DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

Test report No:

NIE: 65408RRF.006

Partial Test Report

USA FCC Part 15.247,15.407, 15.209
CANADA RSS-247, RSS-Gen

Radio Frequency Devices.
Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.
Unlicensed National Information Infrastructure (U-NII) Devices:
General technical requirements.
Radiated emission limits; general requirements.
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.
General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Automotive infotainment system
(*) Trademark	BMW
(*) Model and /or type reference	MGU21 APN
Other identification of the product	HW version: 1.4 SW version: 20w37.5-1 FCC ID: A269ZUA163 IC: 700B-UA163
(*) Features	BT, WiFi, USB2/3, GPS
Applicant	ALPSALPINE INC. 20-1 YOSHIMA INDUSTRIAL PARK, IWAKI, FUKUSHIMA 970-1192, JAPAN
Test method requested, standard	USA FCC Part 15.407 (10-1-19) Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. USA FCC Part 15.247 (10-1-19) Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-19) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

	ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices. -Transmitter out of band radiated emissions with simultaneous transmissions.
Approved by (name / position & signature)	Rafael López EMC/RF Lab. Manager RAFAEL LÓPEZ MARTÍN 2021.03.05 13:03:05 +01'00'
Date of issue	2021-03-05
Report template No	FDT08_23 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample of the model MGU21 APN is a Device for entertainment and communication inside the car, this includes playing music from several external sources or internal flash-memory, connecting mobile devices (e.g. Apple Car Play) and a Navigation system.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
65408/001	Automotive infotainment system	MGU21 APN	ALB458L1300040	2020/10/06
65408/018	BT / WLAN Antenna	--	--	2020/10/06

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
65408/002	CAN-Box	--	80008154	2020/10/06
65408/003	OABR-Converter Board	--	--	2020/10/06
65408/004	OABR-Converter Cable	--	--	2020/10/06
65408/005	Ethernet / USB Adaptor	EU-4306	--	2020/10/06
65408/006	Main Wireharness	--	--	2020/10/06

Sample S/01 has undergone the following test(s): The Radiated tests indicated in the Appendix A.

Test sample description

Ports……..:	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	BT/WLAN		☒	☐	☐
	GPS		☒	☐	☐
	USB2		☒	☐	☐
	APIX		☒	☐	☐
	AR-CAM		☒	☐	☐
	OABR		☒	☐	☐
	Gbit Ethernet		☒	☐	☐
Supplementary information to the ports…… :	-				
Rated power supply .....:	Voltage and Frequency		Reference poles		

			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC:					
	☐	DC:					
Rated Power .....:	12V						
Clock frequencies.....:	-						
Other parameters .....:	-						
Software version .....:	20w37.5-1						
Hardware version .....:	1.4						
Dimensions in cm (W x H x D) ....:	-						
Mounting position .....:	☒	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☐	Other:					

	Module/parts of test item	Type	Manufacturer
Modules/parts.....:	BT		WNC
	WiFi		WNC
	-		
	-		

	Description	Type	Manufacturer
Accessories (not part of the test item) .....:	Can Box		Harman
	Display		Visteon
	OABR-converter		Harman
	-		
	-		

	-		
Documents as provided by the applicant.....:	Description	File name	Issue date
	Testing manual for BT and WLAN	I&K MGU_Testing Manual (Radio_WLAN_BT)_v11_2018-01-18	18.1.2018
	-		
	-		
	-		

(3) Only for Medical Equipment

Identification of the client

ALPS ALPINE EUROPE GmbH

Ohmstrasse 4, 85716 Unterschleißheim, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-10-19
Date (finish)	2020-10-20

Document history

Report number	Date	Description
65408RRF.006	2021-03-05	First release.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Alfonso Gutiérrez, Cristina Calle, Pablo Redondo, José Gabriel Pendón.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
3.	Hybrid Bilog Antenna 30MHz-6GHz SUNOL SCIENCES CORPORATION JB6	2018/10	2021/10
4.	Attenuator 3 dB 2W, DC-6GHz, JFW 50HN-03	2019/10	2020/10
5.	RF Preamplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2020/02	2021/02
6.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
7.	Low Pass Filter DC - 1 GHz TEMSTRON / TEMWELL ST-1GA3250-LS	2019/10	2020/10
8.	DC Power Supply 150V/22A, AGILENT TECHNOLOGIES N8740A	N.A.	N.A.
9.	Biconical Antenna SCHWARZBECK VHBB9124	2019/11	2022/11
10.	Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
11.	Horn Antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
12.	RF Preamplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/11	2020/11
13.	Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
14.	Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2019/10	2021/10
15.	High Pass Filter 7-18 GHz TEMSTRON / TEMWELL ST-7GA3619-HS	2019/11	2020/11
16.	High Pass Filter 18-40 GHz TEMSTRON / TEMWELL ST-18G-40G-798S	2018/12	2019/12
17.	Attenuator 10dB, 2W, DC-18GHz, TECHNIWAVE TWTS2G	2020/01	2021/01
18.	Digital Multimeter, FLUKE 175	2019/10	2020/10

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

FCC PART 15 PARAGRAPH / RSS-247		
Requirement – Test case	**Verdict**	**Remark**
FCC 15.209 (a), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2, 6.2.4.2: - Emission limitations radiated (Transmitter)	P	(1)
Supplementary information and remarks: (1) Only Co-Location radiated spurious emission test was requested.		

