Report on the FCC and IC Testing of the KATHREIN SE

Model: 86010158

In accordance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN

Prepared for: KATHREIN SE
Anton-Kathrein-Str. 1-3
83022 Rosenheim
Germany

FCC ID: SP3-86010158
IC: 5530A-86010158

Product Service

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COMMERCIAL-IN-CONFIDENCE

Date: 2019-10-21
Document Number: TR-11297-54567-04 | Issue: 1

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Michael Ingerl	2019-10-21	
Authorised Signatory	Markus Biberger	2019-10-21	

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

ENGINEERING STATEMENT
The measurements 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 15C and ISED RSS-247 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Michael Ingerl	2019-10-21	

Laboratory Accreditation	Laboratory recognition	ISED test site registration
DAkkS Reg. No. D-PL-11321-11-02	Registration No. BNetzA-CAB-16/21-15	3050A-2

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C. ISED RSS-247 and ISED RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11).

Trade Register Munich
HRB 85742
VAT ID No. DE129484267
Information pursuant to Section 2(1)
DL-InfoV (Germany) at
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Product Service

Contents

Product Service

1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	2019-10-21

Table 1

1.2 Introduction

Applicant	KATHREIN SE
Manufacturer	KATHREIN SE
Model Number(s)	86010158
Serial Number(s)	---
Hardware Version(s)	Prototyp B
Software Version(s)	Build 139
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C. ISED RSS-247 and ISED RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11), FCC rule Part 2.1093, KDB 447498 D01, RSS-102 Issue 5
Test Plan/Issue/Date	---
Order Number Date	7500026363
Date of Receipt of EUT	2019-04-02
Start of Test	2019-04-04
Finish of Test	2019-04-08
Name of Engineer(s)	Michael Ingerl
Related Document(s)	ANSI C63.10 (2013) KDB 662911 D01 v02r02

Product Service

1.3 Technical data of EUT

Application frequency range: 2400.0 - 2483.5 MHz

Operating frequency: 2417 MHz – 2462 MHz

Number of RF-channels: 11

Channel spacing: 5 MHz

Spectrum Access: ☐ Frequency hopping ☒ Digital Modulated

Type of antenna: Internal antenna

Antenna nominal Gain: ---

Size/length of antenna: ---

Connection of antenna: ☐ Detachable ☒ Not detachable

Type of power supply: ☐ AC ☒ DC (Battery supplied)

Nominal Voltage: 14.8V

Minimum Voltage: ---

Maximum Voltage: ---

1.4 Configuration Mode(s)

1. Configuration Mode-1

Transmitting continuously on selected Channel

Setup on all Channels Bandwidth: 20 MHz
Modulation: OFDM
Data rate: 6 Mbps

Product Service

1.5 Brief Summary of Results

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

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Configuration Mode-1				
2.1	15.207. N/A and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.2	15.247 (b). 5.4 and 6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013) KDB 662911 D01 v02r02
2.3	15.247 (e). 5.2 and 6.12	Power Spectral Density	Pass	ANSI C63.10 (2013) KDB 662911 D01 v02r02
2.4	15.247 (a)(2). 5.2 and 6.6	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.5	15.247 (d). 5.5 and N/A	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.6	15.205 N/A and 8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.7	15.247 (d). 15.205. 5.5 and 6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
2.8	NA. NA. 6.11	Transmitter Frequency Stability	Pass	ANSI C63.10 (2013)
2.9	15.107 and 6.1	Exposure of Humans to RF Fields	Pass	ANSI C63.4: 2014

Table 2

Product Service

1.6 EUT Modification 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
Serial Number: ---			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: Configuration Mode-1	
AC Power Line Conducted Emissions	Michael Ingerl
Maximum Conducted Output Power	Michael Ingerl
Power Spectral Density	Michael Ingerl
Emission Bandwidth	Michael Ingerl
Authorised Band Edges	Michael Ingerl
Restricted Band Edges	Michael Ingerl
Spurious Radiated Emissions	Michael Ingerl
Transmitter Frequency Stability	Michael Ingerl
Exposure of Humans to RF Fields	Michael Ingerl

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 AC Power Line Conducted Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C. ISED RSS-247 and ISED RSS-GEN. Clause 15.207. N/A and 8.8

2.1.2 Equipment Under Test and Modification State

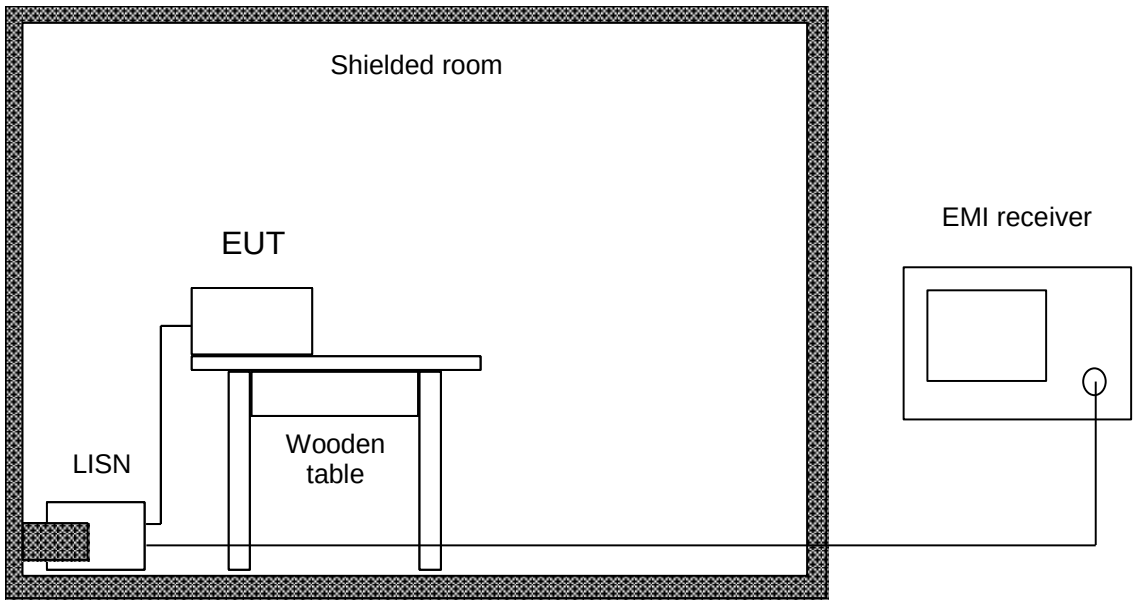
86010158. S/N: --- - Modification State 0

2.1.3 Date of Test

2019-04-08

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10. clause 6.2.
Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:
First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with detector set to peak using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with detector set to quasi-peak. If average limit is kept with quasi-peak levels no additional scan with average detector is necessary. In cases of emission levels between quasi-peak and average limit an additional scan with detector set to average is performed.
According to ANSI C63.4. section 13.1.3.1. testing of intentional radiators with detachable antenna shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise. the tests shall be made with the antenna connected and. if adjustable. fully extended. Testing with dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines from (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. Usage of dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.



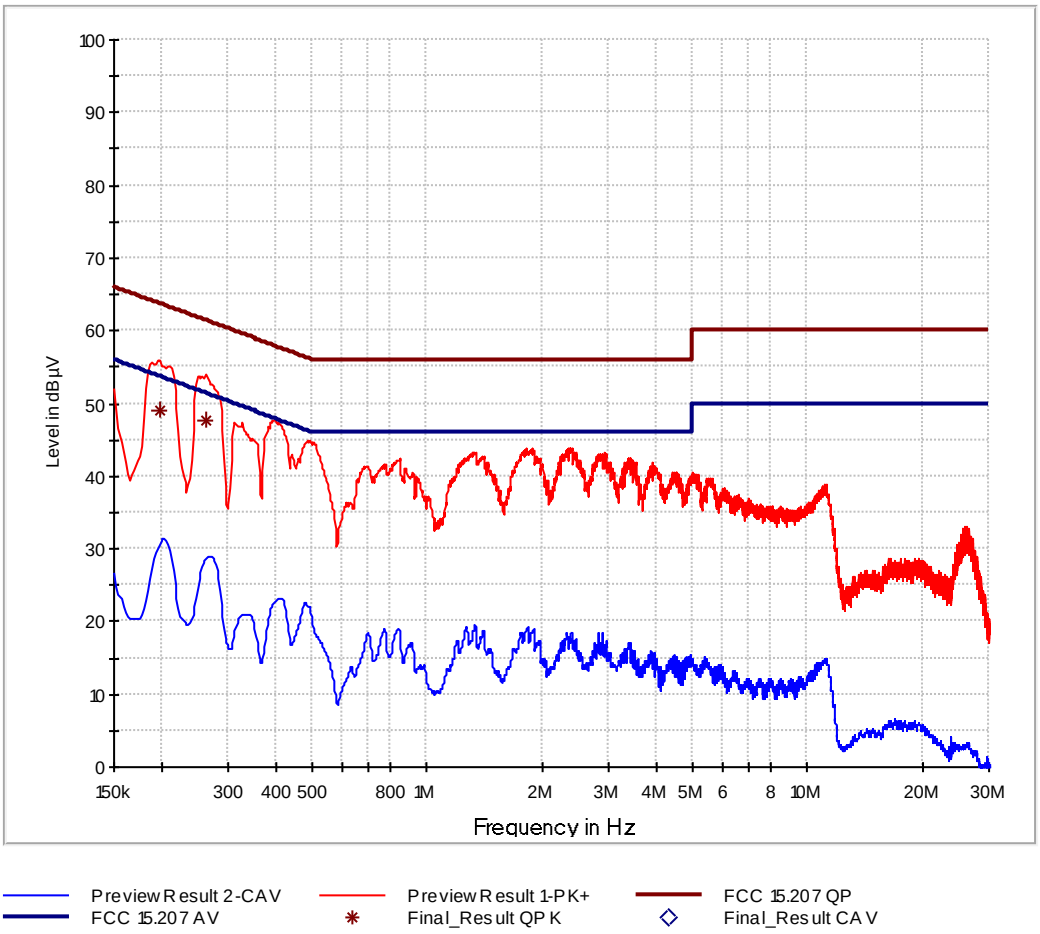
2.1.5 Environmental Conditions

Ambient Temperature	*21 °C*
Relative Humidity	*30 %*

Product Service

2.1.6 Test Results

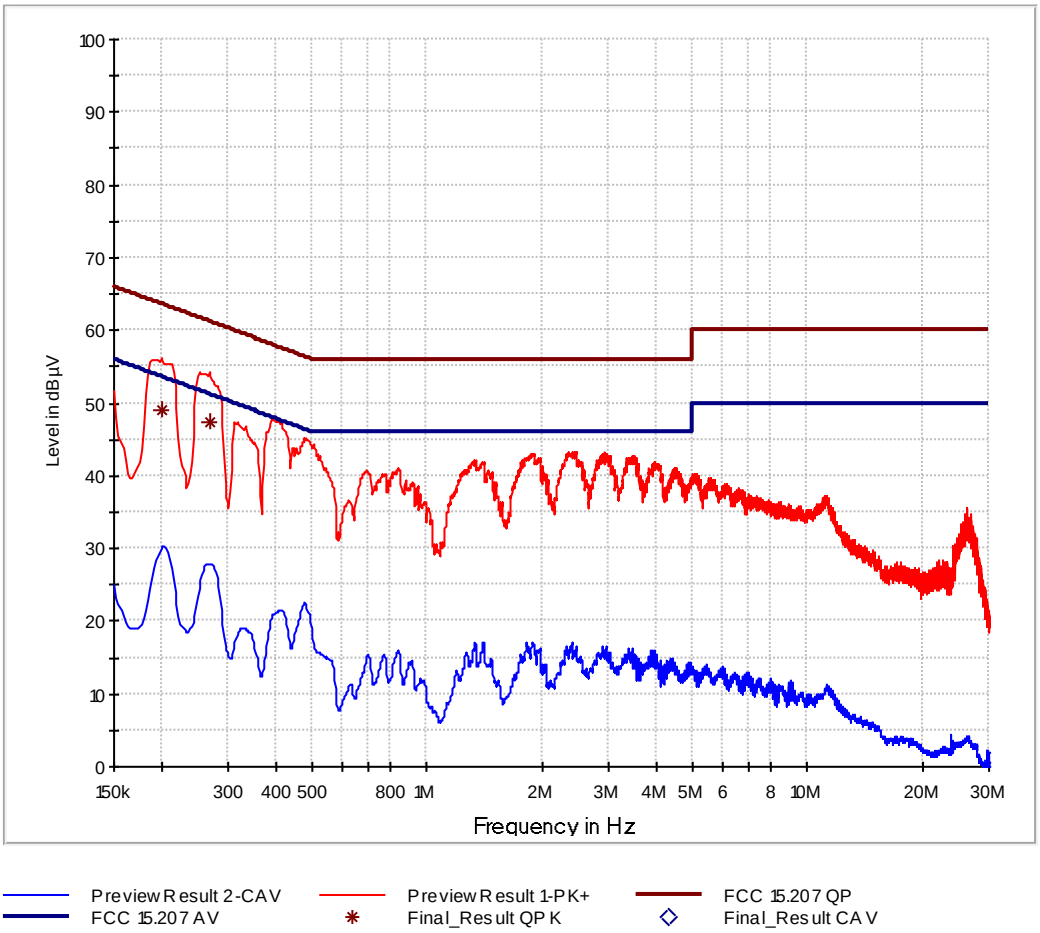
Configuration Mode-1



Final Results 1:

Frequency MHz	*QuasiPeak dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Line*	*PE*	*Corr. dB*
0.197250	49.12	63.73	14.60	1000.0	9.000	L1	GND	0.0
0.262500	47.55	61.35	13.80	1000.0	9.000	L1	GND	0.0

Figure 1 - Live Line - 150 kHz to 30 MHz



Final Results 1:

Frequency MHz	*QuasiPeak dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Line*	*PE*	*Corr. dB*
0.199500	49.15	63.63	14.49	1000.0	9.000	N	GND	0.0
0.267000	47.51	61.21	13.70	1000.0	9.000	N	GND	0.0

Figure 2 - Neutral Line - 150 kHz to 30 MHz

Sample calculation of final values:

Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)

FCC 47 CFR Part 15, Limit Clause 15.207 and ISED RSS-GEN, Limit Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 5

*Decreases with the logarithm of the frequency.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Shielded room - cabin no. *9*.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESU8	19904	12	2019-12-31
V-network	Rohde & Schwarz	ESH 3-Z5	18919	36	2019-10-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V9.26.01	20090	N/A	N/A

Table 6

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

2.2 Maximum Conducted Output Power

2.2.1 Specification Reference

FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN, Clause 15.247 (b), 5.4 and 6.12

2.2.2 Equipment Under Test and Modification State

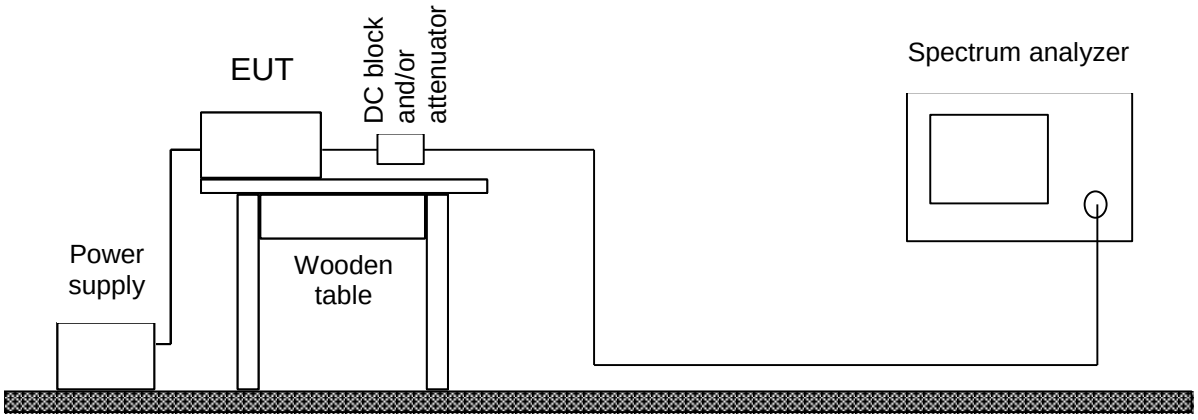
86010158, S/N: --- - Modification State 0

2.2.3 Date of Test

2019-04-08

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.9.1.
The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.



