

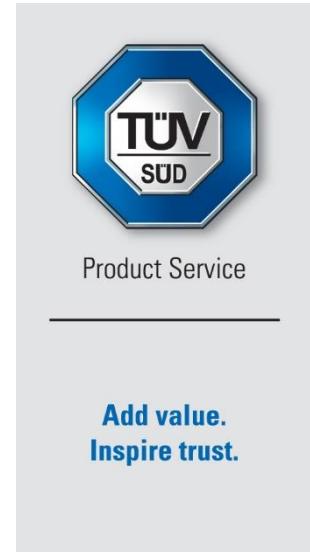
Report on the FCC and IC Testing of the
ASAP Electronics GmbH
CARSHARING ZUSATZKARTENLESER
In accordance with FCC 47 CFR Part
15 C and ISED RSS-247 and ISED RSS-
GEN

Prepared for:

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COMMERCIAL-IN-CONFIDENCE

Date: 2021-07-13

Document Number: TR-44451-66496-07 | Issue 4

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	M. Steindl	2021-07-13	 SIGN-ID 530791
Authorised Signatory	Matthias Stumpe		 SIGN-ID 349980

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

Engineering Statement:

This measurement shown in this report were made in accordance with the procedures described on test pages.

All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15 C and ISED RSS-247 and RSS-GEN.

The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	M. Steindl	2021-07-13	 SIGN-ID 530801

Laboratory Accreditation
DAkkS Reg. No. D-PL-11321-11-02
DAkkS Reg. No. D-PL-11321-11-03

Laboratory recognition
Registration No. BNetzA-CAB-16/21-15

Industry Canada test site registration
3050A-2

Executive Statement:

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15 C:2019 and ISED RSS-247:2017 and RSS-GEN:2019

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1 Report Summary

1.1 Modification Report

Alternations and additions of this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of changes	Date of Issue
1	First Issue	2021-04-15
2	Model number corrected from "CARSHARING ZUSATZKARTEN-LESER ROW" to "CARSHARING ZUSATZKARTENLESER"	2021-05-06
3	Explanation added to Spurious Emission results at 2.4 GHz	2021-06-11
4	Removed RF Exposure Added radiated emissions for lowest, middle and highest frequency. Updated photos in Annex 1 for radiated emission test	2021-07-13

Table 1: Report of Modifications

1.2 Introduction

Applicant	ASAP Electronics GmbH
Manufacturer	ASAP Electronics GmbH
Model Number(s)	CARSHARING ZUSATZKARTENLESER
Serial Number(s)	---
Hardware Version(s)	V1.5
Software Version(s)	V1.5
Number of Samples Tested	1
Test Specification(s) / Issue / Date	FCC 47 CFR Part 15 C : 2019 ISED RSS-247, Issue 2 : 2017 ISED RSS-GEN, Issue 5, Amendment 1 : 2019
Test Plan/Issue/Date	---
Order Number	B15-19-31857
Date	2019-07-29
Date of Receipt of EUT	2020-05-28; 2021-07-06
Start of Test	2020-05-28; 2021-07-12
Finish of Test	2020-07-01; 2021-07-12
Name of Engineer(s)	Alex Fink, Agnieszka Hruszcz; M. Steindl
Related Document(s)	ANSI C63.4: 2014 ANSI C63.10: 2013 FCC 47 CFR Part 2 J : 2019 KDB 558074 D01 V05R02 ISED RSS-102, Issue 5, 2015

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15 C, ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause	Test Description	Result
Transmitting Continuously – BLE Advertising with Channel switching without RFID			
Continuously reading RFID Tag - BLE Advertising with RFID			
Transmitting Continuously – BLE Fast Channel Switch			
2.1	15.203, 15.247(b)	Antenna requirement	Pass
2.2	15.247(a)(2)	Emission Bandwidth	Pass
2.3	15.247(b)(3)	Output Power	Pass
2.4	15.247(e)	Power Spectral Density	Pass
2.5	15.247(d)	Frequency Band Edge	Pass
2.6	15.247(d), 15.205, 15.209	Spurious Emissions	Pass
---	15.207	Conducted Emissions on Mains Terminals	N/A*

Table 2: Results according to FCC 47 CFR Part 15 C

Section	Specification Clause	Test Description	Result
Transmitting Continuously – BLE Advertising with Channel switching without RFID			
Continuously reading RFID Tag - BLE Advertising with RFID			
Transmitting Continuously – BLE Fast Channel Switch			
2.2	5.2 a	Emission Bandwidth	Pass
2.3	5.4 d.	Output Power	Pass
2.4	5.2 b.	Power Spectral Density	Pass
2.5	5.5	Frequency Band Edge	Pass
2.6	5.5	Spurious Emissions	Pass

Table 3: Results according to ISED RSS-247

Section	Specification Clause	Test Description	Result
Transmitting Continuously – BLE Advertising with Channel switching without RFID			
Continuously reading RFID Tag - BLE Advertising with RFID			
Transmitting Continuously – BLE Fast Channel Switch			
2.2	6.7	Emission Bandwidth	Pass
2.6	8.9, 8.10	Spurious Emissions	Pass
2.7	8.11	Frequency Stability	Pass
---	8.8	Conducted Emissions on Mains Terminals	N/A*

Table 4: Results according to RSS-Gen

Note:

* N/A – Not Applicable – EUT battery supplied



1.4 Product Information

1.4.1 Technical Description

CARSHARING ZUSATZKARTENLESER is a BLE Advertising device with / without RFID function.

Operating frequency:	13.56 MHz RFID 2.4 GHz BLE
<i>Frequency Band</i>	2400.0 MHz – 2483.5 MHz
<i>Number of frequency channels:</i>	40
<i>Emission designator:</i>	2M00
<i>Supply Voltage:</i>	3.0 V battery supplied
<i>Supply Frequency:</i>	---
<i>Highest clock frequency (radio part):</i>	2.4 GHz
<i>Highest clock frequency (non-radio part):</i>	32.0 MHz

1.4.2 List of Antennas

Manufacturer	Model	Antenna impedance	Antenna Type	Antenna gain
STMicroelectronics	AN3359	50 Ohm	PCB Antenna	1.95 dBi

Table 5: List of antennas

1.4.3 EUT Ports / Cables identification

Port	Max Cable Length specified	Usage	Type	Screened
Transmitting continuously – BLE Advertising with Channel Switching without RFID, 80:E1:26:08:44:B4 Continuously reading RFID Tag - BLE Advertising with RFID, 80:E1:26:08:49:2F Transmitting continuously – BLE Fast Channel Switch, 80:E1:26:08:45:7E Transmitting Continuously BLE Fast Channel Switch, 80:E1:26:08:44:84				
---	---	---	---	---
---	---	---	---	---

Table 6 Ports and Cables identification



1.5 Test Configuration

Transmitting Continuously – BLE Advertising with Channel Switching without RFID.
Continuously reading RFID Tag - BLE Advertising with RFID
Transmitting Continuously - BLE Fast Channel Switch

1.6 Modes of Operation

Transmitting Continuously – BLE Advertising with Channel Switching without RFID.
Continuously reading RFID Tag - BLE Advertising with RFID
Transmitting Continuously – BLE Fast Channel Switch

1.7 Deviations from Standard

None.

1.8 EUT Modifications Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Transmitting Continuously – BLE Advertising with Channel Switching without RFID, 80:E1:26:08:44:B4			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 7

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Continuously reading RFID Tag - BLE Advertising with RFID, 80:E1:26:08:49:2F			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 8

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Transmitting Continuously BLE Fast Channel Switch, 80:E1:26:08:45:7E			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 9



Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Transmitting Continuously BLE Fast Channel Switch, 80:E1:26:08:44:84			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 10

1.9 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing test laboratory:

Test Name	Name of Engineer(s)
Transmitting Continuously – BLE Advertising with Channel Switching without RFID, 80:E1:26:08:44:B4	
Emission Bandwidth	Alex Fink, Agnieszka Hruscz
Transmitting Continuously BLE Fast Channel Switch, 80:E1:26:08:44:84	
Output Power	Alex Fink, Agnieszka Hruscz
Power Spectral Density	Alex Fink, Agnieszka Hruscz
Frequency Band Edges	Alex Fink, Agnieszka Hruscz
Transmitting Continuously – BLE Fast Channel Switch, 80:E1:26:08:44:84	
Transmitting Continuously BLE Fast Channel, 80:E1:26:08:35:EB	
Spurious Emissions	Alex Fink, Agnieszka Hruscz; Martin Steindl
Transmitting Continuously – BLE Advertising with Channel without RFID, 80:E1:26:12:35:EB	
Transmitting Continuously – BLE Fast Channel Switch, 80:E1:26:08:44:84	
Frequency stability	Alex Fink, Agnieszka Hruscz
Transmitting Continuously BLE Fast Channel Switch, 80:E1:26:08:44:84	
RF Exposure	Alex Fink, Agnieszka Hruscz

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany



2 Test Details

2.1 Antenna requirement

2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.203, 15.247(b)

2.1.2 Equipment under Test and Modification State

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Advertising with Channel Switching without RFID, 80:E1:26:08:44:B4, Modification State 0

2.1.3 Date of Test

2020-05-28

2.1.4 Specification Limits

FCC 47 CFR 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some fields disturbance sensors, or to other intentional radiators which must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits are not exceeded.

FCC 47 CFR 15.247(b)

Except for point-to-point operation and multiple directional beams, if the transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

2.1.5 Test Results

Antenna connector type: PCB Antenna
Antenna connector impedance: 50 Ω

Manufacturer	Model	Antenna gain	Result
STMicroelectronics	AN3359	1.95	Pass



2.2 Emission Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(a)(2)
ISED RSS-247, Clause 5.2 a. / 6.2.4.1
ISED RSS-Gen, Clause 6.7

2.2.2 Equipment under Test and Modification State

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Advertising with Channel Switching without RFID, 80:E1:26:08:44:B4, Modification State 0

2.2.3 Date of Test

2020-05-28 and 2020-06-02

2.2.4 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	32.0 %

2.2.5 Specification Limits

For systems using digital modulation techniques, operating in the 902 MHz – 928 MHz, 2400 MHz – 2483.5 MHz and/or 5725 MHz – 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz

ISED RSS-GEN:

The occupied (99 %) bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSS.

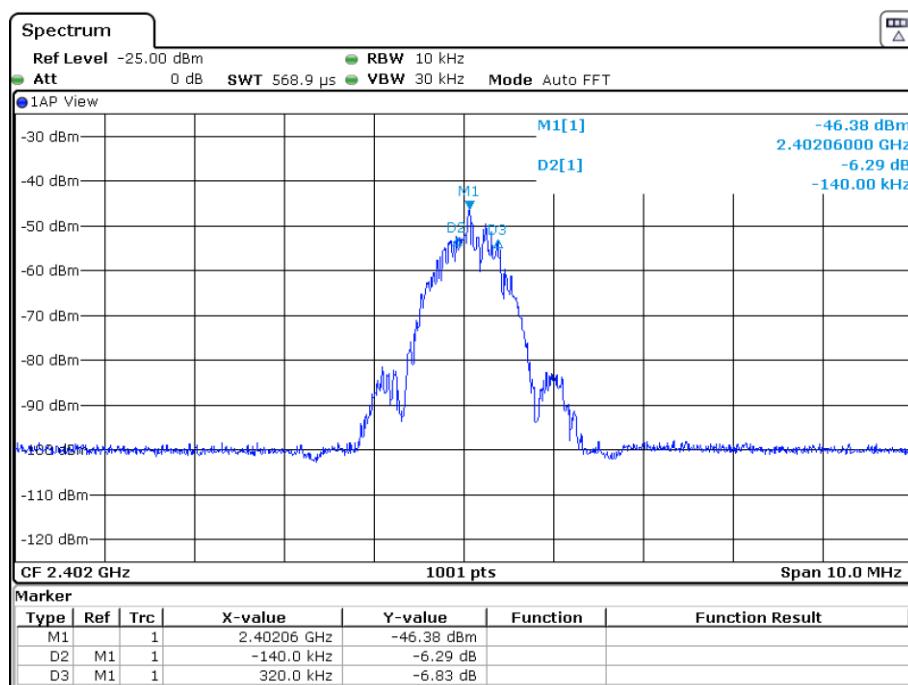
2.2.6 Test Method

The test was performed according to ANSI C63.10, clauses 6.9.3 and 11.8.1

2.2.7 Test Results

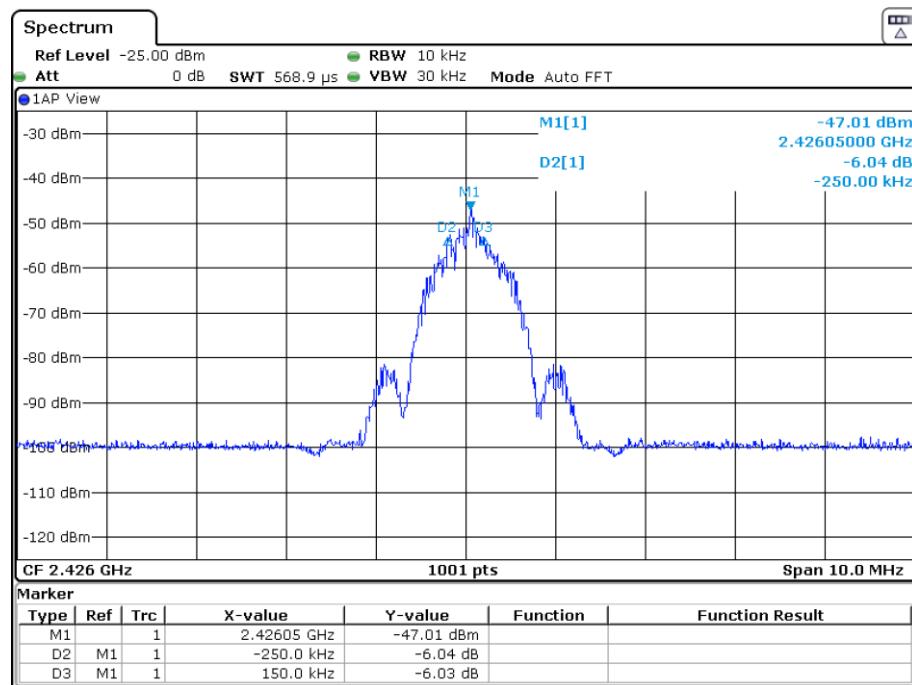
Frequency Channel (MHz)	Environmental Conditions (°C)	6 dB Bandwidth (MHz)	Limit (kHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402	+20.0	0.460	0.500	2401.92	2402.38
2426	+20.0	0.400	0.500	2425.80	2426.20
2480	+20.0	0.350	0.500	2479.87	2480.22

