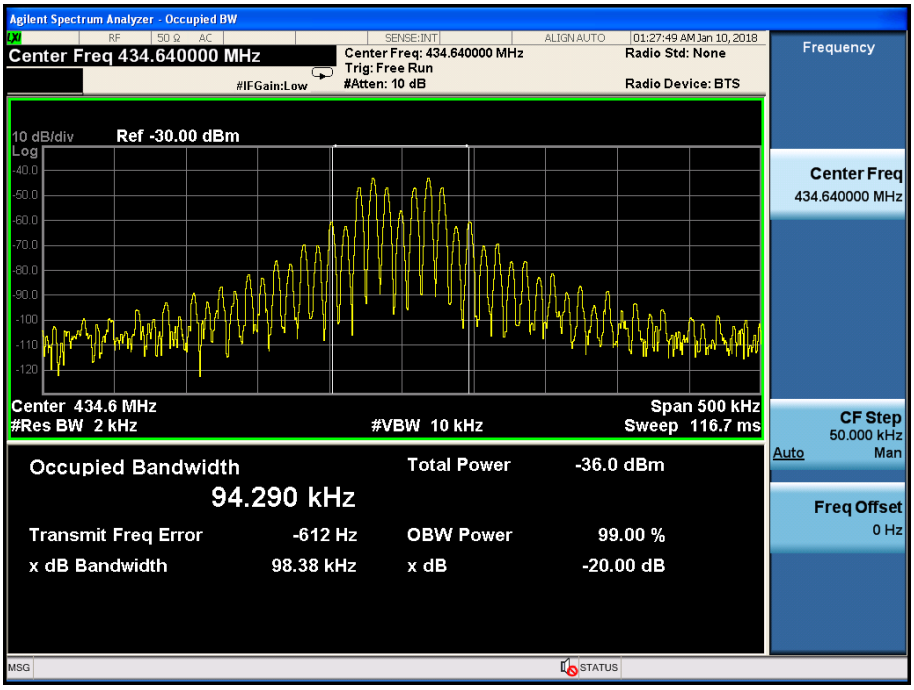
Channel / MHz	Test conditions		Signal bandwidth / kHz	
	Mode		OBW 99%	20 dB-bandwidth
433.20 CA	T_{nom}	V_{nom}	94.28	98.40
434.64 CA	T_{nom}	V_{nom}	94.29	98.38
433.20 RKE	T_{nom}	V_{nom}	38.97	42.58
434.64 RKE	T_{nom}	V_{nom}	38.88	42.53

Plots:

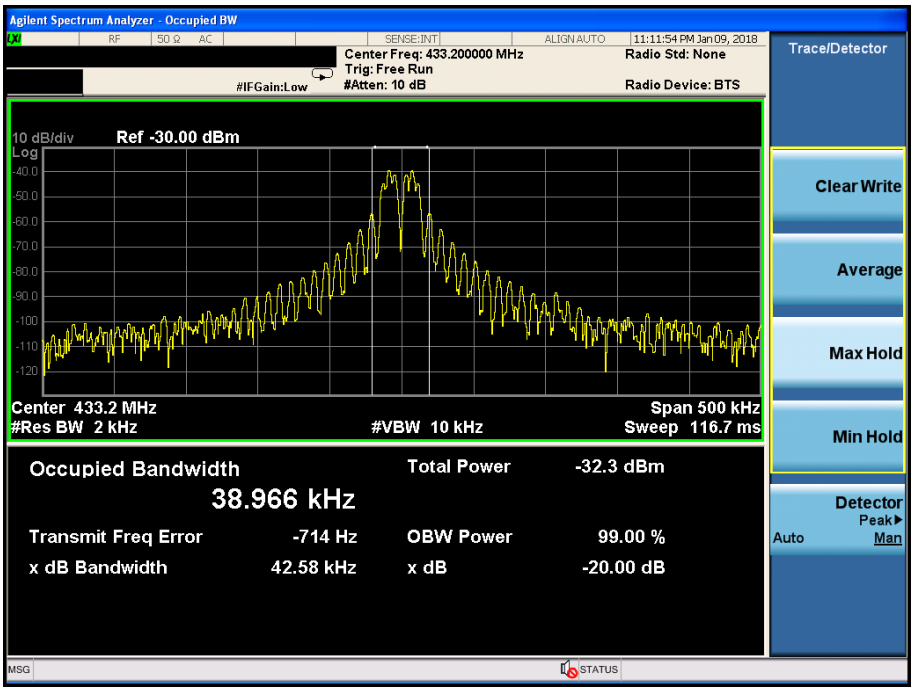
Plot 1: 99% bandwidth and 20 dB bandwidth, 433.20 MHz, CA-Mode



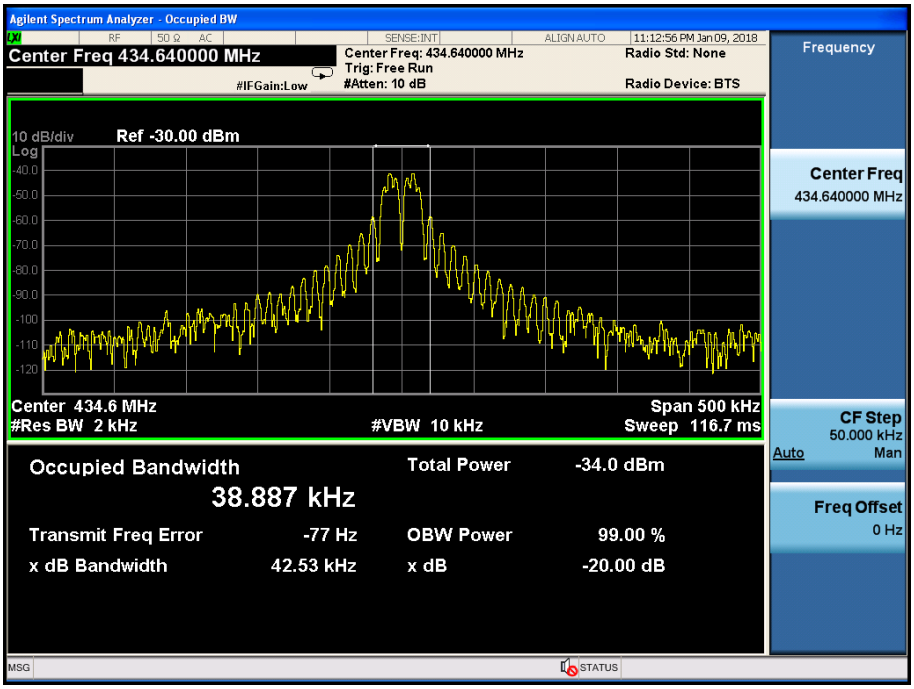
Plot 2: 99% bandwidth and 20 dB bandwidth, 434.64 MHz, CA-Mode



Plot 3: 99% bandwidth and 20 dB bandwidth, 433.20 MHz, RKE-Mode



Plot 4: 99% bandwidth and 20 dB bandwidth, 434.64 MHz, RKE-Mode



10.4 Field strength of the fundamental

Measurement:

Measurement parameter	
Detector:	Peak / pulse averaging / quasi peak
Sweep time:	Auto
Resolution bandwidth:	120 kHz
Video bandwidth:	3 x RBW
Span:	Zero
Trace-Mode:	Max. hold
Test setup:	See chapter 6.1 A
Measurement uncertainty:	See chapter 8