Appendix A: Test results

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FCC 15.209 (a), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2 & 6.2.4.2 Emission limitations radiated (Transmitter).....17

TEST CONDITIONS

POWER SUPPLY (V):

Vnominal: 12 Vdc

Type of Power Supply: DC External (Car Battery).

ANTENNA:

Bluetooth EDR:

Type of Antenna: External antenna.

Maximum Declared Antenna Gain: -6.2 dBi (Antenna gain plus antenna cable loss).

802.11 bgn20 SISO:

Type of Antenna: External antenna.

Maximum Declared Antenna Gain: -6.2 dBi (Antenna gain plus antenna cable loss).

802.11 a20 / n2040 / ac2040 / ac80 SISO:

Type of Antenna: External antenna.

Maximum Declared Antenna Gain: -5.4 dBi (Antenna gain plus antenna cable loss).

RADIOS AND CHANNELS TESTED:

* Co-location Bluetooth, WLAN 2.4 GHz, WLAN 5 GHz band U-NII-1:

	Bluetooth EDR / FHSS	
Mode:	Basic Rate (GFSK - 1DH5)	
Channel Spacing:	1 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Middle: 38	2440

	WLAN 2.4 GHz (IEEE 802.11 b/g/n20) / DTS	
Mode:	802.11 b: 6 Mbps	
Channel Spacing:	20 MHz	
Frequency Range:	2412 MHz to 2472 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Middle: 6	2437

	WLAN 5 GHz (IEEE 802.11 a20/n2040/ac204080) / U-NII-1	
Mode:	802.11 ac VHT20: MCS0	
Frequency Range:	5150 MHz to 5250 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Middle: 40	5200

* Co-location Bluetooth, WLAN 2.4 GHz, WLAN 5 GHz band U-NII-3:

	Bluetooth EDR / FHSS	
Mode:	Basic Rate (GFSK - 1DH5)	
Channel Spacing:	1 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Middle: 38	2440

	WLAN 2.4 GHz (IEEE 802.11 b/g/n20) / DTS	
Mode:	802.11 b: 6 Mbps	
Channel Spacing:	20 MHz	
Frequency Range:	2412 MHz to 2472 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Middle: 6	2437

	WLAN 5 GHz (IEEE 802.11 a20/n2040/ac204080) / U-NII-3	
Mode:	802.11 a20: 6 Mbps	
Frequency Range:	5725 MHz to 5850 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Middle: 157	5785

The test set-up was made in accordance to the general provisions of FCC DTS Measurement 558074 D01 DTS Meas Guidance v05r2 dated April 2, 2019 and FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuous transmission with a modulated carrier at maximum power in all required channels selecting the supported data rates/modulations types.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes.

Selected Transmission Mode for each Radio:

The following configurations were selected based on preliminary testing that identified those corresponding to the worst cases:

* Bluetooth Basic Rate: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in Basic Rate mode because its power is higher than the other modes.

* WLAN 2.4 GHz: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11 b / 6 Mbps mode configuration as this mode was found as the worst case for spurious emissions than all the other 2.4 GHz WLAN SISO modes

* WLAN 5 GHz band U-NII-1: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11 ac / VHT20 / MCS0 mode configuration as this mode was found as the worst case for spurious emissions than all the other WLAN 5 GHz band U-NII-1 SISO modes.

* WLAN 5 GHz band U-NII-3: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11 a / 20 / 6 Mbps mode configuration as this mode was found as the worst case for spurious emissions than all the other WLAN 5 GHz band U-NII-3 SISO modes.

TESTED SIMULTANEOUS TRANSMISSION MODES:

*** Co-location Bluetooth, WLAN 2.4 GHz, WLAN 5 GHz band U-NII-1**, with the EUT configured to simultaneously transmit three signals at maximum output power:
Bluetooth Basic Rate in DH5 mode, WLAN 2.4GHz in 802.11 b / 6 Mbps, WLAN 5GHz band U-NII-1 in 802.11 ac / VHT20 / MCS0.

*** Co-location Bluetooth, WLAN 2.4 GHz, WLAN 5 GHz band U-NII-3**, with the EUT configured to simultaneously transmit three signals at maximum output power:
Bluetooth Basic Rate in DH5 mode, WLAN 2.4GHz in 802.11 b / 6Mbps, WLAN 5GHz band U-NII-3 in 802.11 a / 20 / 6Mbps.