Table 11: 6 dB Bandwidth



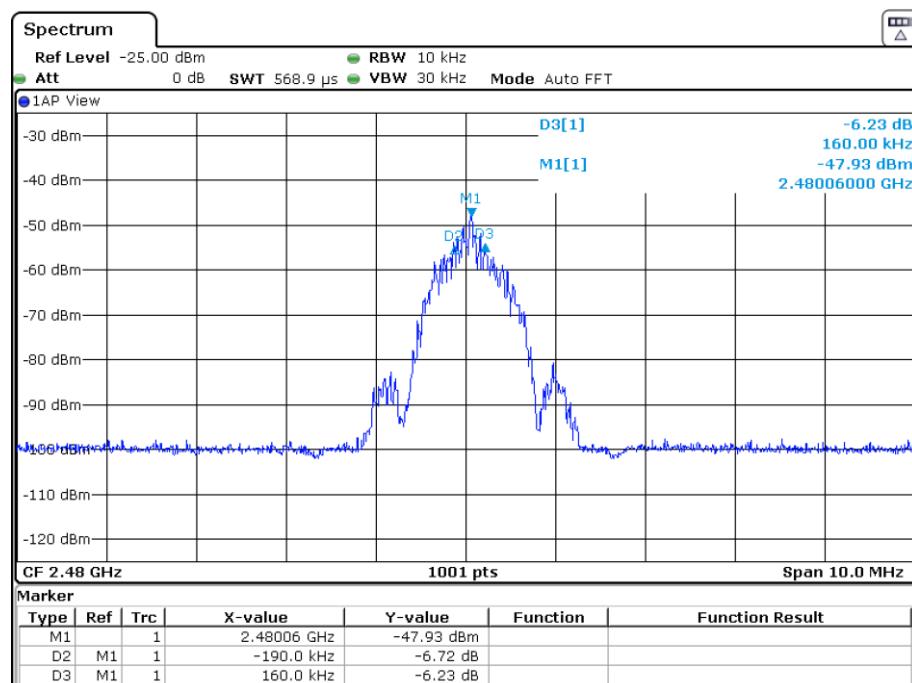
Date: 2.JUL.2020 08:49:58

Figure 1: 6 dB Bandwidth at 2402 MHz



Date: 2.JUL.2020 08:44:38

Figure 2: 6 dB Bandwidth at 2426 MHz

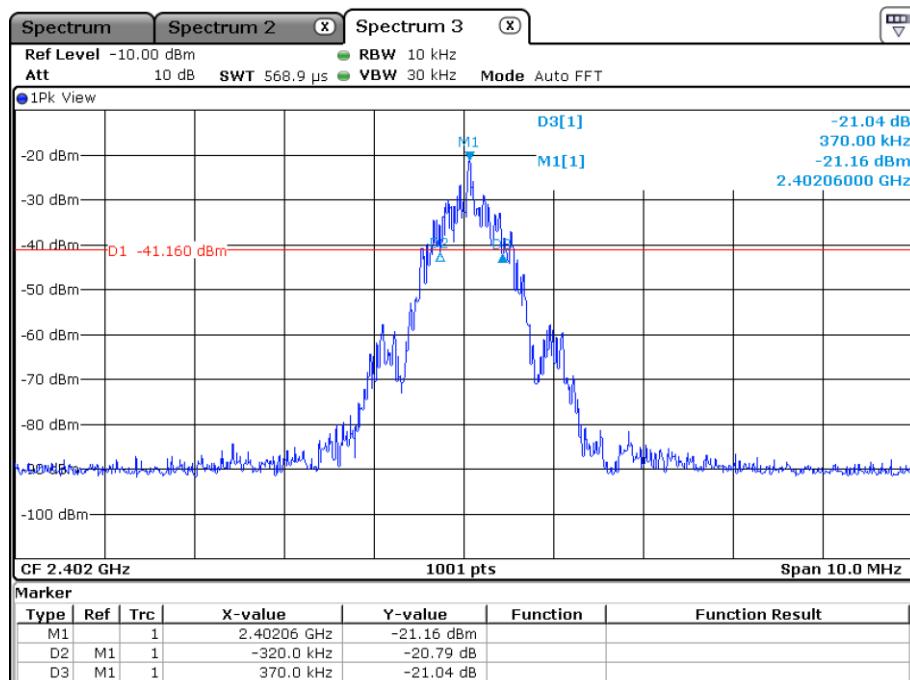


Date: 2.JUL.2020 08:47:46

Figure 3: 6 dB Bandwidth at 2480 MHz

Frequency Channel (MHz)	Temperature (°C)	20 dB Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402	+20.0	0.690	2401.74	2402.43
2426	+20.0	1.089	2425.51	2426.60
2480	+20.0	1.088	2479.53	2480.62

Table 12: 20 dB Bandwidth



Date: 2.JUN.2020 18:49:04

Figure 4: 20 dB Bandwidth at 2402 MHz

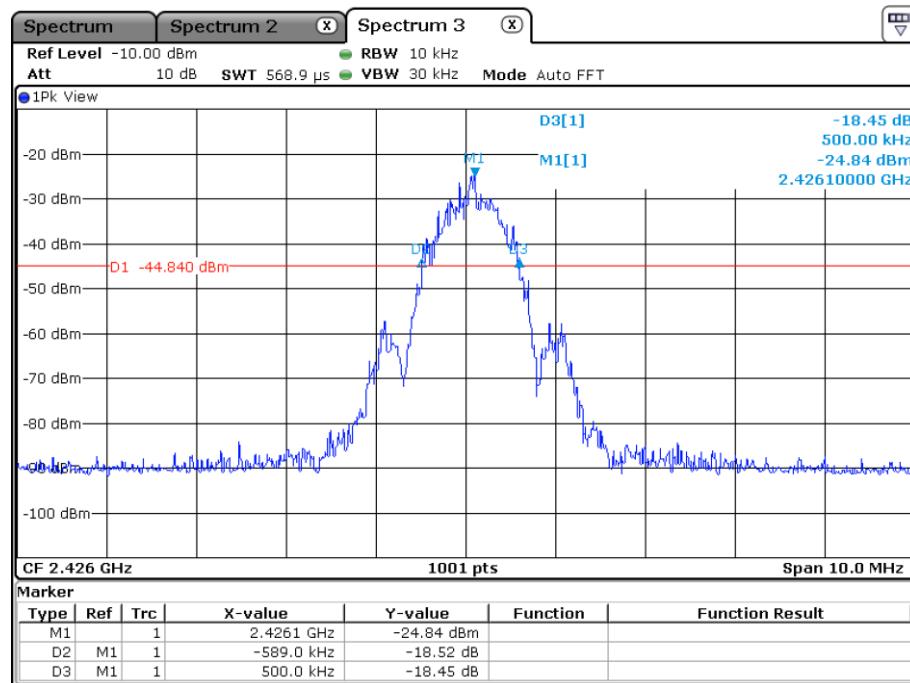


Figure 5: 20 dB Bandwidth at 2426 MHz

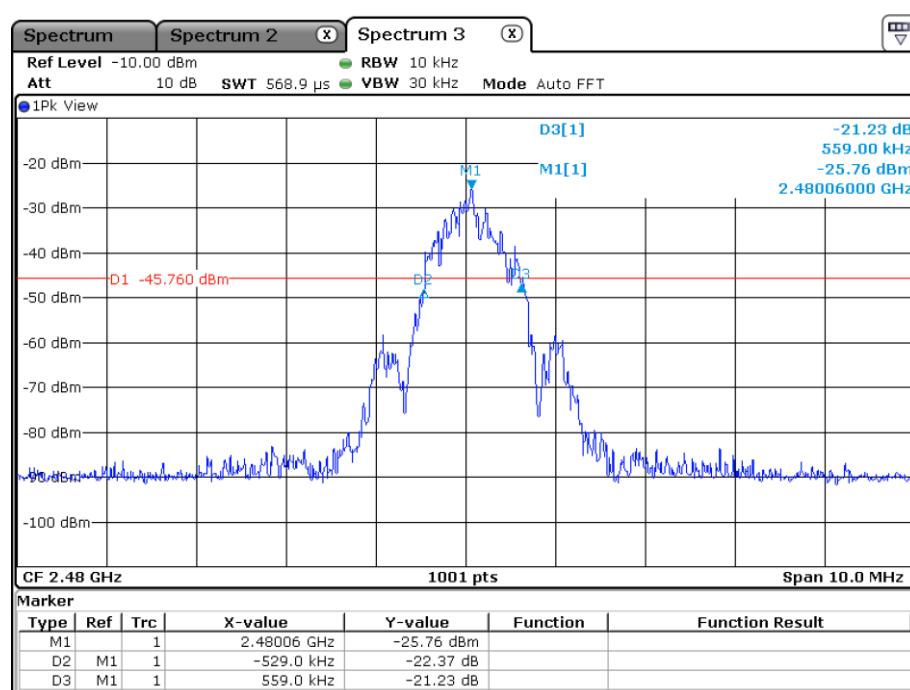


Figure 6: 20 dB Bandwidth at 2480 MHz

Frequency Channel (MHz)	Temperature (°C)	99% Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402	+20.0	0.989	2401.570	2402.559
2426	+20.0	1.009	2425.560	2426.569
2480	+20.0	1.009	2479.550	2480.559

Table 13: 99% Bandwidth

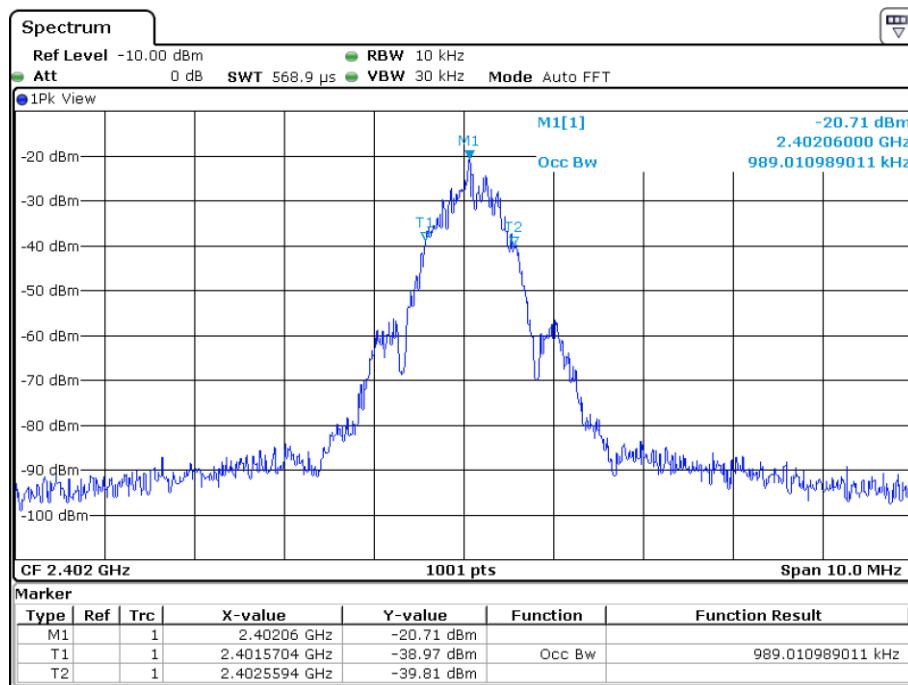
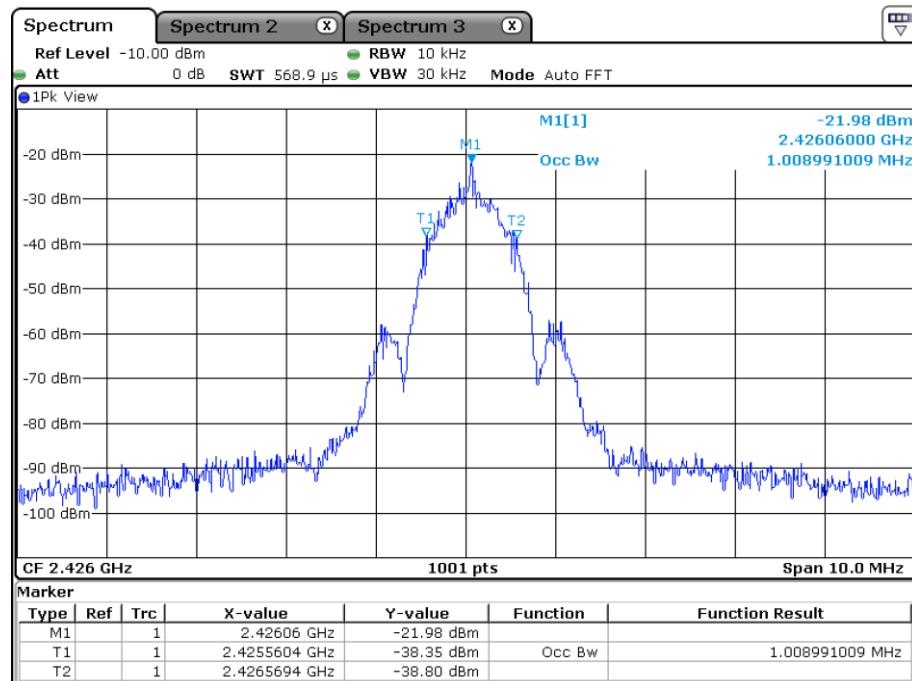
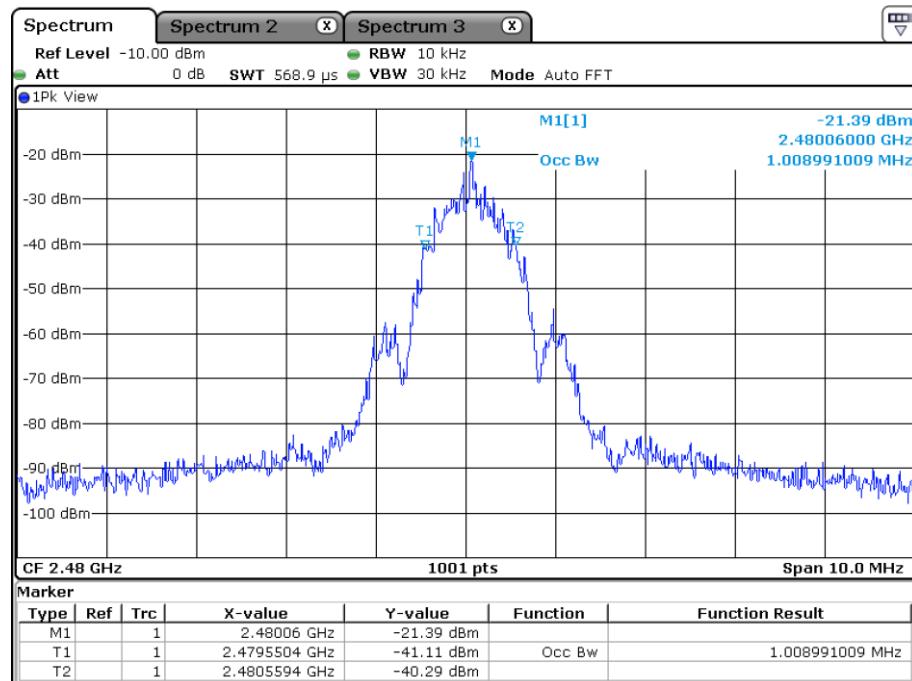


Figure 7: 99% Bandwidth at 2402 MHz



Date: 2.JUN.2020 18:51:13

Figure 8: 99% Bandwidth at 2426 MHz



Date: 2.JUN.2020 18:58:53

Figure 9: 99% Bandwidth at 2480 MHz



2.2.8 Test Location and Test Equipment

The test was carried out in Non shielded room

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz & Co. KG	FSV40 for TS8997	20219	12	2021-01-31
Switching device	Rohde & Schwarz & Co. KG	OSP120 for TS8997	20248	24	2022-02-28
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30

Table 14



2.3 Output Power

2.3.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(b)(3)
ISED RSS-247, Clause 5.4 d. / 6.2.4.1

2.3.2 Equipment under Test and Modification State

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch,
80:E1:26:08:44:84, Modification State 0

2.3.3 Date of Test

2020-07-01

2.3.4 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	50.0 %

2.3.5 Specification Limits

The maximum conducted output power shall not exceed 1 W (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm).

