

TEST REPORT

Test report no.: 1-1842/16-01-08-B



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

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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

Applicant

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78604 Rietheim-Weilheim / GERMANY

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Manufacturer

Marquardt GmbH

Schloss-Str. 16

78604 Rietheim-Weilheim / GERMANY

Test standard/s

47 CFR Part 15

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: Remote key
Model name: MS2
FCC ID: IYZ-MS2A
Frequency: 434 MHz
Technology tested: Modulated carrier
Antenna: Integrated PCB loop antenna
Power supply: 3.0 V DC by Lithium 2032 type battery
Temperature range: -40°C to +85°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 1-1842/16-01-08 and dated 2016-11-14

2.2 Application details

Date of receipt of order:	2016-07-07
Date of receipt of test item:	2016-10-11
Start of test:	2016-10-11
End of test:	2016-10-19
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

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 :		55 %
Barometric pressure :		1021 hpa
Power supply :	V _{nom} V _{max} V _{min}	3.0 V DC by Lithium 2032 type battery No tests under extreme conditions required! No tests under extreme conditions required!

5 Test item

5.1 General description

Kind of test item :	Remote key
Type identification :	MS2
S/N serial number :	No information available
HW hardware status :	No information available
SW software status :	No information available
Frequency :	434 MHz Provided frequencies: 433.47 MHz; 433.92 MHz; 434.37 MHz
Type of radio transmission :	modulated carrier
Use of frequency spectrum :	
Type of modulation :	FSK-2
Number of channels :	3
Antenna :	Integrated PCB loop antenna
Power supply :	3.0 V DC by Lithium 2032 type battery
Temperature range :	-40°C to +85°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: 1-1842/16-01-01_AnnexA
 1-1842/16-01-01_AnnexB
 1-1842/16-01-01_AnnexD

6 Test laboratories sub-contracted

None

7 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).

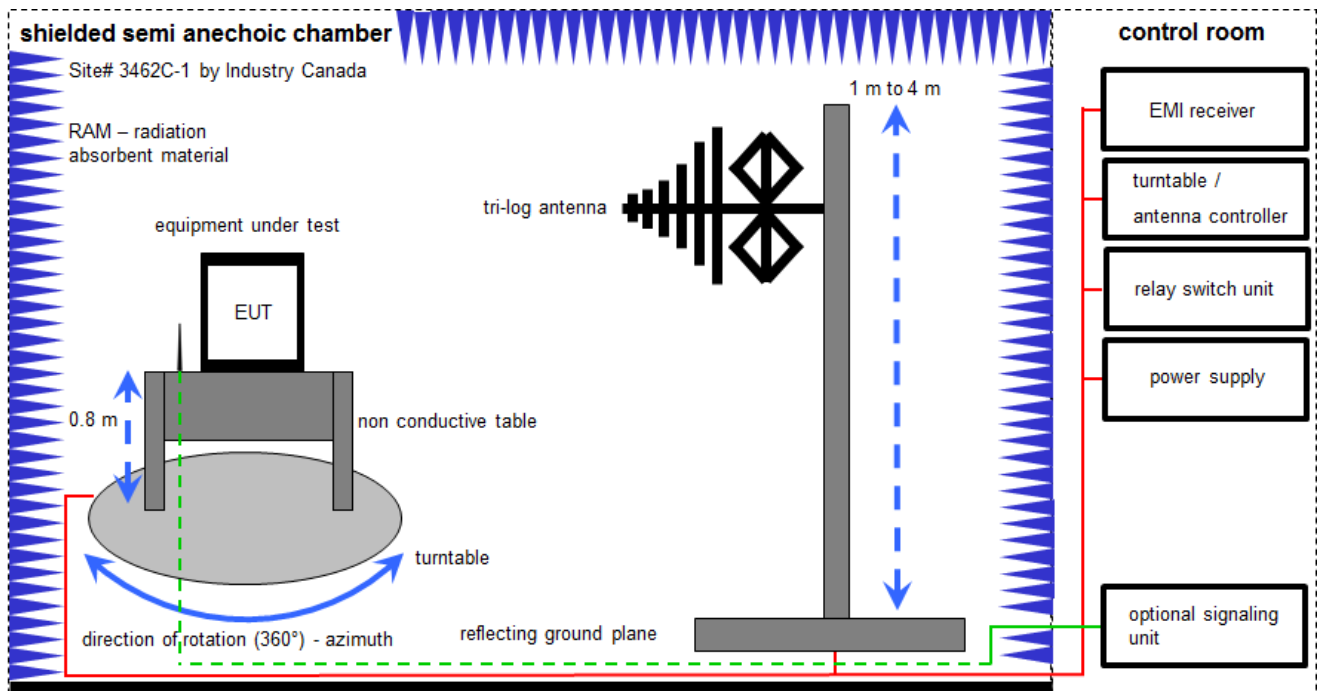
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 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)

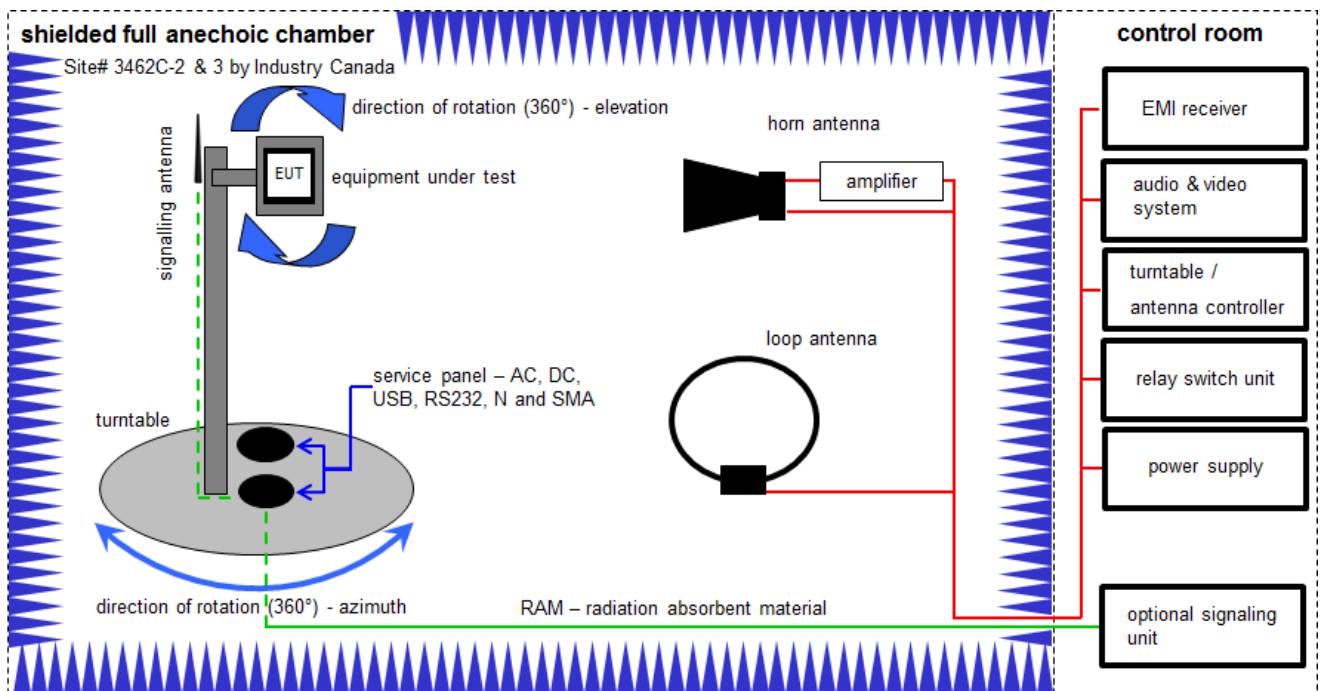
Example calculation:

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter / 1 meter

$$FS = UR + CA + AF$$

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

Example calculation:

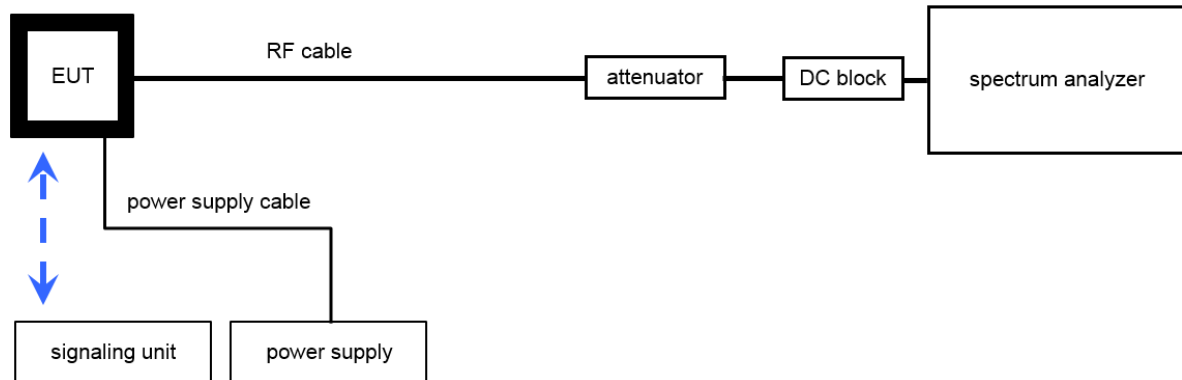
$$FS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB/m]} = 37.1 \text{ [dB}\mu\text{V/m]} (71.61 \mu\text{V/m})$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	20.05.2015	20.05.2017
2	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A, B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	B	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
5	A	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne	-/-	-/-
6	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
7	A, B	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	vIKI!	13.09.2016	13.03.2018

7.3 Conducted measurements

Conducted measurements normal 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	Type	Manufacturer	Serial No.	INV. No	Kind of Calibration	Last Calibration	Next Calibration
1	A	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	26.01.2016	26.01.2017
2	A	RF-Cable	ST18/SMAM/SMAM/72	Huber & Suhner	Batch no. 699714	400001184	ev	-/-	-/-

8 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Occupied bandwidth	$\pm$ RBW
Spurious emissions conducted	$\pm$ 3 dB
Spurious emissions radiated below 30 MHz	$\pm$ 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	$\pm$ 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	$\pm$ 3.7 dB

9 Sequence of testing

9.1 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.

9.2 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 $\pm 45^\circ$ 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.

9.3 Sequence of testing radiated spurious 1 GHz to 12.75 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.

10 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 8, Annex 8	See table!	2016-12-02	-/-

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

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

10.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

11 Measurement results

11.1 Timing of the transmitter

Measurement:

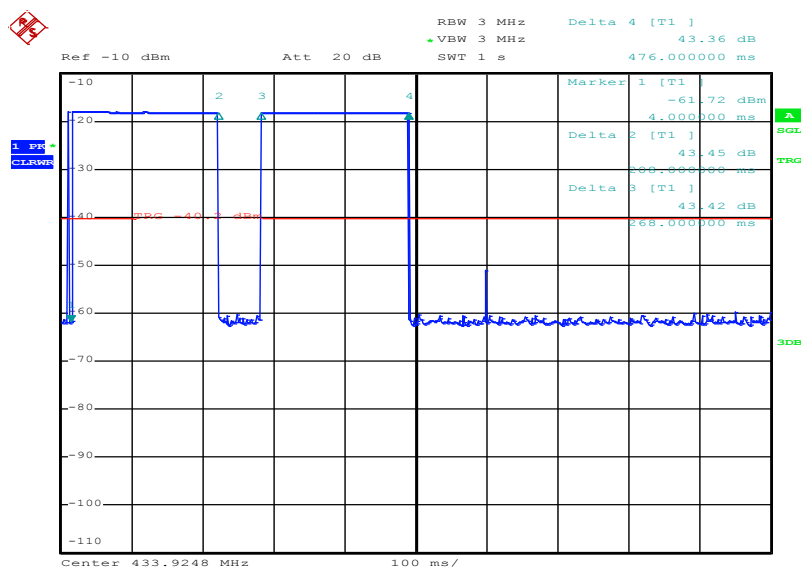
Measurement parameter	
Detector:	Peak
Sweep time:	1s
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Span:	Zero
Trace-Mode:	Single sweep
Used equipment:	See chapter 7.3 - A

Limits:

FCC
(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 +timing



Date: 18.OCT.2016 09:18:24

Transmit time (Tx on) = 416 ms (Plot 1)
 Tx on + Tx off = 476 ms (Plot 1)

The peak-to-average correction factor is calculated with $20\log [Tx\ on/(Tx\ on + Tx\ off)]$.
 Hereby the peak-to-average correction factor is 0 dB*

*Pulse length > 100ms

11.2 Switch off time

Measurement:

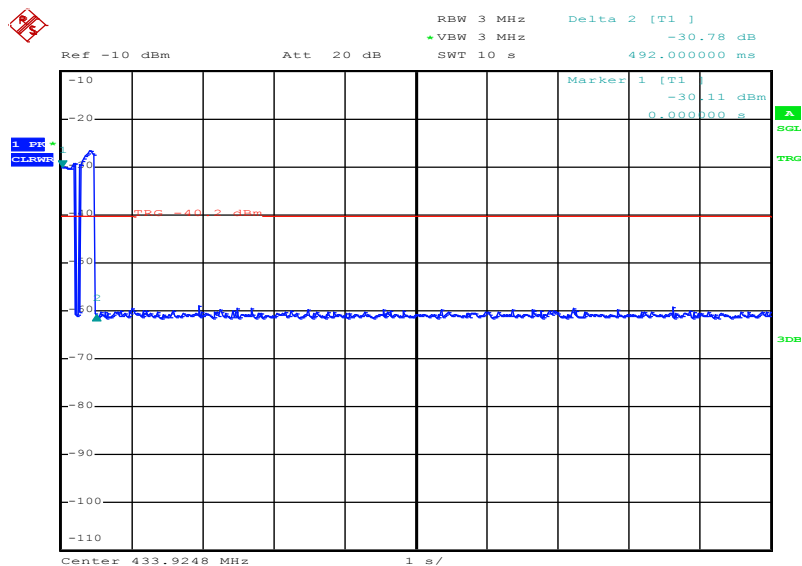
Measurement parameter	
Detector:	Peak
Sweep time:	10s
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Span:	Zero
Trace-Mode:	Single sweep
Used equipment:	See chapter 7.3 - A

Limits:

FCC
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



Date: 18.OCT.2016 09:21:39

The EUT automatically ceases transmission within 492 ms after releasing the switch.

11.3 Emission bandwidth

Measurement:

Measurement of the 99 % bandwidth of the modulated signal

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 % of the span
Video bandwidth:	3 x RBW
Span:	300 kHz
Trace-Mode:	Max. hold
Used equipment:	See chapter 7.3 - A
Measurement uncertainty:	See chapter 8

Limits:

FCC
The OBW shall not be wider than 0.25% of the centre frequency, here maximum 787.5 kHz.