2.2.5 Environmental Conditions

Ambient Temperature	*21 °C*
Relative Humidity	*30 %*

Product Service

2.2.6 Test Results

Configuration Mode-1

Frequency (MHz)	dBm	mW
2417	-1.789	0.662
2437	-4.087	0.390
2462	-4.200	0.380

Table 7

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

ISED RSS-247, Limit Clause 5.4 (d)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e) of the specification.

2.2.7 Test Location and Test Equipment Used

This test was carried out in a non-shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz GmbH & Co. KG	FSV40 for TS8997	20219	12	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	20248	24	2020-01-31
Testsystem 2,4 & 5 GHz Band	Rohde & Schwarz GmbH & Co. KG	TS8997	20251	24	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.50.00	19893	N/A	N/A

Table 8

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.3 Power Spectral Density

2.3.1 Specification Reference

FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN, Clause 15.247 (e), 5.2 and 6.12

2.3.2 Equipment Under Test and Modification State

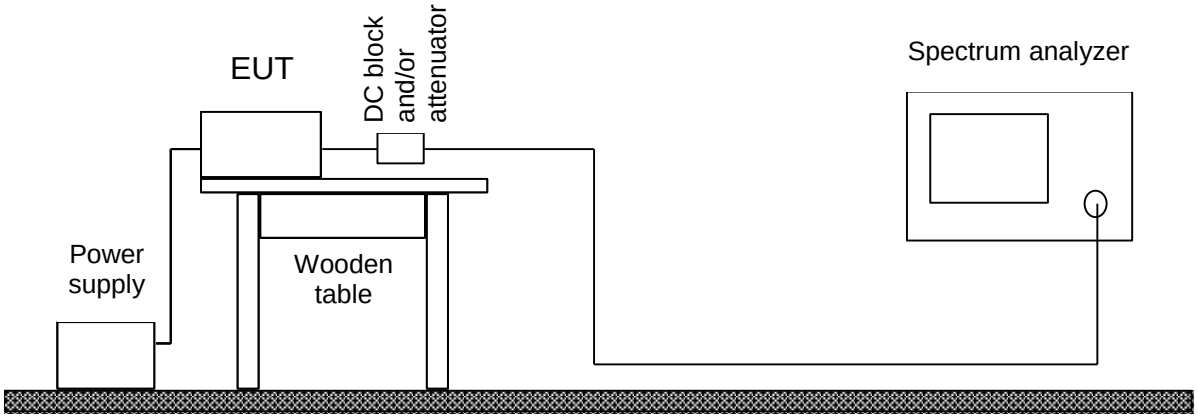
86010158, S/N: --- - Modification State 0

2.3.3 Date of Test

2019-04-08

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.10.2.
The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.



2.3.5 Environmental Conditions

Ambient Temperature	*21 °C*
Relative Humidity	*30 %*

Product Service

2.3.6 Test Results

Configuration Mode-1

Frequency (MHz)	Power Spectral Density (dBm)
2417	-10.94
2437	-14.77
2462	-13.83

Table 9

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

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.

ISED RSS-247, Limit Clause 5.2(b)

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

Product Service

2.3.7 Test Location and Test Equipment Used

This test was carried out in Semi non-shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz GmbH & Co. KG	FSV40 for TS8997	20219	12	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	20248	24	2020-01-31
Testsystem 2,4 & 5 GHz Band	Rohde & Schwarz GmbH & Co. KG	TS8997	20251	24	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.50.00	19893	N/A	N/A

Table 10

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.4 Emission Bandwidth

2.4.1 Specification Reference

FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN, Clause 15.247 (a)(2), 5.2 and 6.6

2.4.2 Equipment Under Test and Modification State

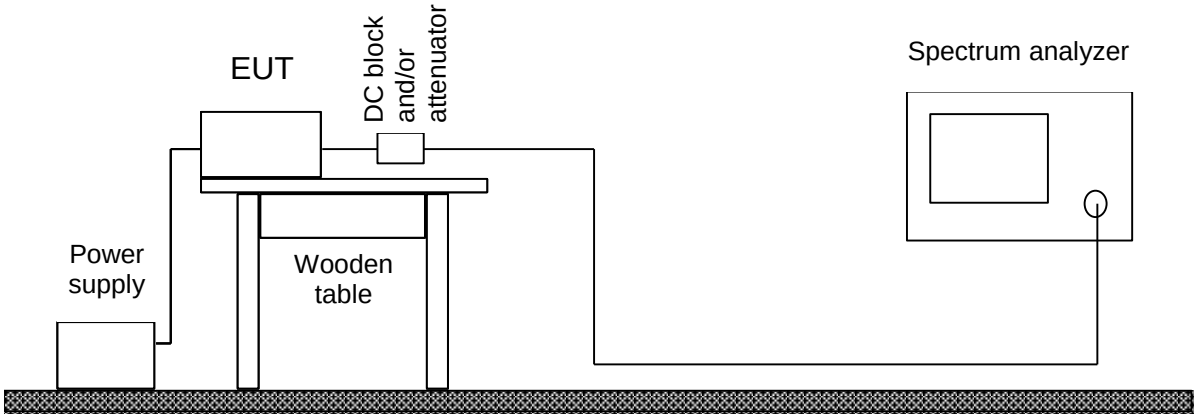
86010158, S/N: --- - Modification State 0

2.4.3 Date of Test

2019-04-08

2.4.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.1.
The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.



2.4.5 Environmental Conditions

Ambient Temperature	*21 °C*
Relative Humidity	*30 %*

Product Service

2.4.6 Test Results

Configuration Mode-1

Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)
2417	9.90	14.60
2437	9.90	14.90
2462	10.15	14.60