2.3.6 Test Method

The test was performed according to ANSI C63.10, section 11.9



2.3.7 Test Results

Frequency Channel (MHz)	Detector	Conducted Output Power (dBm)	Limit (dBm)
2402	Peak	-16.6	30.0
2426	Peak	-16.4	30.0
2480	Peak	-16.5	30.0

Table 15: Conducted Output Power

2.3.8 Test Location and Test Equipment

The test was carried out in Non shielded room

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz & Co. KG	FSV40 for TS8997	20219	12	2021-01-31
Switching device	Rohde & Schwarz & Co. KG	OSP120 for TS8997	20248	24	2022-02-28
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30

Table 16



2.4 Power Spectral Density

2.4.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(e)
ISED RSS-247, Clause 5.2 b. / 6.2.4.1

2.4.2 Equipment under Test and Modification State

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch,
80:E1:26:08:44:84, Modification State 0

2.4.3 Date of Test

2020-07-01

2.4.4 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	50.0 %

2.4.5 Specification Limits

FCC 47 CFR, section 15.257(e)
ISED RSS-247, Clause 5.2.(b)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The same method (detector) of determining the conducted output power shall be used to determine the power spectral density.

ISED RSS-247, Clause 6.2.4.1

The output power spectral density shall not exceed 30 dBm in any 500 kHz band.

2.4.6 Test Method

The test was performed according to ANSI C63.10, section 11.10

2.4.7 Test Results

Frequency Channel (MHz)	Detector	Spectral Power Density (dBm)	Limit (dBm)
2402	Peak	-22.686	8.0
2426	Peak	-25.292	8.0
2480	Peak	-22.680	8.0

Table 17: Spectral Power Density

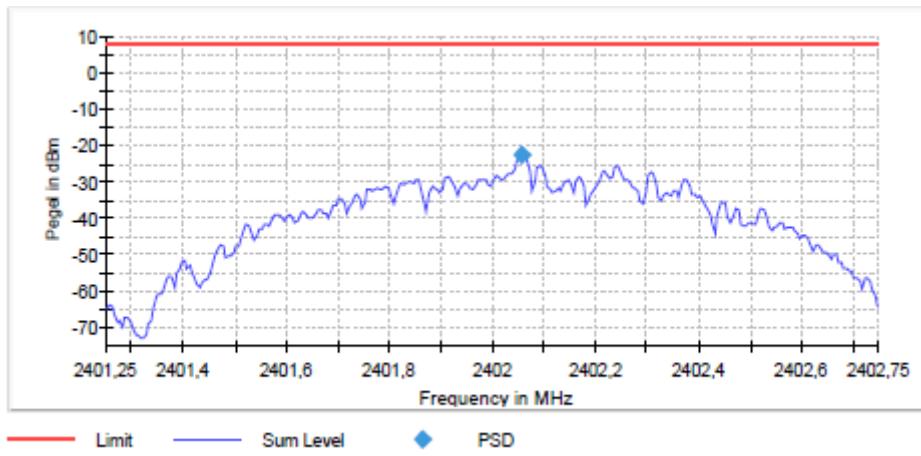


Figure 10: Power Spectral Density at 2402 MHz

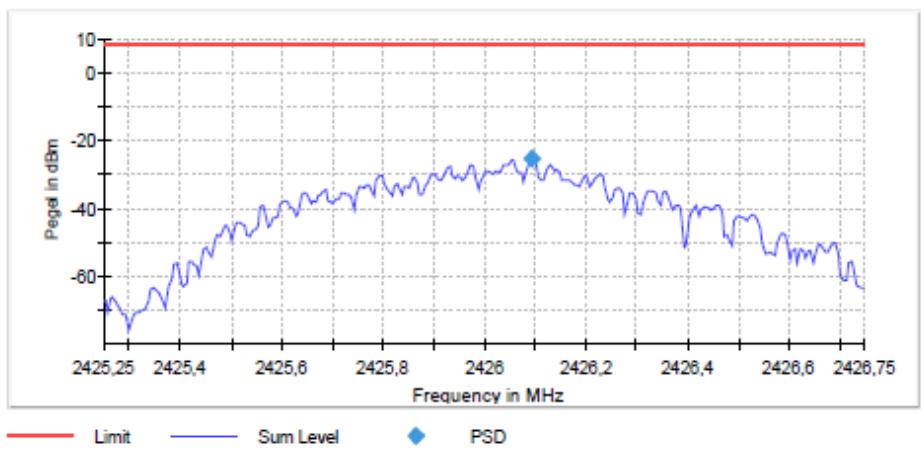


Figure 11: Power Spectral Density at 2426 MHz

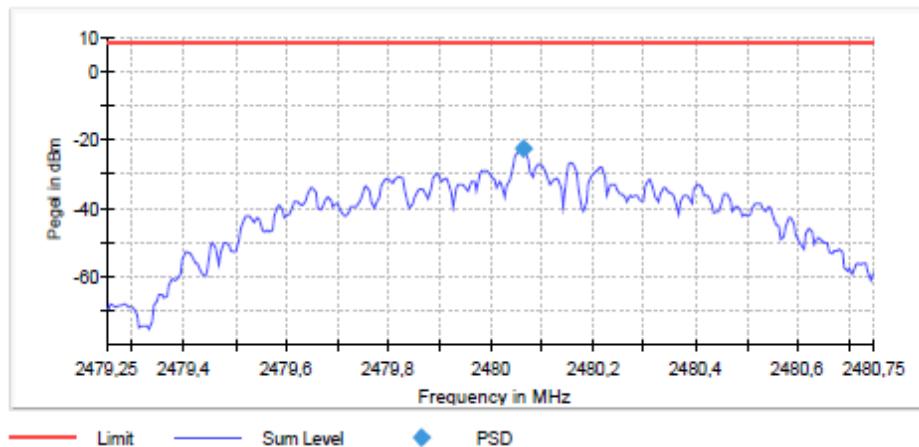


Figure 12: Power Spectral Density at 2480 MHz



2.4.8 Test Location and Test Equipment

The test was carried out in Non shielded room

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz & Co. KG	FSV40 for TS8997	20219	12	2021-01-31
Switching device	Rohde & Schwarz & Co. KG	OSP120 for TS8997	20248	24	2022-02-28
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30

Table 18



2.5 Frequency Band Edge

2.5.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.247(d)
ISED RSS-247, Clause 5.5 / 6.2.4.2

2.5.2 Equipment under Test and Modification State

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch, 80:E1:26:08:44:84, Modification State 0

2.5.3 Date of Test

2020-07-01

2.5.4 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	50.0 %

2.5.5 Specification Limits

In any 100 kHz bandwidth outside the frequency band in which the device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either conducted or radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits is not required.

In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

ISED RSS-247 Clause 6.2.4.2

The power and e.i.r.p. of the equipment unwanted emission shall be measured in peak value. However, the equipment is restricted to comply with the provisions in RSS-Gen with respect to emissions falling within restricted frequency bands.

Devices operating in the band 5725 MHz – 5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

- a. 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- b. 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c. 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm at 75 MHz above or below the band edges; and
- d. -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

2.5.6 Test Method

The test was performed according to ANSI C63.10, sections 11.11

2.5.7 Test Results

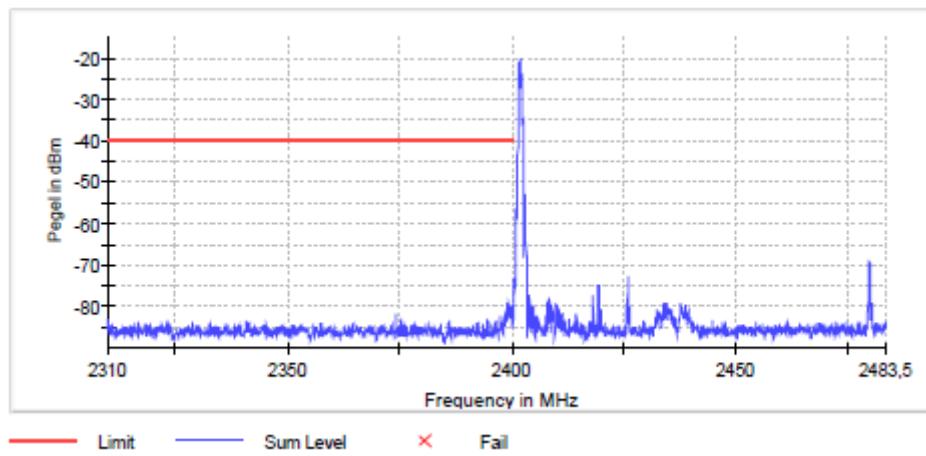


Figure 13: Band Edge Low

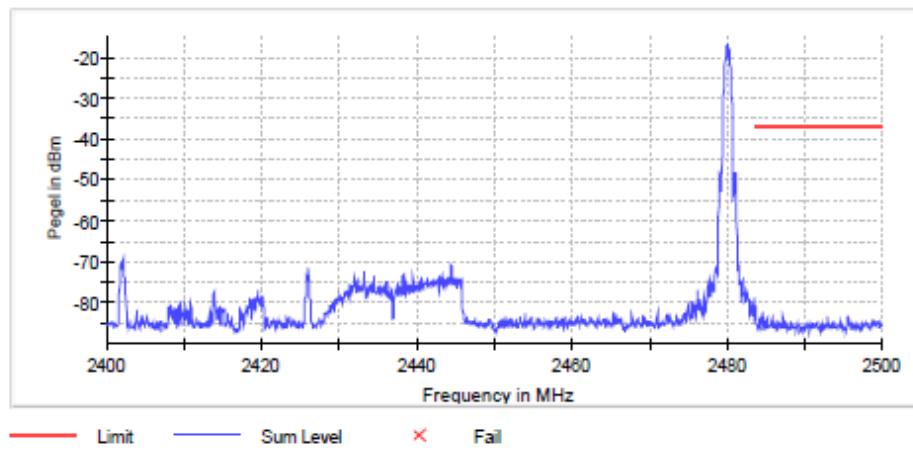


Figure 14: Band Edge High

2.5.8 Test Location and Test Equipment

The test was carried out in Non shielded room



Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz & Co. KG	FSV40 for TS8997	20219	12	2021-01-31
Switching device	Rohde & Schwarz & Co. KG	OSP120 for TS8997	20248	24	2022-02-28
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30

Table 19



2.6 Spurious emissions

2.6.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.205, 15.209, 15.247(d)

ISED RSS-247, Clause 5.5 / 6.2.4.2

ISED RSS-Gen, Clauses 8.9 and 8.10

2.6.2 Equipment under Test and Modification State

CARSHARING ZUSATZKARTENLESER, Continuously reading RFID Tag - BLE Advertising with RFID, 80:E1:26:08:49:2F, Modification State: 0

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Advertising with Channel without RFID, 80:E1:26:08:44:B4, Modification State 0

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel, 80:E1:26:12:35:EB, Modification State 0

2.6.3 Date of Test

2020-05-06

2020-05-07

2020-07-01

2.6.4 Environmental Conditions

Ambient Temperature	24.0 °C
Relative Humidity	48.0 %

2.6.5 Specification Limits

In any 100 kHz bandwidth outside the frequency band in which the device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either conducted or radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits is not required.

In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.



<i>General radiated emission limits:</i>					
<i>Frequency Range (MHz)</i>	<i>Test distance (m)</i>	<i>Field strength</i>		<i>Field strength</i>	
		<i>(μA/m)</i>	<i>(dBμA/m)</i>	<i>(μV/m)</i>	<i>(dBμV/m)</i>
0.009 – 0.49	300	6.37 / <i>f</i>	20*lg(6.37 / <i>f</i>)	2400 / <i>f</i>	20*lg(2400 / <i>f</i>)
0.49 – 1.705	30	63.7 / <i>f</i>	20*lg(63.7 / <i>f</i>)	24000 / <i>f</i>	20*lg(24000 / <i>f</i>)
1.705 – 30	30	0.08	20*lg(0.08 / <i>f</i>)	30	20*lg(30 / <i>f</i>)
30 – 88	3	---	--	100	40
88 – 216	3	--	--	150	43.5
126 – 960	3	--	--	200	46
above 960	3	--	--	500	54

Note 1: *f* in kHz

Table 20 General radiated emission limits

ISED RSS-247 Clause 6.2.4.2

The power and e.i.r.p. of the equipment unwanted emission shall be measured in peak value. However, the equipment is restricted to comply with the provisions in RSS-Gen with respect to emissions falling within restricted frequency bands.

Devices operating in the band 5725 MHz – 5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

- a. 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- b. 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c. 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm at 75 MHz above or below the band edges; and
- d. -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

2.6.6 Test Method

The test was performed according to ANSI C63.10, sections 11.11 and 11.12

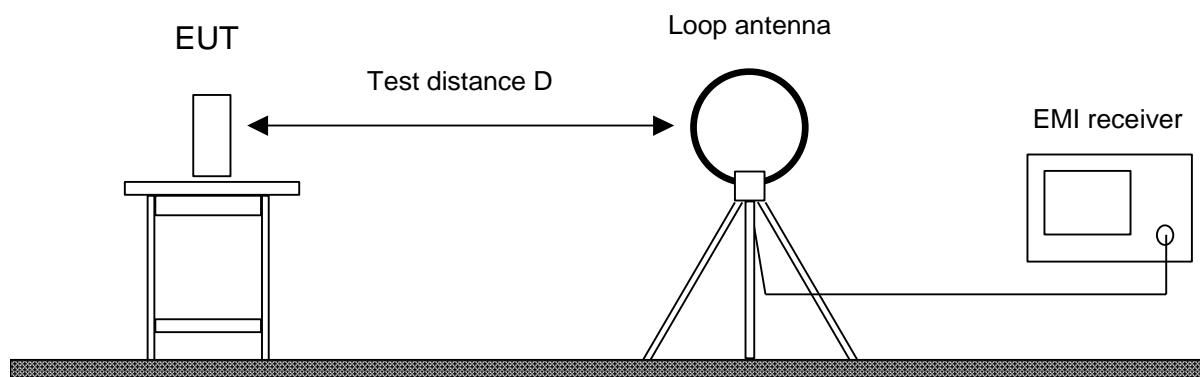
Prescans are performed in six positions of the EUT to get the full spectrum of emission caused by the EUT with the measuring antenna raised and lowered from 1 m to 4 m with vertical and horizontal polarisation to find the combination of table position, antenna height and antenna polarisation for the maximum emission levels.

Data reduction is applied to these results to select those levels having less margin than 10 dB or exceeding the limit using subranges and limited number of maximums.

Further maximisation for adjusting the maximum position is following.

Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

2.6.6.1 Frequency range 9 kHz – 30 MHz

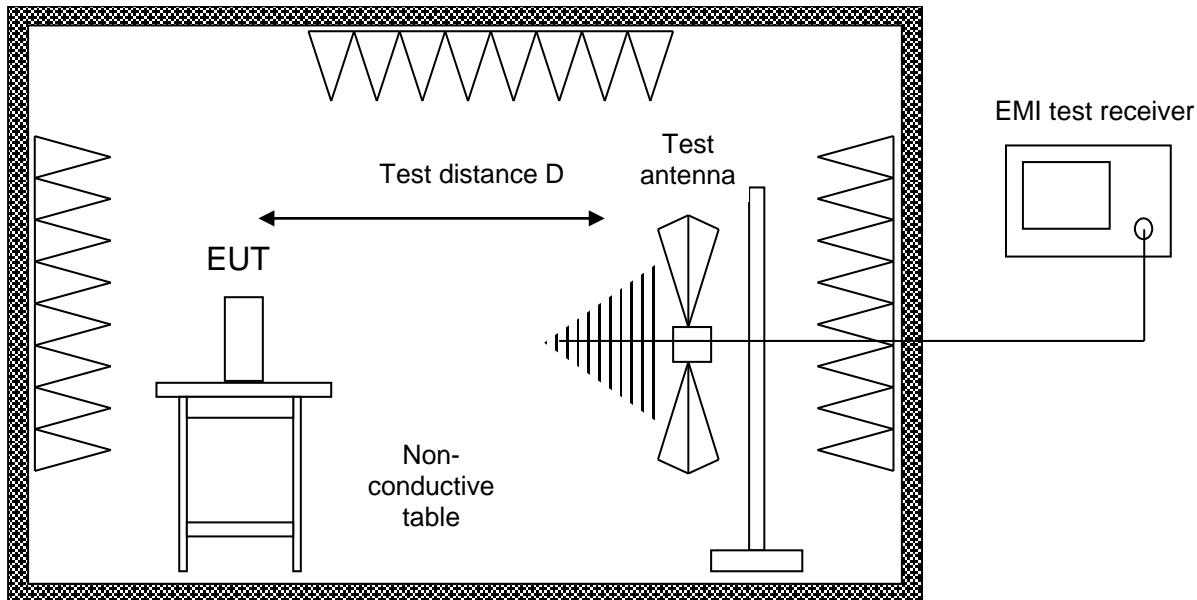


The EUT was placed on a non-conductive table, 0.8 m above the ground.

