DEKRA Certification, Inc.
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United States of America

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test report No:
3669ERM.008

Partial Test report

USA FCC Part 15.247, 15.407 15.209, 15.207
CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Infotainment Head Unit
(*) Trademark	BMW
(*) Model and /or type reference tested	IDC23H
Other identification of the product	FCC ID: T8GIDC23H IC: 6434A-IDC23H
(*) Features	Bluetooth classic; BLE; Wi-Fi 2.4GHz; Wi-Fi 5GHz; GNSS
Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH Becker-Goering-Str. 16 76307, Karlsbad, GERMANY
Test method requested, standard	USA FCC Part 15.247, 10-1-20 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz USA FCC Part 15.407 10-1-20 Edition : Unlicensed National Information Infrastructure Devices. General technical requirements. USA FCC Part 15.209 10-1-20 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). 558074 D01 15.247 Meas Guidance v05r02. Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under section §15.247 of the FCC Rules ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	See Appendix A
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=DEKRA Certification Inc., ou=Regulatory Lab, email=dgalvez@dekra.com, c=US Date: 2022.08.19 14:57:08 -04'00'
Date of issue	08-18-2022
Report template No	FDT08_23 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

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

DEKRA Certification Inc. 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 Certification at the time of performance of the test.

DEKRA Certification Inc. 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.

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 Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Certification internal document PODT000.

Test case	Frequency (MHz)	U (k=2)	Units
Radiated Spurious Emission	30-180	4.27	dB
	180-1000	3.14	dB
	1000-18000	3.30	dB
	18000-40000	3.49	dB

Data provided by the client

The sample consists of an Infotainment Head Unit. The main functionalities are: Navigation, USB, voice recognition and several interfaces to the vehicle and Bluetooth / WLAN. The Head-unit provides different interfaces like: AR-CAM input, Video-out APIX3 (for the connection of an external Display), 3 USB interfaces.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples used for 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
3669/03	Infotainment Head Unit	IDC23H High 8155	B44439N035900012	04/07/2022
3669/08	Quad mate AXZ - High speed Fakra to SMA (male)	MGU22 RF	-	04/07/2022
3669/11	BT/WLAN Antenna with SMA (male) connector	λ/4 coax cable antenna BM	-	04/07/2022

Sample S/01 is composed of the following accessories:

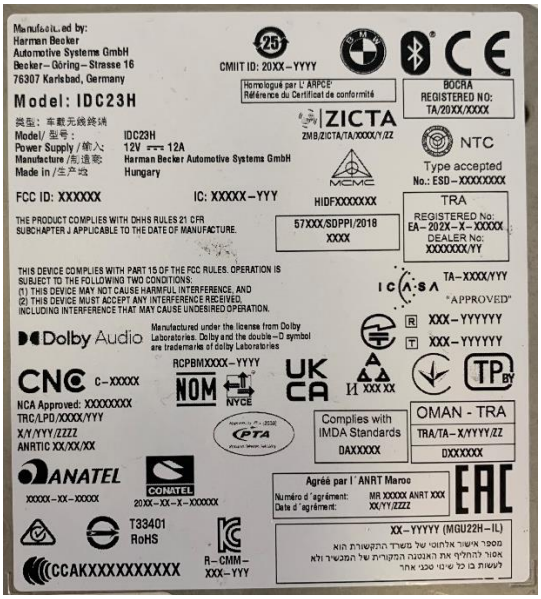
Control Nº	Description	Model	Serial Nº	Date of reception
3669/05	Harness	-	-	04/07/2022
3669/35	BR-Adapter	Harman	-	04/07/2022
3669/39	Plug cable for BR-Adapter	Harman	-	04/07/2022
3669/41	HSD (male) to OABR cable	Harman		04/07/2022

Sample S/01 was used for following test(s): All Radiated tests indicated in appendix A.

Test sample description

Ports…… :	Port name and description	Cable					
		Specified length [m]	Attached during test	Shielded	Coupled to patient		
	BT/Wifi Antenna	2	☒	☐	☐		
	USB1/2	2	☒	☐	☐		
	Power	2	☒	☐	☐		
	CID	2	☒	☐	☐		
	AR-Cam	2	☒	☐	☐		
	100 Base T1/1G Base T1/GPS/DCS/HUD/DFE	2	☒	☐	☐		
Supplementary information to the ports…… :	N/A						
Rated power supply .....:	Voltage and Frequency	Reference poles					
		L1	L2	L3	N	PE	
	☐ AC:	☐	☐	☐	☐	☐	
	☐ AC:	☐	☐	☐	☐	☐	
	☒ DC: 8 - 16 Vdc						
	☐ DC:						
Rated Power .....:	No Data Provided						
Clock frequencies.....:	No Data Provided						
Other parameters .....:	No Data Provided						
Software version .....:	22w05.3-1-21						
Hardware version .....:	5.1.5						
Dimensions in cm (W x H x D) ....:	No Data Provided						
Mounting position .....:	☐ Table top equipment						
	☐ Wall/Ceiling mounted equipment						
	☐ Floor standing equipment						
	☐ Hand-held equipment						
	☒ Other: Automotive						