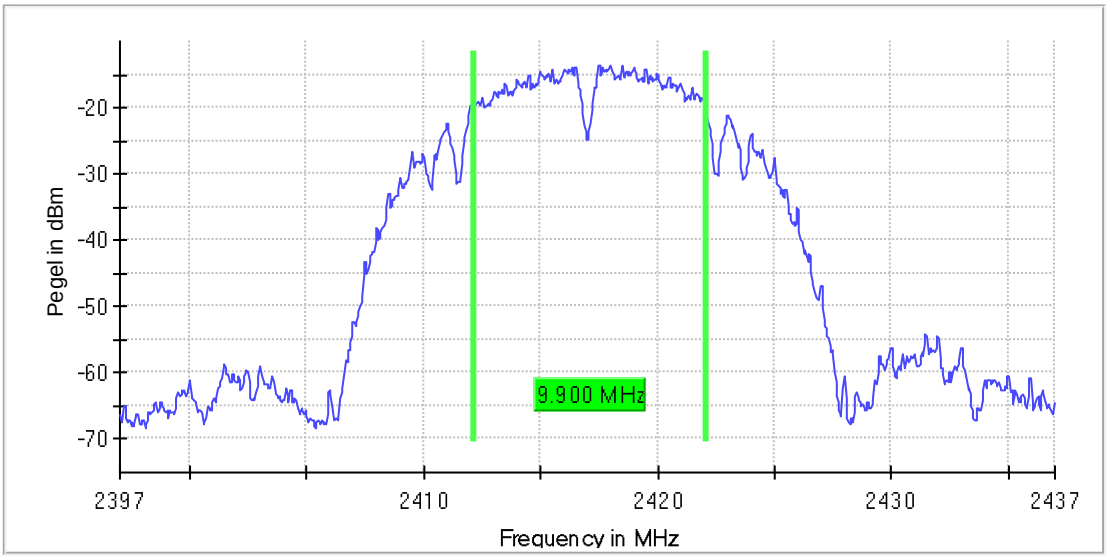


Figure 3 – *2417 MHz* – 6 dB Bandwidth

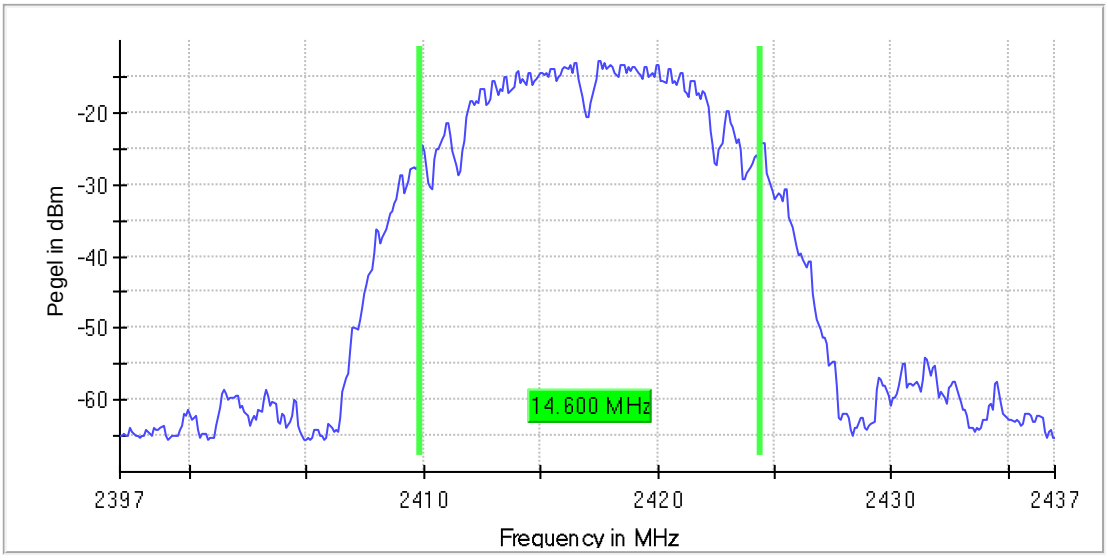


Figure 4 - *2417 MHz* – 99% Bandwidth

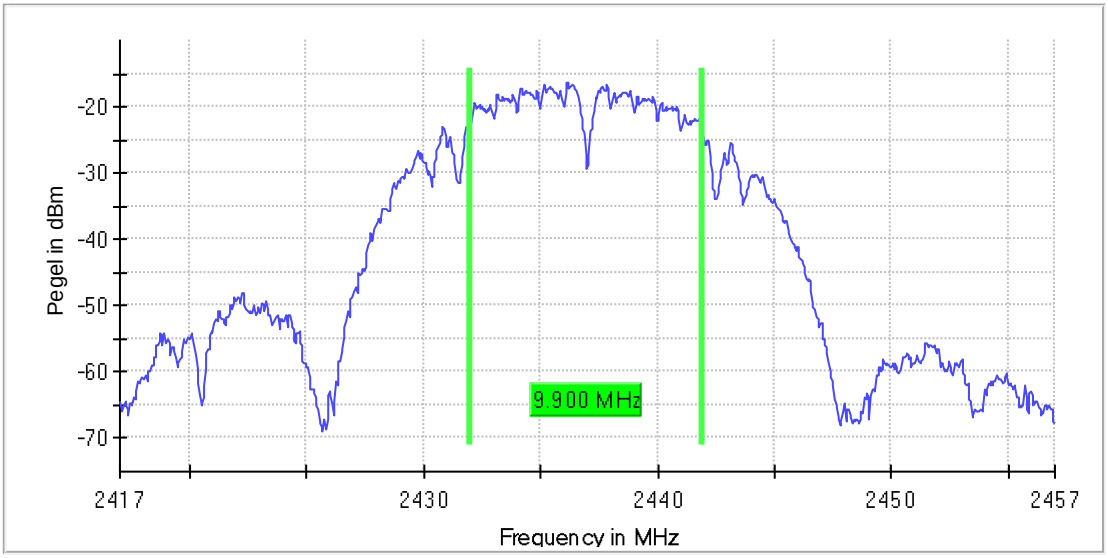


Figure 5 – *2437 MHz* – 6 dB Bandwidth

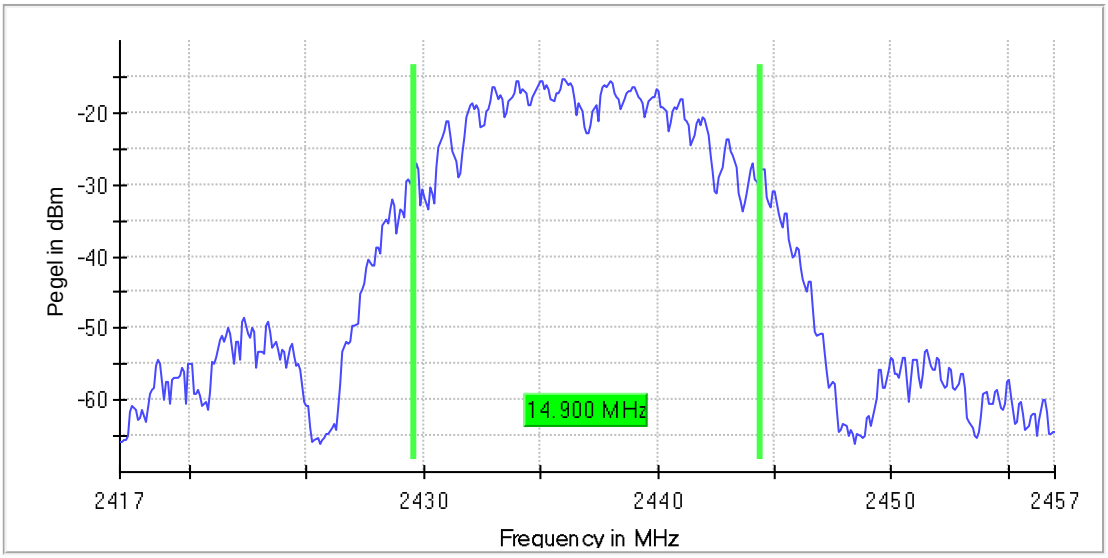


Figure 6 - *2437 MHz* – 99% Bandwidth

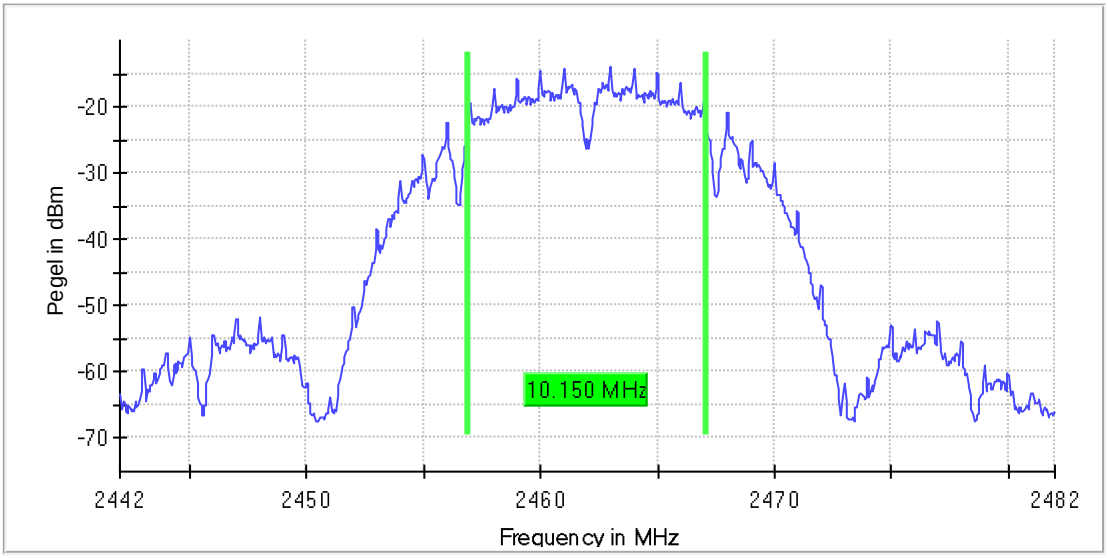


Figure 7 – *2462 MHz* – 6 dB Bandwidth

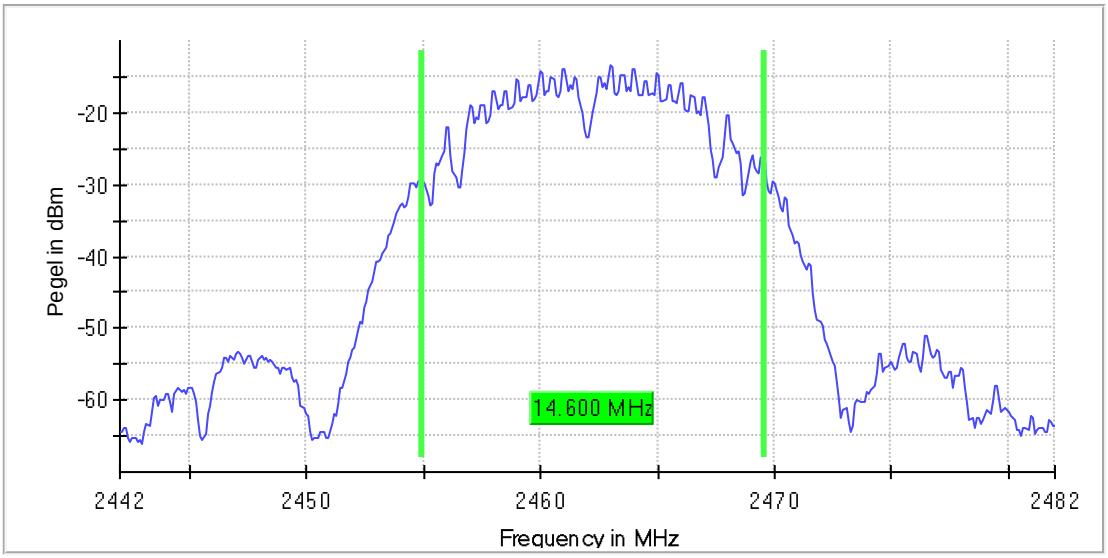


Figure 8 - *2462 MHz* – 99% Bandwidth

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2) and ISED RSS-247, Clause 5.2(a)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

Product Service

2.4.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz GmbH & Co. KG	FSV40 for TS8997	20219	12	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	20248	24	2020-01-31
Testsystem 2,4 & 5 GHz Band	Rohde & Schwarz GmbH & Co. KG	TS8997	20251	24	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.50.00	19893	N/A	N/A

Table 11

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

2.5 Authorised Band Edges

2.5.1 Specification Reference

FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN, Clause 15.247 (d), 5.5 and N/A

2.5.2 Equipment Under Test and Modification State

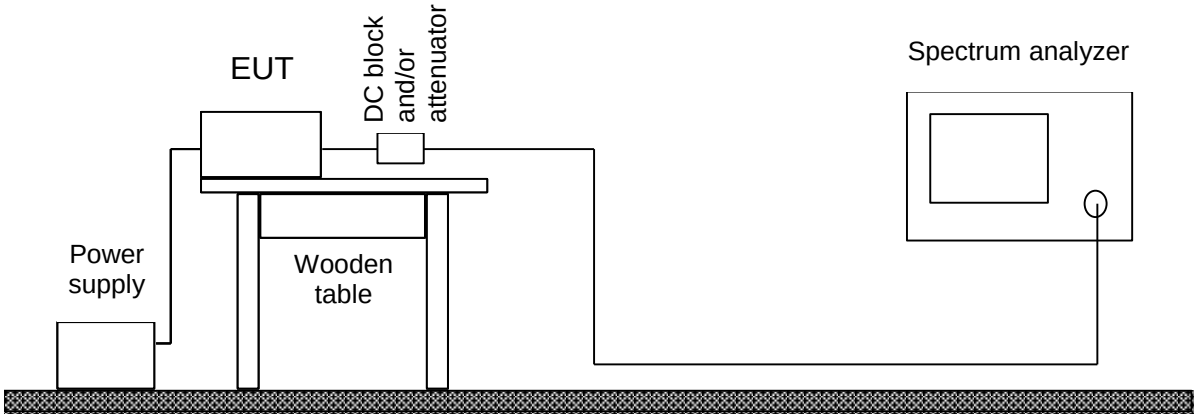
86010158, S/N: --- - Modification State 0

2.5.3 Date of Test

2019-04-08

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.
The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.



2.5.5 Environmental Conditions

Ambient Temperature	*21 °C*
Relative Humidity	*30 %*

Product Service

2.5.6 Test Results

Configuration Mode-1

EUT Frequency (MHz)	Frequency (MHz)	Peak Level (dBm)
2417	2399.975	-62.8
2417	2399.675	-63.3
2462	2483.625	-65.7
2462	2483.675	-65.5

Table 12

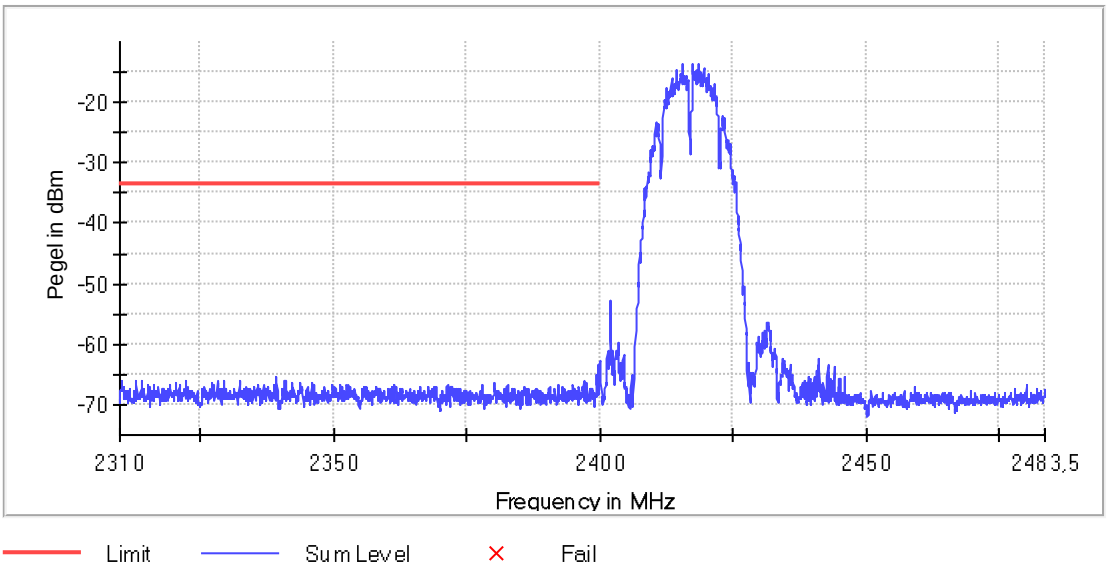


Figure 9 – *2417 MHz*

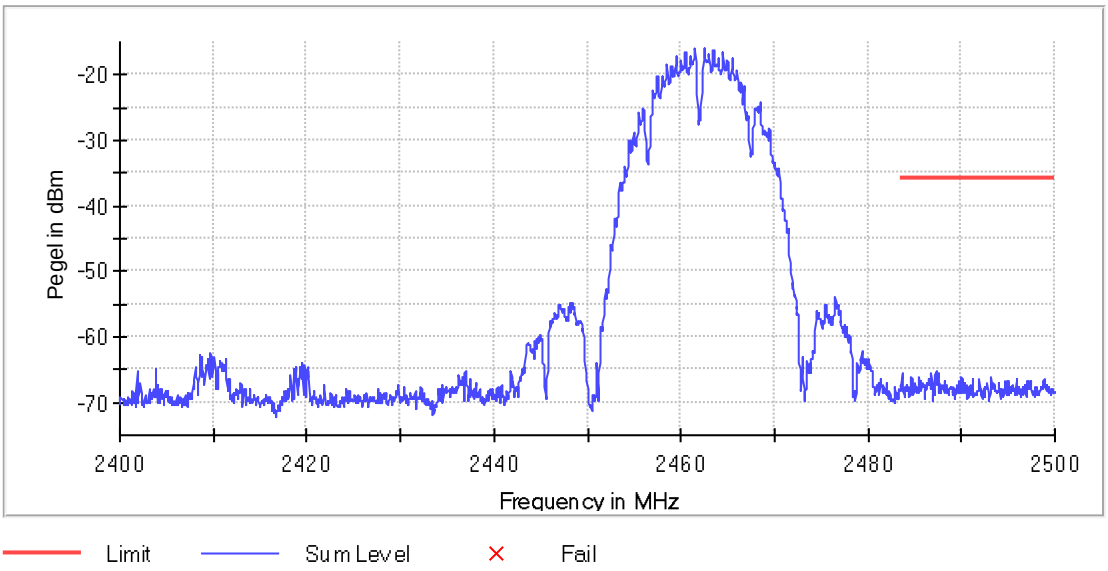


Figure 10 – *2462 MHz*

Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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 the desired power, based on either an RF conducted or a 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 under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.5.7 Test Location and Test Equipment Used

This test was carried out in Semi unshielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz GmbH & Co. KG	FSV40 for TS8997	20219	12	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	20248	24	2020-01-31
Testsystem 2,4 & 5 GHz Band	Rohde & Schwarz GmbH & Co. KG	TS8997	20251	24	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.50.00	19893	N/A	N/A

Table 13

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

2.6 Restricted Band Edges

2.6.1 Specification Reference

FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN, Clause 15.205 N/A and 8.10

2.6.2 Equipment Under Test and Modification State

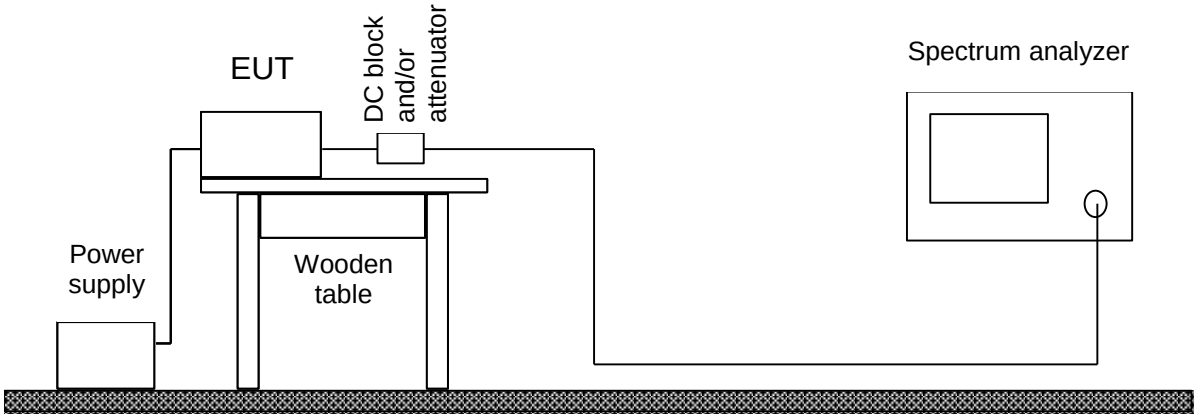
86010158, S/N: --- - Modification State 0

2.6.3 Date of Test

2019-04-08

2.6.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.12.2.
The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.