Radiated emissions in the frequency 9 kHz – 30 MHz is measured within a semi-anechoic room with an active loop antenna with the measurement detector set to peak. In addition in the frequency range 9 kHz to 490 kHz also an average detector was used. The measurement bandwidth of the receiver was set to 300 Hz in the frequency range 9 kHz to 150 kHz and 10 kHz in the frequency range 150 kHz to 30 MHz. Prescans were performed in six positions of the EUT.

For final measurements the detector was set to CISPR quasi-peak and in addition to CISPR average in the frequency range 9 kHz to 490 kHz with a resolution bandwidth 200 Hz in the frequency range 9 kHz to 150 kHz and 9 kHz in the frequency range 150 kHz to 30 MHz. Final tests were performed immediately after a final frequency and zoom (for drifting disturbances) and maximum adjustment.

2.6.6.2 Frequency range 30 MHz – 1 GHz

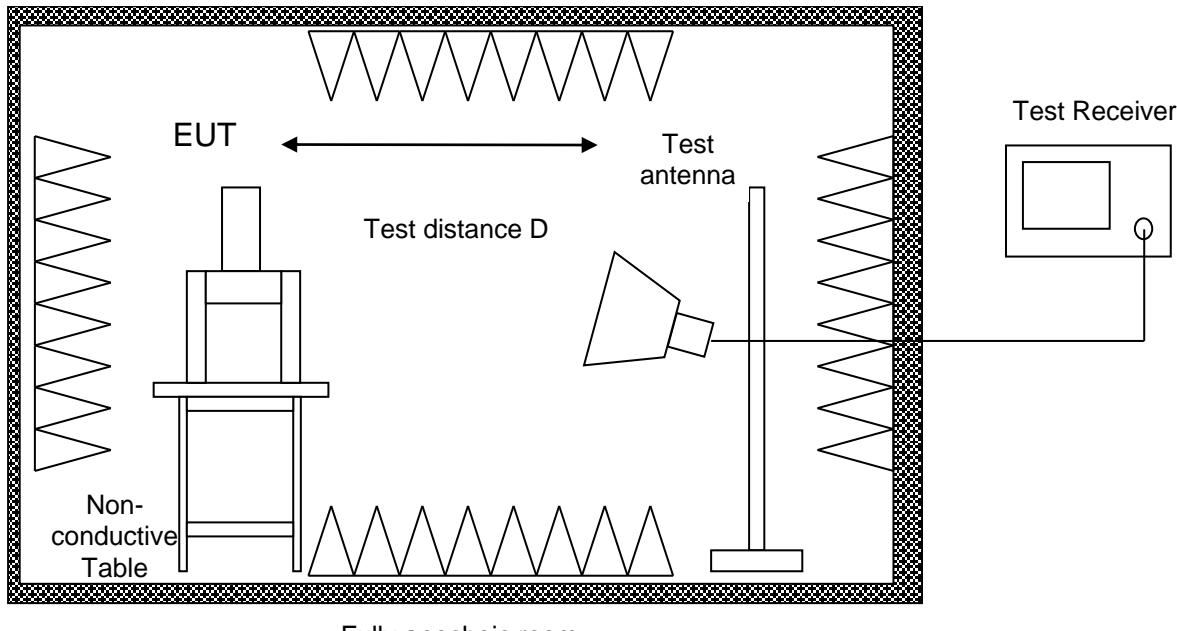


Alternate test site (semi anechoic room)

The EUT was placed on a non-conductive table, 0.8 m above the ground plane. Radiated emissions in the frequency range 30 MHz – 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4. for alternative test sites. A linear polarised logarithmic periodic antenna combined with a 4:1 broadband dipole (“Trilog broadband antenna”) is used.

For prescan tests the test receiver is set to peak-detector with a bandwidth of 120 kHz. With the measurement bandwidth of the test receiver set to 120 kHz CISPR quasi-peak detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.

2.6.6.3 Frequency range above 1 GHz



The EUT was placed on a non-conductive table, 1.5 m above the ground plane. Radiated emission tests above 1 GHz are performed in a fully anechoic room with the S_{VSWR} requirements of ANSI C63.4. Measurements are performed both in the horizontal and vertical planes of polarisation using a test receiver with the detector function set to peak and average and the resolution bandwidth set to 1 MHz. Testing above 1 GHz is performed with horn antennas with the EUT in boresight of the antenna.

For prescan tests the test receiver is set to peak- and average-detector with a bandwidth of 1 MHz. With the measurement bandwidth of the test receiver set to 1 MHz and peak- and CISPR average-detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.



2.6.7 Test Results

The test was performed radiated as well as conducted.

Radiated test results:

<i>Frequency range</i>	<i>Limit applied</i>	<i>Test distance</i>
9 kHz – 30 MHz	FCC Part 15.225	3 m
30 MHz – 1 GHz	FCC Part 15 C	3 m
1 GHz – 18 GHz	FCC Part 15 C	3 m
18 GHz – 25 GHz	FCC Part 15 C	3 m

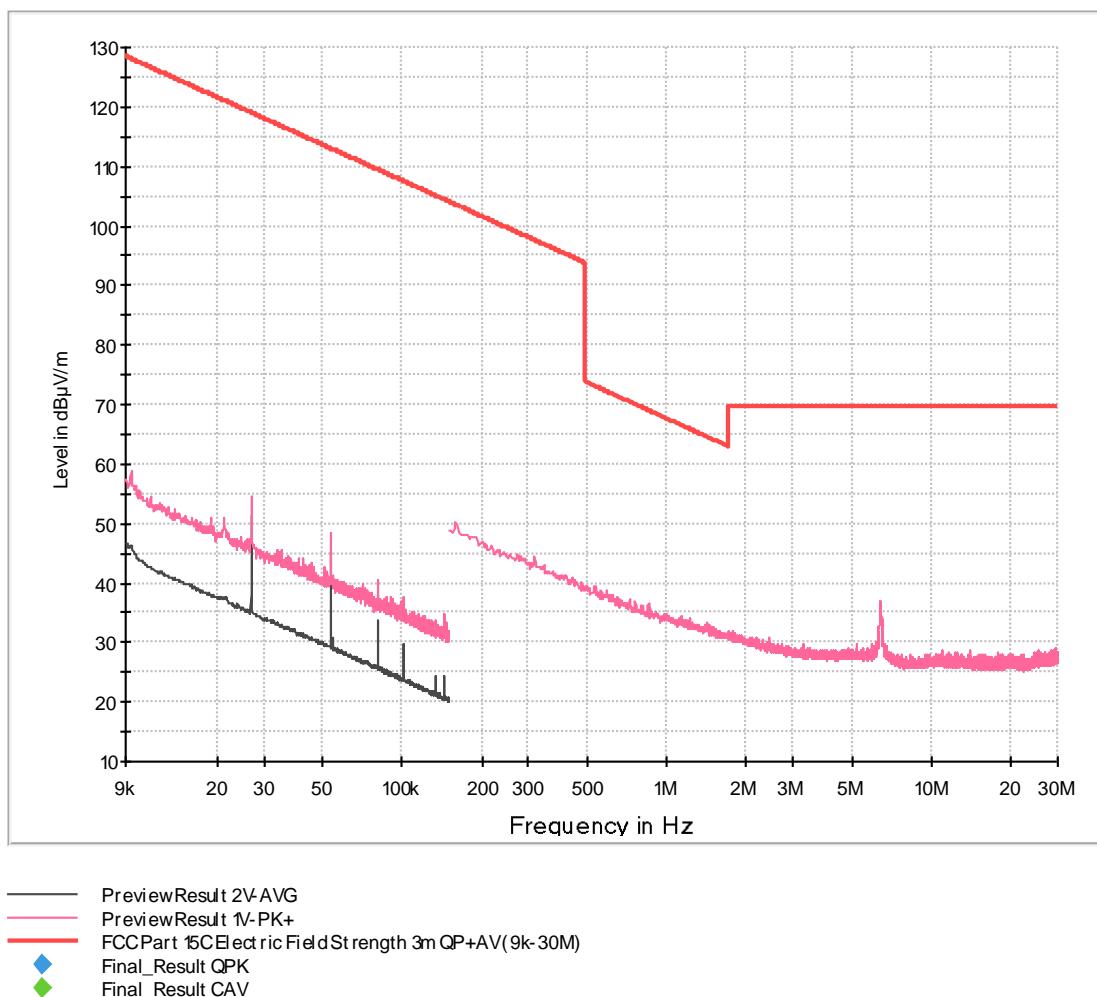
Table 21

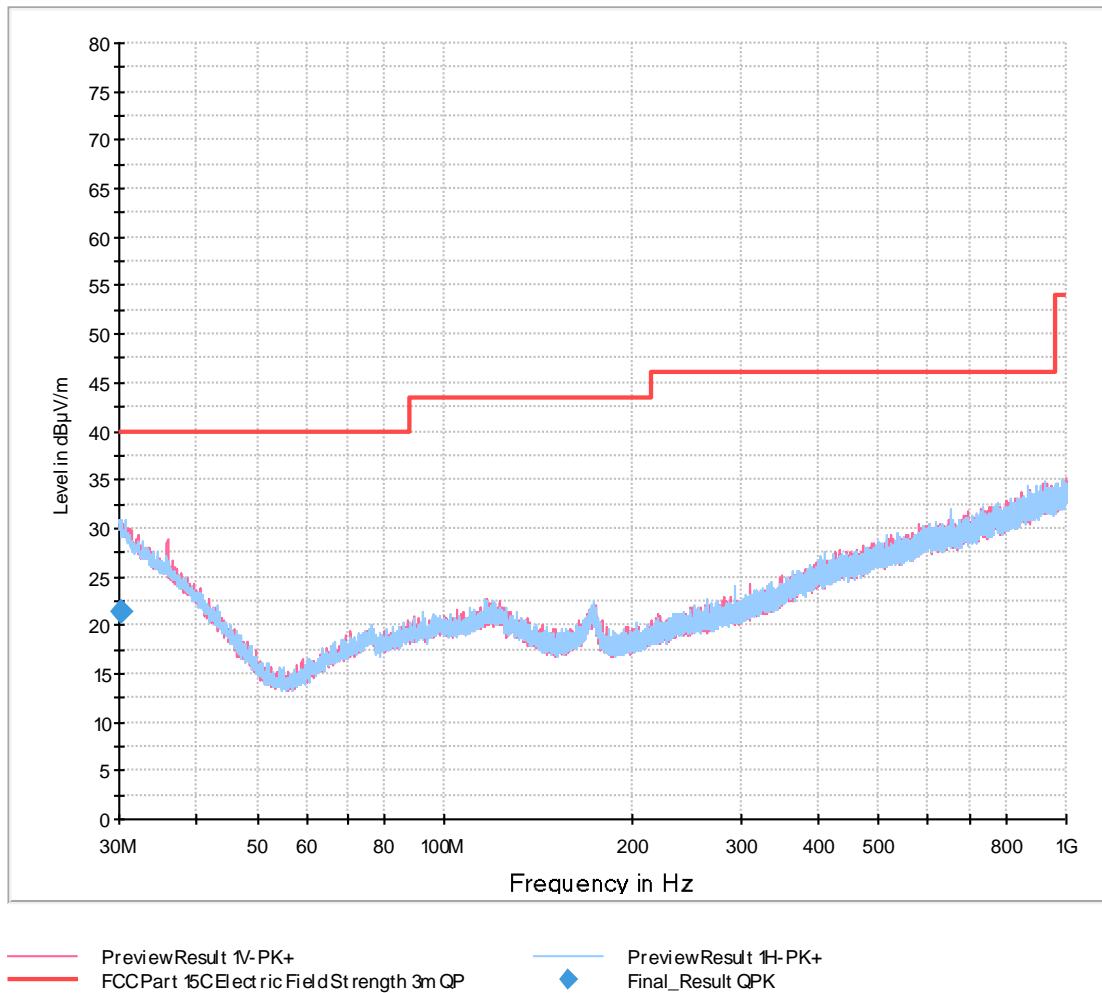
Sample calculation:

Final Value (dB μ V/m) = Reading Value (dB μ V) + (Cable attenuation (dB)
+ Antenna Transducer (dB(1/m)))

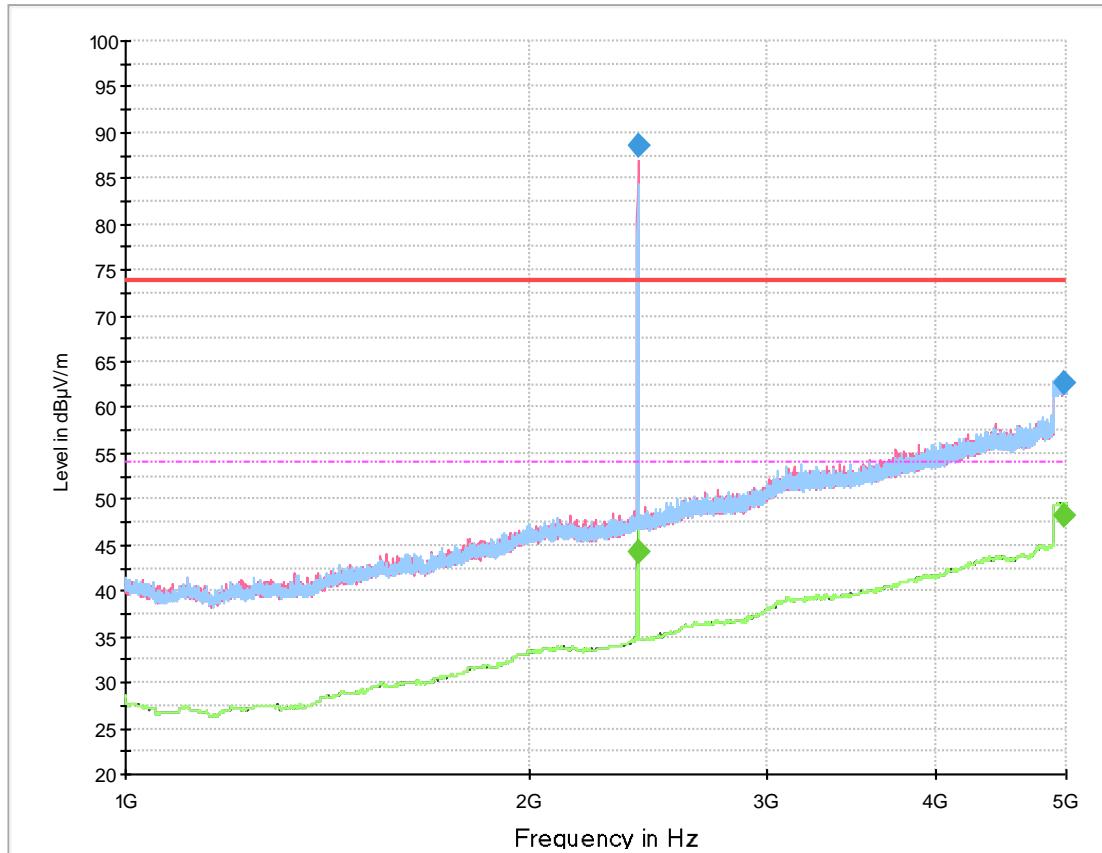
2402 MHz

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel,
80:E1:26:12:35:EB, Modification State 0