Modules/parts.....:	Module/parts of test item	Type	Manufacturer
	N/A		
Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	N/A		
Documents as provided by the applicant .....:	Description	File name	Issue date
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data IDC23_8155_20220318	04/01/2022
Copy of marking plate:			



Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
Becker-Goering-Str. 16
76307, Karlsbad, GERMANY.

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	06-28-2022
Date (finish)	07-06-2022

Document history

Report number	Date	Description
3669ERM.008	08-18-2022	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. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

1. The tests have been performed by the technical personnel: Nasir Khan and Koji Nishimoto.

Testing verdicts

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

Summary

FCC PART 15 PARAGRAPH / RSS-247 (Bluetooth BR/EDR)					
Report Section	**15.247 Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
-	§ 2.1049 & § 15.247 (a) (1)	RSS-247 5.1 (b)	20dB Emission Bandwidth, Occupied Bandwidth & Carrier Frequency Separation	N/M	Refer 1
-	§ 15.247 (a) (1) (iii)	RSS-247 5.1 (d)	Number of hopping channels	N/M	Refer 1
-	§ 15.247 (a) (1) (iii)	RSS-247 5.1 (d)	Time of Occupancy (Dwell Time)	N/M	Refer 1
-	§ 15.247 (b) (3)	RSS-247 5.4 (b)	Maximum peak conducted output power and antenna gain	N/M	Refer 1
-	§ 15.247 (d)	RSS-247 5.5	Band-edge conducted emissions compliance (Transmitter)	N/M	Refer 1
-	§ 15.247 (d)	RSS-247 5.5	Emission limitations Conducted (Transmitter)	N/M	Refer 1
A.1	§ 15.247 (d)	RSS-247 5.5	Emission limitations Radiated (Transmitter)	P	N/A
Supplementary information and remarks: 1) Only multi-transmitter radiated spurious emission test was requested.					

FCC PART 15 PARAGRAPH (Wi-Fi 2.4GHz)					
Report Section	**15.247 Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
-	§ 2.1049 & §15.247 (a) (2)	RSS-247 5.2 (a)	99% Occupied Bandwidth & 6dB Bandwidth	N/M	Refer 1
-	§ 15.247 (b)	RSS-247 5.4 (d)	Maximum Output Power and antenna gain	N/M	Refer 1
-	§ 15.247 (d)	RSS-247 5.5	Band-edge conducted emissions compliance (Transmitter)	N/M	Refer 1
-	§ 15.247 (e)	RSS-247 5.2 (b)	Power Spectral Density	N/M	Refer 1
-	§15.247(d)	RSS-247 5.5	Emission limitations Conducted (Transmitter)	N/M	Refer 1
A.1	§15.247 (d)	RSS-247 5.5	Emission limitations Radiated (Transmitter)	P	N/A
Supplementary information and remarks: 1) Only multi-transmitter radiated spurious emission test was requested.					

FCC PART 15 PARAGRAPH / RSS-247 (Wi-Fi 5GHz) UNII-1 5.150 - 5.250 GHz Band, UNII-3 5.725 - 5.825 GHz Band					
Report Section	**15.407 Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
	§ 15.403 KDB 789033 D02	RSS 247 6.2.4	26dB Emission Bandwidth & Occupied Bandwidth	N/M	Refer 1
	§ 15.407 (e)	RSS 247 6.2.4.1	6dB Bandwidth	N/M	Refer 1
	§ 15.407 (a)(3)	RSS 247 6.2.4.1	Power Limits. Maximum Output Power	N/M	Refer 1
	§ 15.407 (a)(3)	RSS-247 6.2.4.1	Maximum Power Spectral Density	N/M	Refer 1
	§ 15.407 (b)(4)	RSS-247 6.2.4.2	Band-edge conducted emissions compliance (Transmitter)	N/M	Refer 1
	§ 15.407 (b)(6) § 15.207	RSS-Gen 8.8	Emission limitations Conducted (Transmitter)	N/M	Refer 1
A.1	§ 15.407 (b)(4),(7) § 15.209 § 15.205	RSS-247 6.2.4.2 RSS-Gen 8.9 & 8.10	Undesirable radiated emissions (Transmitter)	P	N/A
	§ 15.407 (g)	RSS-Gen 6.11 & 8.11	Frequency Stability	N/M	Refer 1
Supplementary information and remarks: 1) Only multi-transmitter radiated spurious emission test was requested.					