Limits:

FCC		IC
Field strength of the fundamental. In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:		
Fundamental Frequency (MHz)	**Field strength of Fundamental (µV/m)**	**Measurement distance (m)**
40.66 – 40.70	2,250	3
70-130	1,250	3
130-174	*1,250 to 3,750	3
174-260	3,750	3
260-470	*3,750 to 12,500	3
Above 470	12,500	3

*) Linear interpolations

Results:

433.20 MHz, CA-Mode

Test conditions	Maximum power (dBµV/m at 3 m distance)		Limit
Model	Peak	Average	Average
black	81.2	72.6	80.8
chrome	78.9	70.3	80.8

*Value recalculated from the peak value with a correction factor of -8.64 acc. Chapter 10.1

434.64 MHz, CA-Mode

Test conditions	Maximum power (dBµV/m at 3 m distance)		Limit
Model	Peak	Average	Average
black	81.5	72.9	80.8
chrome	79.4	70.8	80.8

*Value recalculated from the peak value with a correction factor of -8.64 acc. Chapter 10.1

433.20 MHz, RKE-Mode

Test conditions	Maximum power (dBµV/m at 3 m distance)		Limit
Model	Peak	Average	Average
black	79.3	70.7	80.8
chrome	77.3	68.7	80.8

*Value recalculated from the peak value with a correction factor of -8.64 acc. Chapter 10.1

434.64 MHz, RKE-Mode

Test conditions	Maximum power (dBµV/m at 3 m distance)		Limit
Model	Peak	Average	Average
black	79.8	71.2	80.8
chrome	77.6	69.0	80.8

*Value recalculated from the peak value with a correction factor of -8.64 acc. Chapter 10.1

10.5 Field strength of the harmonics and spurious

Measurement:

Measurement parameter	
Detector:	Peak / average / quasi peak
Sweep time:	Auto
Resolution bandwidth:	200 Hz / 9 kHz / 120 kHz / 1 MHz
Video bandwidth:	3 x RBW
Span:	See plots
Trace-Mode:	Max. hold
Test setup:	See chapter 6.1 A & 6.2 A, B
Measurement uncertainty:	See chapter 8

Limits:

FCC		IC
Field strength of the fundamental. In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:		
Fundamental Frequency (MHz)	**Field strength of spurious (µV/m)**	**Measurement distance (m)**
40.66 – 40.70	225	3
70-130	125	3
130-174	125 to 375	3
174-260	375	3
260-470	375 to 1,250	3
Above 470	1,250	3

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

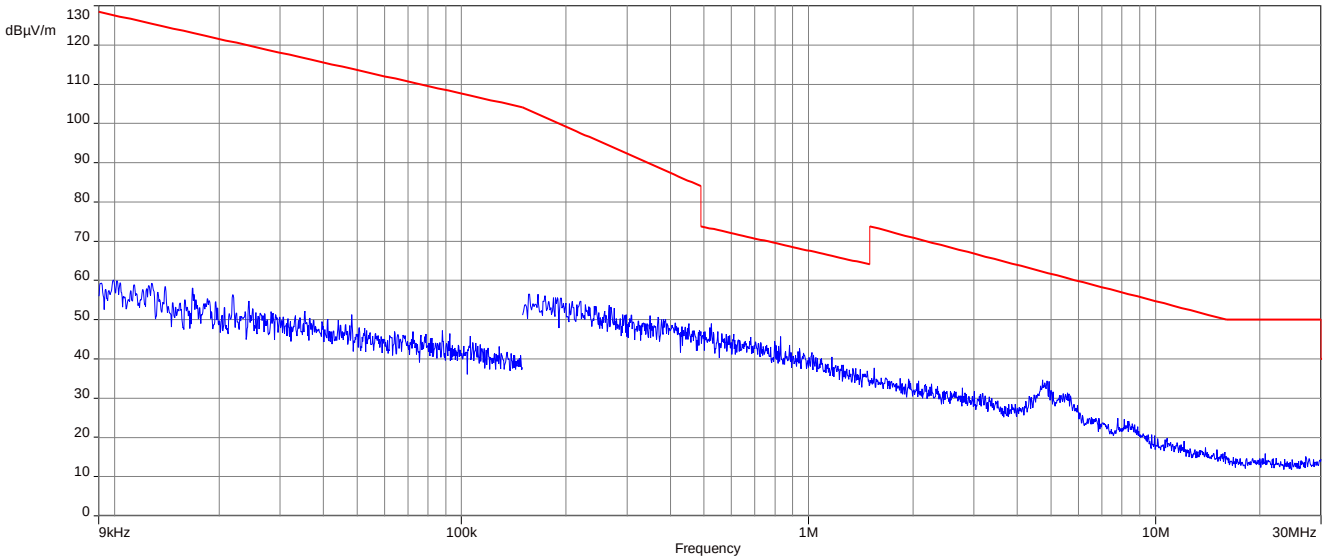
FCC		IC
Frequency (MHz)	**Field strength (µV/m)**	**Measurement distance (m)**
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
above 960	500	3

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

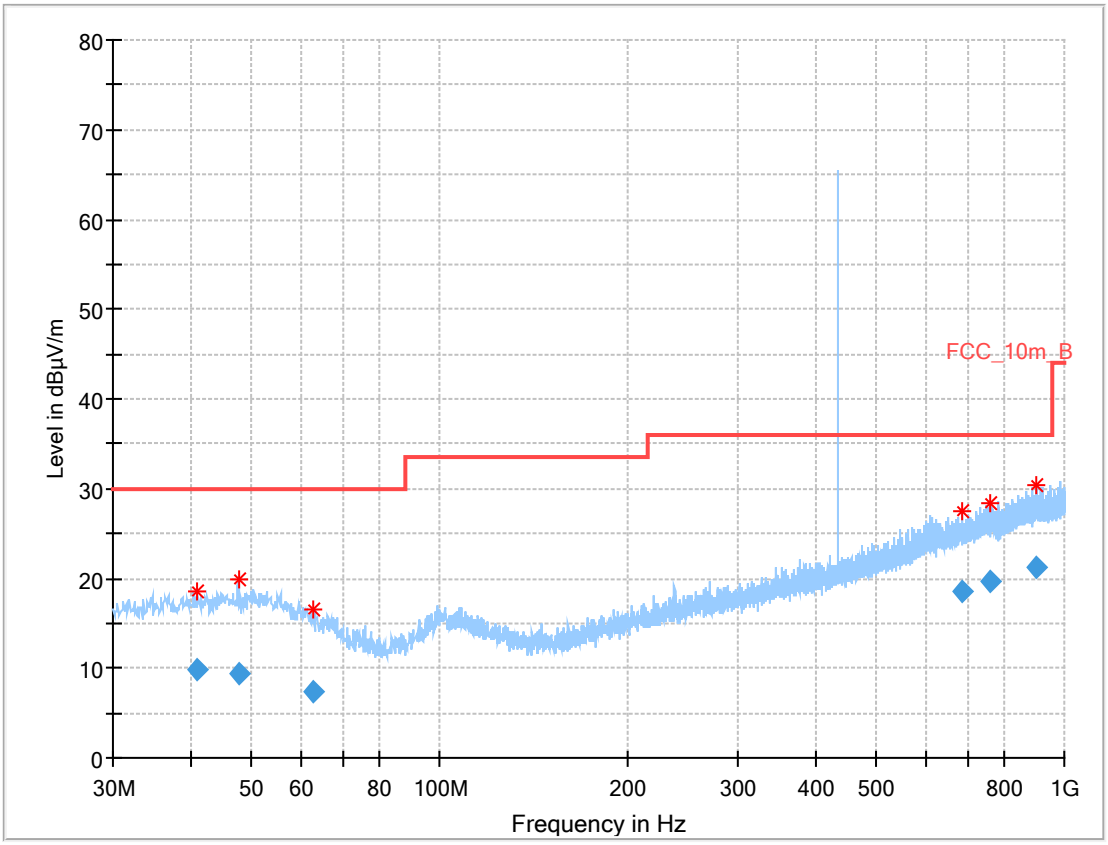
- for the band 130-174 MHz, µV/m at 3 meters = 56.81818(F) - 6136.3636;
- for the band 260-470 MHz, µV/m at 3 meters = 41.6667(F) - 7083.3333.