RADIATED MEASUREMENTS:

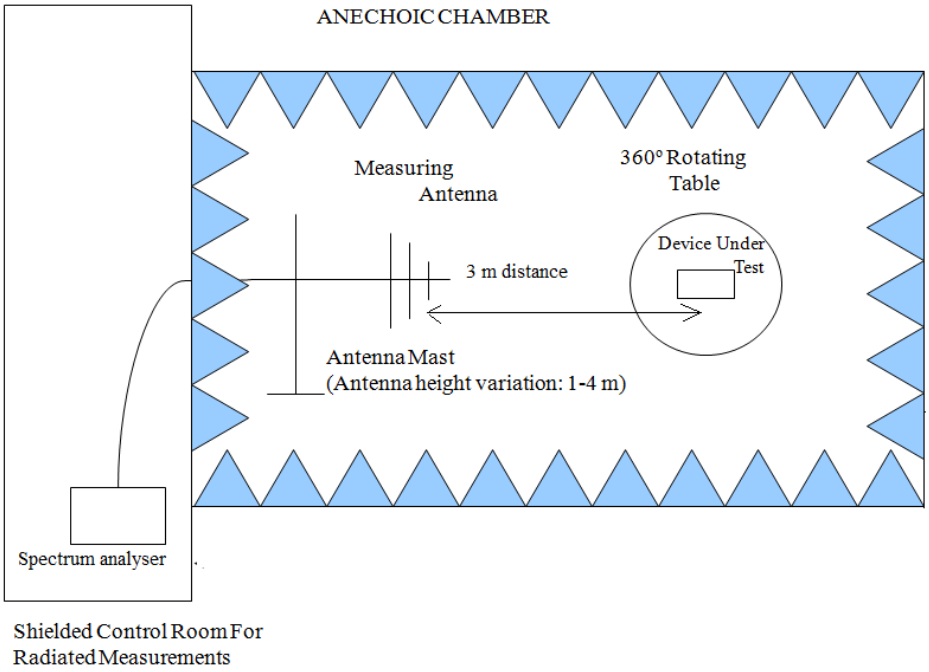
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1 GHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1m for the frequency range 17 GHz-40 GHz (17 GHz-40 GHz horn antenna).

For radiated emissions in the range 17 GHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

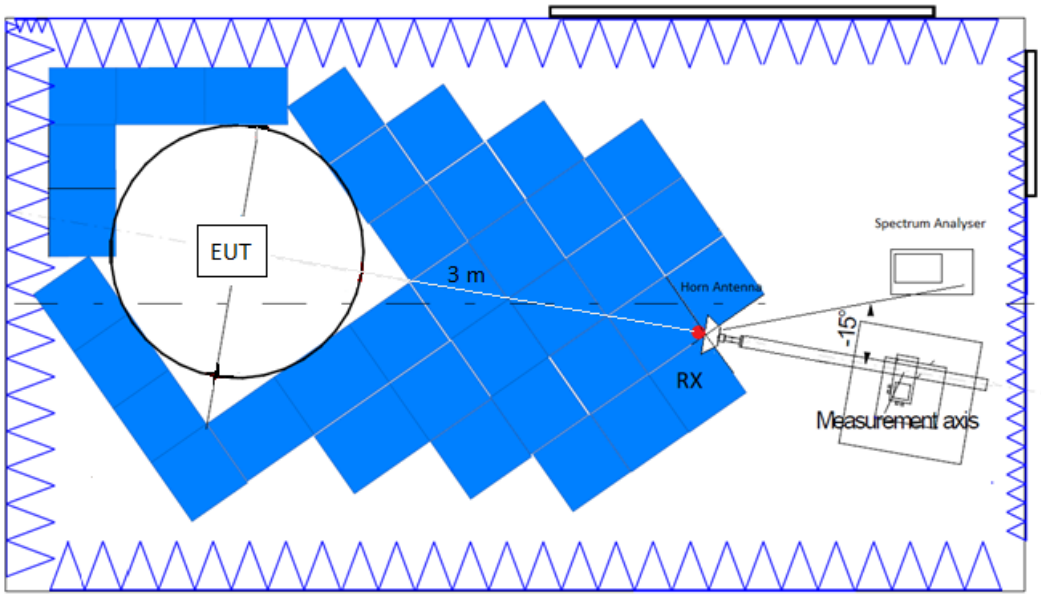
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