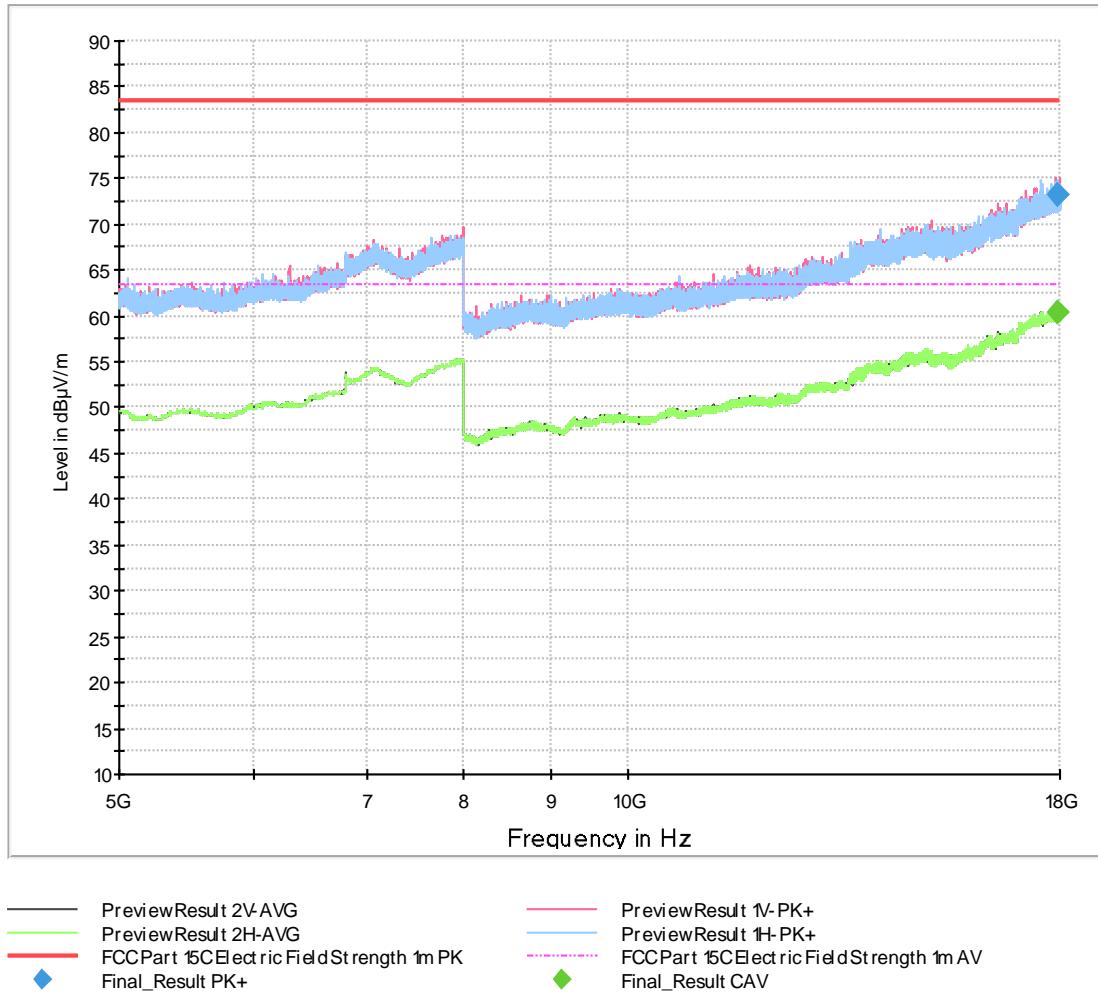
Frequency MHz	Qua- siPeak dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
30.150000	21.33	40.00	18.67	1000	120	150.0	H	-110.0	25.8



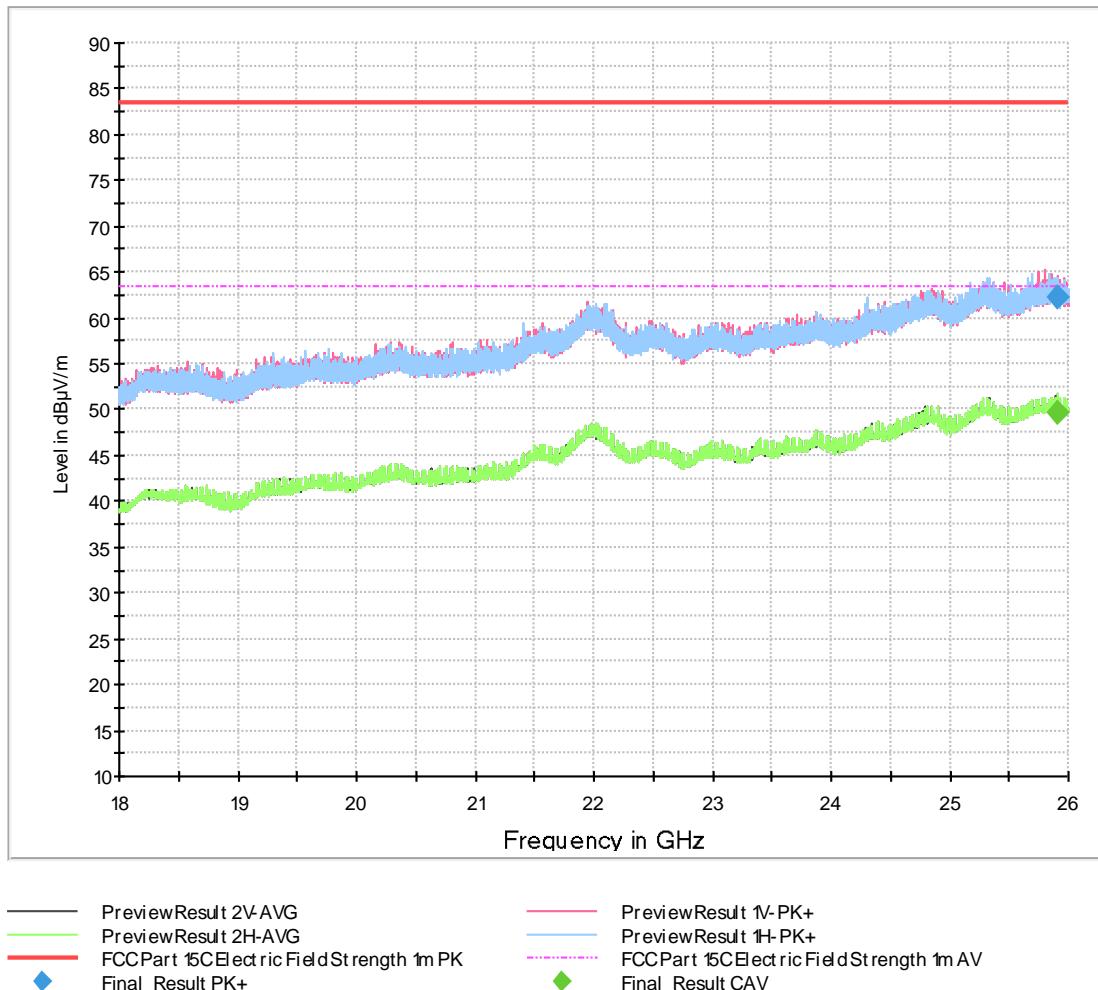
——	PreviewResult 2V-AVG	——	PreviewResult 1V-PK+
——	PreviewResult 2H-AVG	——	PreviewResult 1H-PK+
——	FCCPart 15C Electric Field Strength 3m PK	····	FCCPart 15C Electric Field Strength 3m AV
◆	Final_Result PK+	◆	Final_Result CAV

Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
2402.250000	88.49		*		1000	1000	144.0	V	63.0	34.0
2402.250000		44.17	*		1000	1000	144.0	V	63.0	34.0
4974.250000	62.74		73.98	11.24	1000	1000	119.0	V	20.0	42.2
4974.250000		48.30	53.98	5.68	1000	1000	119.0	V	20.0	42.2

* No limit for radiated emission of carrier



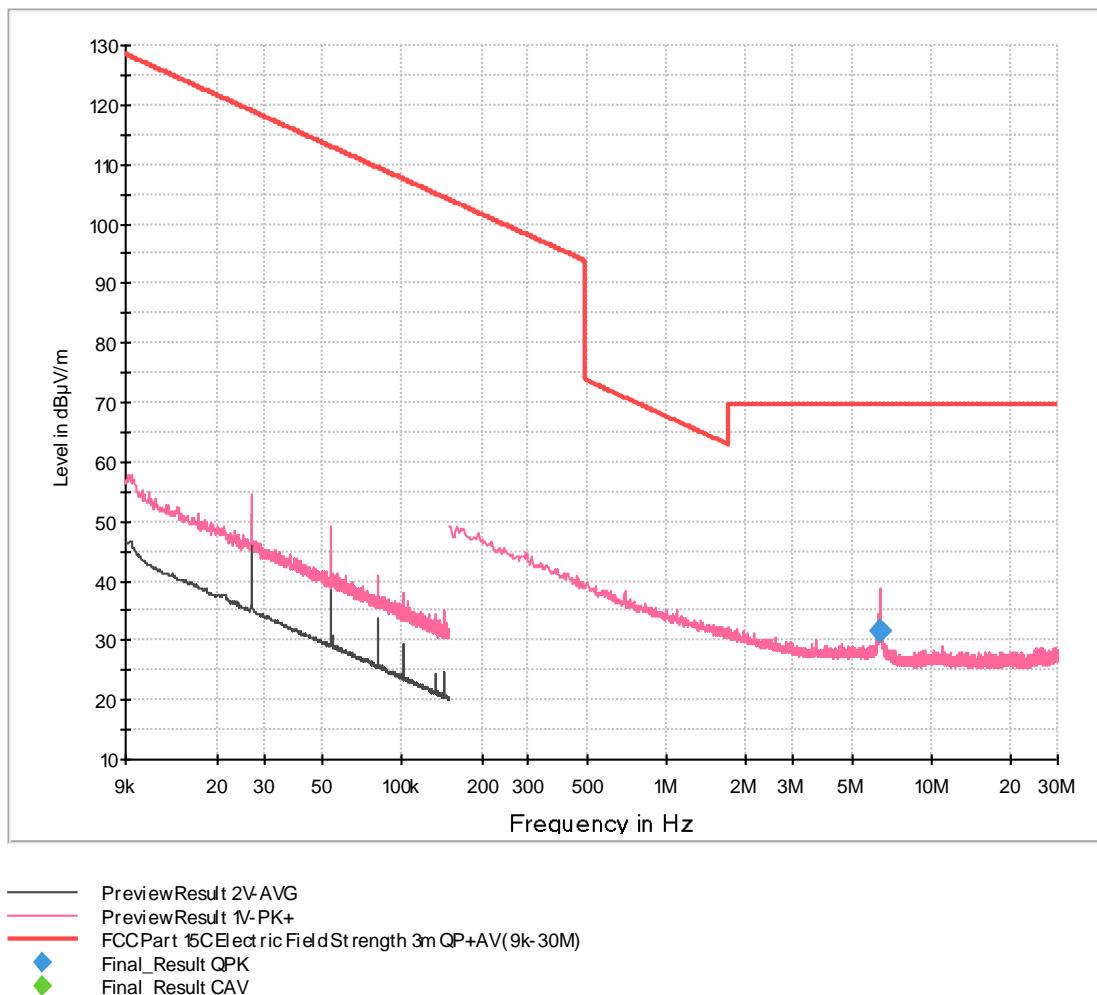
Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Mar- gin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
17944.750000		60.41	63.50	3.09	1000	1000	146.0	H	-80.0	59.2
17944.750000	73.31		83.50	10.19	1000	1000	146.0	H	-80.0	59.2



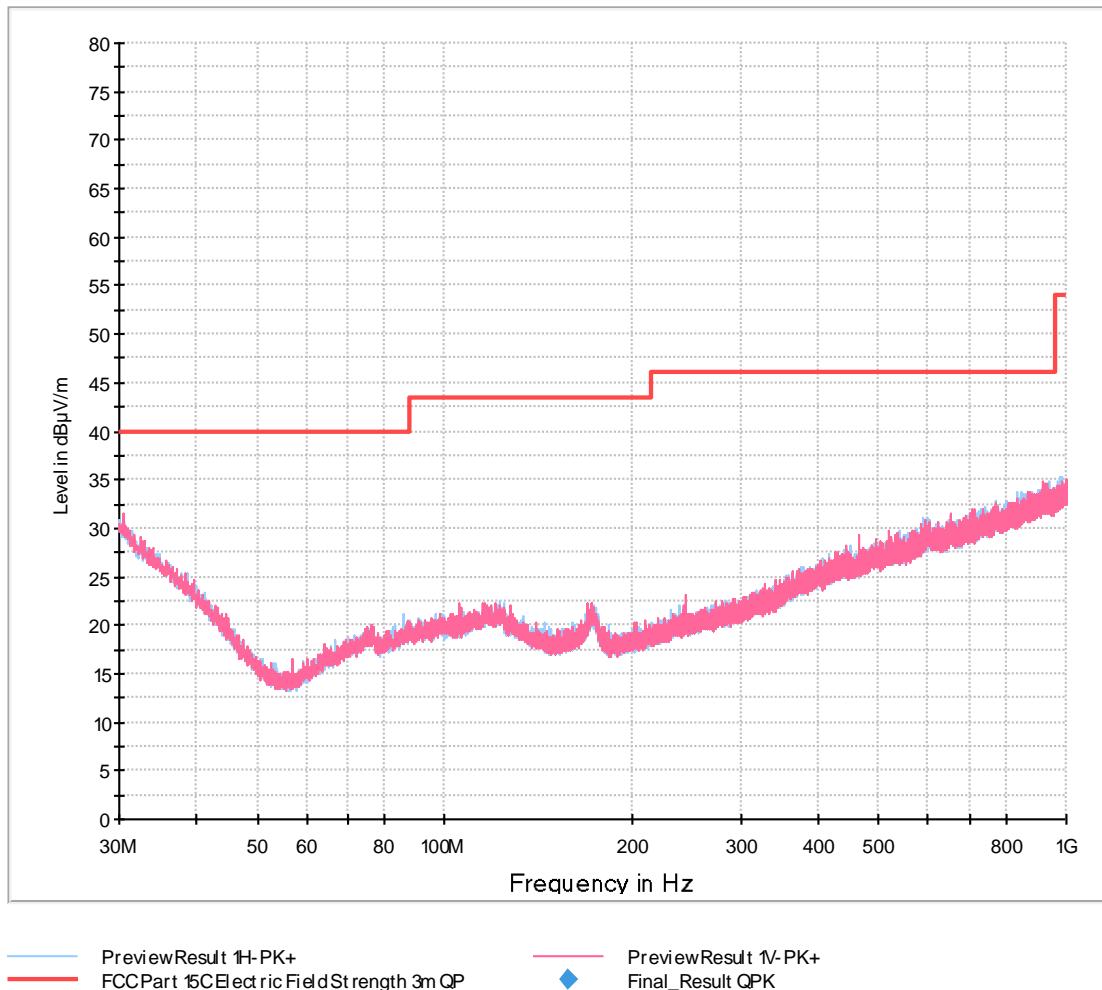
Frequency MHz	MaxPeak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
25910.000		49.65	63.50	13.85	1000	1000	156.0	H	-102.0	31.1
25910.000	62.18		83.50	21.32	1000	1000	156.0	H	-102.0	31.1