Plots low channel (433.20 MHz): chrome

Plot 1: 9 kHz to 30 MHz



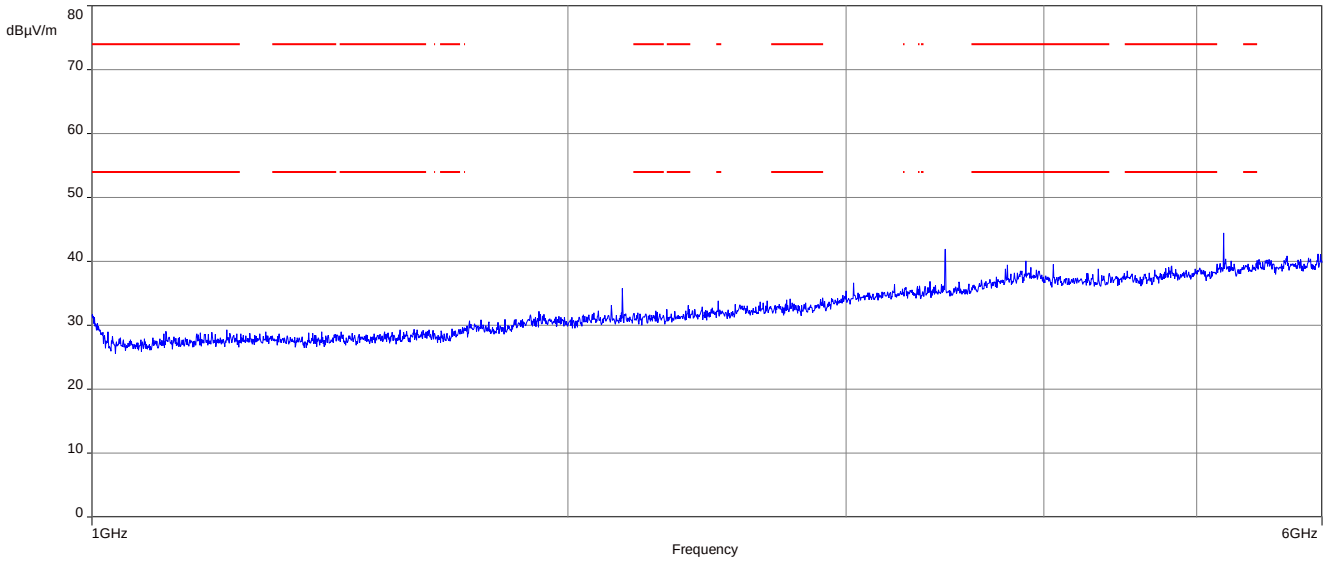
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
40.982	9.88	30.0	20.12	1000	120	98.0	V	63.0	13.3
47.675	9.38	30.0	20.62	1000	120	101.0	V	144.0	13.7
62.973	7.44	30.0	22.56	1000	120	101.0	H	109.0	11.2
685.725	18.63	36.0	17.37	1000	120	98.0	V	97.0	21.4
760.692	19.71	36.0	16.29	1000	120	101.0	H	319.0	22.7
900.091	21.26	36.0	14.74	1000	120	170.0	H	296.0	24.2

Plot 3: 1 GHz to 6 GHz, vertical & horizontal polarization

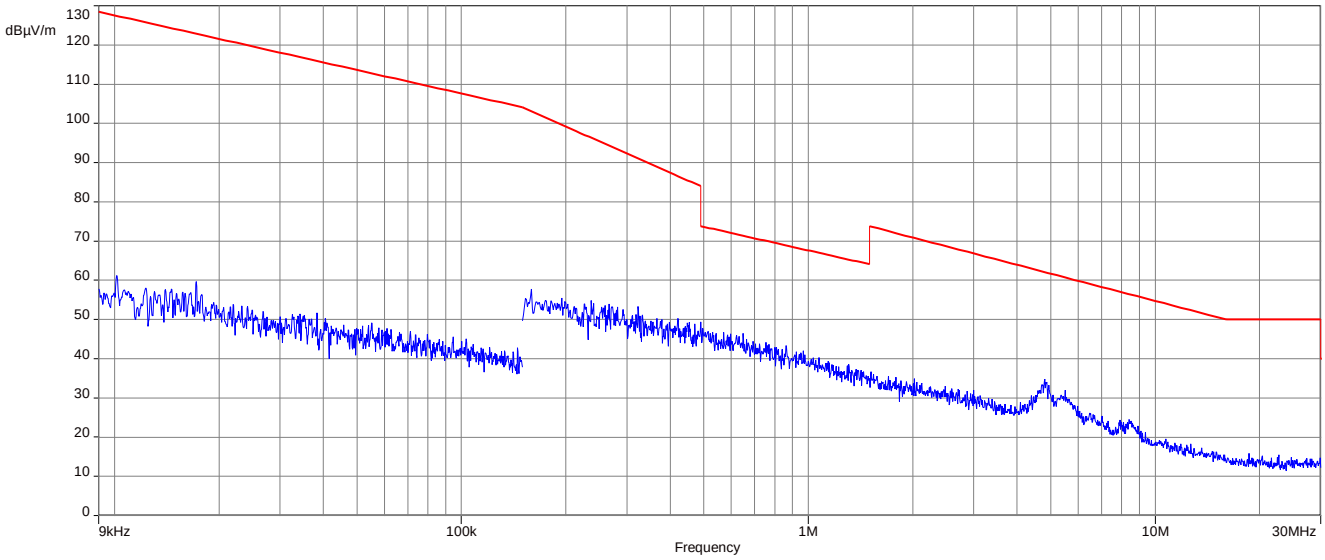


Results:

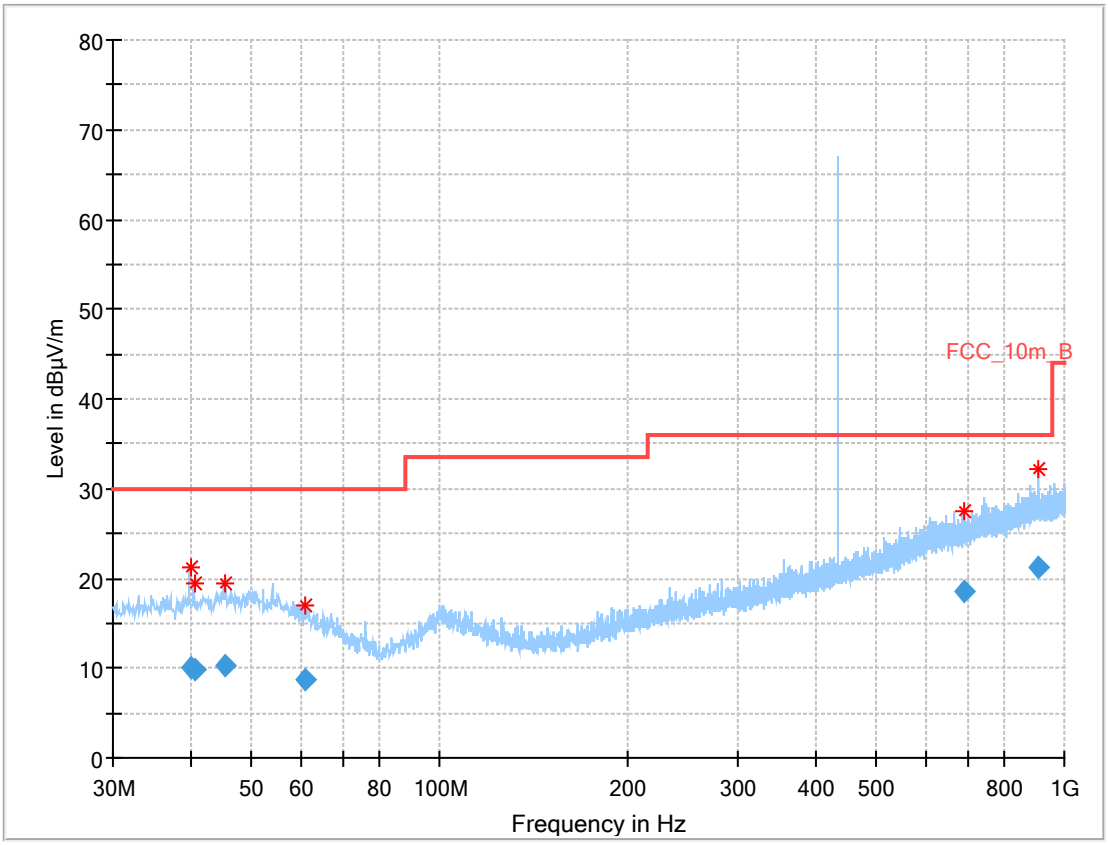
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
2166	PP	-/-	35.8	compliant
3466	PP	-/-	41.9	compliant
5198	PP	-/-	44.5	compliant

Plots high channel (434.64 MHz): chrome

Plot 1: 9 kHz to 30 MHz



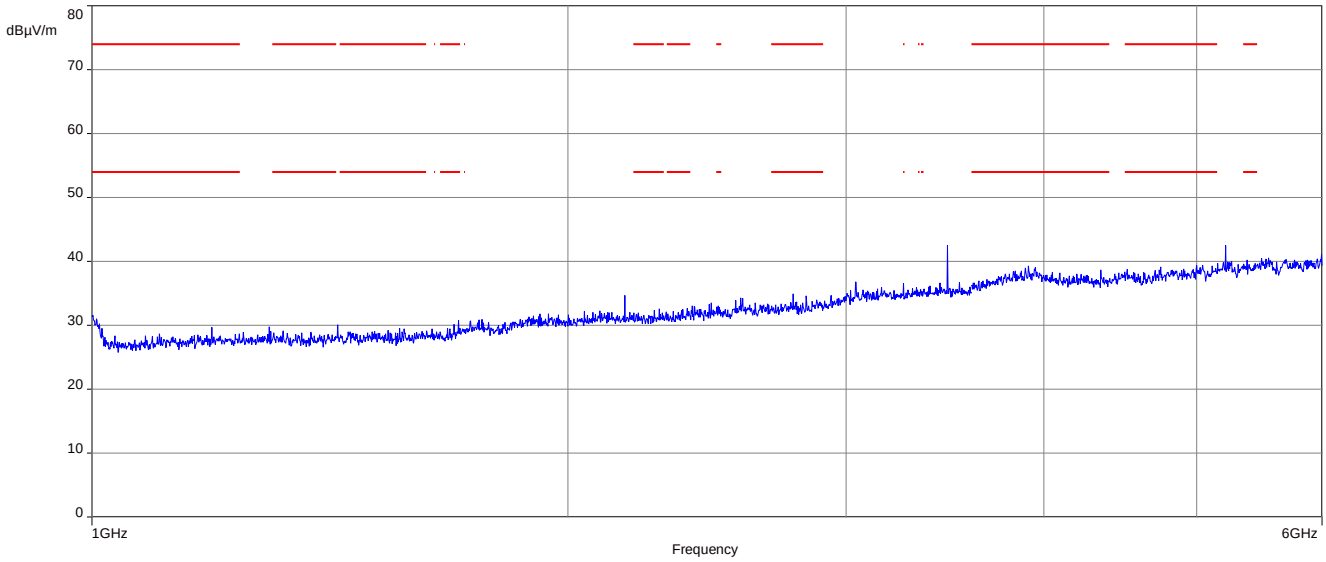
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
39.975	9.98	30.0	20.02	1000	120	101.0	V	106.0	13.2
40.748	9.89	30.0	20.11	1000	120	101.0	V	272.0	13.3
45.418	10.25	30.0	19.75	1000	120	101.0	V	259.0	13.6
61.020	8.63	30.0	21.37	1000	120	100.0	V	348.0	11.6
692.565	18.63	36.0	17.37	1000	120	101.0	H	184.0	21.5
906.400	21.19	36.0	14.81	1000	120	170.0	V	96.0	24.2

Plot 3: 1 GHz to 6 GHz, vertical & horizontal polarization

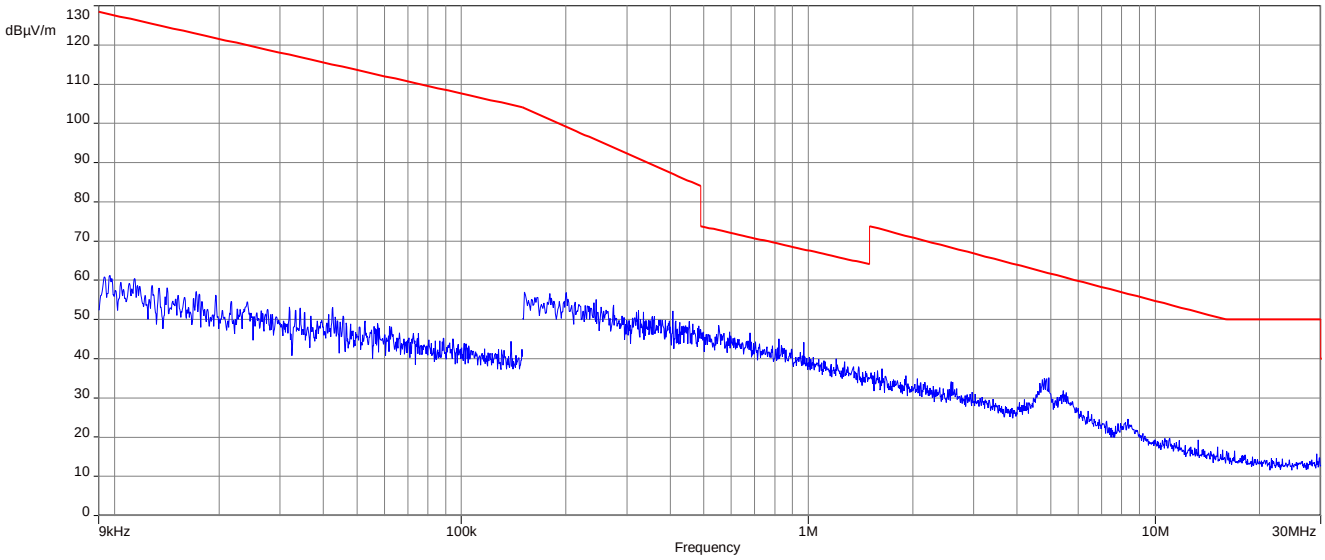


Results:

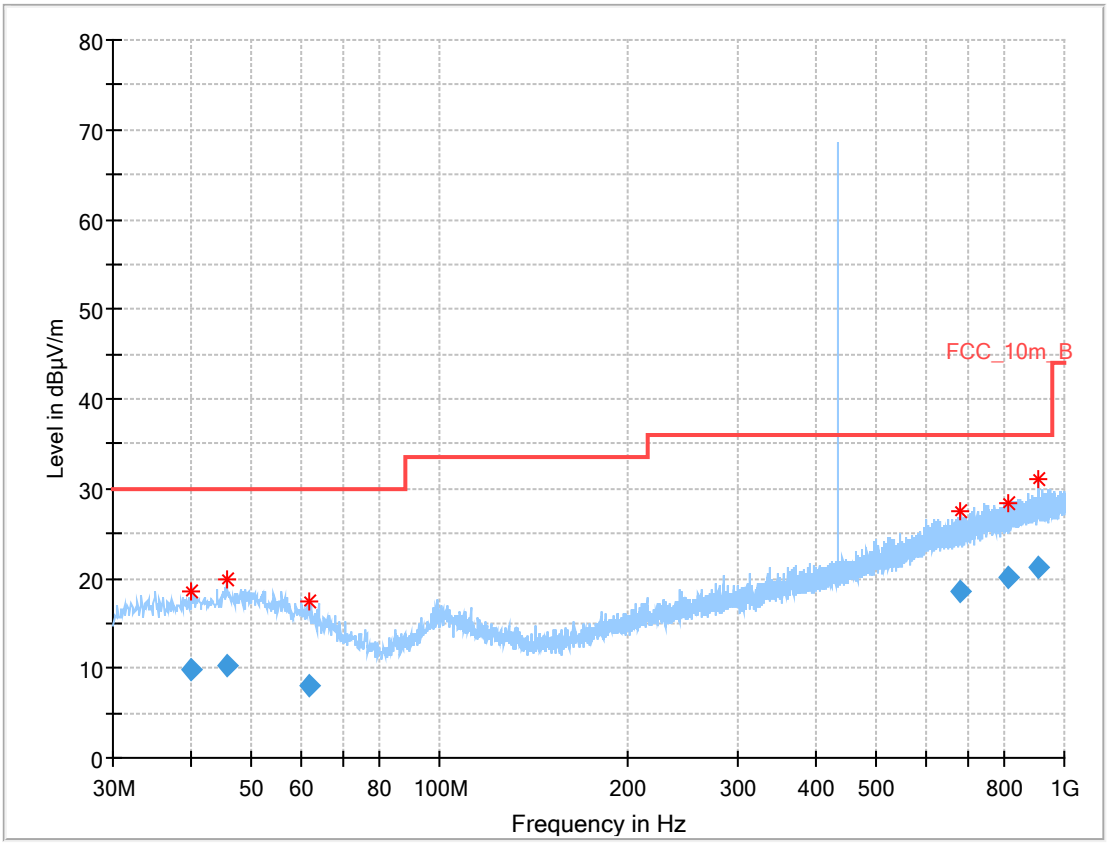
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
2173	PP	-/-	34.7	compliant
3477	PP	54 AVG / 74 PP	42.5	compliant
5216	PP	-/-	42.5	compliant

Plots low channel (433.20 MHz): black

Plot 1: 9 kHz to 30 MHz



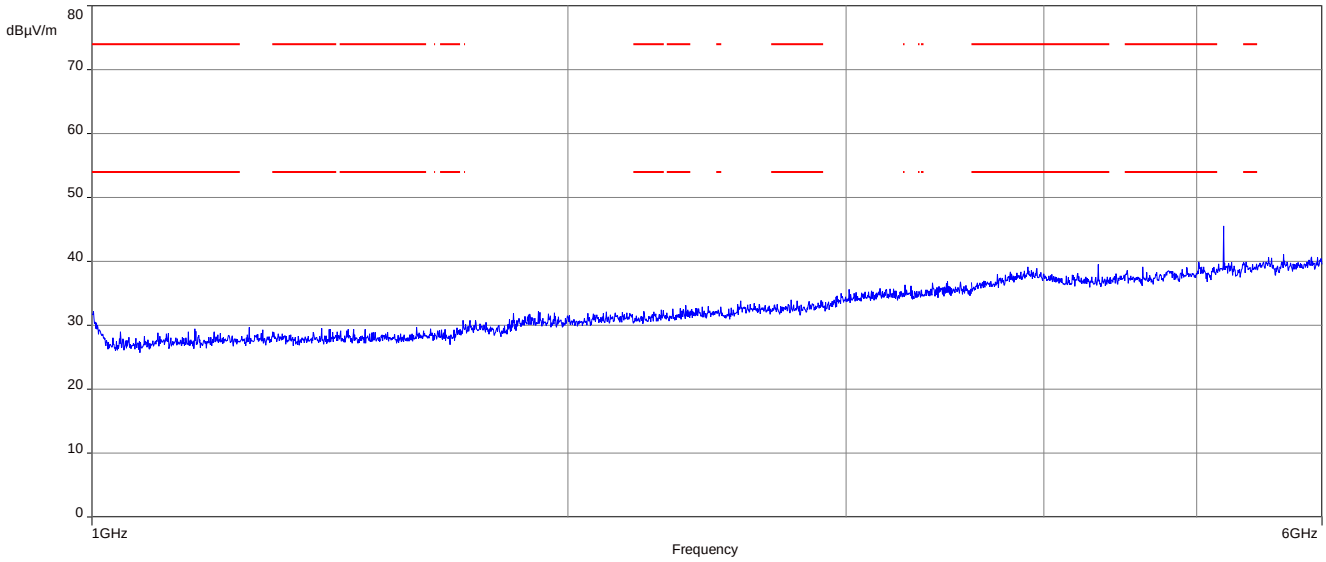
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
40.107	9.90	30.0	20.10	1000	120	101.0	V	51.0	13.2
45.624	10.26	30.0	19.74	1000	120	101.0	V	-7.0	13.6
62.070	8.11	30.0	21.89	1000	120	101.0	V	110.0	11.4
681.569	18.54	36.0	17.46	1000	120	170.0	V	309.0	21.4
816.180	20.11	36.0	15.89	1000	120	170.0	V	101.0	23.0
907.674	21.24	36.0	14.76	1000	120	101.0	H	341.0	24.2