List of equipment used during the test

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
0981	RF pre-amplifier	Bonn Elektronik	BLMA0118-2A	2020/11	2022/11
1012	EMI Test Receiver	Rohde & Schwarz	ESR26	2022/04	2024/04
1014	FSV40 Signal Analyzer 40GHz	Rohde & Schwarz	FSV40	2021/05	2023/05
1055	3116C Double-Ridged Waveguide Horn Antennas	ETS Lindgren	3116C	2019/12	2022/12
1057	Double-ridge Waveguide Horn antenna	ETS Lindgren	3115	2020/06	2023/06
1065	Biconical Log antenna	ETS Lindgren	3142E	2020/08	2023/08
1108	Ethernet SNMP Thermometer- CR Room	HW Group	HWg-STE Plain	2020/08	2022/08
1111	Ethernet SNMP T Thermometer	HW Group	HWg-STE Plain	2020/08	2022/08
1179	Semi anechoic Absorber Lined Chamber	Frankonia	SAC 3 plus “L”	N/A	N/A
1314	Wireless Measurement Software R&S EMC32	Rohde & Schwarz	N/A	N/A	N/A

Appendix A: Test results (Multi-transmitter)

Appendix A Content

PRODUCT INFORMATION

Information	Description
Modulation	BR/EDR: GFSK, π/4-DQPSK, 8-DPSK Wi-Fi 2.4 GHz: DSSS, OFDM, MIMO-OFDM Wi-Fi 5 GHz: DSSS, OFDM, MIMO-OFDM
Operation mode 1: Single Antenna Equipment	
- Operating Frequency Range	BR/EDR: 2400 - 2483.5 MHz Wi-Fi 2.4 GHz: 2.402 - 2.483.5 GHz Wi-Fi 5 GHz: 5.150 - 5.250 GHz 5.725 - 5.875 GHz
- Nominal Channel Bandwidth	BR/EDR: 1 MHz Wi-Fi 2.4 GHz: 20MHz, 40MHz Wi-Fi 5GHZ: 20MHz, 40MHz, 80MHz
- RF Output Power	BR/EDR: 4 dBm Wi-Fi 2.4 GHz: 14 dBm Wi-Fi 5 GHz: 14 dBm (Beamforming)
Antenna type	1/4 wave coax
Antenna gain	BR/EDR: -2.5 dBi Wi-Fi 2.4 GHz: -2.5 dBi Wi-Fi 5 GHz: -2.8 dBi
Nominal Voltage	
- Supply Voltage	12 Vdc
- Type of power source	DC voltage
Equipment type	Bluetooth, Wi-Fi 2.4 GHz, and Wi-Fi 5 GHz
Geo-location capability	No

DESCRIPTION OF TEST CONDITIONS

<table>
<tr><th>TEST CONDITIONS</th><th>DESCRIPTION</th></tr>
<tr><td>TC#01(1)</td><td>
Power supply (V):
DC 12 V

Test Frequencies for Radiated tests:
<table>
<tr><th>Technology</th><th>Tested Frequency</th><th>BW (MHz)</th><th>Modulation</th><th>Mode</th></tr>
<tr><td>Bluetooth</td><td>2402</td><td>3</td><td>FHSS</td><td>8DPSK</td></tr>
<tr><td>Wi-Fi 2.4 GHz MIMO (non - beamforming)</td><td>2437</td><td>20</td><td>OFDM</td><td>b mode</td></tr>
</table>
The test was performed with the equipment transmitting with Bluetooth and Wi-Fi 2.4GHz radios simultaneously. These measurements have been performed in order to check the impact of the multi-transmitter of all radio interfaces that can be transmitting simultaneously.
</td></tr>
<tr><td>TC#02(1)</td><td>
Power supply (V):
DC 12 V

Test Frequencies for Radiated tests:
<table>
<tr><th>Technology</th><th>Tested Frequency</th><th>BW (MHz)</th><th>Modulation</th><th>Mode</th></tr>
<tr><td>Bluetooth</td><td>2402</td><td>3</td><td>FHSS</td><td>8DPSK</td></tr>
<tr><td>Wi-Fi 5 GHz MIMO (non-beamforming)</td><td>5180</td><td>20</td><td>OFDM</td><td>a mode</td></tr>
</table>
The test was performed with the equipment transmitting with Bluetooth and Wi-Fi 5GHz radios simultaneously. These measurements have been performed in order to check the impact of the multi-transmitter of all radio interfaces that can be transmitting simultaneously.
</td></tr>
</table>

Note (1): Preliminary scan was performed to determine the worst case between two SISO ports (2.4 GHz or + 5 GHz) and MIMO (2.4 GHz or 5 GHz) ports. The following tables and plots show the results for the worst case in MIMO (2.4 GHz or 5 GHz) + BT.