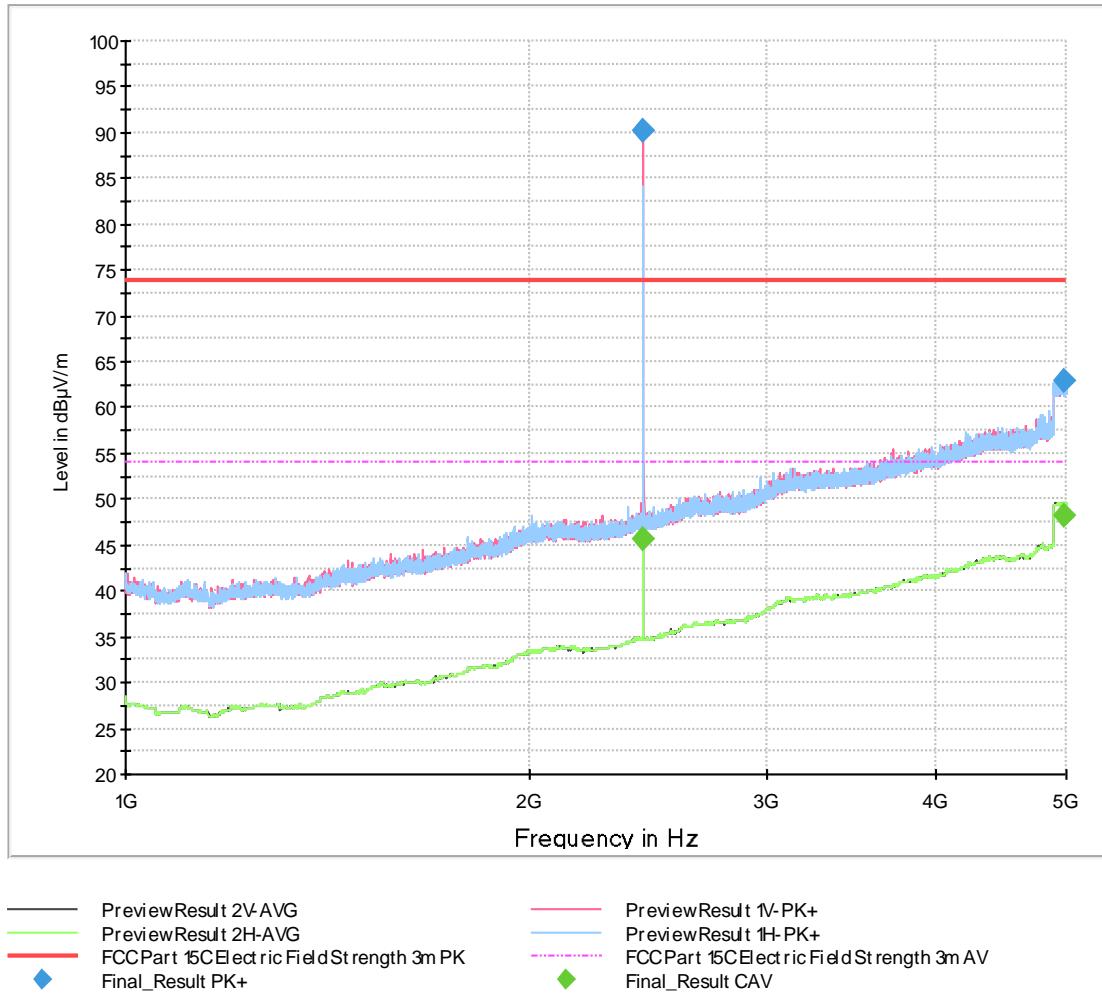
2426 MHz

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel,
80:E1:26:12:35:EB, Modification State 0



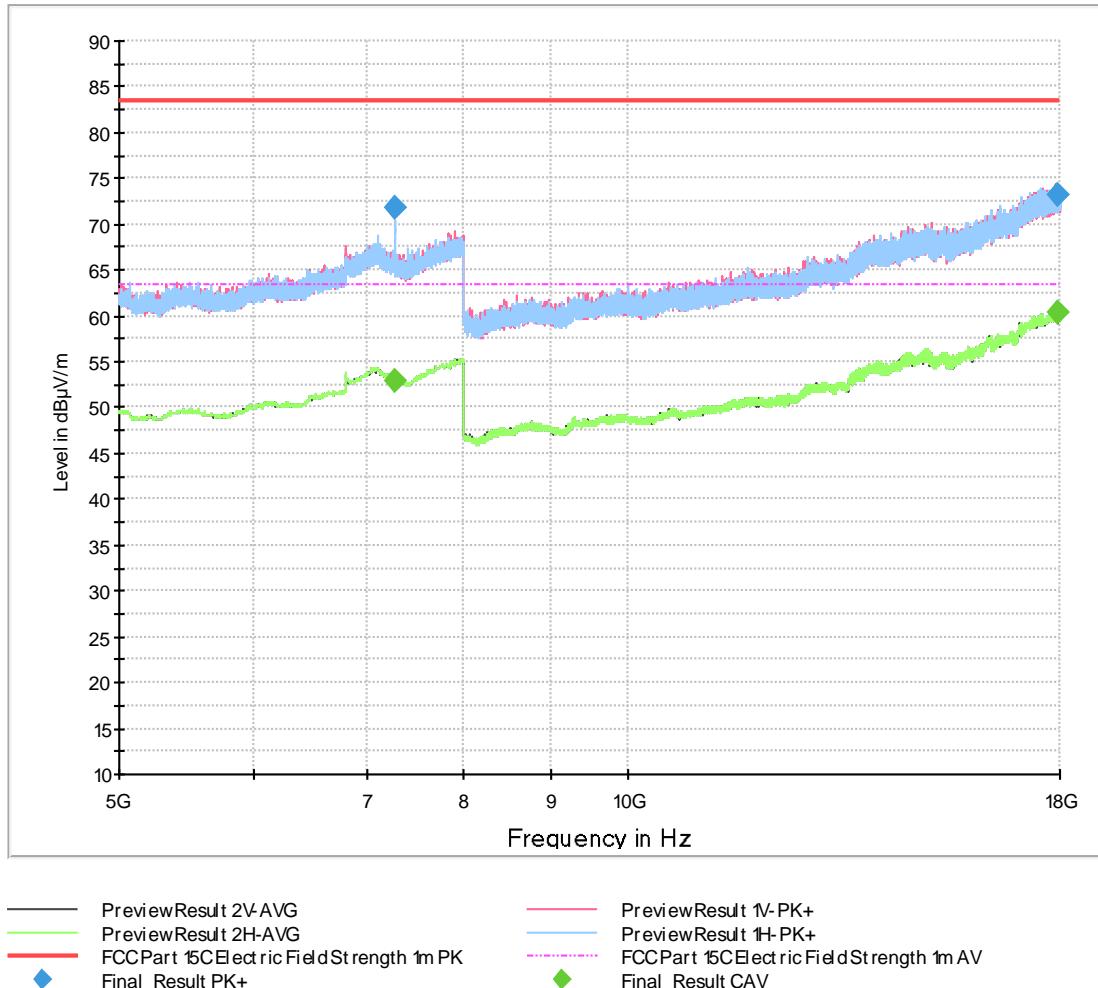
Frequency MHz	QuasiPeak dB μ V/m	CAverage dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
6.384750	31.52		69.54	38.02	1000	9	100.0	V	149.0	19.1



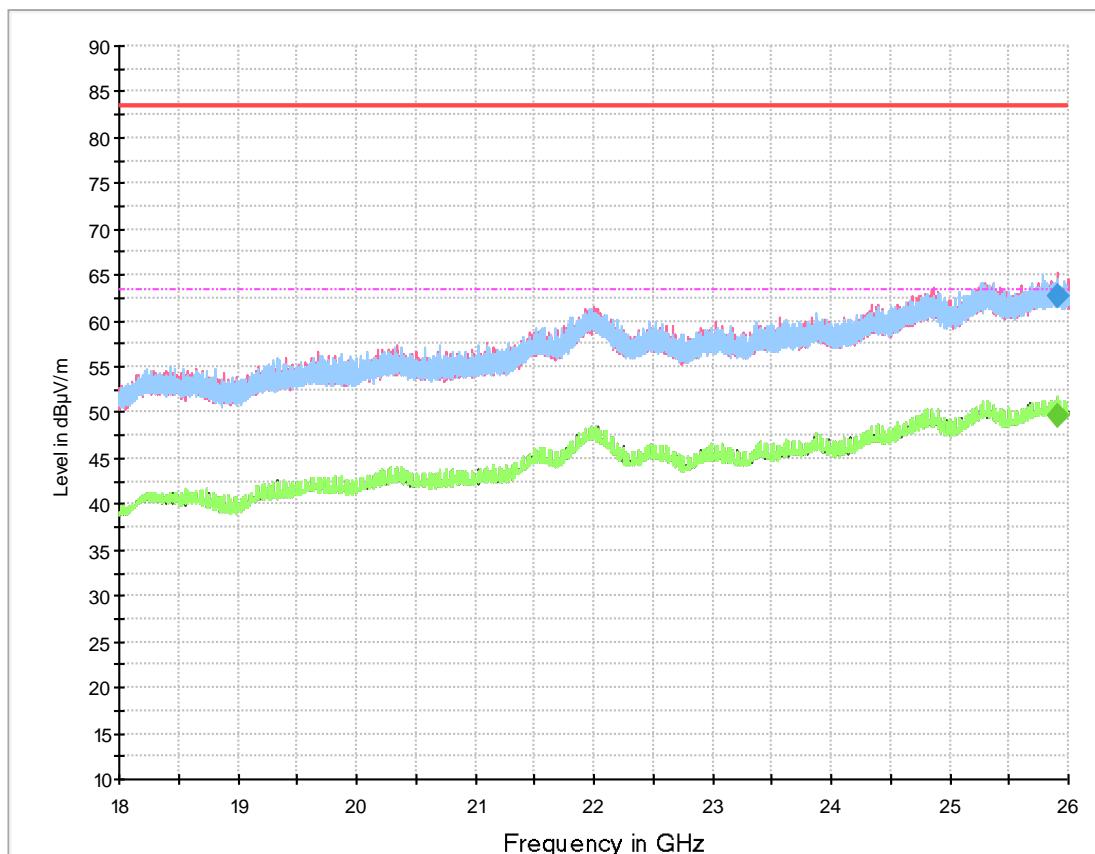


Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
2426.250000	90.22		*		1000	1000	100.0	V	82.0	34.0
2426.250000		45.63	*		1000	1000	100.0	V	82.0	34.0
4973.250000	63.01		73.98	10.97	1000	1000	200.0	H	-40.0	42.2
4973.250000		48.29	53.98	5.69	1000	1000	200.0	H	-40.0	42.2

* No limit for radiated emission of carrier



Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
7278.750000	71.79		83.50	11.71	1000	1000	140.0	H	-2.0	45.0
7278.750000		52.92	63.50	10.58	1000	1000	140.0	H	-2.0	45.0
17940.500000	73.29		83.50	10.21	1000	1000	158.0	V	-178.0	59.2
17940.500000		60.42	63.50	3.08	1000	1000	158.0	V	-178.0	59.2

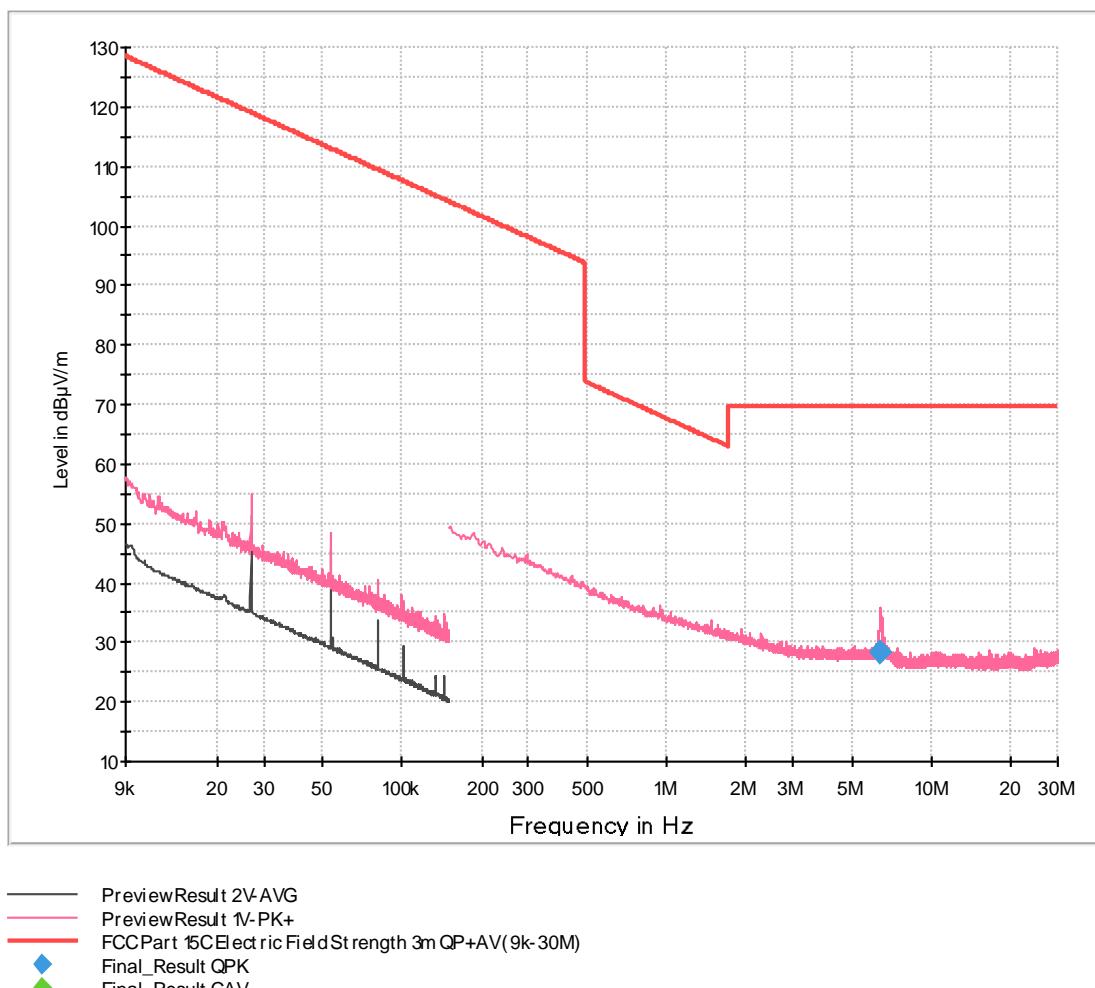


PreviewResult 2V-AVG	PreviewResult 1V-PK+
PreviewResult 2H-AVG	PreviewResult 1H-PK+
FCC Part 15C Electric Field Strength 1m PK	FCC Part 15C Electric Field Strength 1m AV
Final_Result PK+	Final_Result CAV