Plot 3: 1 GHz to 6 GHz, vertical & horizontal polarization

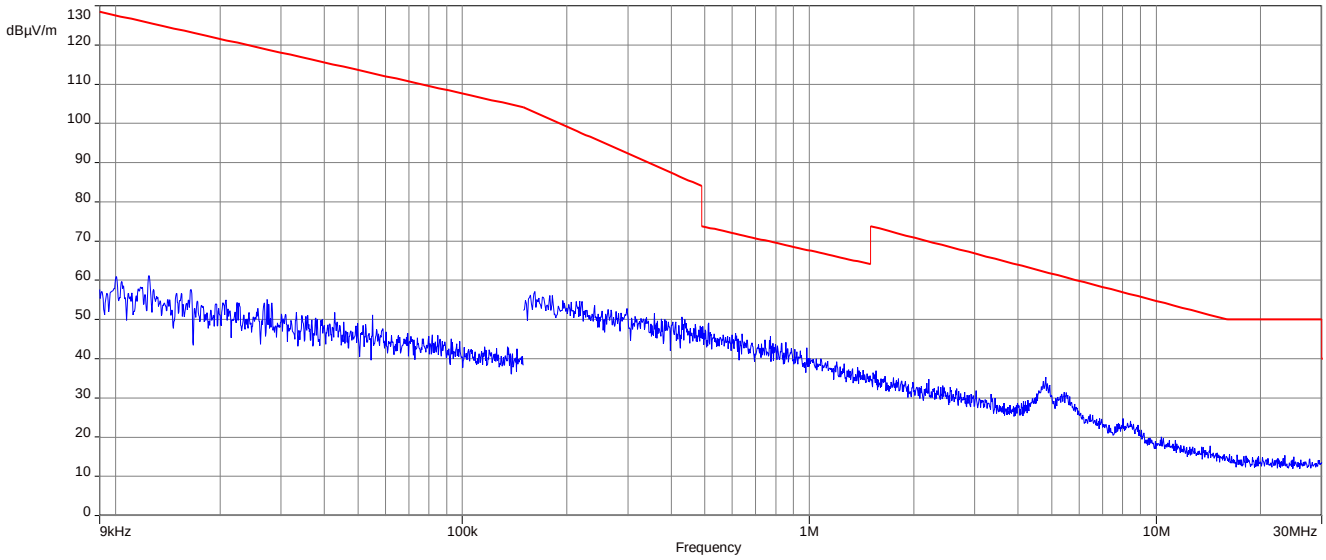


Results:

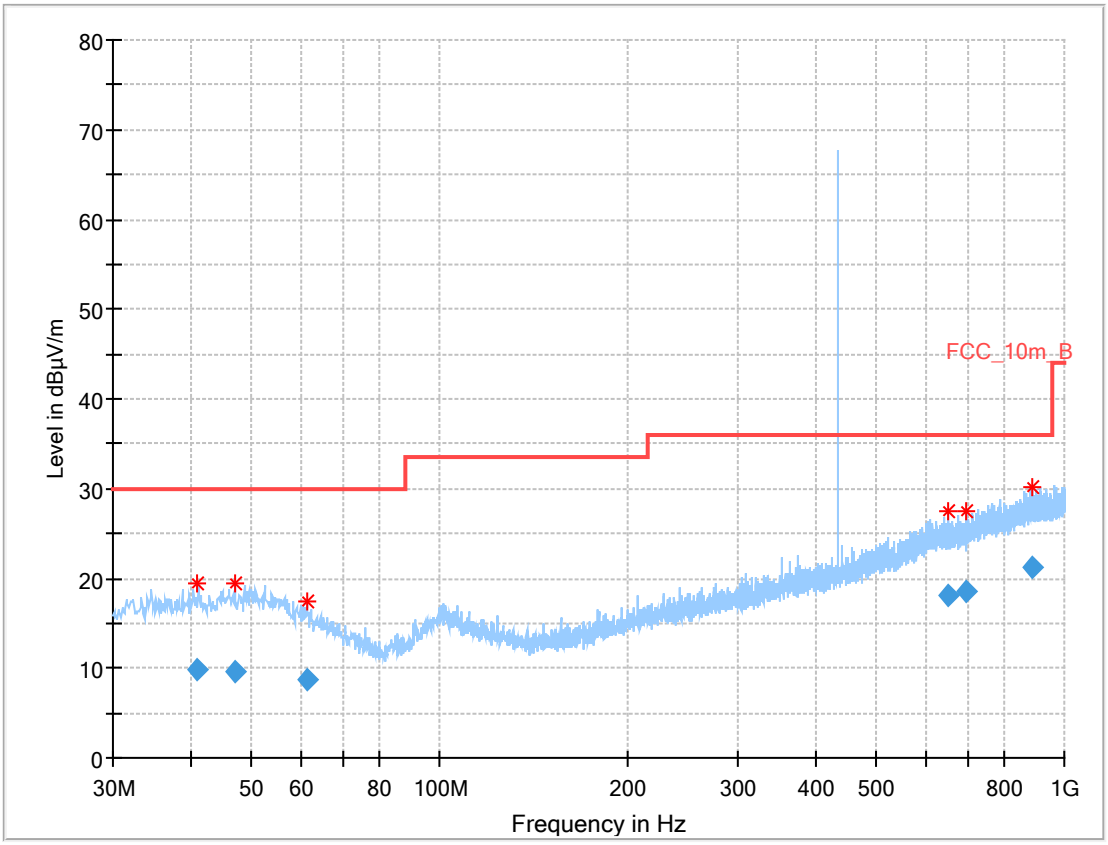
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
1002	PP	54 AVG / 74 PP	32.2	compliant
4332	PP	54 AVG / 74 PP	39.5	compliant
5198	PP	-/-	47.9	compliant

Plots high channel (434.64 MHz): black

Plot 1: 9 kHz to 30 MHz



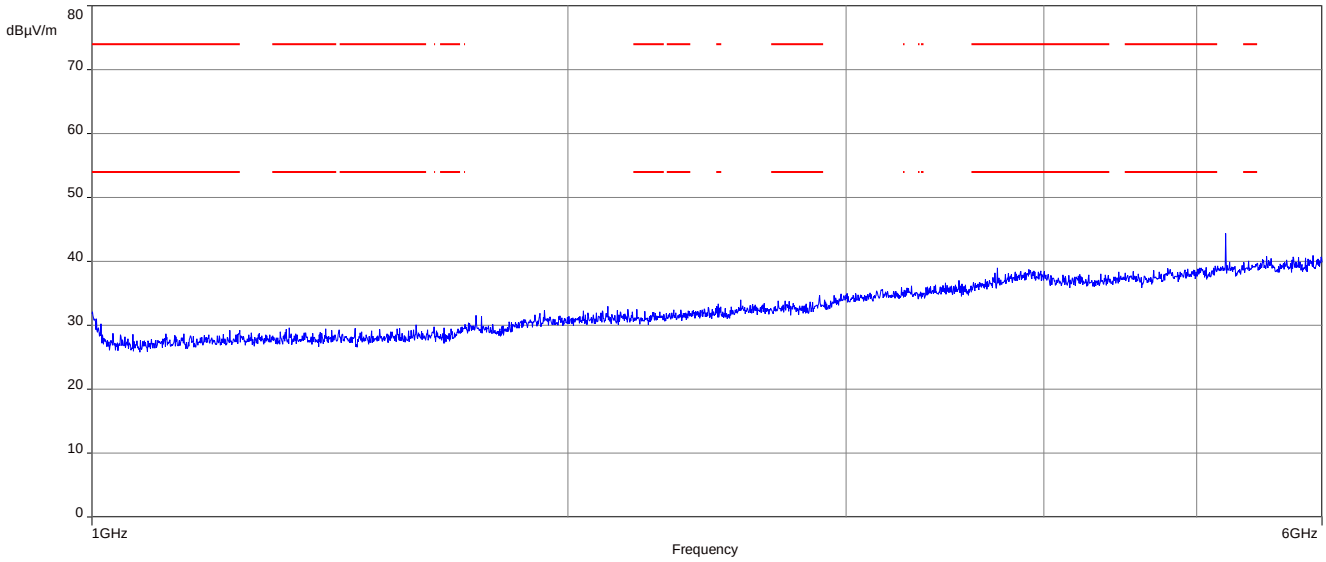
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
40.967	9.83	30.0	20.17	1000	120	98.0	H	263.0	13.3
47.036	9.60	30.0	20.40	1000	120	101.0	V	277.0	13.7
61.539	8.68	30.0	21.32	1000	120	101.0	V	28.0	11.5
651.942	18.13	36.0	17.87	1000	120	101.0	V	-9.0	21.1
694.277	18.63	36.0	17.37	1000	120	170.0	V	99.0	21.5
888.002	21.20	36.0	14.80	1000	120	170.0	V	-9.0	24.0