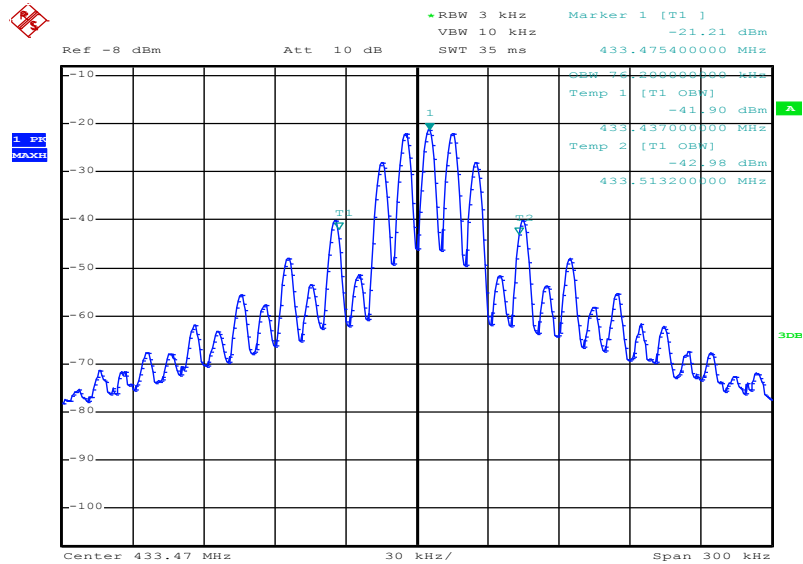
Result:

TEST CONDITIONS	OBW 99% [kHz]
Channel 1	76.2
Channel 2	76.2
Channel 3	75.6

TEST CONDITIONS	20 dB -BW [kHz]
Channel 1	82.2
Channel 2	81.6
Channel 3	81.6

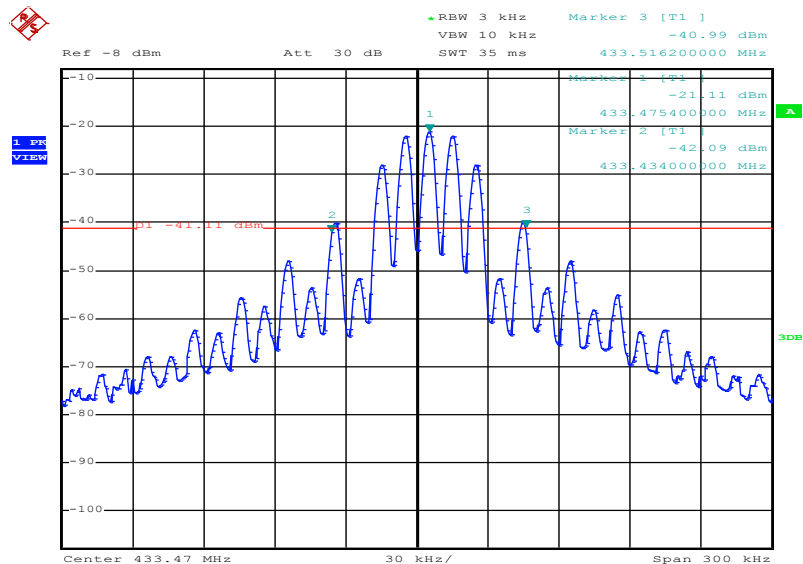
Plots:

Plot 1: 99% Emissions bandwidth ch 1



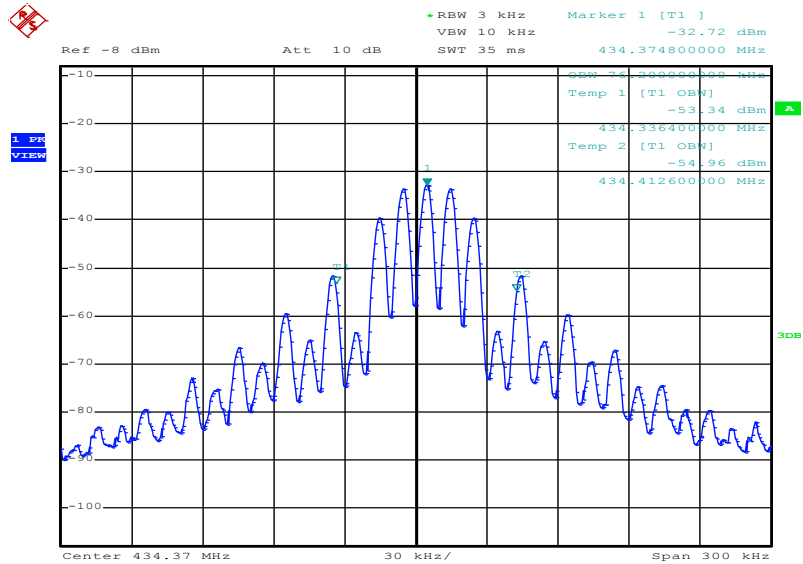
Date: 18.OCT.2016 09:06:51

Plot 2: 20 dB Emissions bandwidth ch 1



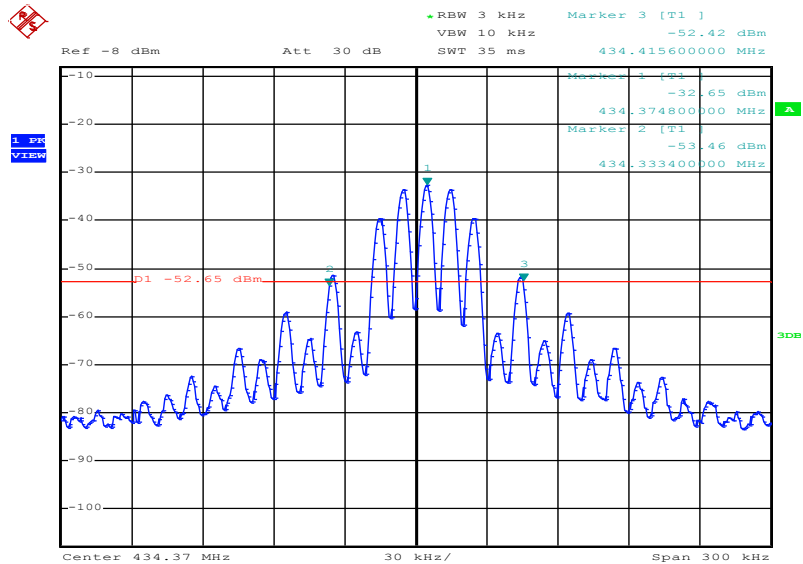
Date: 18.OCT.2016 09:05:58

Plot 3: 99% Emissions bandwidth ch 2



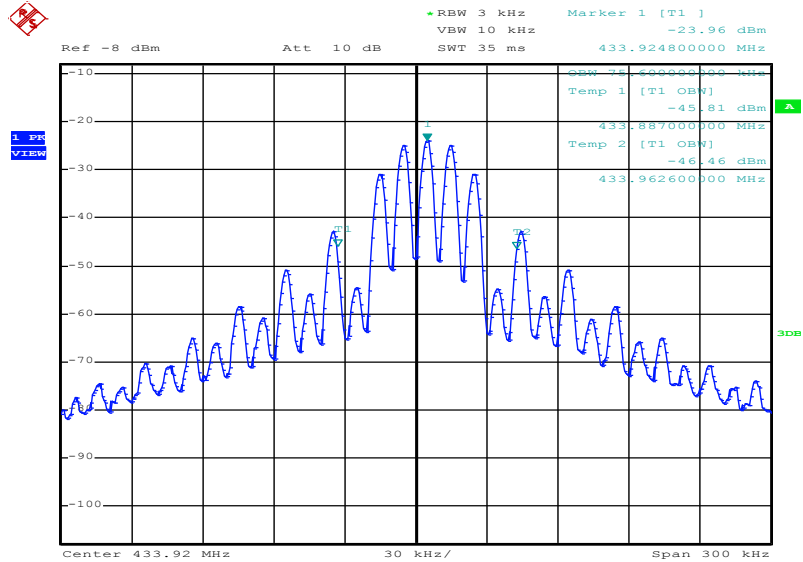
Date: 18.OCT.2016 09:07:47

Plot 4: 20 dB Emissions bandwidth ch 2



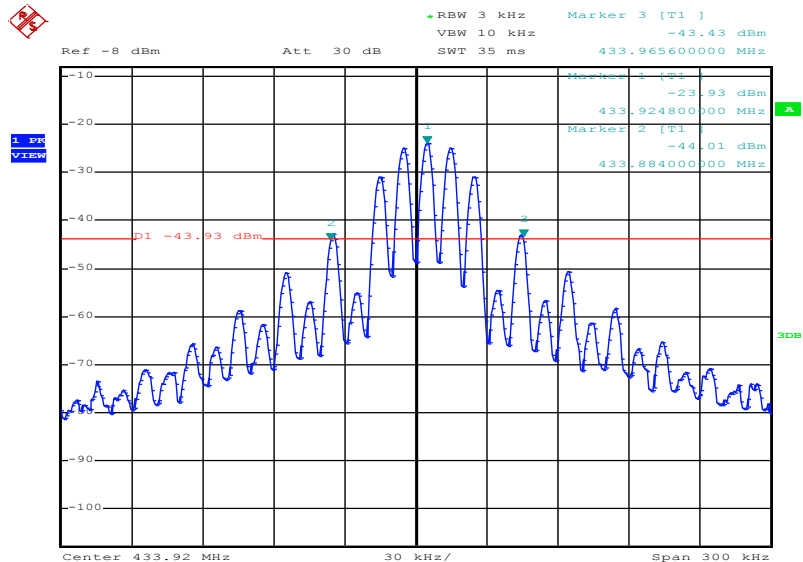
Date: 18.OCT.2016 09:09:07

Plot 5: 99% Emissions bandwidth ch 3



Date: 18.OCT.2016 09:12:28

Plot 6: 20 dB Emissions bandwidth ch 3



Date: 18.OCT.2016 09:11:32

11.4 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
Trace-Mode:	Max. hold
Used equipment:	See chapter 7.1 - A
Measurement uncertainty:	See chapter 8

Limits:

FCC		
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

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 = $41.6667(F) - 7083.3333$. ->80.8 dBμV/m @433.5 MHz

Result:

TEST CONDITIONS	Field strength (dBμV/m at 3 m distance)	
Frequency	MHz	MHz
Mode	Peak	Average
Low channel T _{nom}	77.5	76.3
Mid channel T _{nom}	76.9	76.1
High channel T _{nom}	77.0	76.2

11.5 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
Video bandwidth:	3 x RBW
Span:	See plots
Trace-Mode:	Max. hold
Used equipment:	See chapter 7.1 - A & 7.2 - A & B
Measurement uncertainty:	See chapter 8

Limits:

FCC		
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.

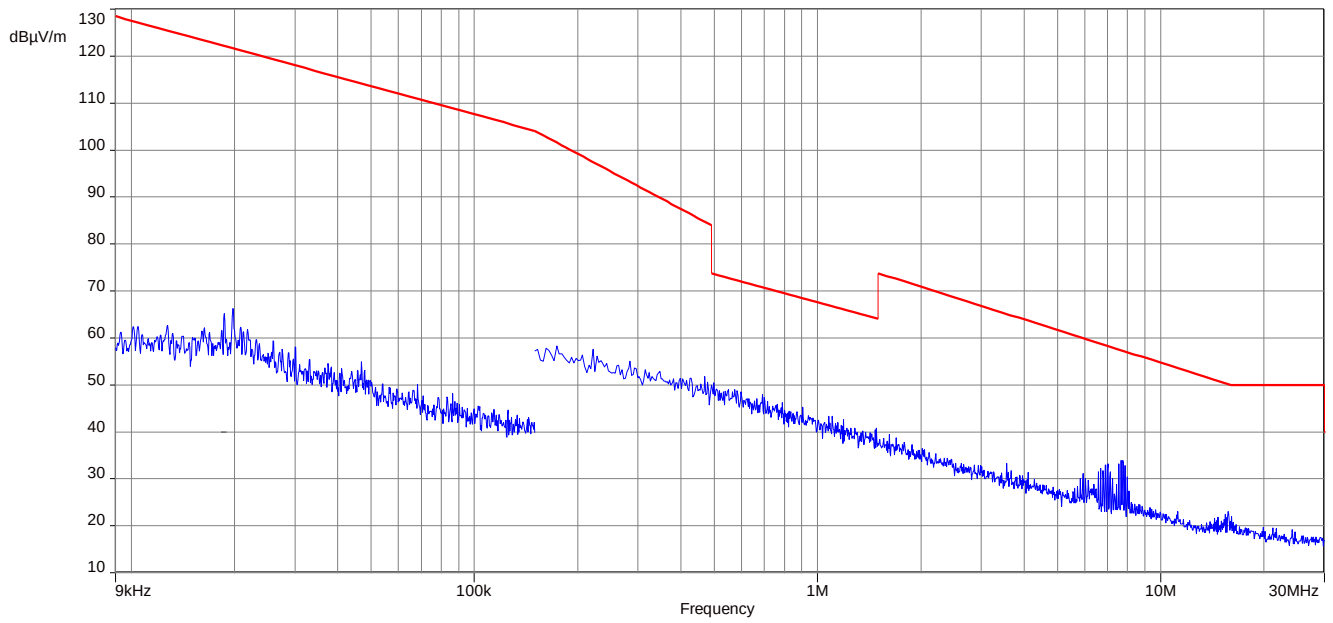
FCC		
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
above 960	500	3

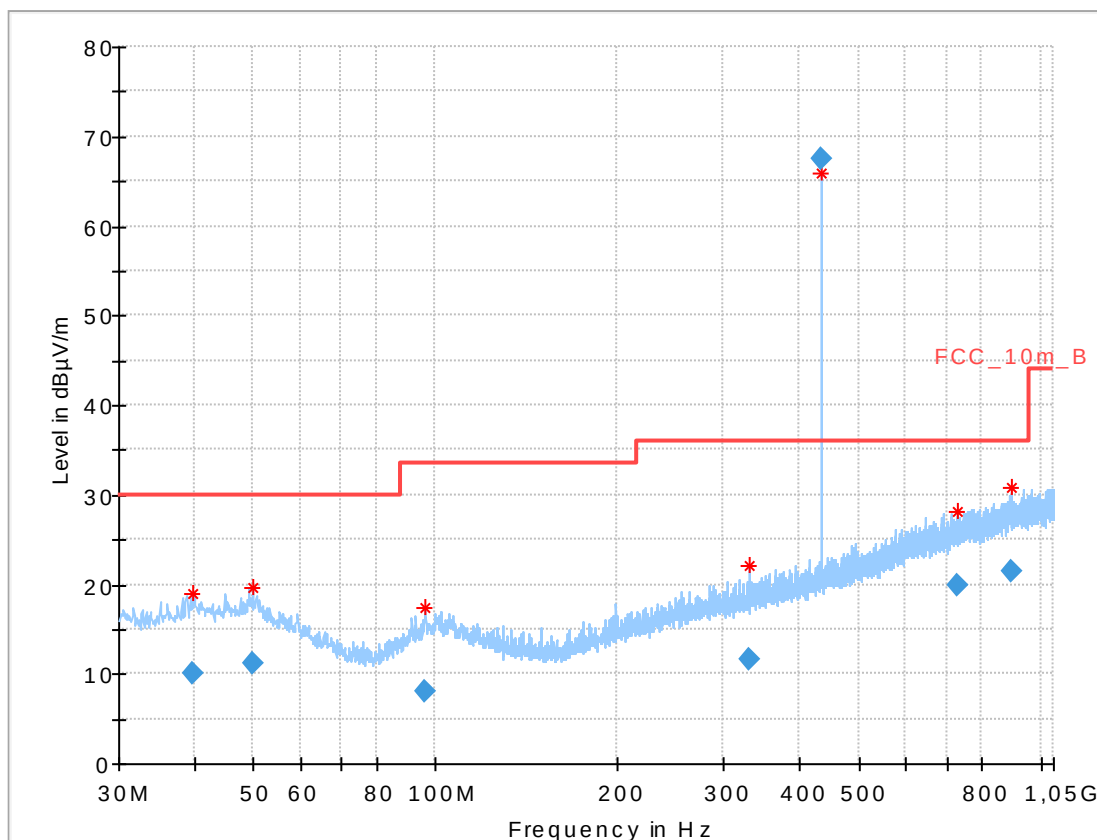
Results:

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

Plots:

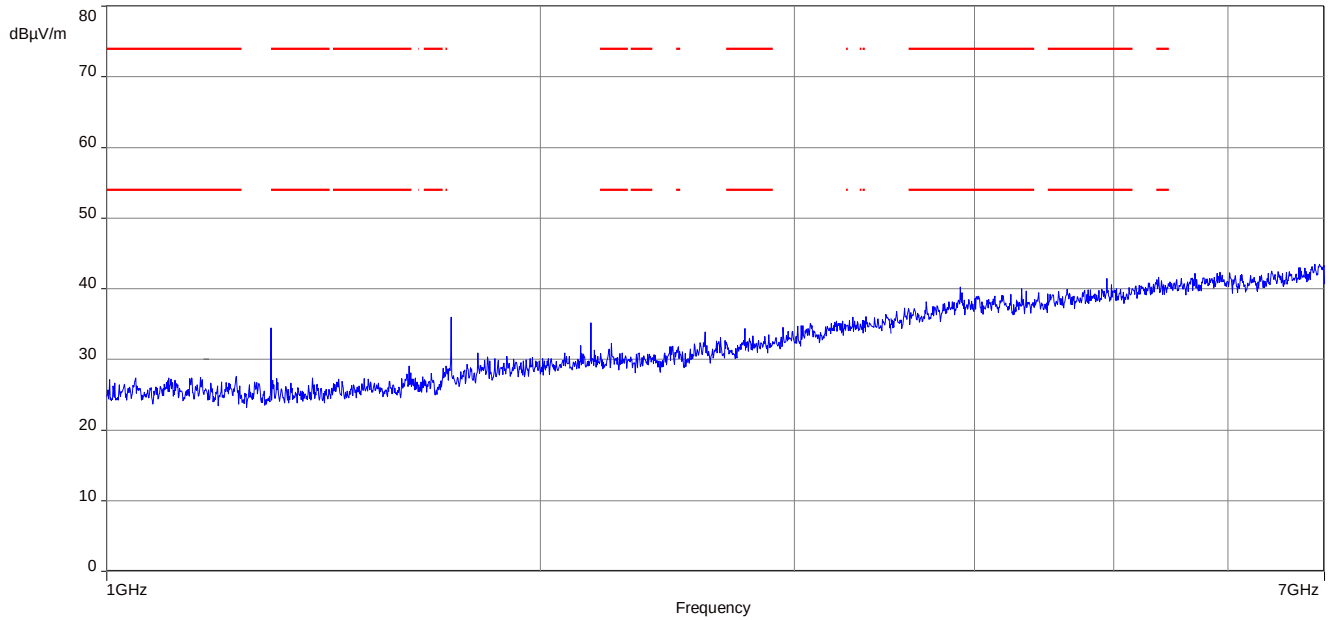
Plot 1: 9 kHz to 30 MHz, low channel



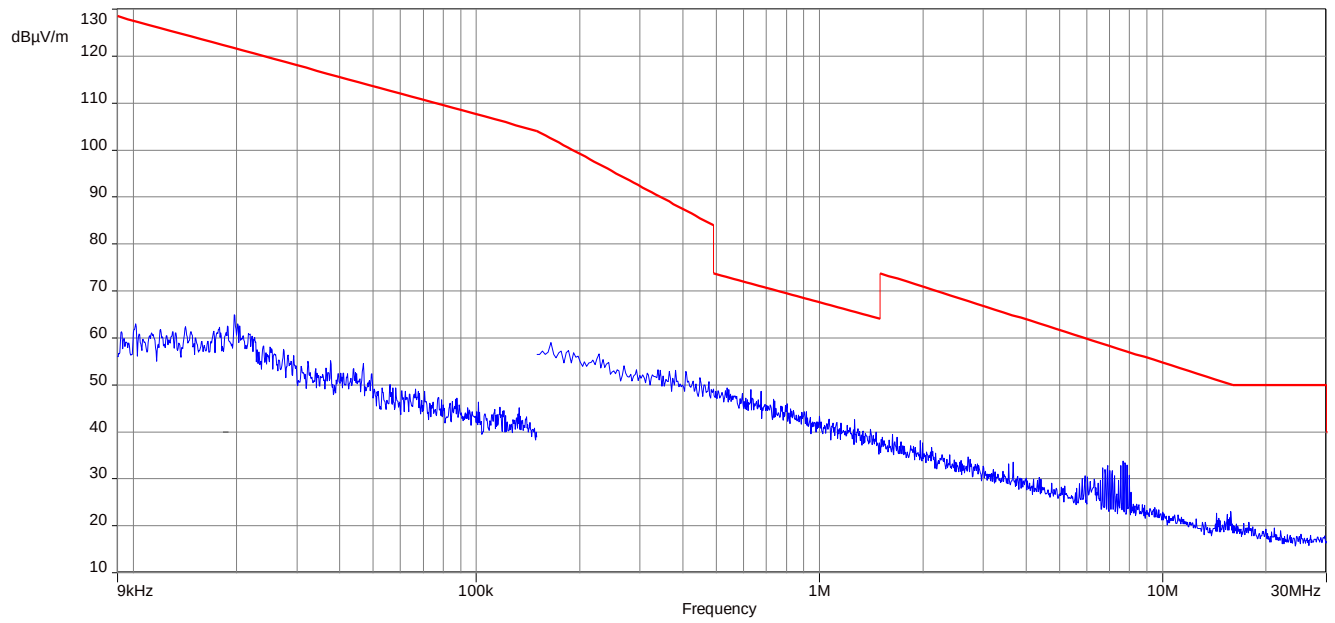
Plot 2: 30 MHz to 1000 MHz, vertical & horizontal polarisation, low channel**Final_Result**