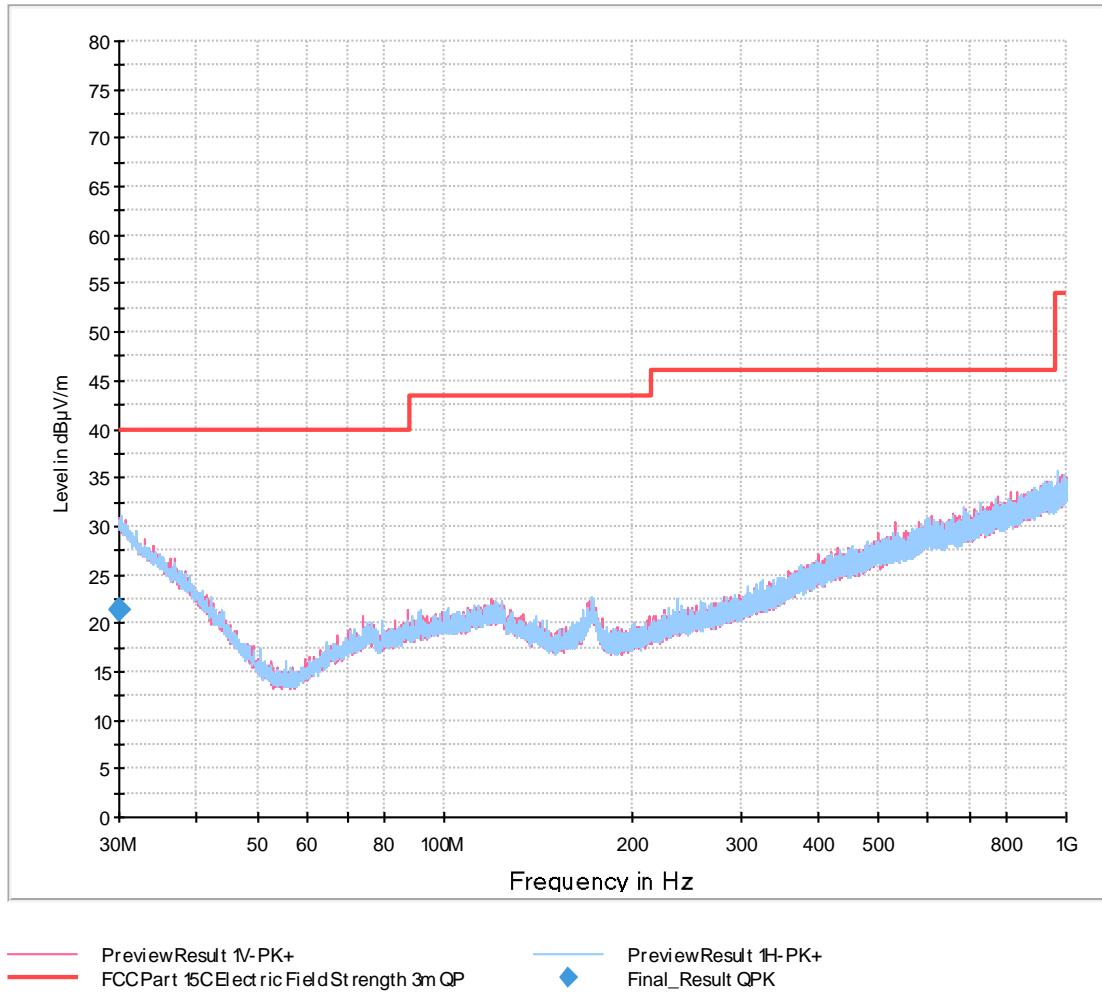
Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Mar- gin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
25914.750000		49.59	63.50	13.91	1000	1000	125.0	V	-30.0	31.1
25914.750000	62.67		83.50	20.83	1000	1000	125.0	V	-30.0	31.1

2480 MHz

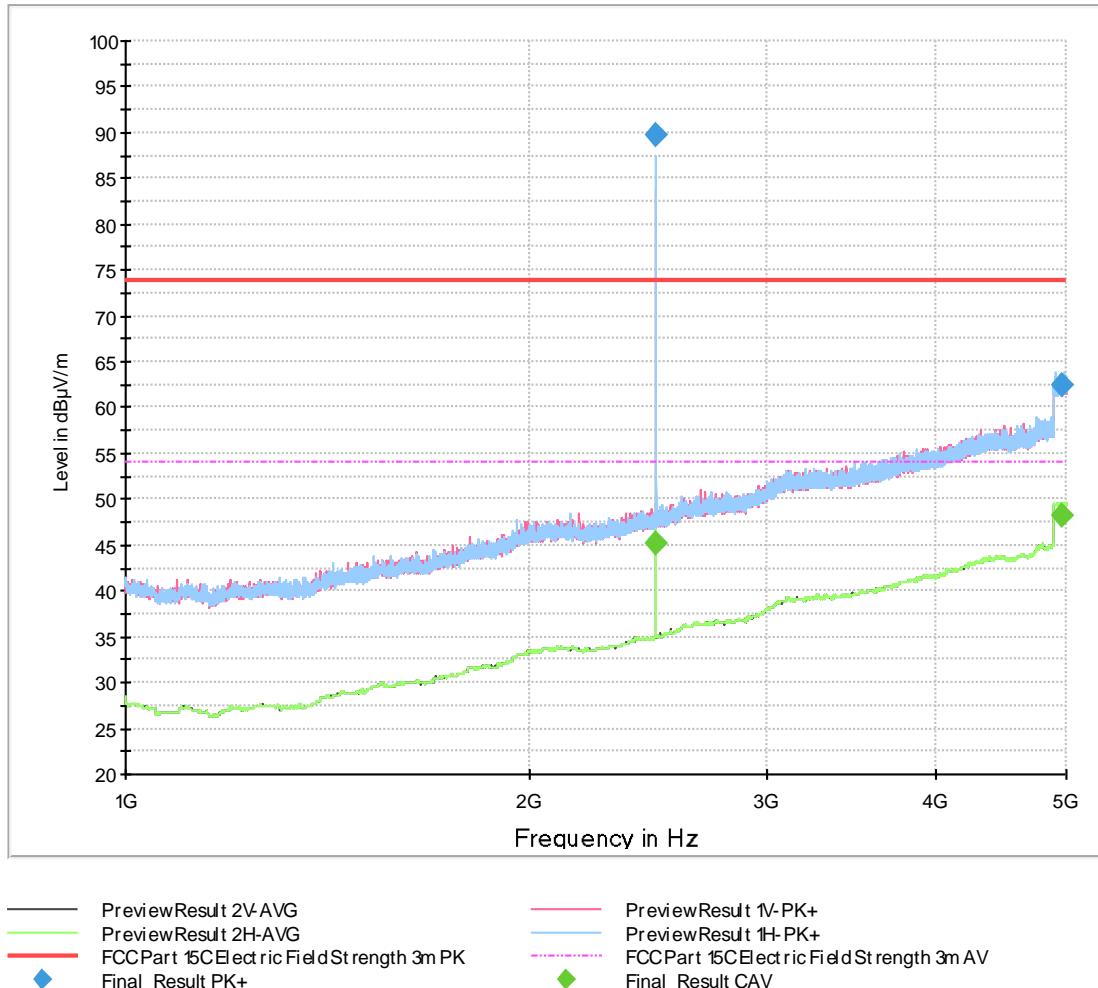
CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel,
80:E1:26:12:35:EB, Modification State 0



Frequency MHz	QuasiPeak dB μ V/m	CAverage dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB/m
6.441000	28.50		69.54	41.04	1000	9	100.0	V	83.0	19.1

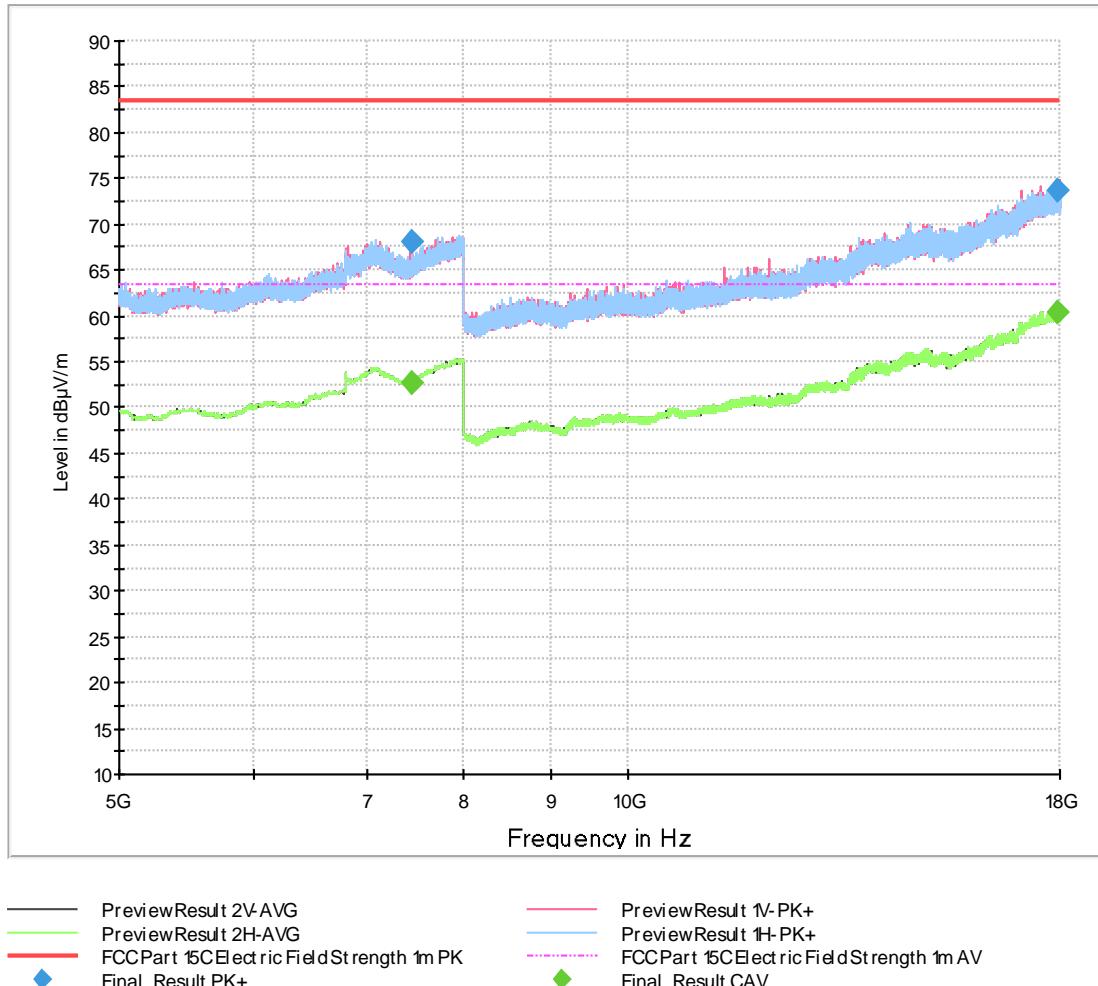


Frequency MHz	QuasiPeak dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB
30.090000	21.35	40.00	18.65	1000	120	343.0	H	-87.0	25.9

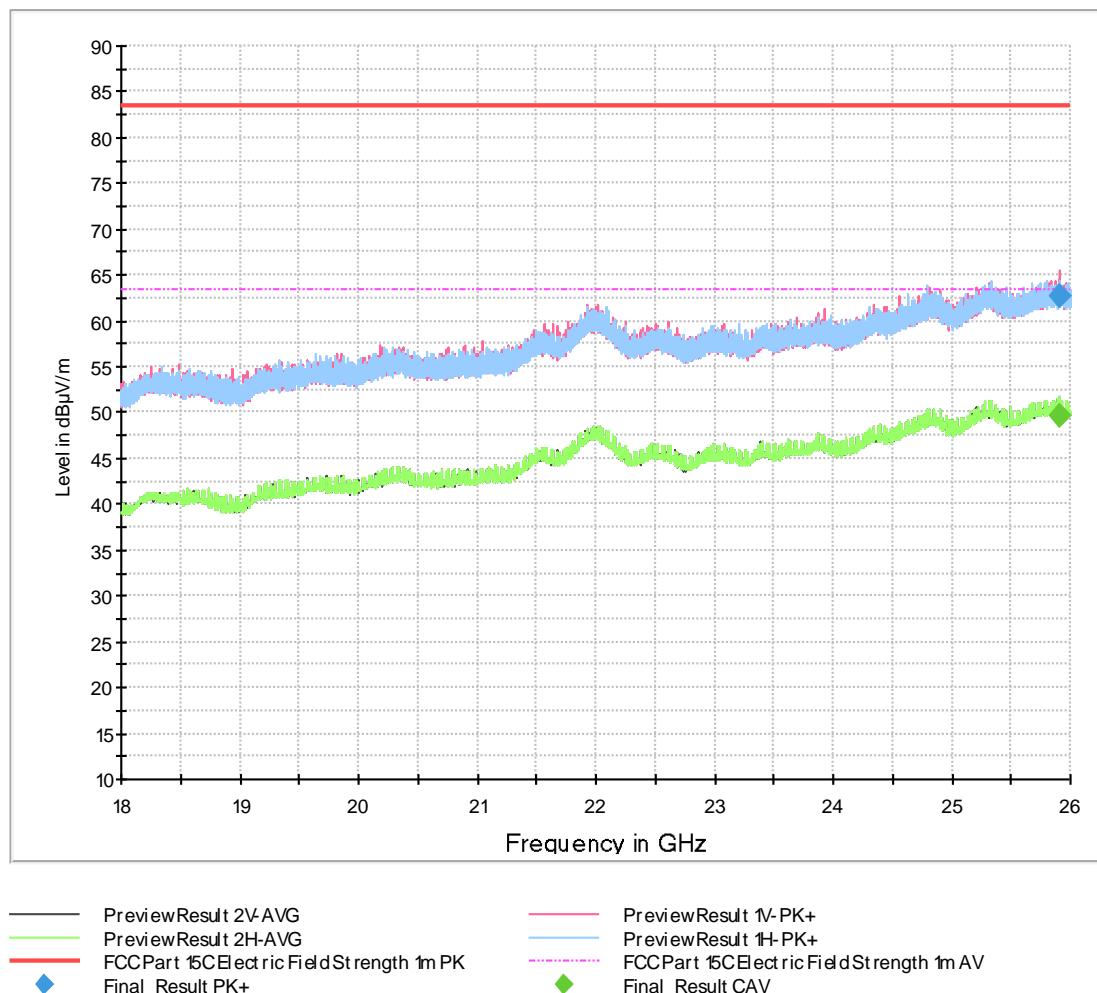


Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
2480.250000	89.82		*		1000	1000	191.0	H	2.0	34.2
2480.250000		45.28	*		1000	1000	191.0	H	2.0	34.2
4969.750000	62.47		73.98	11.51	1000	1000	159.0	V	-11.0	42.2
4969.750000		48.26	53.98	5.71	1000	1000	159.0	V	-11.0	42.2

* No limit for radiated emission of carrier



Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Margin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
7440.750000		52.66	63.50	10.84	1000	1000	165.0	V	-151.0	45.0
7440.750000	68.11		83.50	15.39	1000	1000	165.0	V	-151.0	45.0
17941.000000		60.48	63.50	3.02	1000	1000	153.0	H	-18.0	59.2
17941.000000	73.69		83.50	9.81	1000	1000	153.0	H	-18.0	59.2