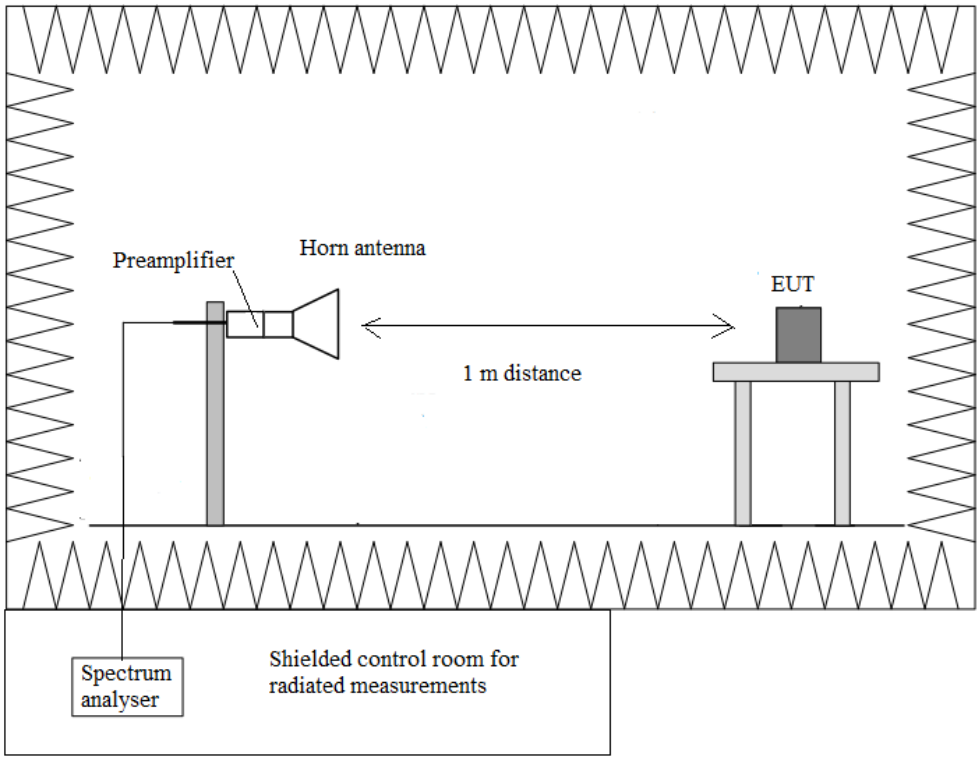
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



FCC 15.209 (a), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2 & 6.2.4.2 Emission limitations radiated (Transmitter)

SPECIFICATION:

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), appearing outside of the band 13.110 MHz - 14.010 MHz band must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	29.54	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-17 GHz and at distance of 1 m for the frequency range 17 GHz-40GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Test performed on the following worst cases in all relevant tests channels:

- **Co-location mode Bluetooth EDR, 802.11 b, U-NII-1 802.11 ac20.**

Bluetooth EDR:	Middle Channel (2440 MHz). Basic Rate. GFSK.
802.11 b:	Middle Channel (2437 MHz). BW: 20 MHz. 6 Mbps.
U-NII-1 802.11 ac20:	Middle Channel (5200 MHz). BW: 20 MHz. VHT-MCS0.

LIMIT: The spurious frequencies were measured at 3 meter. The limit of the test is determined by:

Frequency Range	Detector	Limit at 3m (dBµV/m)
30 MHz to 88 MHz	Quasi-peak	40 dBµV/m
88 MHz to 216 MHz	Quasi-peak	43.5 dBµV/m
216 MHz to 960 MHz	Quasi-peak	46 dBµV/m
960 MHz to 1 GHz	Quasi-peak	54 dBµV/m
1 GHz to 26 GHz	Peak	74 dBµV/m
26 to 40 GHz	Peak	68.23 dBµV/m (*) OR 74 dBµV/m (**)
1 to 40 GHz	Average	54 dBµV/m (**)

(*) Radiated emissions which fall in the non-restricted bands.

(**) Radiated emissions which fall in the restricted bands, as defined in §15.205(a).

Frequency range 30 MHz - 1 GHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No spurious frequencies at less than 20 dB below the limit.