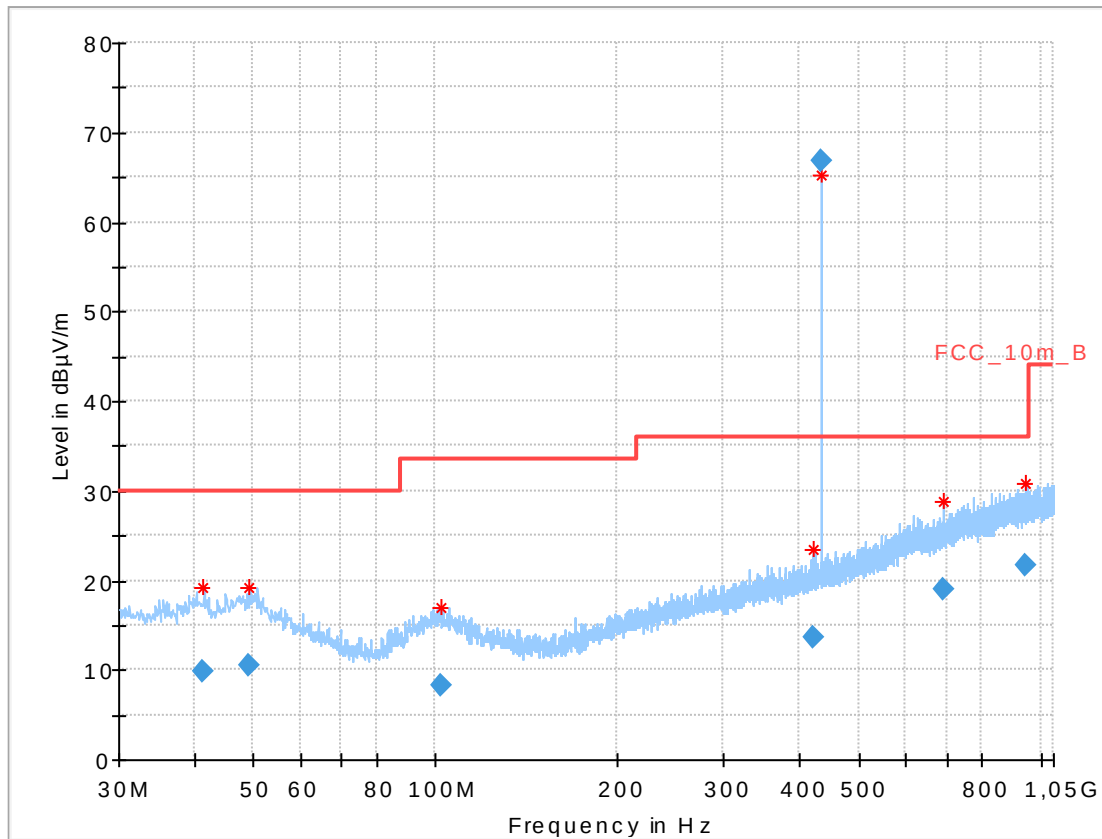
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
39.753900	10.06	30.00	19.94	1000.0	120.000	101.0	H	352.0	13.1
49.784850	11.25	30.00	18.75	1000.0	120.000	101.0	V	352.0	13.6
95.827650	8.06	33.50	25.44	1000.0	120.000	185.0	H	224.0	11.5
329.431050	11.73	36.00	24.27	1000.0	120.000	98.0	H	231.0	15.4
434.363700	67.46	36.00	-31.46	1000.0	120.000	98.0	V	101.0	17.4
729.251400	19.88	36.00	16.12	1000.0	120.000	185.0	V	0.0	22.2
892.194600	21.53	36.00	14.47	1000.0	120.000	185.0	V	124.0	24.0

Plot 3: 1000 MHz to 7 GHz, vertical & horizontal polarisation, low channel



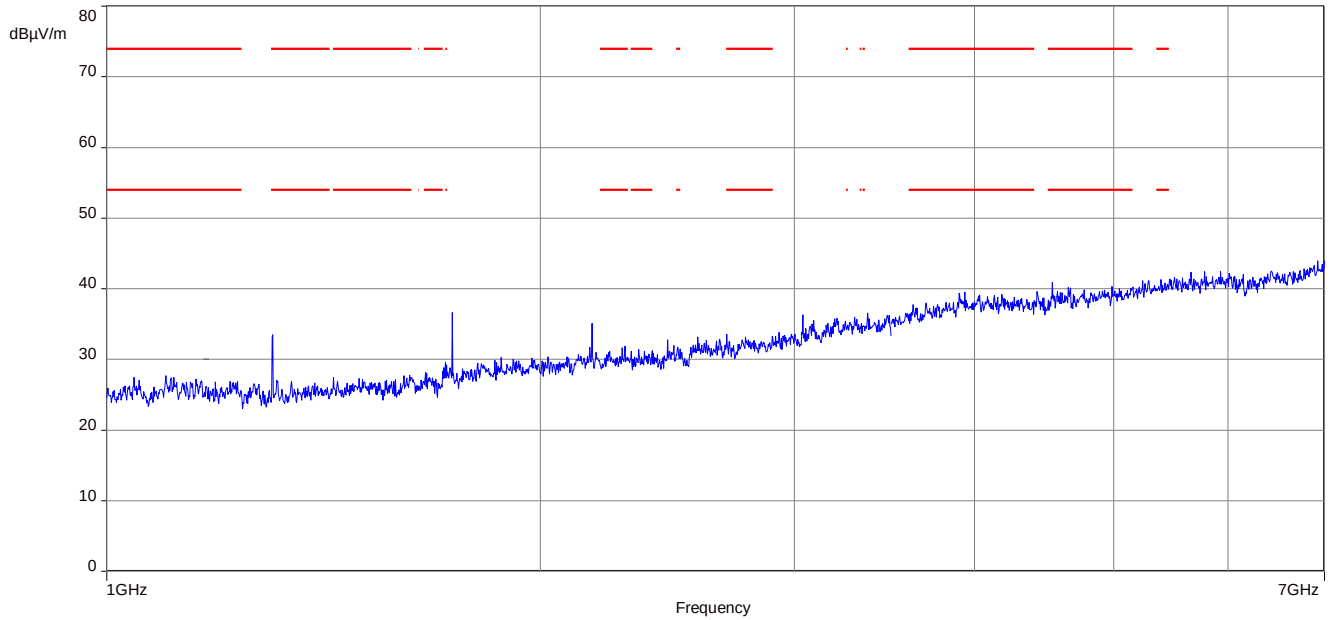
Plot 4: 9 kHz to 30 MHz, mid channel



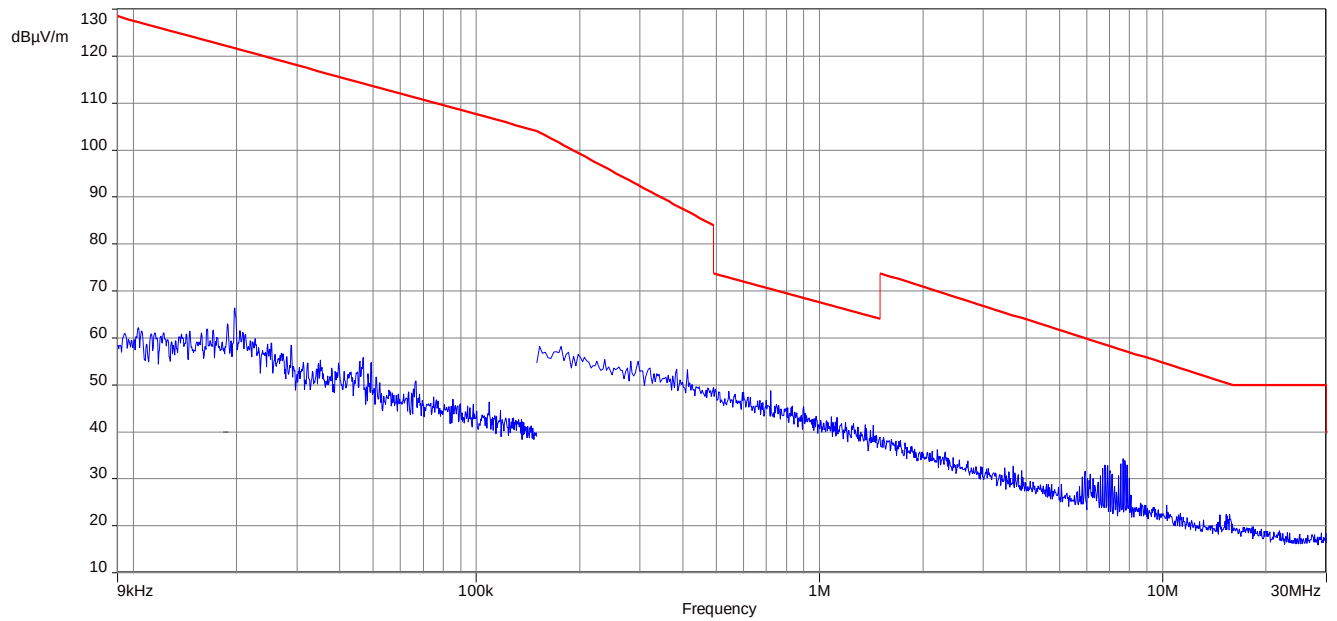
Plot 5: 30 MHz to 1000 MHz, vertical & horizontal polarisation, mid channel**Final_Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
41.235750	9.89	30.00	20.11	1000.0	120.000	101.0	H	258.0	13.1
49.352250	10.52	30.00	19.48	1000.0	120.000	101.0	V	48.0	13.6
102.203250	8.37	33.50	25.13	1000.0	120.000	101.0	V	336.0	11.9
421.094550	13.52	36.00	22.48	1000.0	120.000	185.0	V	32.0	17.2
433.464450	66.88	36.00	-30.88	1000.0	120.000	98.0	V	101.0	17.4
692.291700	19.09	36.00	16.91	1000.0	120.000	185.0	V	289.0	21.5
945.101700	21.61	36.00	14.39	1000.0	120.000	101.0	H	336.0	24.2