2.6.5 Environmental Conditions

Ambient Temperature	*21 °C*
Relative Humidity	*30 %*

Product Service

2.6.6 Test Results

Configuration Mode-1

See plots for details

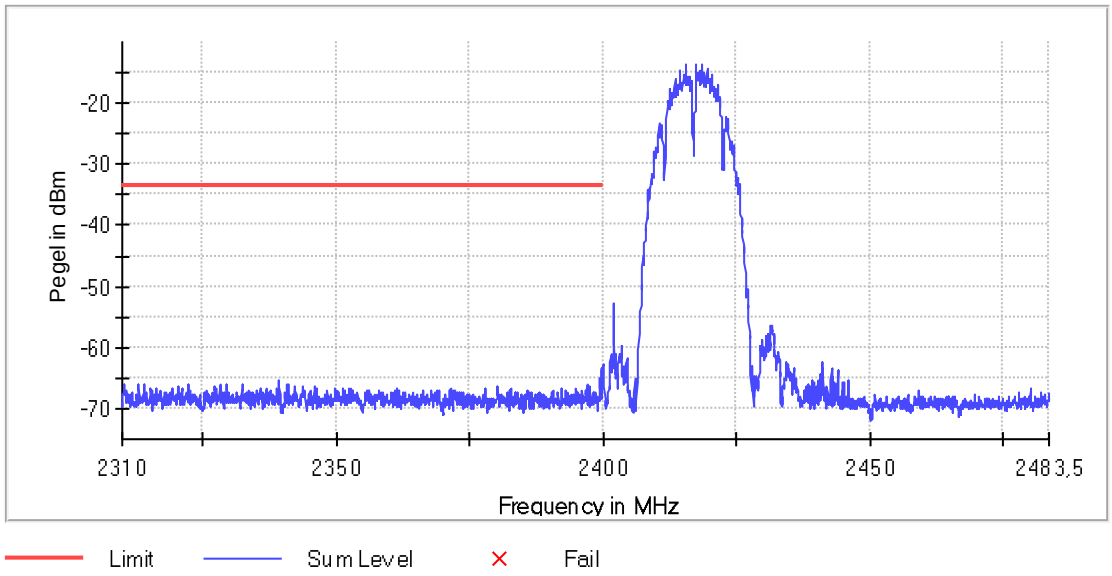


Figure 11 – *2417 MHz – Restricted Band*

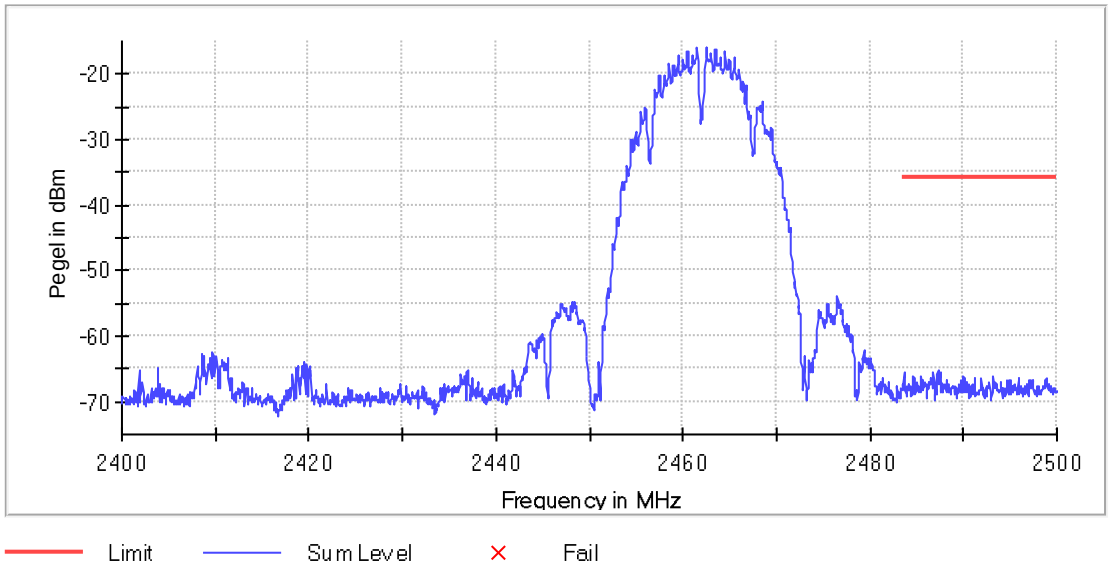


Figure 12 – *2462 MHz – Restricted Band*

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (µV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 14

ISED RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (µV/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 15

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.6.7 Test Location and Test Equipment Used

This test was carried out in Semi unshielded room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz GmbH & Co. KG	FSV40 for TS8997	20219	12	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	20248	24	2020-01-31
Testsystem 2,4 & 5 GHz Band	Rohde & Schwarz GmbH & Co. KG	TS8997	20251	24	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.50.00	19893	N/A	N/A

Table 16

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.7 Spurious Radiated Emissions

2.7.1 Specification Reference

FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN, Clause 15.247 (d), 15.205, 5.5 and 6.13

2.7.2 Equipment Under Test and Modification State

86010158, S/N: --- - Modification State 0

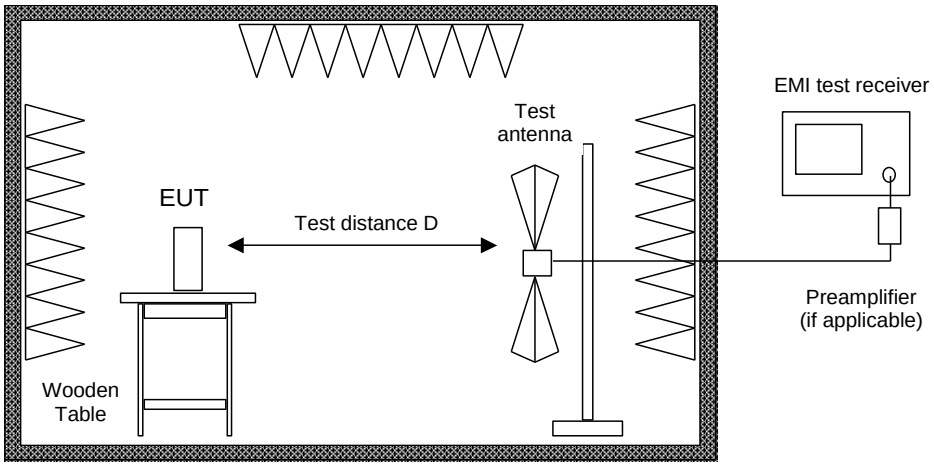
2.7.3 Date of Test

2019-04-04

Product Service

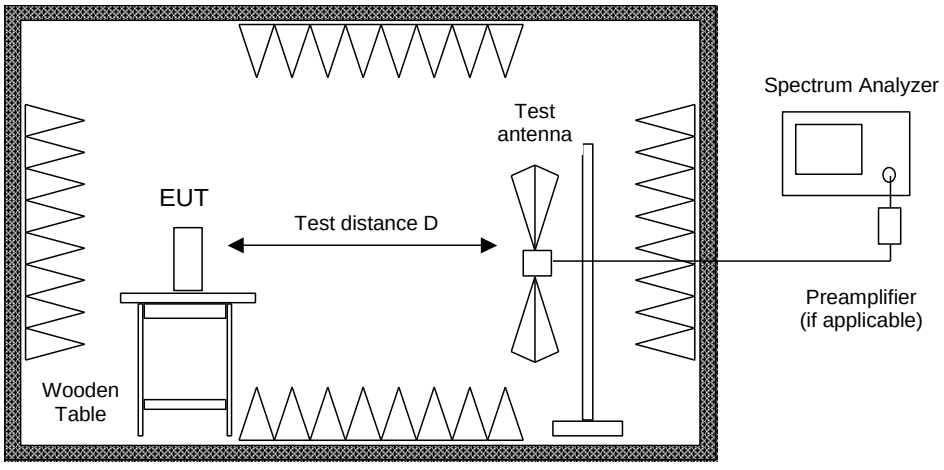
2.7.4 Test Method

Testing was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6.
Radiated emission in the frequency range 30 MHz to 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 polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit.
Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.
Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.
If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is dircharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.



Alternate test site (semi anechoic room)

Radiated emission in fully or semi anechoic room is measured in the frequency range from 1 GHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.
Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set 1 MHz (above 1 GHz).
All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit.
Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.
Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.
During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.4 for alternative test sites is used (see 6.5). If prescans are recorded in fully anechoic room they are indicated appropriately.



Fully or semi anechoic room

2.7.5 Environmental Conditions

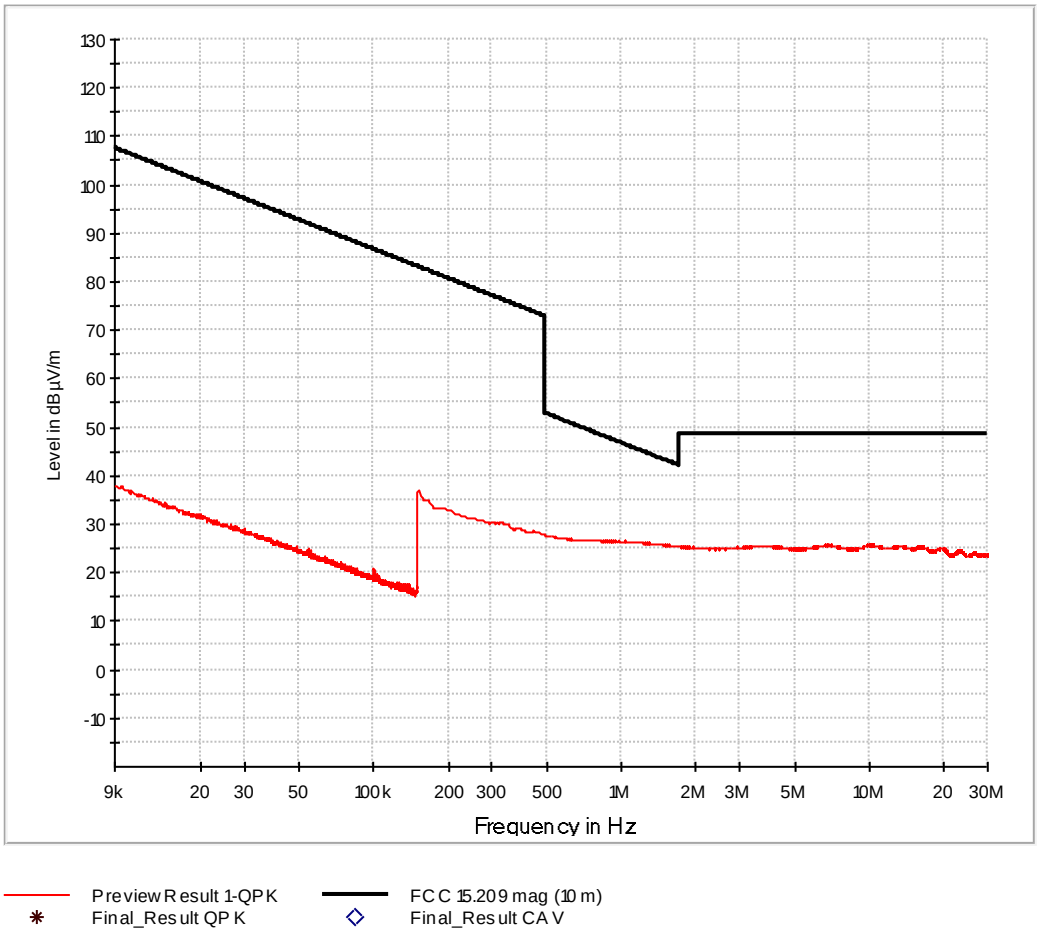
Ambient Temperature	*20 °C*
Relative Humidity	*32 %*