Measurement Uncertainty (dB): <± 5.08

Frequency range 1 - 40 GHz

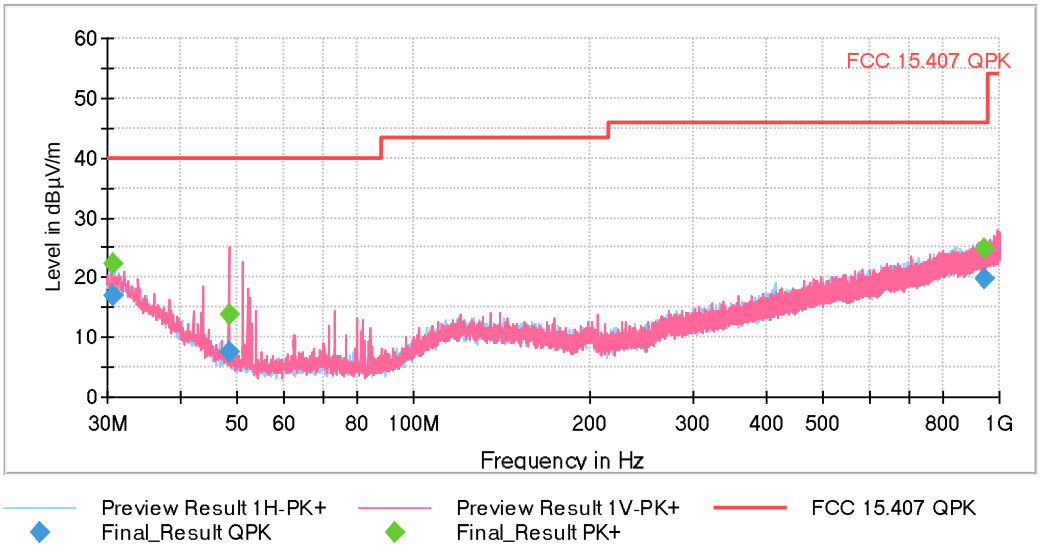
Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
8.9996	47.17	V	Peak	<± 5.13
10.3984	54.24	V	Peak	<± 5.13
34.1994	51.15	V	Peak	<± 5.14
39.5906	58.95	V	Peak	<± 5.14
	48.91		Average	<± 5.14

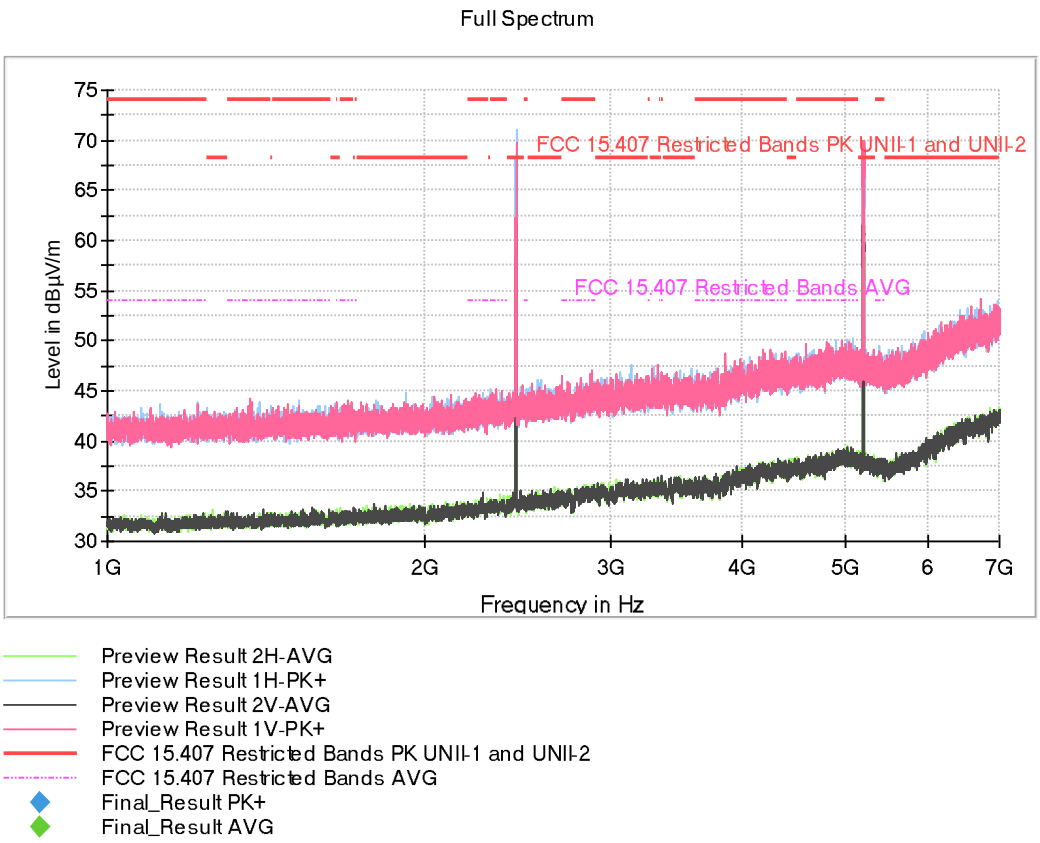
Measurement Uncertainty (dB): 1 GHz – 17 GHz <± 5.13
17 GHz – 26.5 GHz <± 4.82
26.5 GHz – 40 GHz <± 5.14