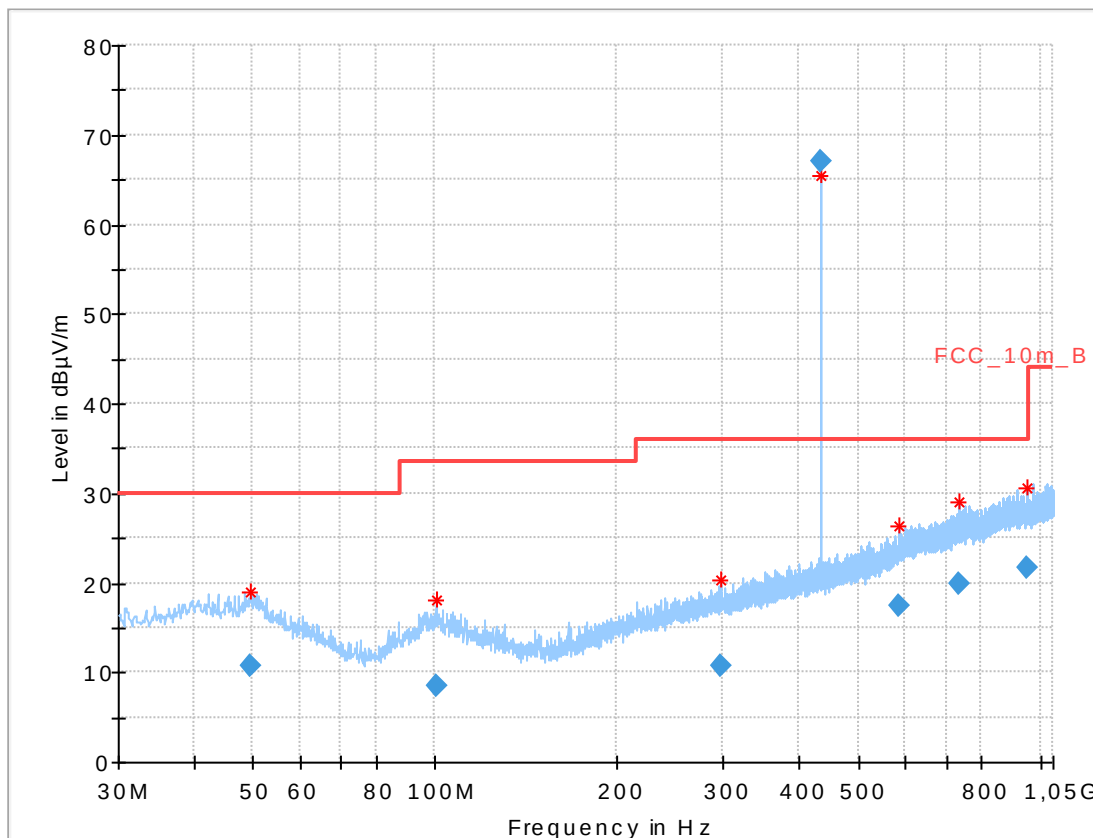
Plot 6: 1000 MHz to 7 GHz, vertical & horizontal polarisation, mid channel



Plot 7: 9 kHz to 30 MHz, high channel



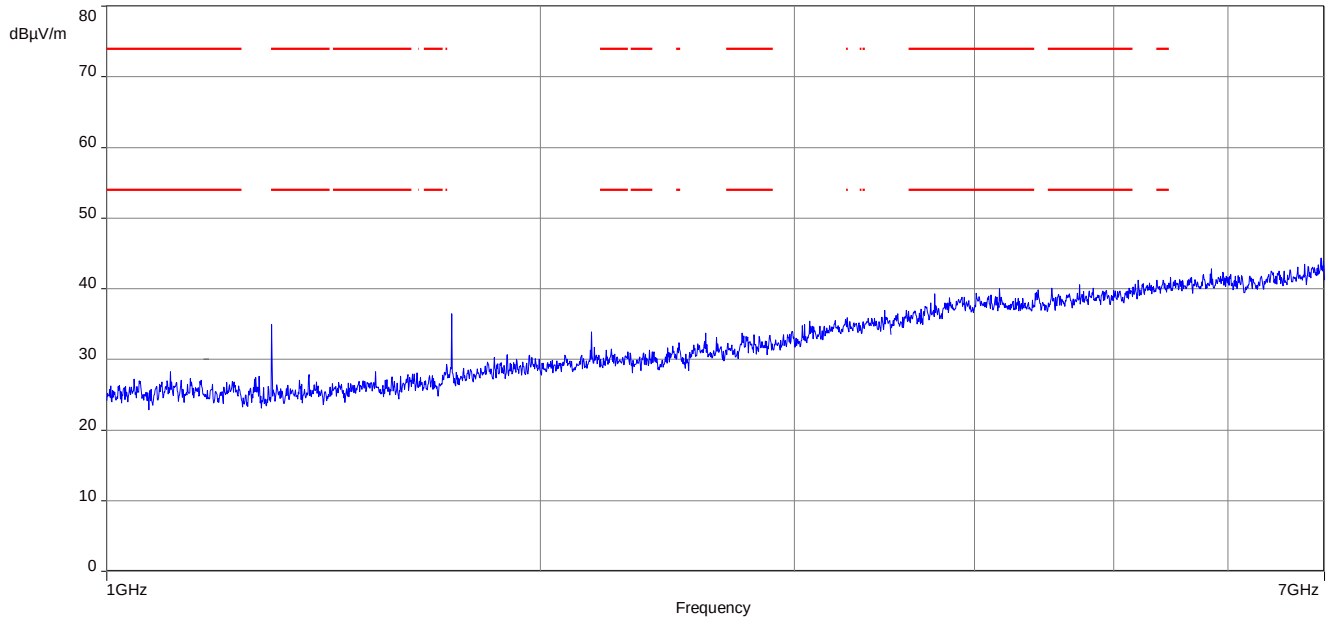
Plot 8: 30 MHz to 1000 MHz, vertical & horizontal polarisation, high channel