Plot 3: 1 GHz to 6 GHz, vertical & horizontal polarization



Results:

f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
1000	PP	54 AVG / 74 PP	32.1	compliant
3741	PP	54 AVG / 74 PP	39.0	compliant
5216	PP	-/-	44.4	compliant

10.6 Receiver spurious emission

Measurement:

Measurement parameter	
Detector:	Peak / average / quasi peak
Sweep time:	Auto
Resolution bandwidth:	120 kHz / 1 MHz
Video bandwidth:	3 x RBW
Span:	See plots
Trace mode:	Max. hold
Test setup:	See chapter 6.1 A & 6.2 B
Measurement uncertainty:	See chapter 8

Limits:

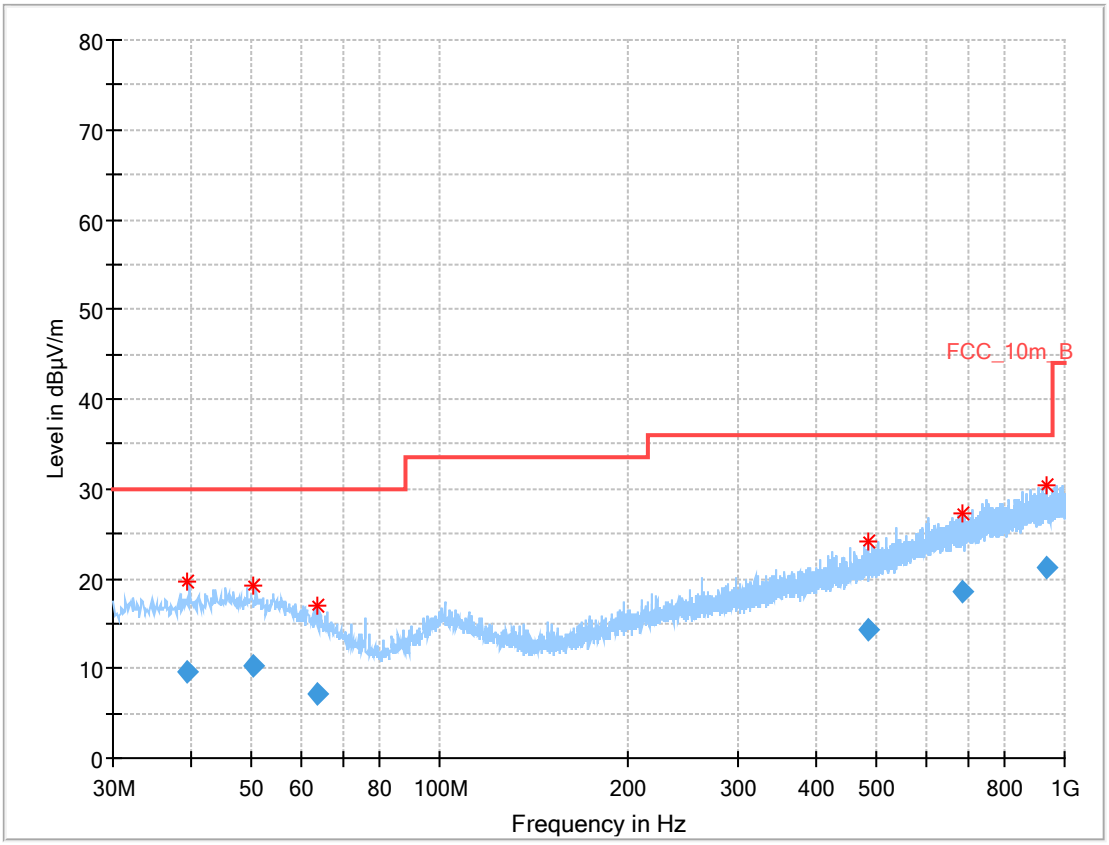
FCC		IC
Frequency (MHz)	**Field strength (µV/m)**	**Measurement distance (m)**
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

Results:

f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
All emissions were more than 10 dB below the peak limit. For emissions between 30 MHz and 1 GHz see result table below the plot.				

Plots: chrome

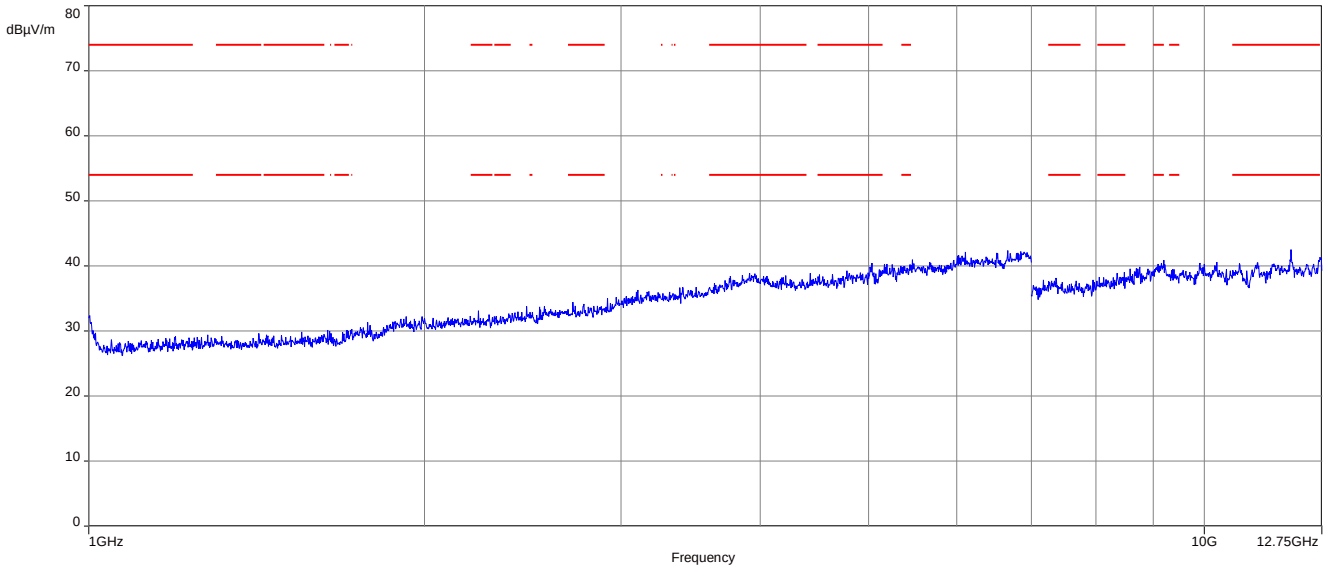
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result