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz



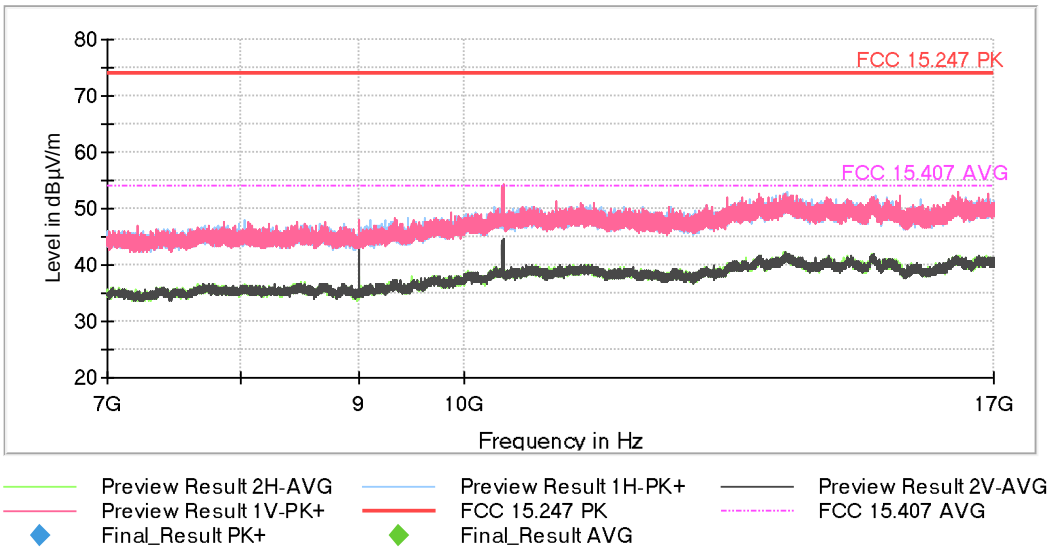
FREQUENCY RANGE 1 – 7 GHz



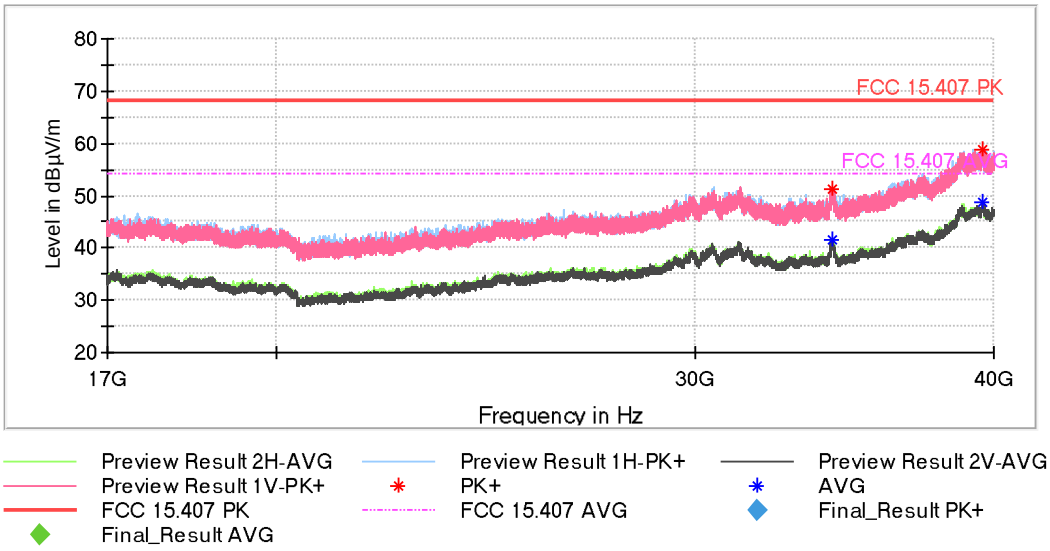
The peaks on the left above the highest limit are the Bluetooth EDR, WLAN 2.4 GHz carrier frequencies.

The peak on the right above the highest limit is the WLAN 5 GHz band U-NII-1 carrier frequency.

FREQUENCY RANGE 7 - 17 GHz



FREQUENCY RANGE 17 - 40 GHz



- **Co-location mode Bluetooth EDR, 802.11 b, U-NII-3 802.11 a20.**

Bluetooth EDR:	Middle Channel (2440 MHz). Basic Rate. GFSK.
802.11 b:	Middle Channel (2437 MHz). BW: 20 MHz. 6 Mbps.
U-NII-3 802.11 a20:	Middle Channel (5785 MHz). BW: 20 MHz. 6 Mbps.

LIMIT: The spurious frequencies were measured at 3 meter. The limit of the test is determined by:

Frequency Range	Detector	Limit at 3m (dBµV/m)
30 MHz to 88 MHz	Quasi-peak	40 dBµV/m
88 MHz to 216 MHz	Quasi-peak	43.5 dBµV/m
216 MHz to 960 MHz	Quasi-peak	46 dBµV/m
960 MHz to 1 GHz	Quasi-peak	54 dBµV/m
1 GHz to 26 GHz	Peak	74 dBµV/m
26 to 40 GHz	Peak	68.23 dBµV/m (*) OR 74 dBµV/m (**)
1 to 40 GHz	Average	54 dBµV/m (**)

(*) Radiated emissions which fall in the non-restricted bands.