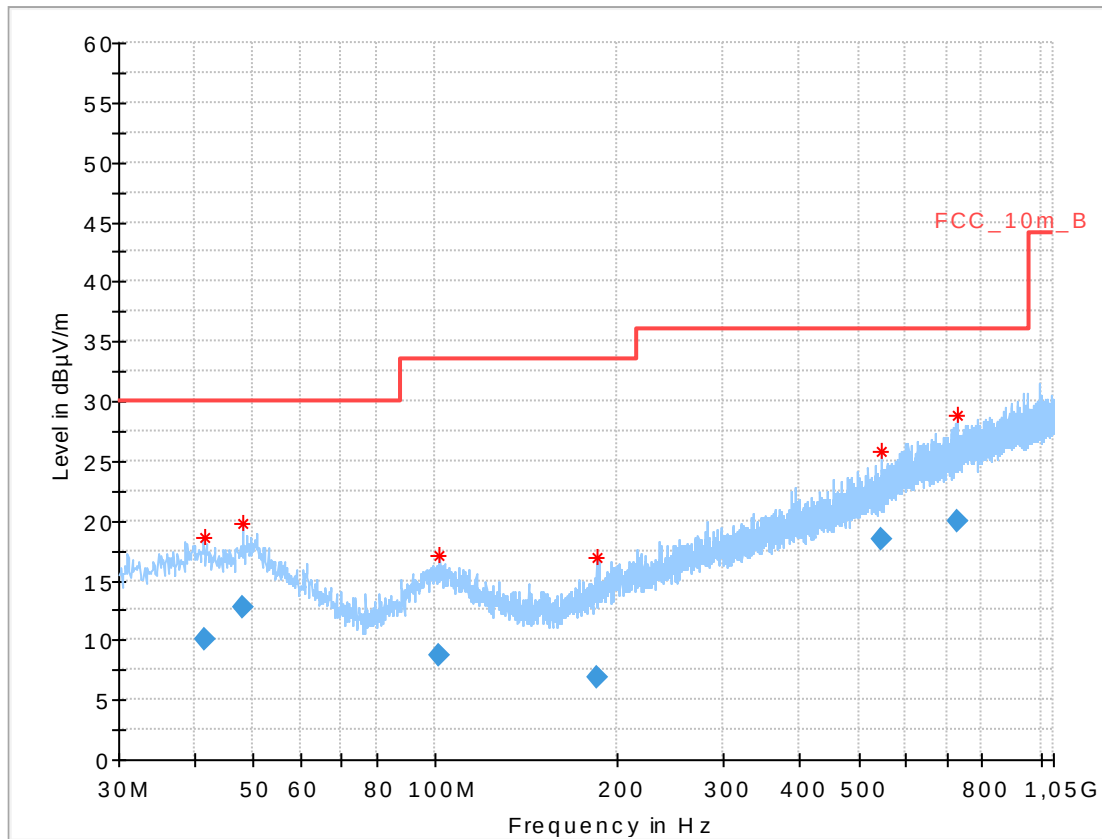


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.591350	10.63	30.00	19.37	1000.0	120.000	101.0	V	89.0	13.6
100.453500	8.53	33.50	24.97	1000.0	120.000	101.0	H	99.0	12.1
297.051900	10.75	36.00	25.25	1000.0	120.000	101.0	H	57.0	14.4
433.935300	67.00	36.00	-31.00	1000.0	120.000	98.0	V	89.0	17.4
582.447450	17.32	36.00	18.68	1000.0	120.000	185.0	H	233.0	20.2
733.367850	19.87	36.00	16.13	1000.0	120.000	185.0	H	275.0	22.3
948.509100	21.77	36.00	14.23	1000.0	120.000	101.0	H	0.0	24.3

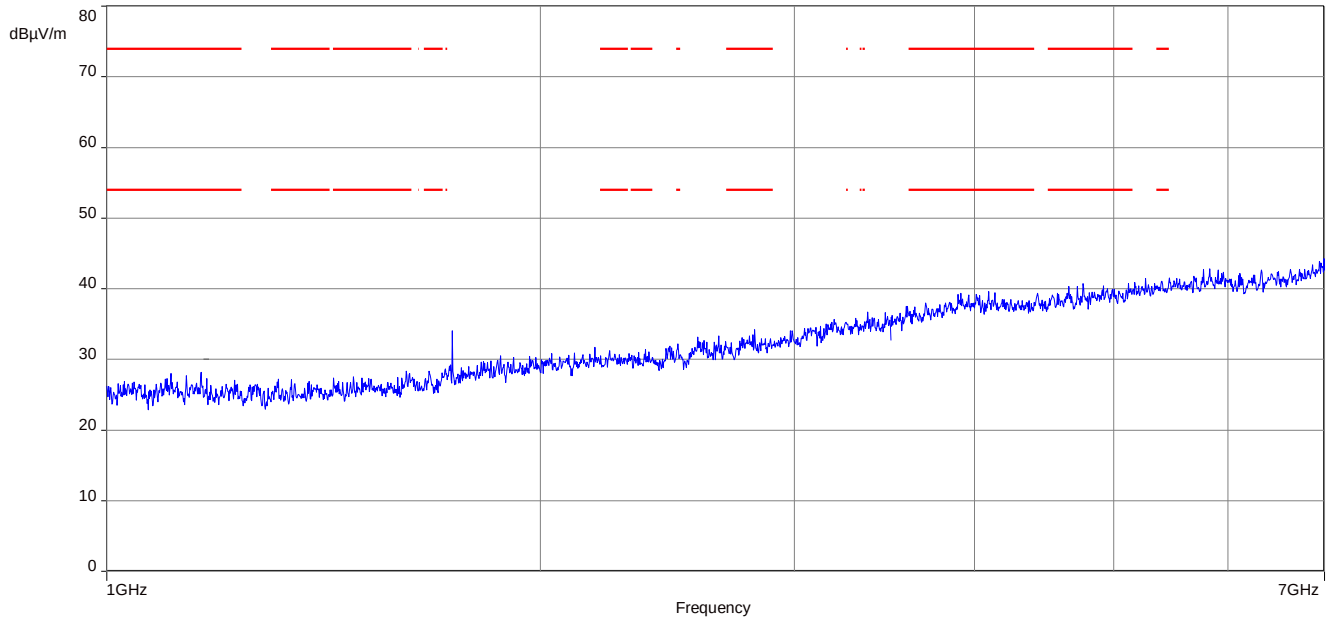
Plot 9: 1000 MHz to 7 GHz, vertical & horizontal polarisation, high channel



Plot 10: 30 MHz to 1000 MHz, vertical & horizontal polarisation, RX**Final_Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
41.472300	9.99	30.00	20.01	1000.0	120.000	103.0	V	205.0	13.1
47.981700	12.80	30.00	17.20	1000.0	120.000	103.0	V	50.0	13.3
101.359950	8.70	33.50	24.80	1000.0	120.000	400.0	H	-5.0	12.0
184.407450	6.92	33.50	26.58	1000.0	120.000	400.0	H	5.0	10.7
544.079250	18.48	36.00	17.52	1000.0	120.000	170.0	V	256.0	19.2
730.363050	19.90	36.00	16.10	1000.0	120.000	103.0	H	281.0	22.2

Plot 11: 1000 MHz to 7 GHz, vertical & horizontal polarisation, RX



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	2016-11-14
-A	Correction of field strength calculation	2016-11-17
-B	Correction of FCC ID & removal of IC statements	2016-12-02

Annex B Further information

Glossary

AVG	-	Average
DUT	-	Device under test
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

Annex C Accreditation Certificate

Front side of certificate



Deutsche Akkreditierungsstelle GmbH

Befehle gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
 Unterzeichnerin der Multilateralen Abkommen
 von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CTC advanced GmbH
 Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

Funk
 Mobilfunk (GSM / DCS) + OTA
 Elektromagnetische Verträglichkeit (EMV)
 Produktsicherheit
 SAR / EMF
 Umwelt
 Smart Card Technology
 Bluetooth®
 Automotive
 Wi-Fi-Services
 Kanadische Anforderungen
 US-Anforderungen
 Akustik
 Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der
 Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt,
 der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-01

Frankfurt, 25.11.2016

Stelle Weisheit auf der Rückseite

 Im Auftrag Dipl.-Ing. Ralf Eigner
 Abteilungsleiter

Back side of certificate

Deutsche Akkreditierungsstelle GmbH

 Standort Berlin
 Spittelmarkt 10
 10117 Berlin

 Standort Frankfurt am Main
 Europa-Allee 52
 60327 Frankfurt am Main

 Standort Braunschweig
 Bundesallee 100
 38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen
 Zustimmung der Deutschen Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate
 Weiterverbreitung des Deckblatts durch die umseitig genannte Konformitätsbewertungsstelle in
 unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt,
 die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom
 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments
 und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung
 im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).
 Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der
 European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und
 der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen
 erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
 EA: www.european-accreditation.org
 ILAC: www.ilac.org
 IAF: www.iaf.nu

Note:

The current certificate including annex can be received from CTC advanced GmbH on request.