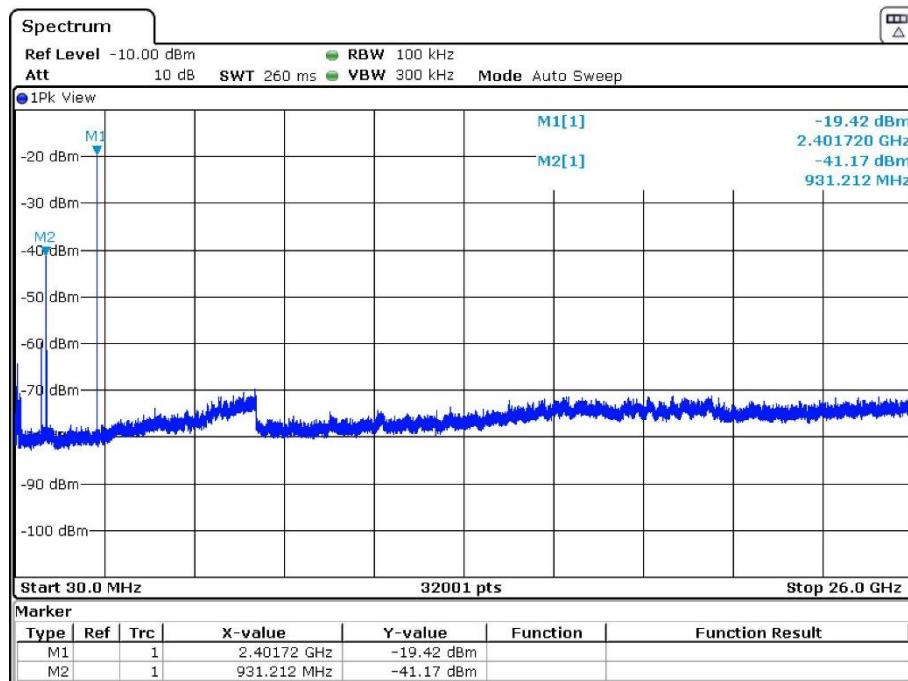


Frequency MHz	Max- Peak dB μ V/m	CAver- age dB μ V/m	Limit dB μ V/m	Mar- gin dB	Meas. Time ms	Band- width kHz	Height cm	Pol	Azi- muth deg	Corr. dB/m
25907.750000		49.63	63.50	13.87	1000	1000	175.0	V	-30.0	31.1
25907.750000	62.77		83.50	20.73	1000	1000	175.0	V	-30.0	31.1



**Frequency Range 30 MHz – 26 GHz
2402 MHz**

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch,
80:E1:26:08:44:84, Modification State 0



Date: 1.JUL.2020 12:46:19

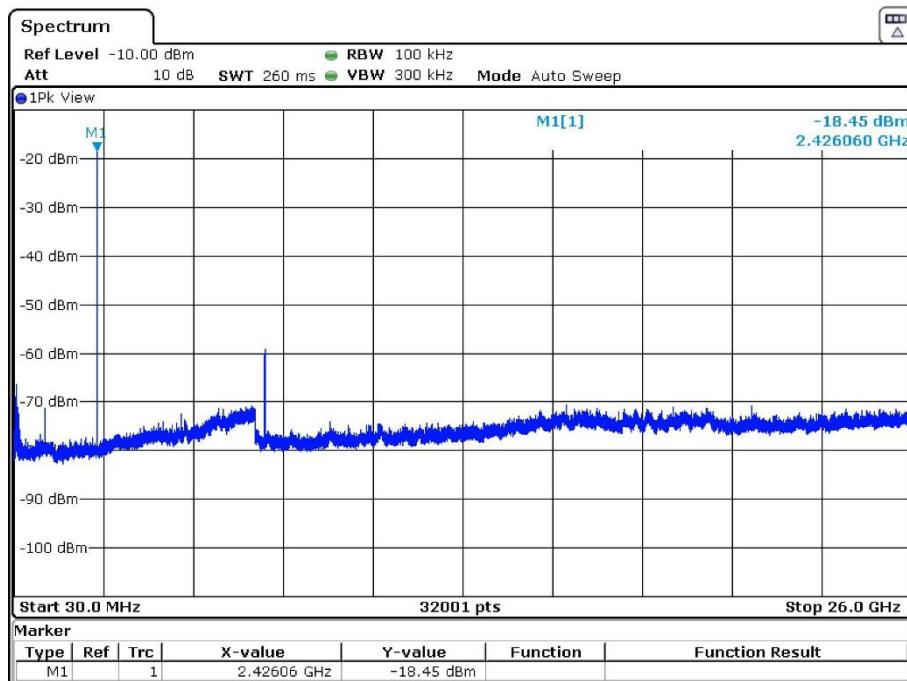
Note:

M1 – intentional radiation



**Frequency Range 30 MHz – 26 GHz
2426 MHz**

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch,
80:E1:26:08:44:84, Modification State 0



Date: 1.JUL.2020 12:52:35

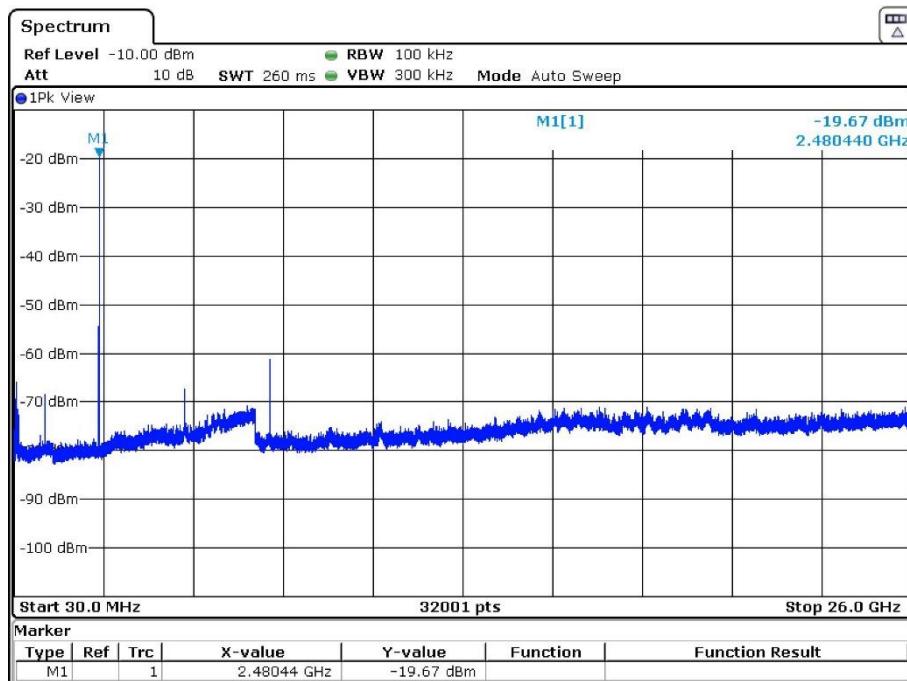
Note:

M1 – intentional radiation



**Frequency Range 30 MHz – 26 GHz
2480 MHz**

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch,
80:E1:26:08:44:84, Modification State 0



Date: 1.JUL.2020 12:57:42

Note:

M1 – intentional radiation

2.6.8 Test Location and Test Equipment

The radiated test was carried out in FAR No. 11:

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rhode & Schwarz	ESW44	39897	12	2022-04-30
Double ridged horn antenna	Rhode & Schwarz	HF907	40089	24	2023-02-28
Loop antenna	Schwarzbeck	FMZB 1519B	44334	36	2023-01-31
ULTRALOG Antenna	Rhode & Schwarz	HL562E	39969	36	2022-11-30
Horn Antenna with preamplifier	Rhode & Schwarz	A-INFOMW LB-180400H-KF+ TS-	43661	12	2021-12-31
EMC measurement software	Rhode & Schwarz	EMC32 Emission K11 – V10.50.10	42986	---	---
Semi Anechoic Room	Frankonia	Cabin No. 11	42961	36	2022-08-31

Table 22

The conducted test was carried out in shielded room

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz & Co. KG	FSV40 for TS8997	20219	12	2021-01-31
Attenuation Clamp	Teseq GmbH	CMAD 10	39385	---	---

Table 23



2.7 Temperature Stability

2.7.1 Specification Reference

ISED RSS-Gen, Clause 6.11, 8.11

2.7.2 Equipment under Test and Modification State

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Advertising with Channel Switching without RFID, 80:E1:26:08:44:B4, Modification State 0

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch, 80:E1:26:08:45:7E, Modification State 0

CARSHARING ZUSATZKARTENLESER, Transmitting Continuously – BLE Fast Channel Switch, 80:E1:26:08:44:84, Modification State 0

2.7.3 Date of Test

2020-05-28 – 2020-07-01

2.7.4 Environmental Conditions

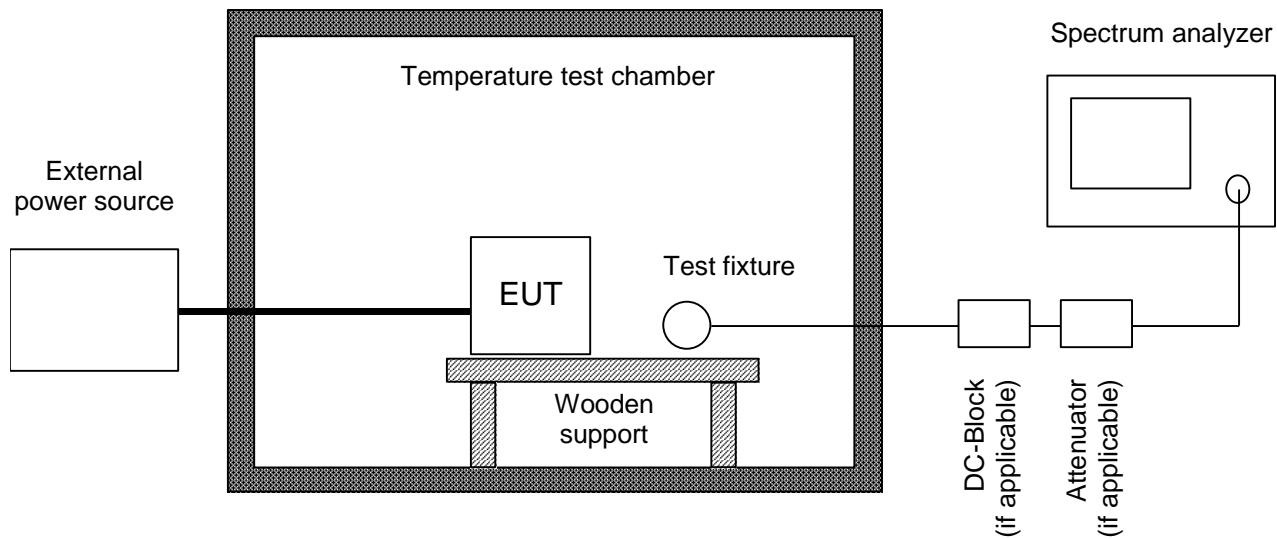
Ambient Temperature	24.0 °C
Relative Humidity	48.0 %

2.7.5 Specification Limits

If the stability of the license-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80 % of its permitted operating frequency band in order to minimize the possibility of out-of-band operation. In addition, its occupied bandwidth shall be entirely outside the restricted bands and the prohibited TV bands of 85 MHz – 72 MHz, 76 MHz – 88 MHz, 174 MHz – 216 MHz, and 470 MHz – 602 MHz, unless otherwise indicated.

2.7.6 Test Method

The test was performed according to ANSI C63.10, section 6.8.



The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °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 °C. Temperature and voltage range may vary if the manufacturer states another temperature or voltage range.

If the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as a DC block and appropriate (50 Ω) attenuators. In case where the EUT does not provide an antenna connector or a test fixture is used.

For battery operated equipment, the test is performed using a new battery. Alternatively, an external supply voltage can be used and is at least set to:

- The maximum battery voltage as delivered by a new battery or 115 % of the battery nominal voltage;
- The battery nominal voltage
- 85 % of the battery nominal voltage
- The battery operating end point voltage which shall be specified by the equipment manufacturer.

The EUT is operating providing an unmodulated carrier for frequency error tests. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to shape of the spectrum of the EUT. The frequency counter mode of the spectrum analyzer is used to maximize the accuracy of the measured frequency tolerance.

If an unmodulated carrier is not available a significant and stable point of the spectrum is selected and the span is reduced to a value that delivers an accuracy which shall be better than 1 % of the maximum frequency tolerance allowed for the carrier signal. This method may be performed as long as the margin to the frequency tolerance is larger than the uncertainty of the measured frequency tolerance.



2.7.7 Test Results

<i>Frequency</i>	<i>Temperature</i>	<i>Supply Voltage</i>	<i>Frequency drift</i>
2402 MHz	+20 °C	3 V	2402.060 MHz
2402 MHz	+20 °C	1.8 V	1402.060 MHz
2402 MHz	+50 °C	3 V	2402.040 MHz
2402 MHz	-30 °C	3 V	2402.050 MHz

Table 24

<i>Frequency</i>	<i>Temperature</i>	<i>Supply Voltage</i>	<i>Frequency drift</i>
2426 MHz	+20 °C	3 V	2426.060 MHz
2426 MHz	+20 °C	1.8 V	2426.060 MHz
2426 MHz	+50 °C	3 V	2426.040 MHz
2426 MHz	-30 °C	3 V	2426.040 MHz

Table 25

<i>Frequency</i>	<i>Temperature</i>	<i>Supply Voltage</i>	<i>Frequency drift</i>
2480 MHz	+20 °C	3 V	2480.060 MHz
2480 MHz	+20 °C	1.8 V	2480.060 MHz
2480 MHz	+50 °C	3 V	2480.040 MHz
2480 MHz	-30 °C	3 V	2480.050 MHz

Table 26

2.7.8 Test Location and Test Equipment

The test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz & Co. KG	FSV40 for TS8997	20219	12	2021-01-31
Switching device	Rohde & Schwarz & Co. KG	OSP120 for TS8997	20248	24	2022-02-28
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30
Climatic Test Chamber	Feutron Klimasimulation GmbH	KPK200-2	19868	18	2021-08-31

Table 27

3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

The measurement uncertainty in the laboratory is less than or equal to the maximum measurement uncertainty according to CISPR16-4-2: 2011 + A1 + A2 + Cor1 (U_{CISPR}). This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

<i>Radio Interference Emission Testing</i>		<i>kp</i>	<i>Expanded Uncertainty</i>
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	
Radiated Emission			
30 MHz to 300 MHz	2	± 4.9 dB	
300 MHz to 1 GHz	2	± 5.0 dB	
1 GHz to 6 GHz	2	± 4.6 dB	
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	
300 MHz to 1 GHz	2	± 4.9 dB	
The expanded uncertainty reported according to CISPR16-4-2: 2011 + A1 + A2 + Cor1 is based on a standard uncertainty multiplied by a coverage factor of $kp = 2$, providing a level of confidence of $p = 95.45\%$			

Table 28 Measurement uncertainty based on CISPR 16-4-2



Radio Interference Emission Testing		
Test Name	<i>kp</i>	Expanded Uncertainty
Occupied Bandwidth	2	± 5 %
Conducted Power		
9 kHz ≤ f < 30 MHz	2	± 1.0 dB
30 MHz ≤ f < 1 GHz	2	± 1.5 dB
1 GHz ≤ f ≤ 40 GHz	2	± 2.5 dB
1 MS/s power sensor (TS8997)	2	± 1.5 dB
Occupied Bandwidth	2	± 5 %
Power Spectral Density	2	± 3.0 dB
Radiated Power		
9 kHz ≤ f < 26.5 GHz	2	± 6.5 dB
26.5 GHz ≤ f < 60 GHz	2	± 8.0 dB
60 GHz ≤ f < 325 GHz	2	± 10 dB
Conducted Spurious Emissions	2	± 3.0 dB
Radiated Spurious Emissions	2	± 6.0 dB
Voltage		
DC	2	± 1.0 %
AC	2	± 2.0 %
Time (automatic)	2	± 5 %
Frequency	2	± 10 ⁻⁷

The expanded uncertainty reported according to ETSI TR 100 028:2001 is based on a standard uncertainty multiplied by a coverage factor of *kp* = 2, providing a level of confidence of *p* = 95.45%

Table 29 Measurement uncertainty based on ETSI TR 100 028