(**) Radiated emissions which fall in the restricted bands, as defined in §15.205(a).

Frequency range 30 MHz - 1 GHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No spurious frequencies at less than 20 dB below the limit.

Measurement Uncertainty (dB): <± 5.08

Frequency range 1 - 40 GHz

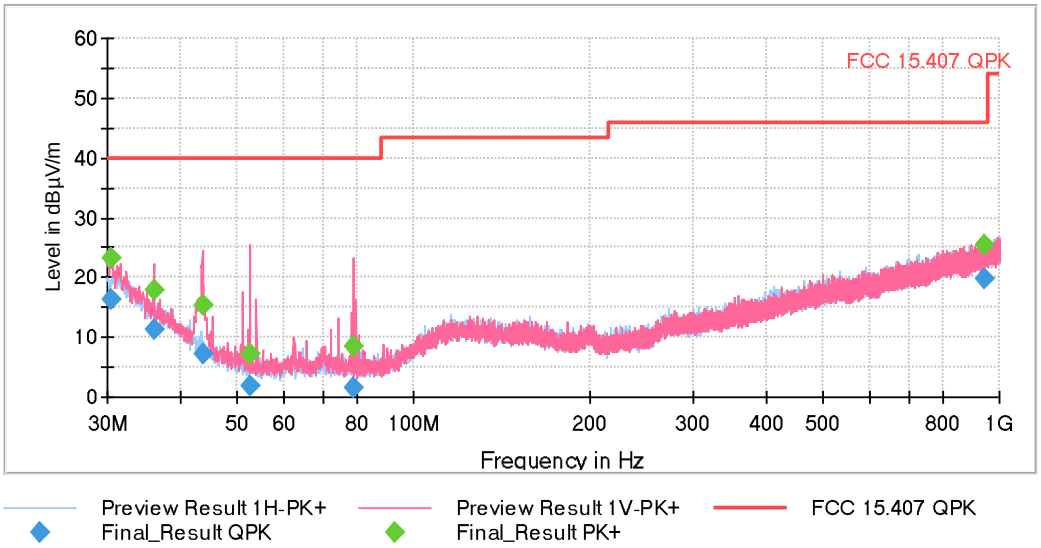
Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
8.9996	47.92	V	Peak	<± 5.13
34.204	51.57	H	Peak	<± 5.14
39.5921333	58.09	H	Peak	<± 5.14
	48		Average	<± 5.14

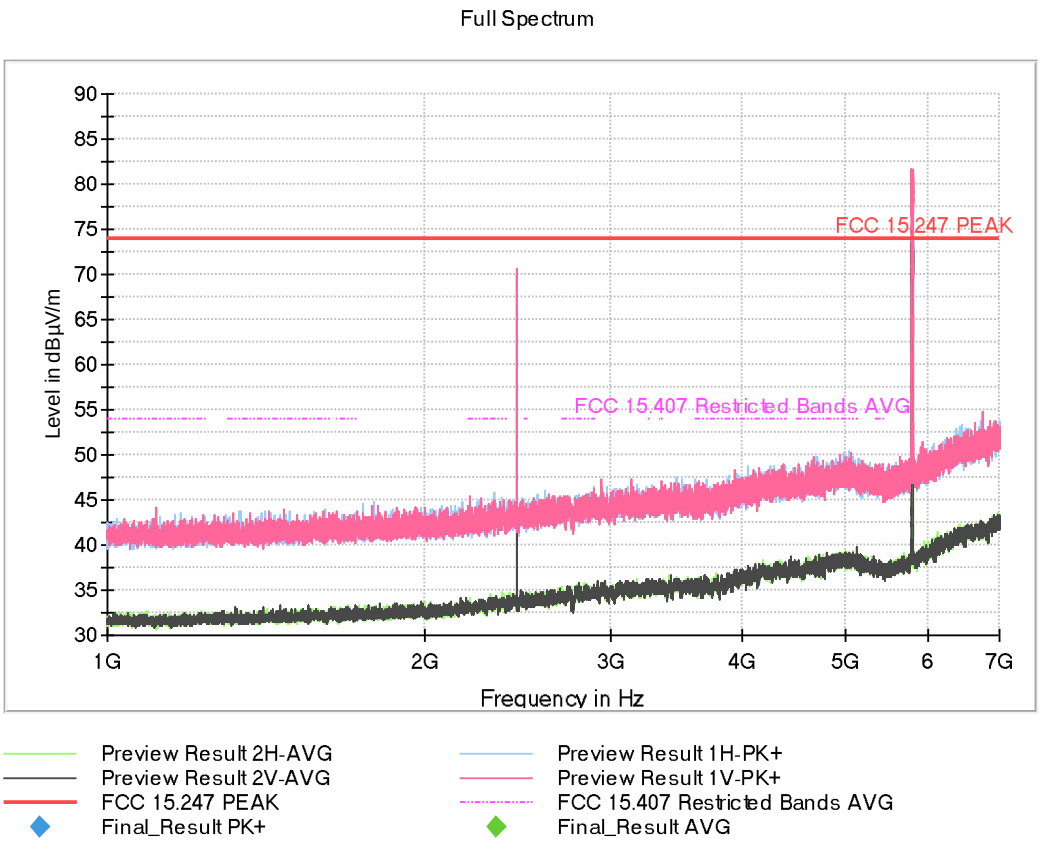
Measurement Uncertainty (dB): 1 GHz – 17 GHz <± 5.13
17 GHz – 26.5 GHz <± 4.82
26.5 GHz – 40 GHz <± 5.14