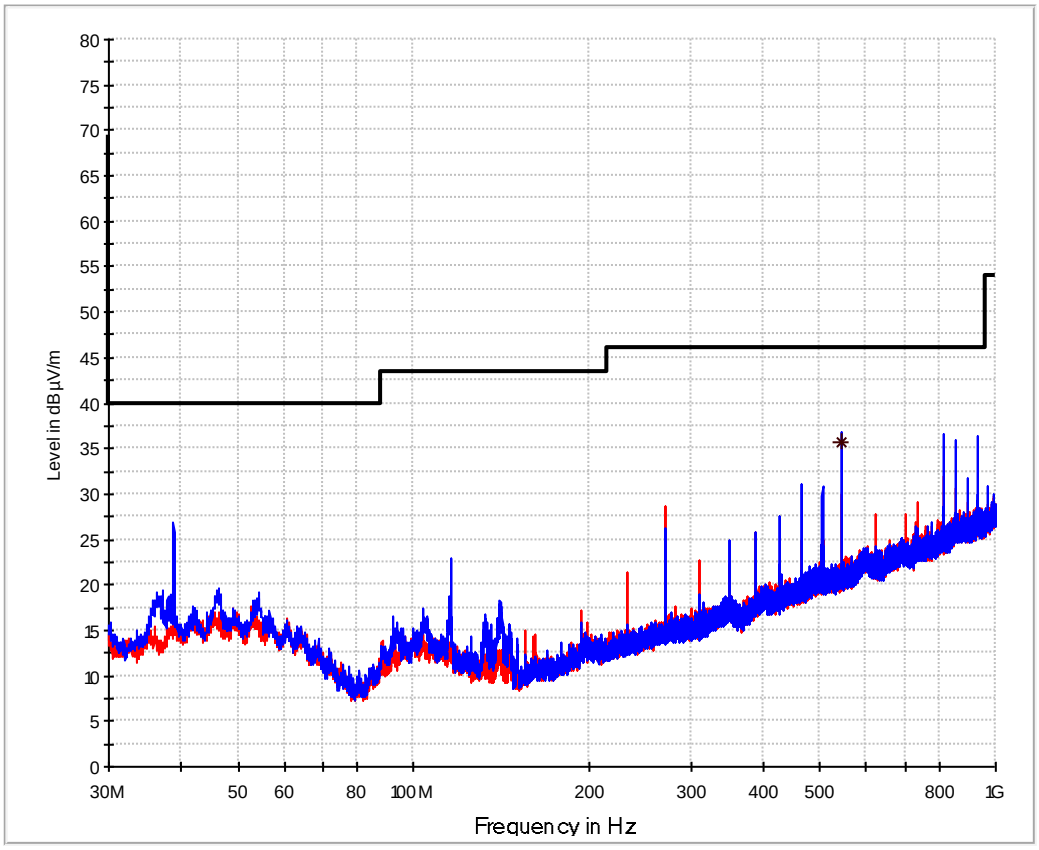
Product Service

2.7.6 Test Results

Configuration Mode-1

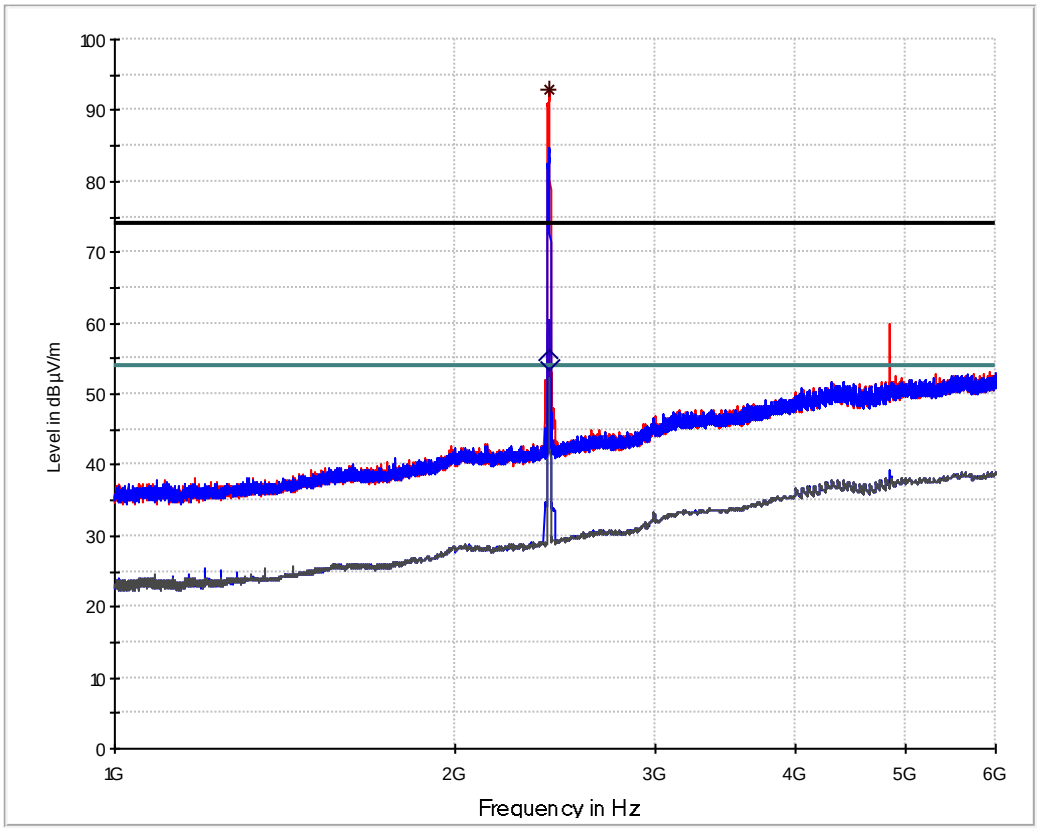
2417 MHz





Final Results 1:

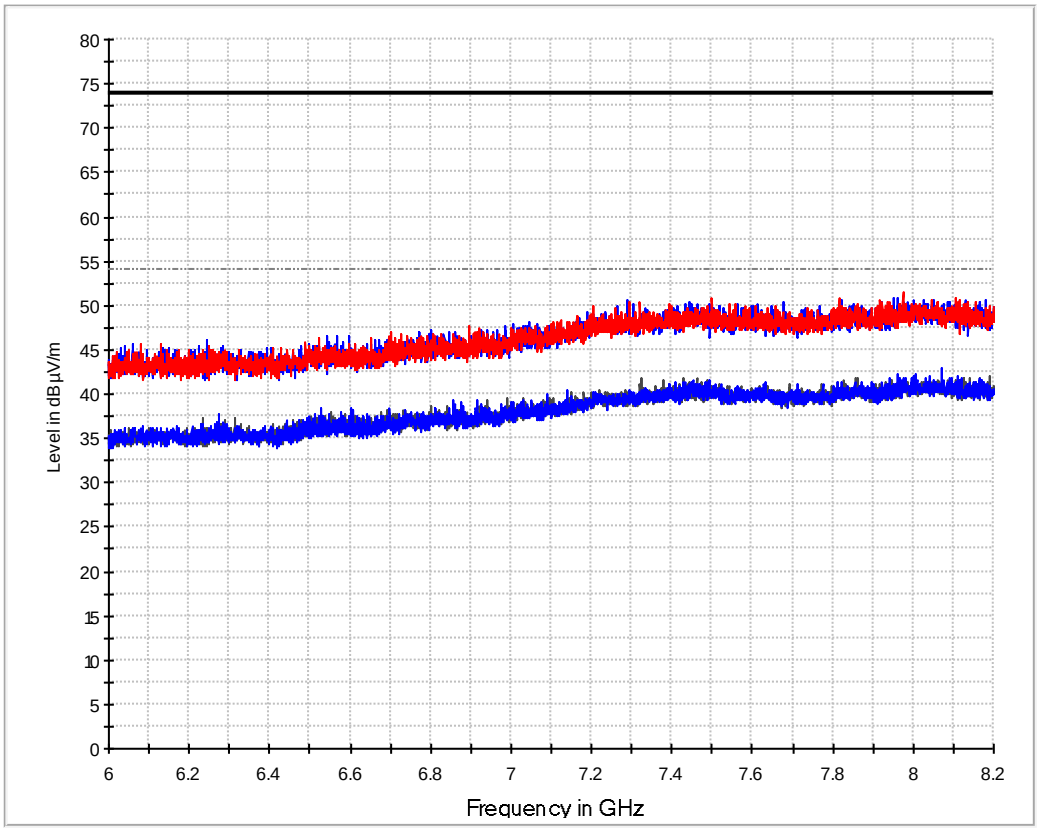
Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
543.060000	35.69	46.00	10.31	1000.0	120.000	100.0	V	-2.0	20.1

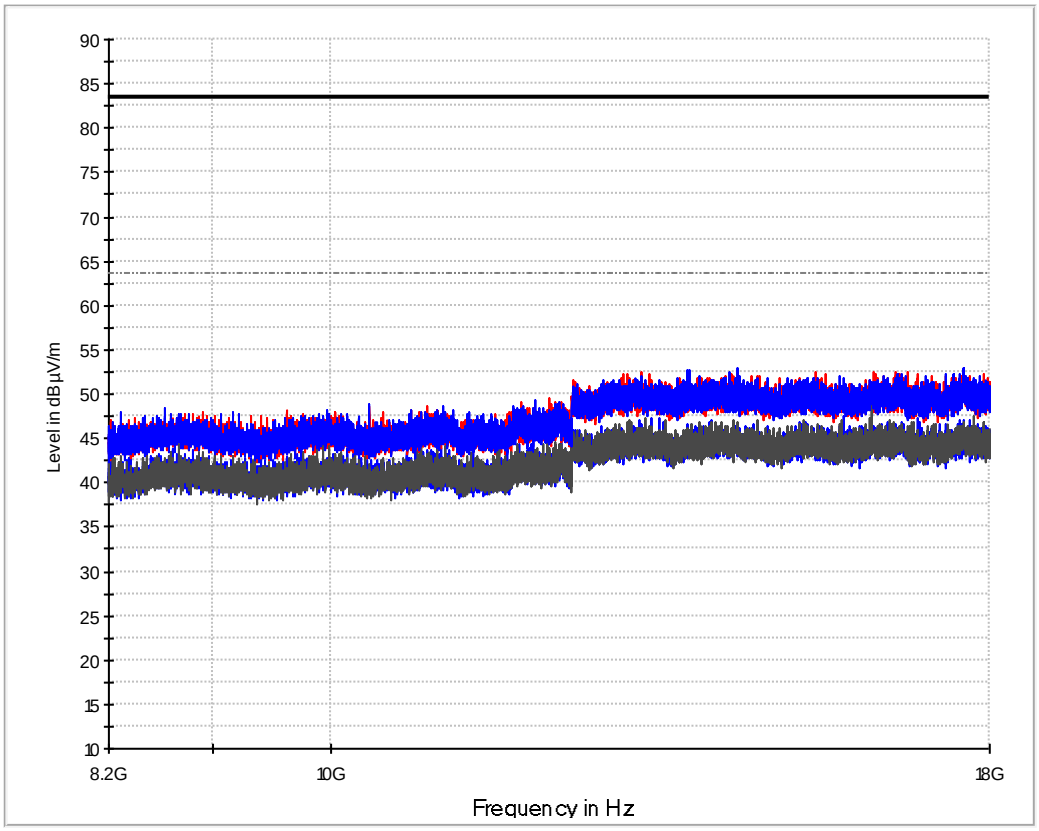


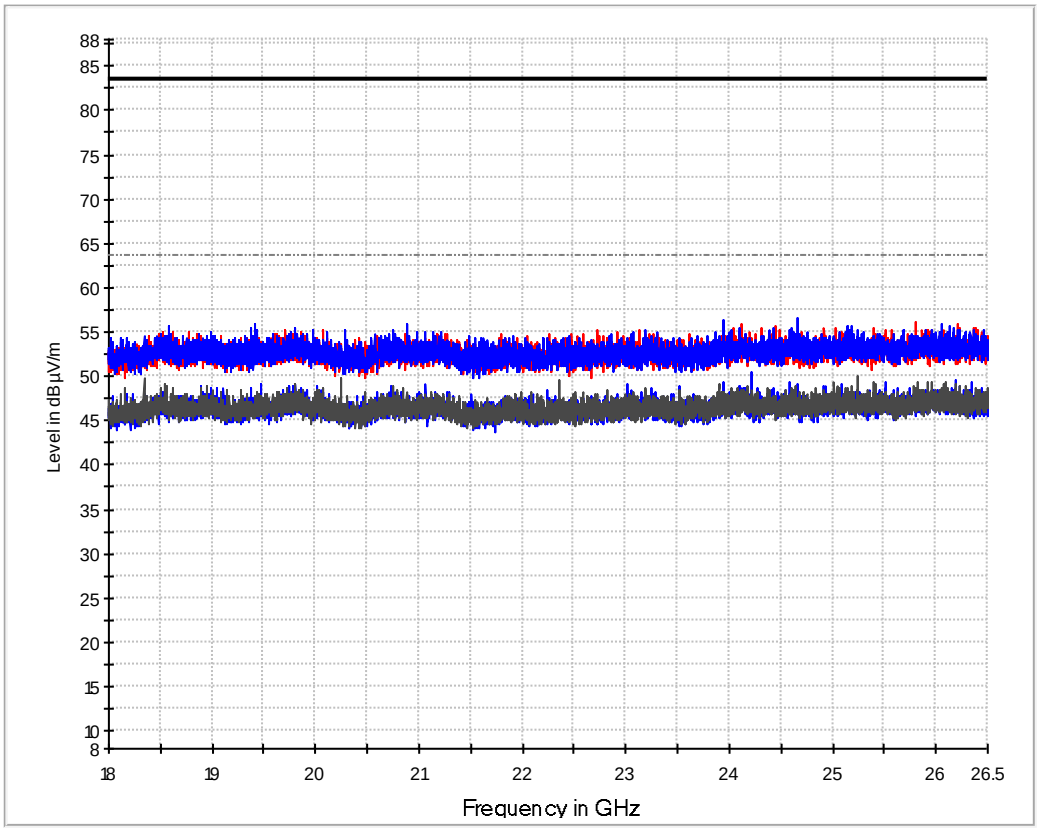
Final Results 1:

Frequency *MHz*	*MaxPeak* *dBµV/m*	*CAverage* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
2418.000000	---	54.70	#1	#1	1000.0	1000.000	301.0	H	-4.0	33.4
2418.000000	92.86	---	#1	#1	1000.0	1000.000	301.0	H	-4.0	33.4

#1 Intentional Radiator

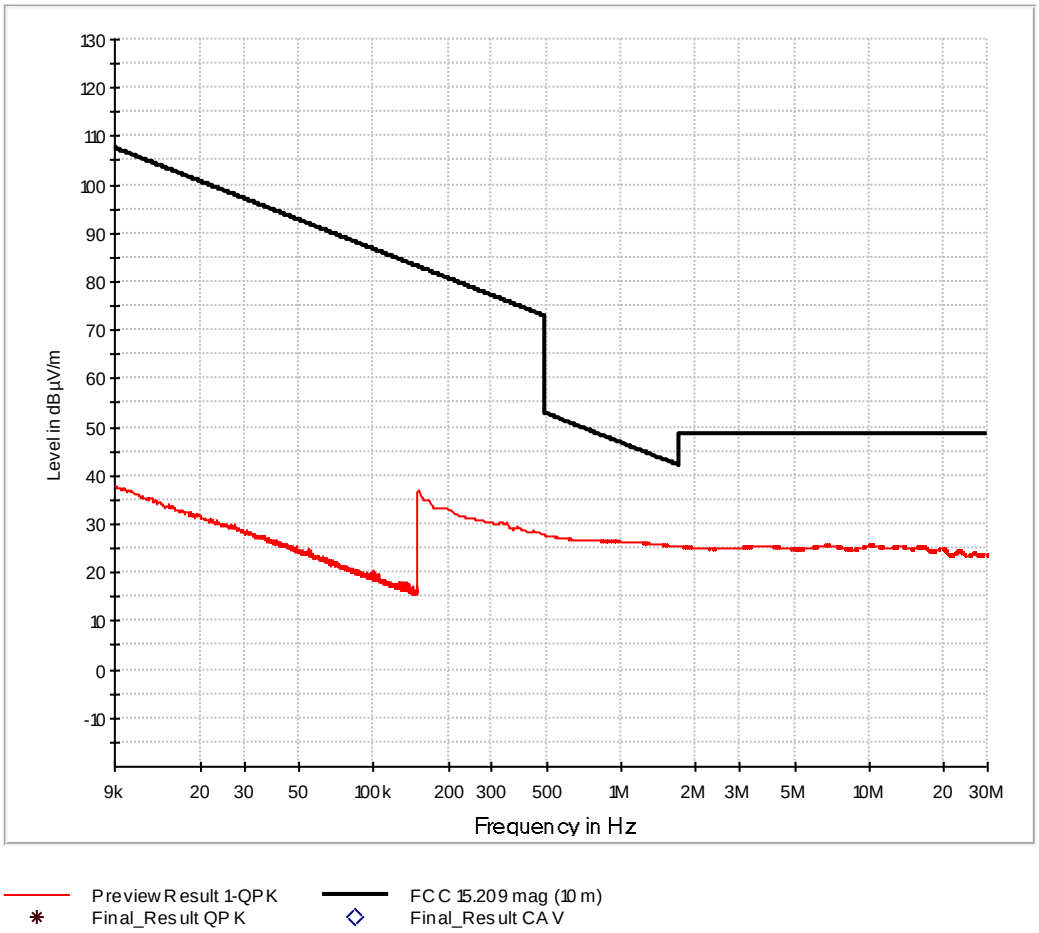

Level in dBµV/m
Frequency in GHz
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
7.8
8
8.2
Preview Result 2V-AVG
Preview Result 1H-PK+
Final_Result PK+
Preview Result 1V-PK+
FCC 15.209 PK
Final_Result AVG
Preview Result 2H-AVG
FCC 15.209 AV