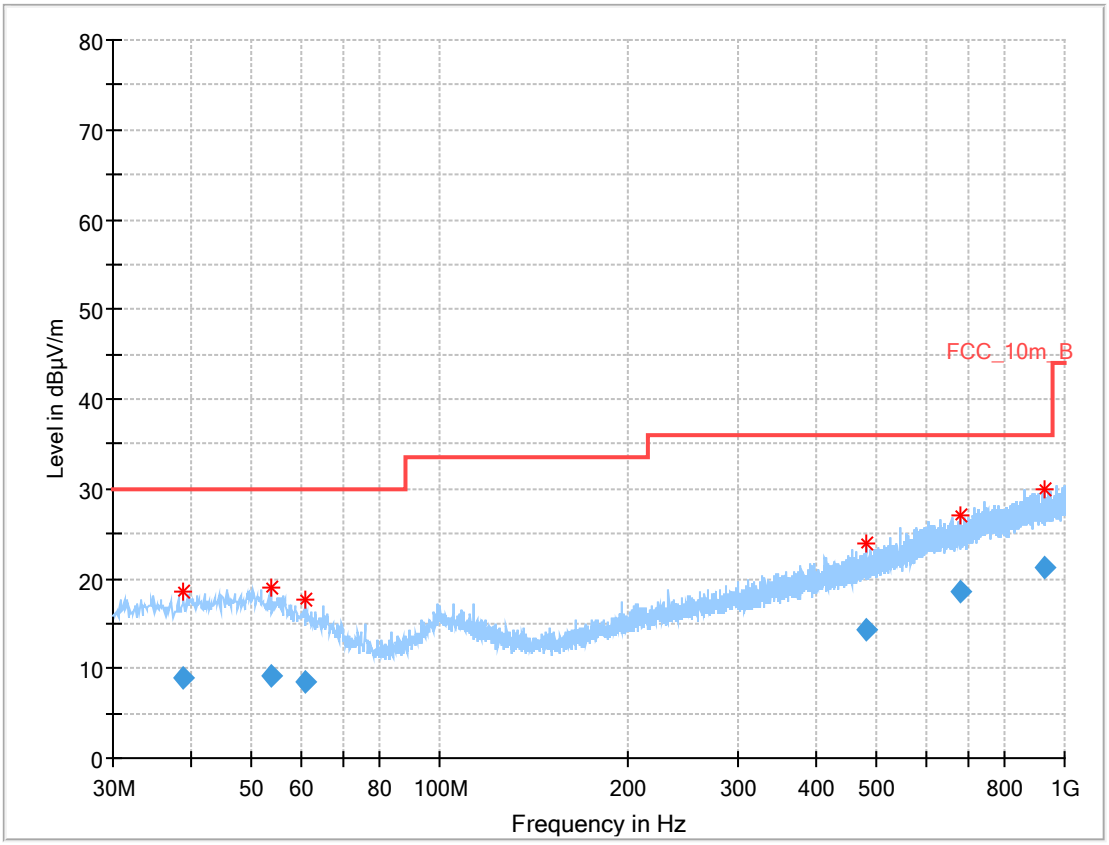
Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
39.508	9.55	30.0	20.45	1000	120	103.0	V	356.0	13.2
50.400	10.25	30.0	19.75	1000	120	101.0	H	351.0	13.7
63.631	7.07	30.0	22.93	1000	120	98.0	H	77.0	11.0
484.130	14.37	36.0	21.63	1000	120	100.0	V	185.0	18.4
688.676	18.65	36.0	17.35	1000	120	101.0	V	240.0	21.5
935.020	21.21	36.0	14.79	1000	120	170.0	V	179.0	24.3

Plot 2: 1 GHz to 6 GHz, vertical & horizontal polarization



Plots: black

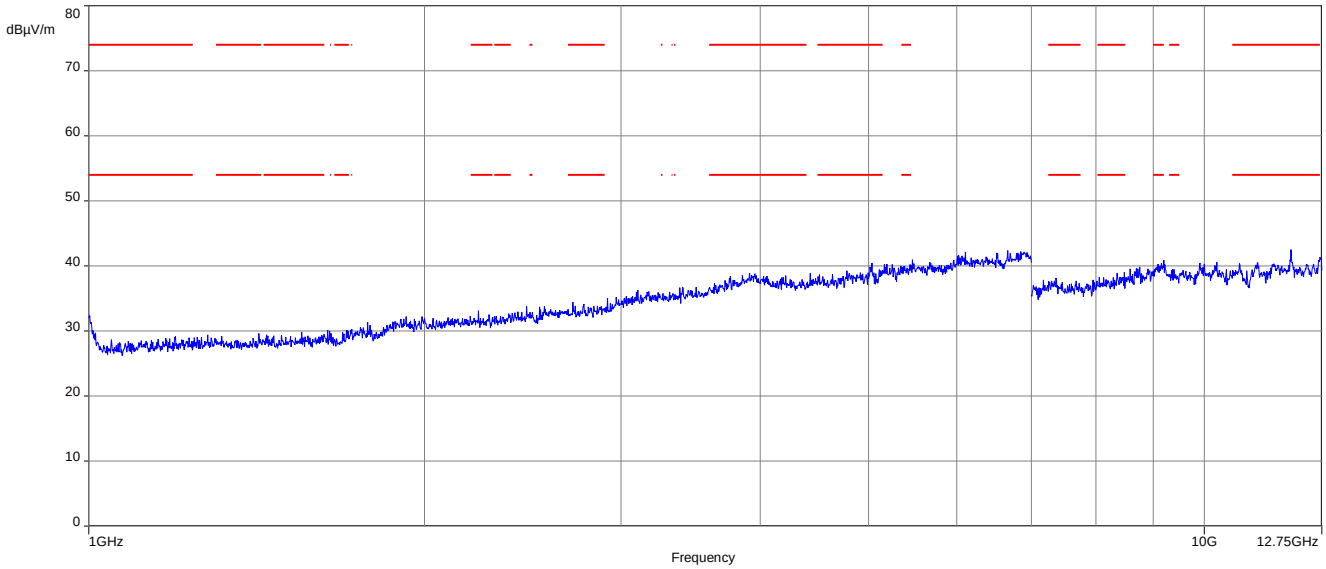
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
38.784	8.97	30.0	21.03	1000	120	101.0	H	338.0	13.1
53.737	9.10	30.0	20.90	1000	120	101.0	H	86.0	13.3
60.807	8.52	30.0	21.48	1000	120	101.0	H	6.0	11.7
481.648	14.32	36.0	21.68	1000	120	170.0	V	236.0	18.3
682.446	18.62	36.0	17.38	1000	120	170.0	V	99.0	21.4
931.508	21.28	36.0	14.72	1000	120	170.0	V	339.0	24.3

Plot 2: 1 GHz to 6 GHz, vertical & horizontal polarization



Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2018-02-17
A	results table for spurious results added, frequency range changed to lowest and highest channel, EUT photo removed.	2018-02-28

Annex C Accreditation Certificate

first page	last page
	

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

http://www.dakks.de/as/ast/d/D-PL-12076-01-03.pdf