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz



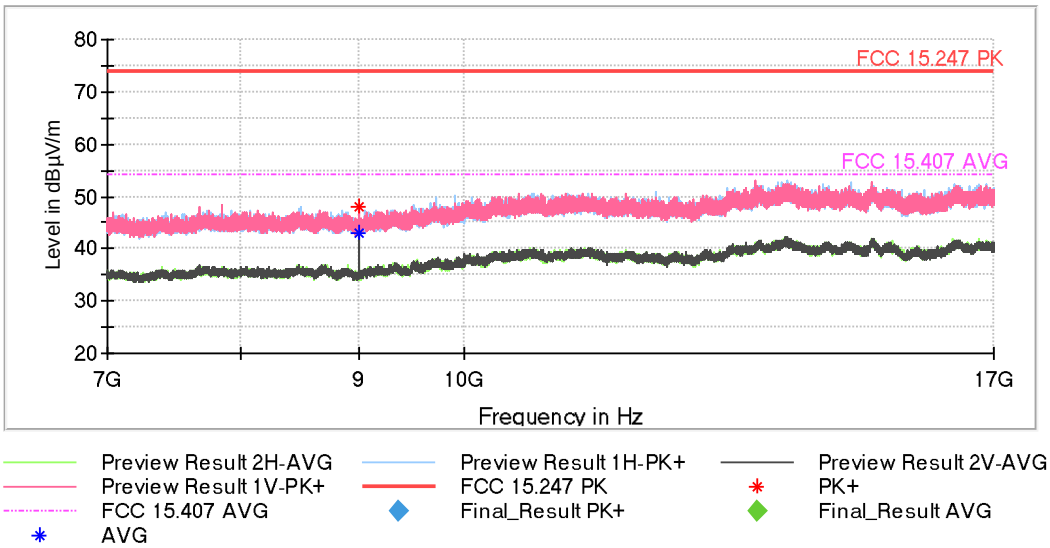
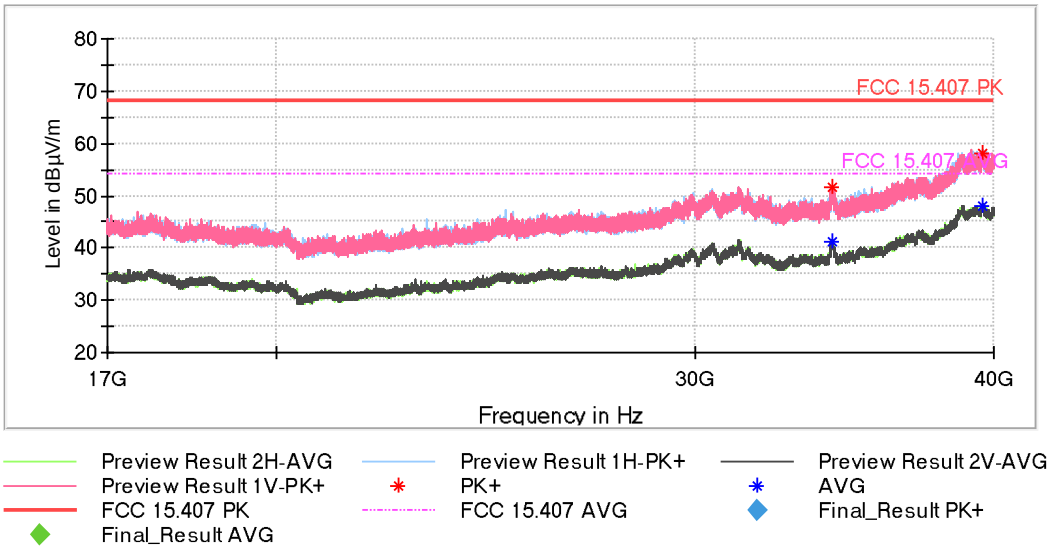
FREQUENCY RANGE 1 – 7 GHz



The peak on the left above the highest limit are the Bluetooth EDR, WLAN 2.4 GHz carrier frequencies.

The peak on the right above the highest limit is the WLAN 5 GHz band U-NII-3 carrier frequency.

FREQUENCY RANGE 7 - 17 GHz



FREQUENCY RANGE 17 - 40 GHz