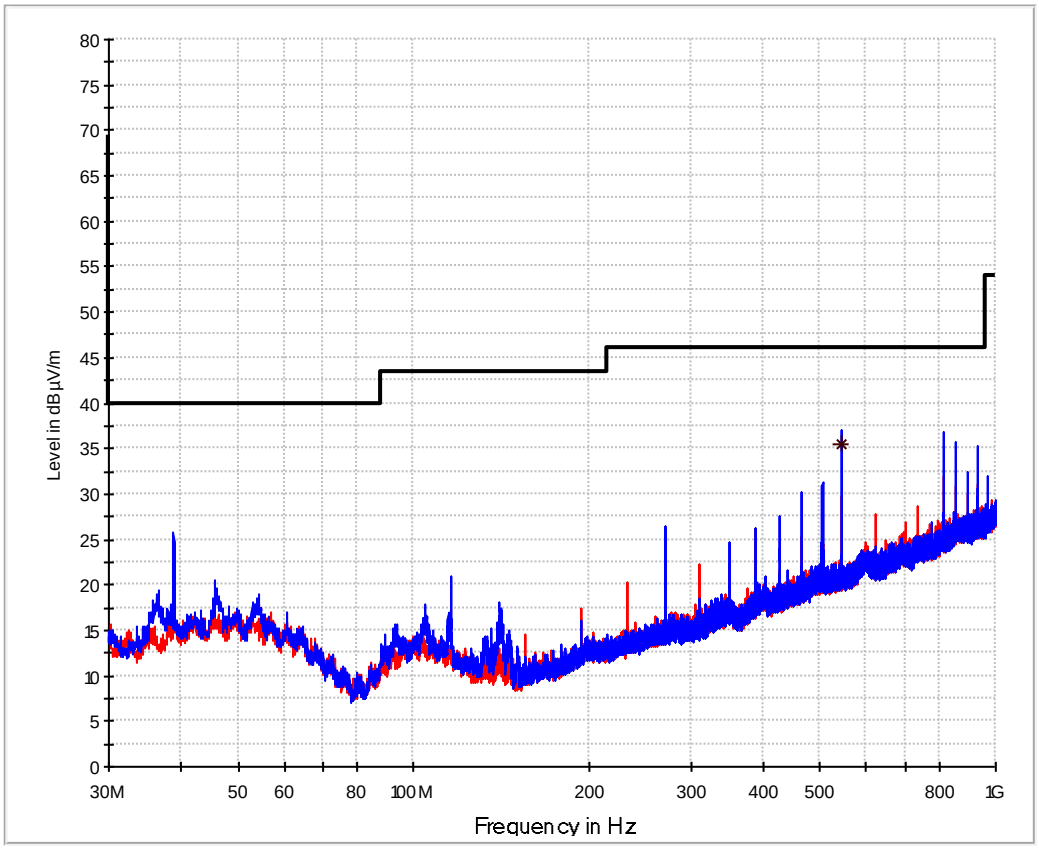

90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
Level in dBµV/m
8.2G
10G
18G
Frequency in Hz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV


Level in dBµV/m
Frequency in GHz
88
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
8
18
19
20
21
22
23
24
25
26
26.5
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV

Product Service

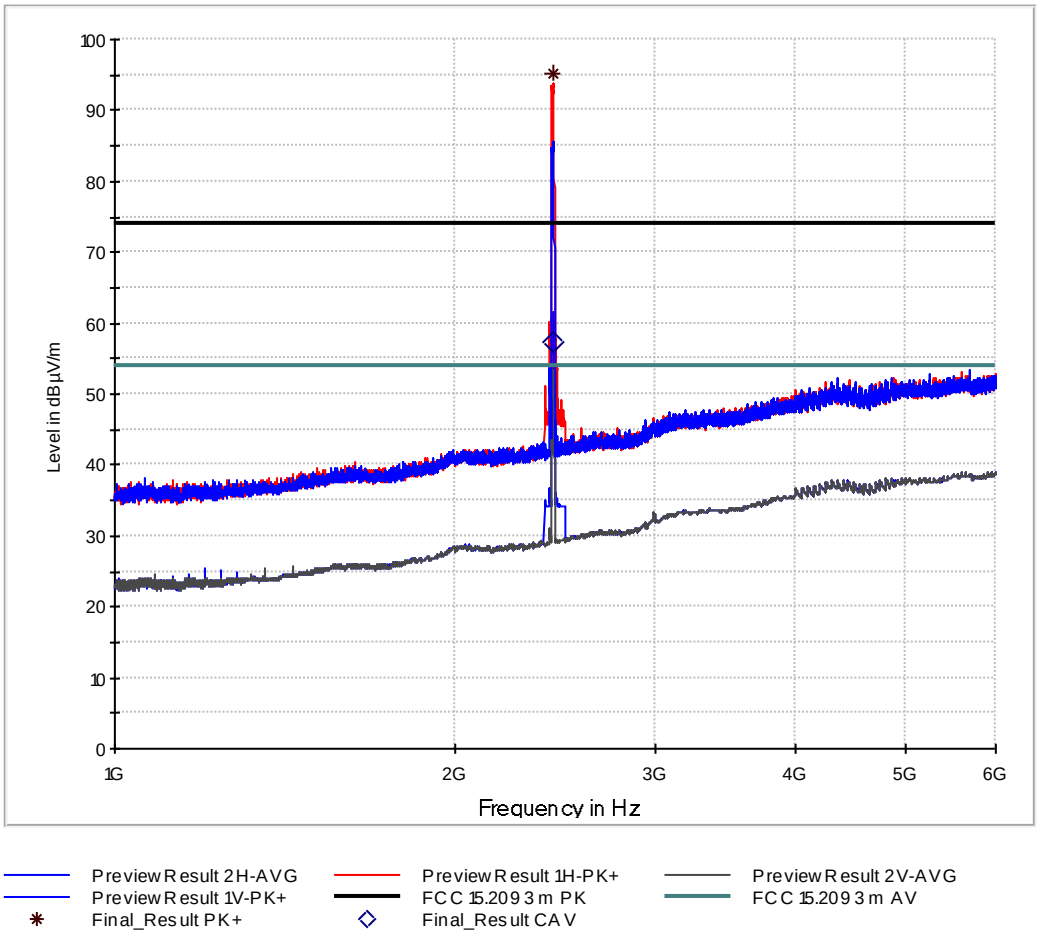
2437 MHz





Final Results 1:

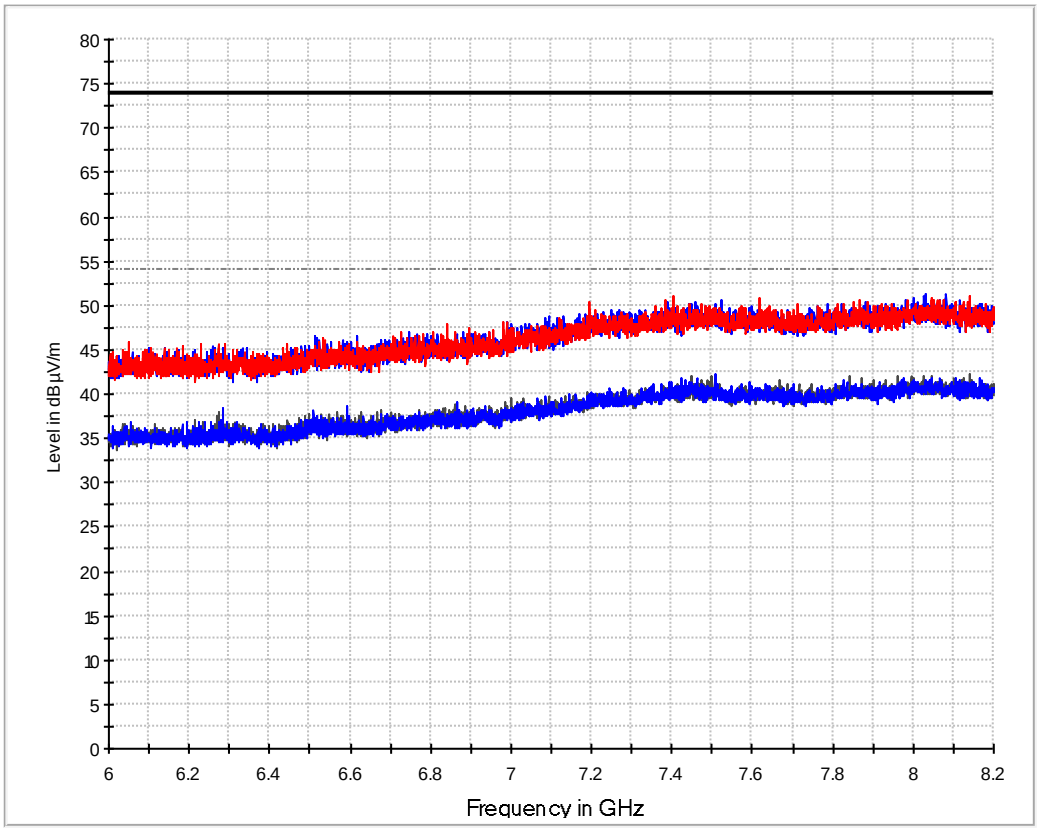
Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
543.060000	35.53	46.00	10.47	1000.0	120.000	103.0	V	1.0	20.1



Final Results 1:

Frequency *MHz*	*MaxPeak* *dBµV/m*	*CAverage* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
2435.500000	---	57.22	#1	#1	1000.0	1000.000	129.0	H	4.0	33.5
2435.500000	95.29	---	#1	#1	1000.0	1000.000	129.0	H	4.0	33.5

#1 Intentional Radiator


Level in dBµV/m
Frequency in GHz
80
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70
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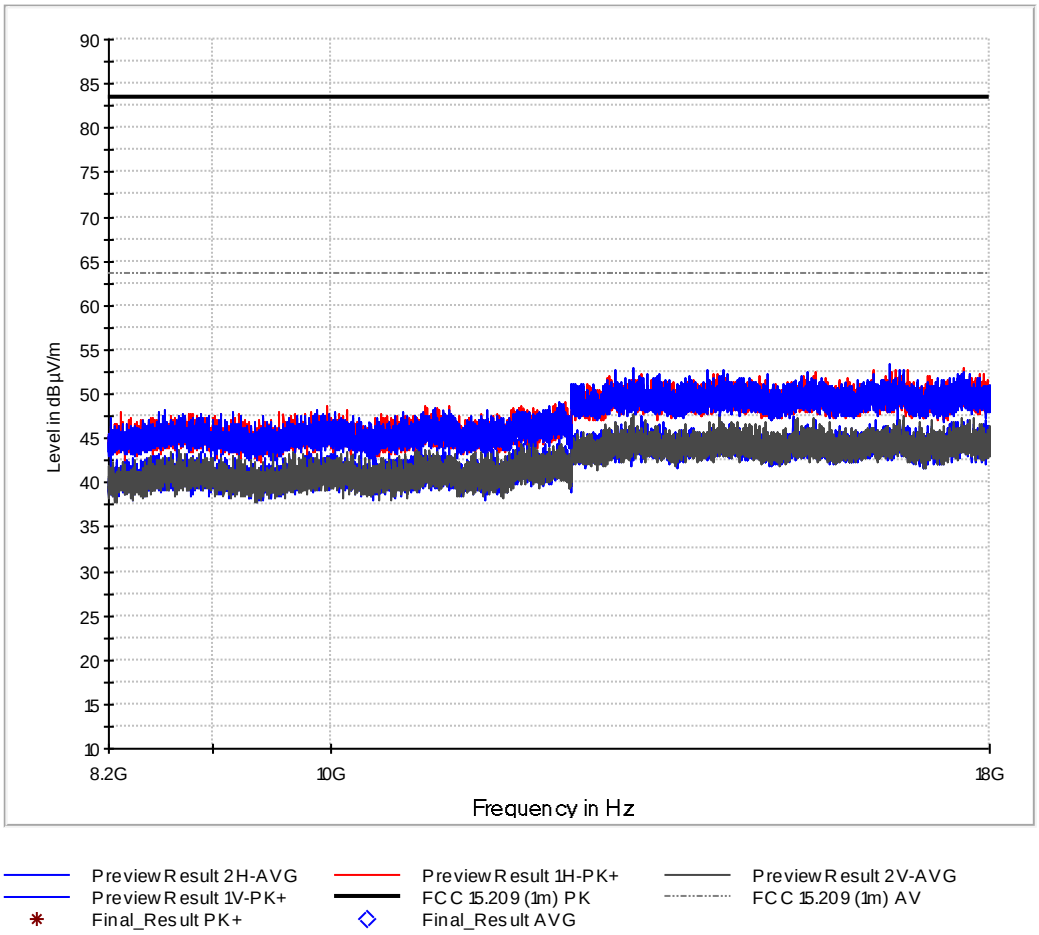
60
55
50
45
40
35
30
25
20
15
10
5
0
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
7.8
8
8.2
Preview Result 2V-AVG
Preview Result 1V-PK+
Preview Result 2H-AVG
Preview Result 1H-PK+
FCC 15.209 PK
FCC 15.209 AV
Final_Result PK+
Final_Result AVG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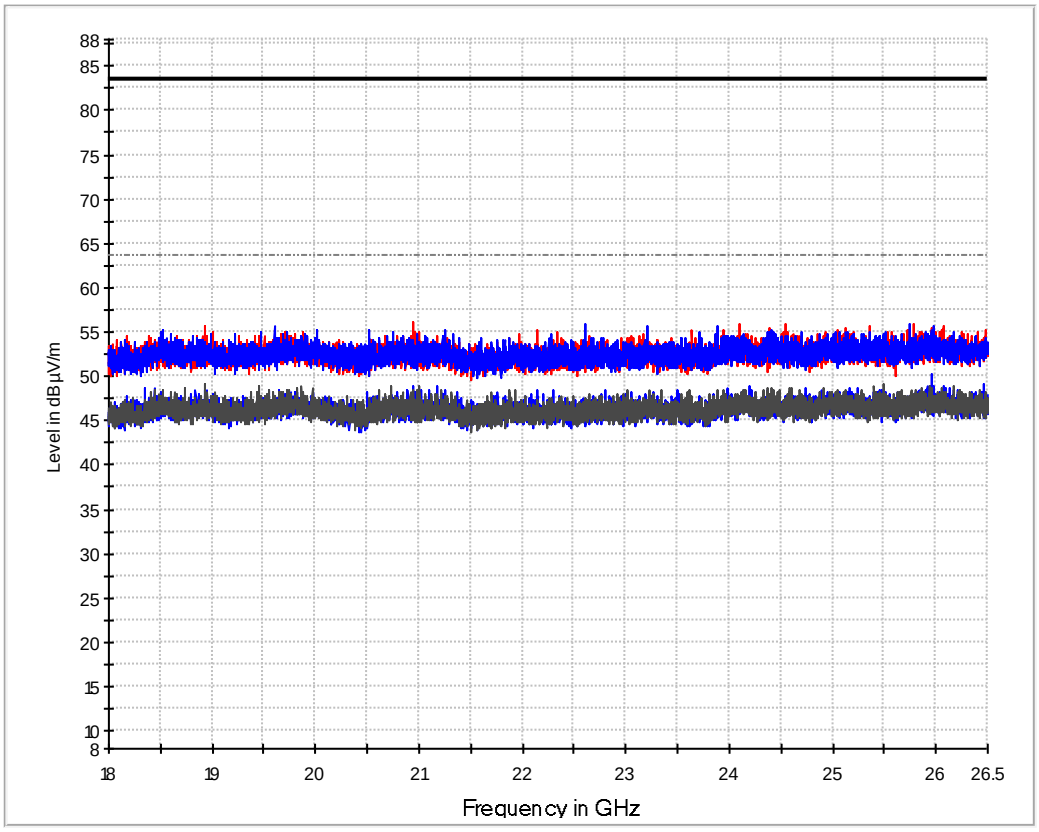
40
35
30
25
20
15
10
Level in dBµV/m
8.2G
10G
18G
Frequency in Hz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV


Level in dBµV/m
Frequency in GHz
88
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70
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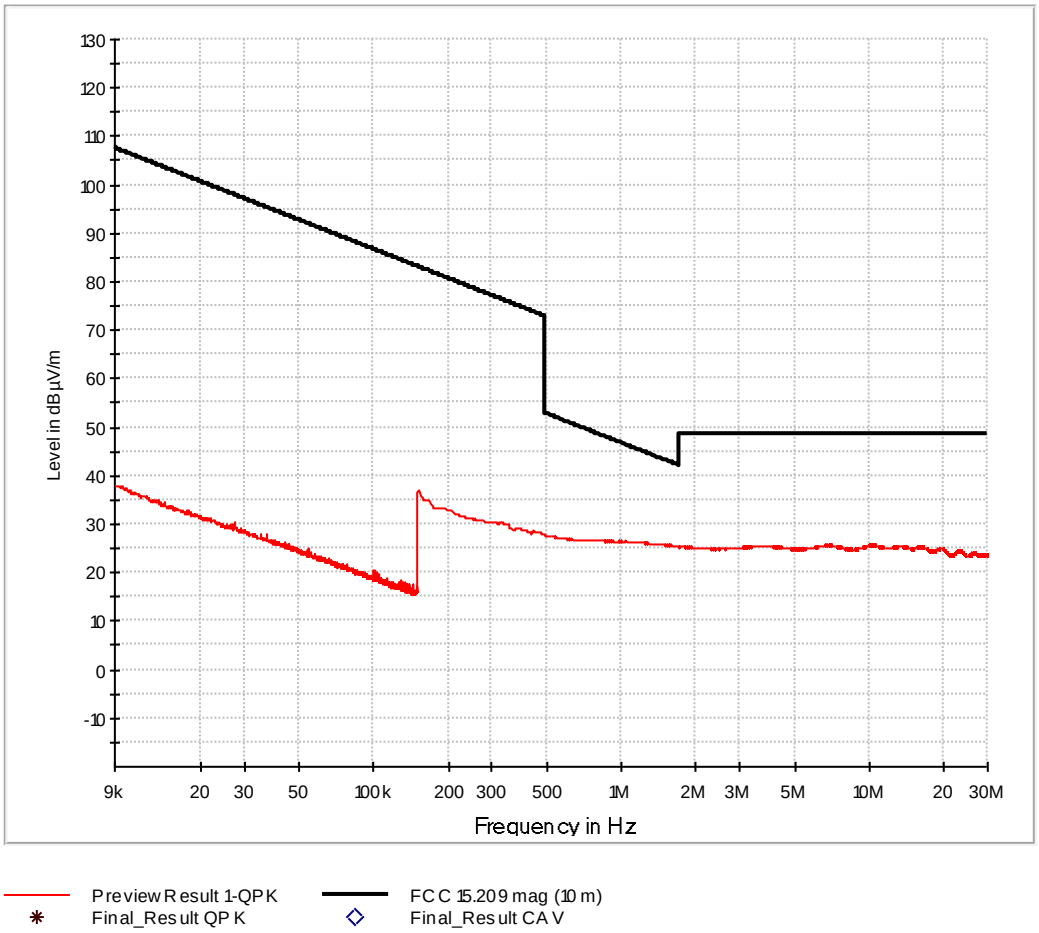
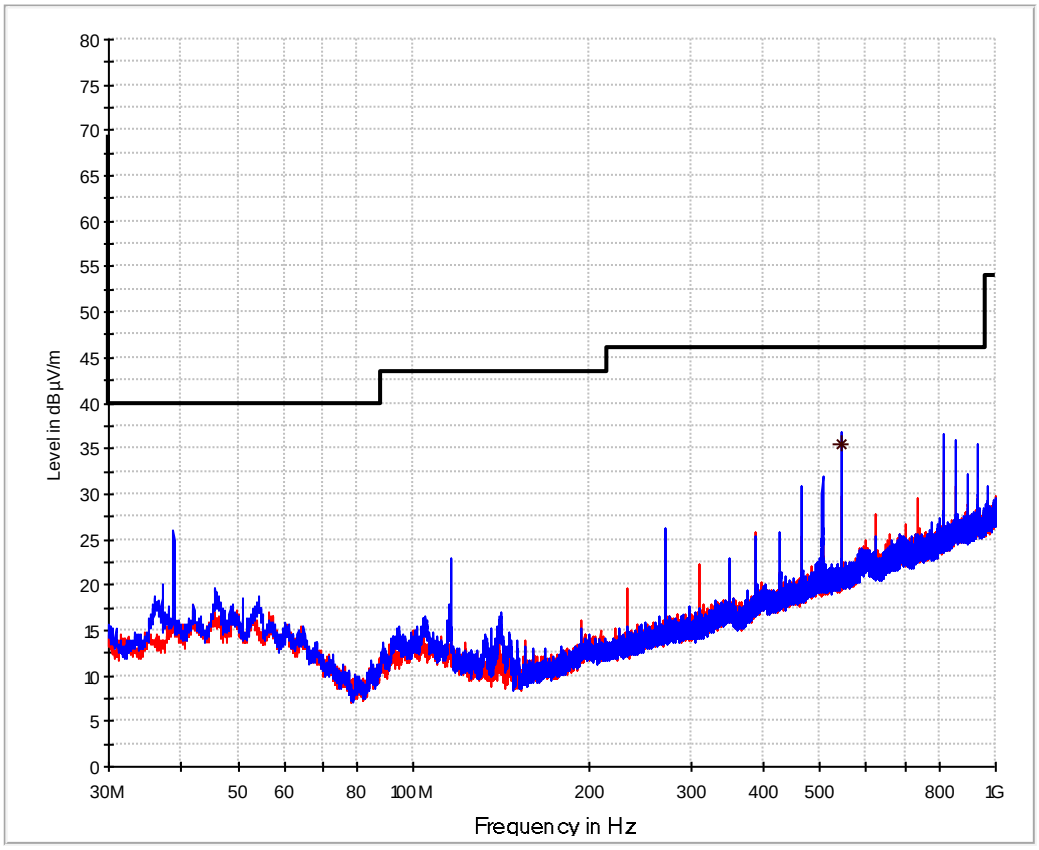
40
35
30
25
20
15
10
8
18
19
20
21
22
23
24
25
26
26.5
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV

Product Service

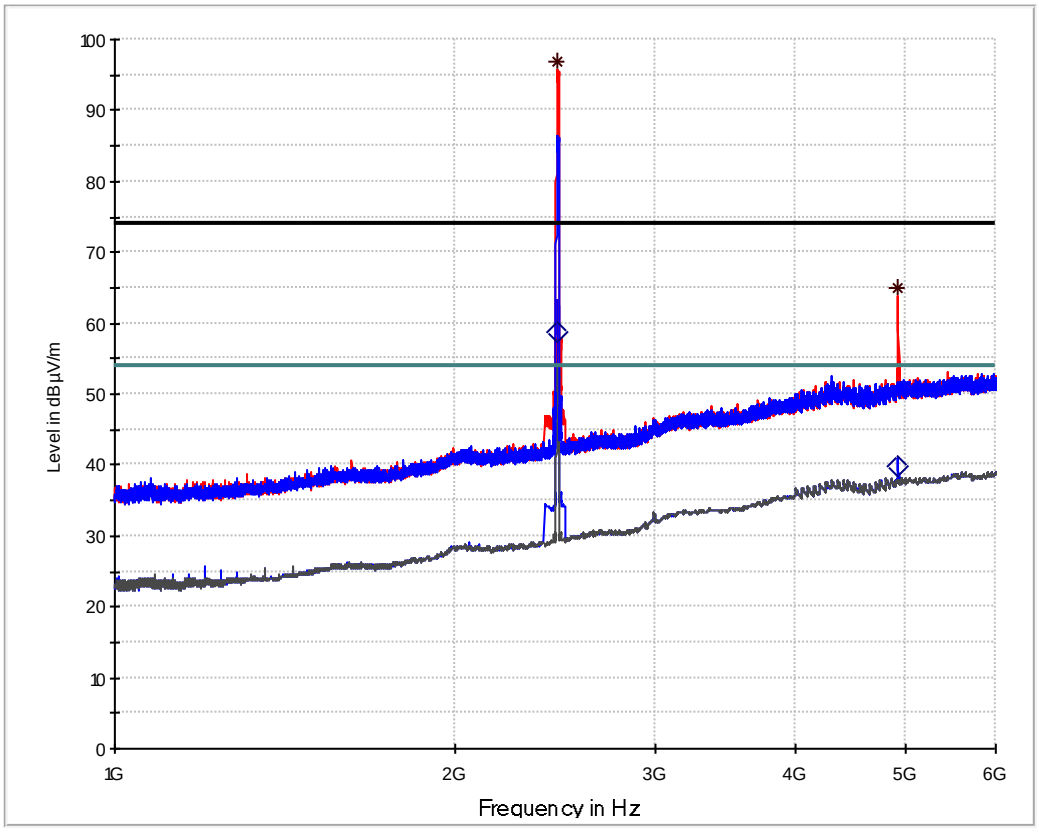
2462 MHz





Final Results 1:

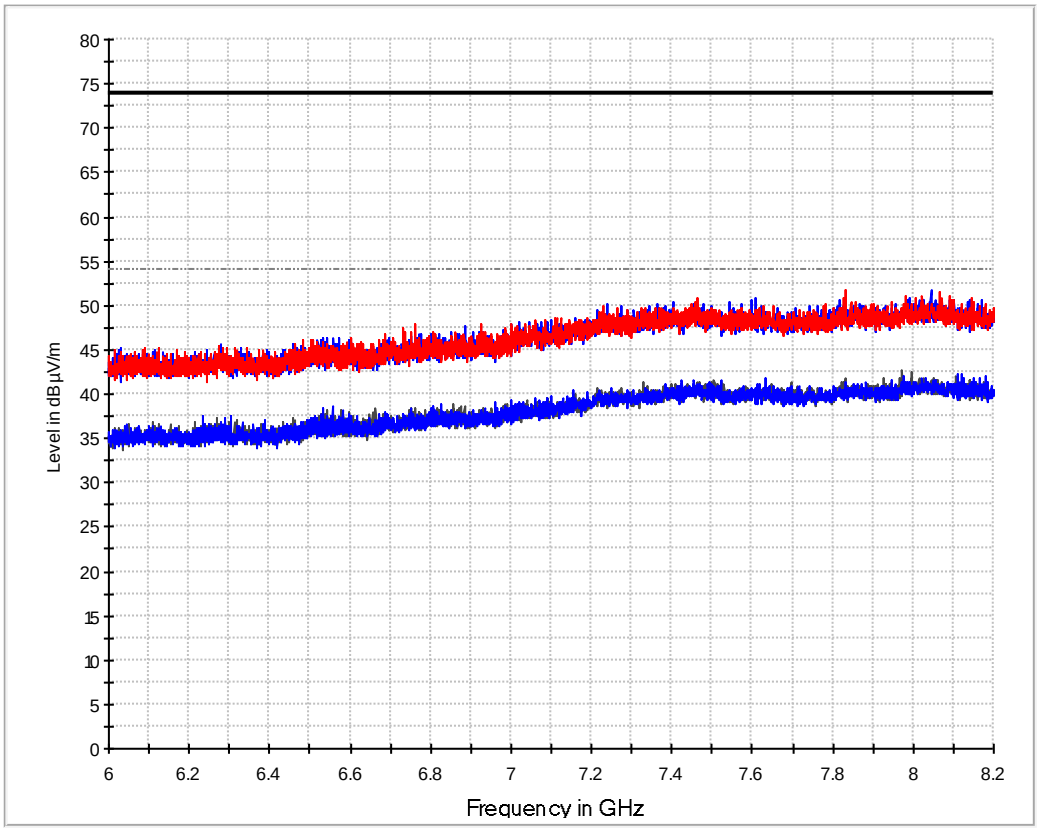
Frequency *MHz*	*QuasiPeak* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
543.060000	35.45	46.00	10.55	1000.0	120.000	100.0	V	-7.0	20.1

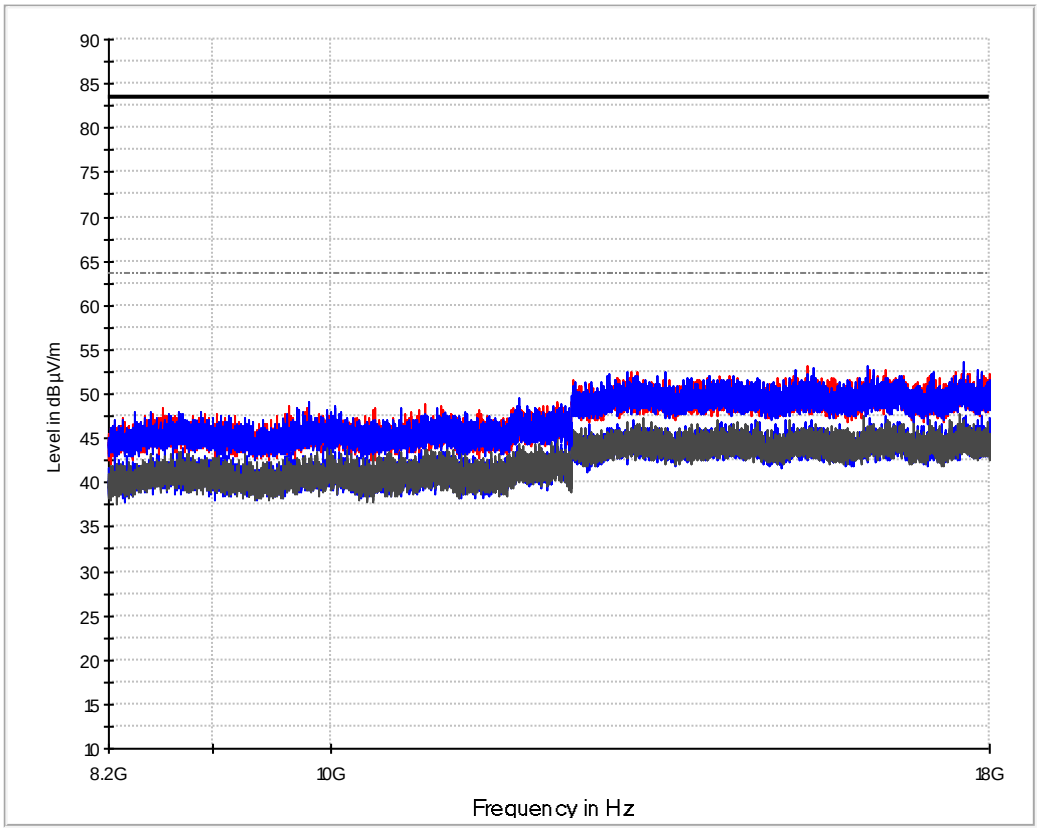


Final Results 1:

Frequency *MHz*	*MaxPeak* *dBµV/m*	*CAverage* *dBµV/m*	*Limit* *dBµV/m*	*Margin* *dB*	*Meas. Time* *ms*	*Bandwidth* *kHz*	*Height* *cm*	*Pol*	*Azimuth* *deg*	*Corr.* *dB*
2463.000000	---	58.89	#1	#1	1000.0	1000.000	159.0	H	-2,0	33,7
2463.000000	96.97	---	#1	#1	1000.0	1000.000	159.0	H	-2.0	33.7
4923.750000	---	39.81	53.98	14.17	1000.0	1000.000	128.0	H	0.0	41.4
4923.750000	64.93	---	73.97	9.04	1000.0	1000.000	128.0	H	0.0	41.4

#1 Intentional Radiator


Level in dBµV/m
Frequency in GHz
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
7.8
8
8.2
Preview Result 2V-AVG
Preview Result 1V-PK+
Preview Result 2H-AVG
Preview Result 1H-PK+
FCC 15.209 PK
FCC 15.209 AV
Final_Result PK+
Final_Result AVG


90
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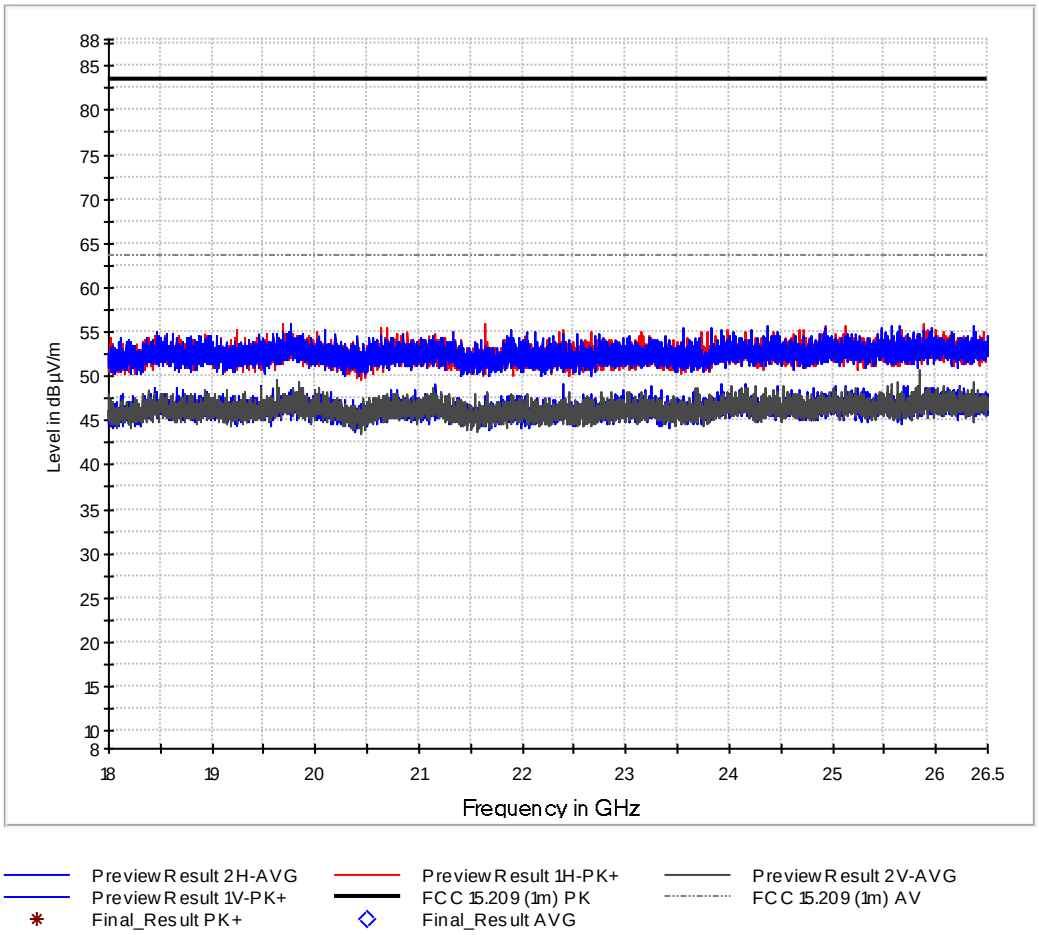
30
25
20
15
10
Level in dBµV/m
8.2G
10G
18G
Frequency in Hz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.209 (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.209 (1m) AV



Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV/m) + Correction Factor (dB)

Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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 the desired power, based on either an RF conducted or a 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 under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Product Service

2.7.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
TRILOG Antenna (4dB)	Schwarzbeck	VULB 9162	20116	36	2022-01-31
Horn antenna	Rohde & Schwarz	HF907	19933	24	2019-06-30
Horn antenna	EMCO	3160-09	19125	N/A	N/A
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.20.01	19719	N/A	N/A

Table 17

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.8 Transmitter Frequency Stability

2.8.1 Specification Reference

ISED RSS-GEN Clause 6.8

2.8.2 Equipment Under Test and Modification State

86010158, S/N: --- - Modification State 0

2.8.3 Date of Test

2019-04-08

2.8.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.8.1 and 6.8.2.
The frequency tolerance of the carrier signal is measured at the temperatures of -30°C,+20°C and +50°C, and at the manufacturer's rated 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.
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 dc block and appropriate attenuators (50 Ohms). In cases where the EUT does not provide an antenna connector 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. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to the 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 on 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 allowed is larger than the uncertainty of the measured frequency tolerance.

2.8.5 Environmental Conditions

Ambient Temperature	*21 °C*
Relative Humidity	*30 %*

Product Service

2.8.6 Test Results

Configuration Mode-1

Operation Condition	EUT Frequency (MHz)	Measured Lower 99%-BW Frequency (MHz)	Measured Upper 99%-BW Frequency (MHz)
20°C / 14.80V	2417	2409.85	2424.45
20°C / 17.02V	2417	2409.25	2424.25
20°C / 12.58V	2417	2409.05	2424.35
-30°C / 14.80V	2417	2408.95	2423.75
+50°C / 14.80V	2417	2409.75	2424.35

Table 18

Operation Condition	EUT Frequency (MHz)	Measured Lower 99%-BW Frequency (MHz)	Measured Upper 99%-BW Frequency (MHz)
20°C / 14.80V	2437	2429.55	2444.45
20°C / 17.02V	2437	2429.05	2444.15
20°C / 12.58V	2437	2429.15	2444.35
-30°C / 14.80V	2437	2428.95	2443.95
+50°C / 14.80V	2437	2429.85	2444.55

Table 19

Operation Condition	EUT Frequency (MHz)	Measured Lower 99%-BW Frequency (MHz)	Measured Upper 99%-BW Frequency (MHz)
20°C / 14.80V	2462	2454.95	2469.55
20°C / 17.02V	2462	2454.45	2469.15
20°C / 12.58V	2462	2454.85	2469.35
-30°C / 14.80V	2462	2454.05	2469.15
+50°C / 14.80V	2462	2454.55	2469.25

Table 20

ISED RSS-GEN, Limit Clause 8.11

Frequency stability is not specified in RSS-247. Measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz.

Product Service

2.8.7 Test Location and Test Equipment Used

This test was carried out in a Non shielded Room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal and Spectrum Analysator	Rohde & Schwarz GmbH & Co. KG	FSV40 for TS8997	20219	12	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	20248	24	2020-01-31
Testsystem 2,4 & 5 GHz Band	Rohde & Schwarz GmbH & Co. KG	TS8997	20251	24	2020-01-31
Switching device	Rohde & Schwarz GmbH & Co. KG	OSP120 for TS8997	38807	24	2020-09-30
Climatic test chamber	ESPEC Corp.	PL-2J	18843	36	2020-03-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.50.00	19893	N/A	N/A

Table 21

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.9 Exposure of Humans to RF Fields

2.9.1 Specification Reference

IC RSS-GEN Issue 4, section 3.2 and
IC RSS-102, Issue 5, section 2.5 and
KDB 447498 D01 V06, section 4.3.1 a)

2.9.2 Guide

IC RSS-102 Issue 5, section 2.5

2.9.3 Equipment Under Test and Modification State

86010158, S/N: --- - Modification State 0

2.9.4 Date of Test

2019-04-04

2.9.5 Test Results

Detailed results are shown below.

Product Service

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP = **..... W**			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G = **.....**		☐		
$EIRP = G \cdot CP \Rightarrow EIRP$ = **..... W**				
☐ the field strength[1] in V/m: FS = **..... V/m**			☐	
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **..... W**				
with:				
Distance between the antennas in m: D = **..... m**			☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by:				
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **1.49 mW**				
with:				
Field strength in V/m: FS **= 0.07 V/m**			☒	
Distance between the two antennas in m: D = **3**			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **1.49 mW**				

[1] The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Product Service

Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is				
☒ less than or equal to 20 cm ☐ greater than 20 cm		☐		
Transmitting device is				
☐ in the vicinity of the human head ☐ body-worn		☐		

SAR evaluation
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

Frequency (MHz)	Exemption limits (mW)[2] at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 [3]	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

[2] The excemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from alinear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from athird order polynomial fit.

[3] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

Product Service

	Carrier frequency:	f	=	**2462 MHz**		
	Distance:	d	=	**5 mm**		
	Transmitter output power:	TP	=	**1.49 mW**		
	Limit:	TP_{limit}	=	**3.98 mW**		☒
☐	SAR evaluation is documented in test report no. …					

Product Service

Specifications:	RSS-102, Issue 5, Section 4, Table 4, Uncontrolled Environment SPR-002, Issue 1
Operation mode:	Configuration Mode-1
Comment:	---

Test procedure:	IEC 62236-1, Section 4.2 “Measurement to show accordance to the reference levels”
Test distance:	Direct contact to EUT
Limit:	*Frequency Range (MHz)* / *Electric Field (V/m_{rms})* / *Magnetic Field (A/m_{rms})* / *Peference Periode (min)* 10-20 / 27.46 / 0.0728 / 6 300-6000 / $3.142\ f^{0.3417}$ / $0.008335\ f^{0.3417}$ / 6 *f* in MHz
Test positions:	All surfaces: The antenna was moved all over the equipment under test using a test distance as stated above.

Measured maximum value *(V/m)*	Maximum Limit at 2462 MHz *(V/m)*	Margin to reference value *(V/m)*
22.51	45.29	22.78

Measured maximum value *(A/m)*	Maximum Limit at 2462 MHz *(A/m)*	Margin to reference value *(A/m)*
0.0592	0.1201	0.0609

Product Service

SAR Exclusion threshold

Maximum Radiated Fields Strength: (see chapter 2.1.6 of this test report)	96.97 dBµV/m (at 3 m distance and 2462 MHz)
Calculated Equivalent Radiated Power:	1.49 mW (e.i.r.p.) < 5 mW
Minimum separation distance:	5 mm (≤ 50 mm)
1-g numeric threshold:	(5 mW / 5 mm) · √(2.462 GHz) = 1.57
1-g numeric threshold limit:	3.0

Note 1:For test distances below 5 mm according to 4.3.1 a) the test distance is fixed to 5 mm.

$$EIRP = \frac{(FS \cdot D)^2}{30}$$

2.9.6 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Horn antenna	Rohde & Schwarz	HF907	19933	24	2019-06-30
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.20.01	19719	N/A	N/A
Electromagnetic radiation meter	Narda Safety	EMR-200	19590	36	2019-10-31
Electric field probe	Narda Safety	Type 8.3	19591	36	2019-10-31
Magnetic field probe	Narda Safety	Type 12.1	19592	36	2019-10-31
Exposure level tester	Narda Safety	ELT-400	19725	24	2020-06-30

Table 22

Product Service

3 Measurement Uncertainty

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

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	±1.14 %	2
RF-Frequency error	1.96	±1 · 10-7	7
RF-Power, conducted carrier	2	±0.079 dB	2
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power, conducted, spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power, radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.4 dB / -4.5 dB	8
40 GHz – 170 GHz	1.96	+4.2 dB / -7.1 dB	8
Spectral Power Density, conducted	2.0	±0.53 dB	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2,89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2,89 %	2
Adjacent channel power 25 MHz – 1 GHz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Table 23

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Table 24

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 25

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05, providing a level of confidence of p = 95.45%
Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.
Note 5:
The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 6:
The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96, providing a level of confidence of p = 95.45%
Note 8:
The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96, providing a level of confidence of p = 95.45%