TEST A.1: EMISSION LIMITATIONS RADIATED (TRANSMITTER)

LIMITS:	Product standard:	Part 15 Subpart C §15.247, Part 15.31(h), and RSS-247
	Test standard:	Part 15 Subpart C §15.247 (d) and RSS-Gen 8.9 and 8.10

LIMITS

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) (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	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	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.

TEST SETUP

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and 1-18 GHz (Double ridge horn antenna), and 1m for the frequency range 18 GHz- 26 GHz (Double ridge horn antenna).

For radiated emissions in the range 18 - 26 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.

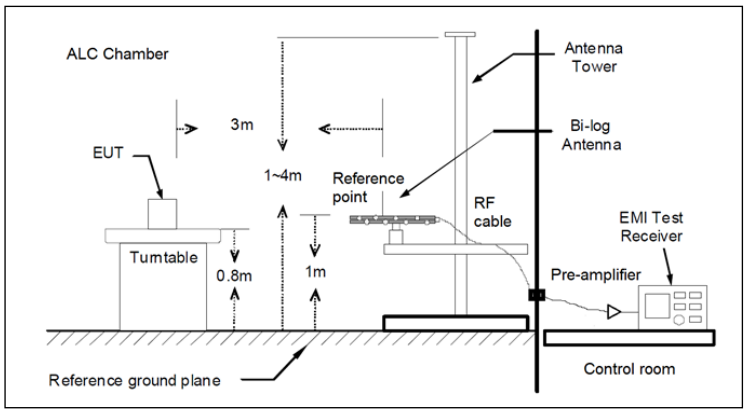
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

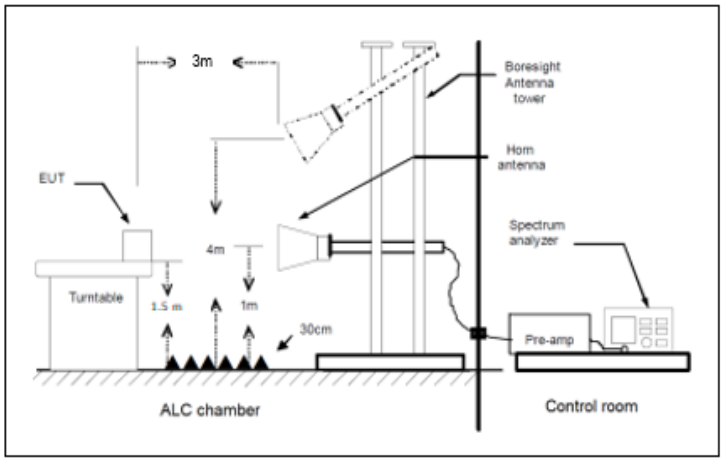
The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

TEST SETUP (CONT.)	

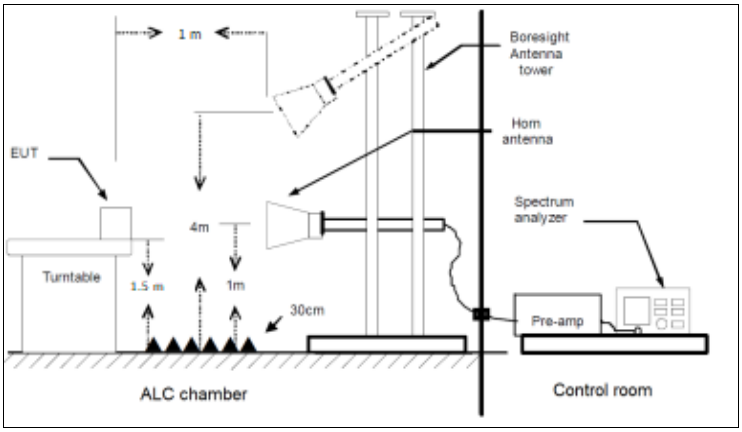
Radiated measurements Setup f < 1 GHz



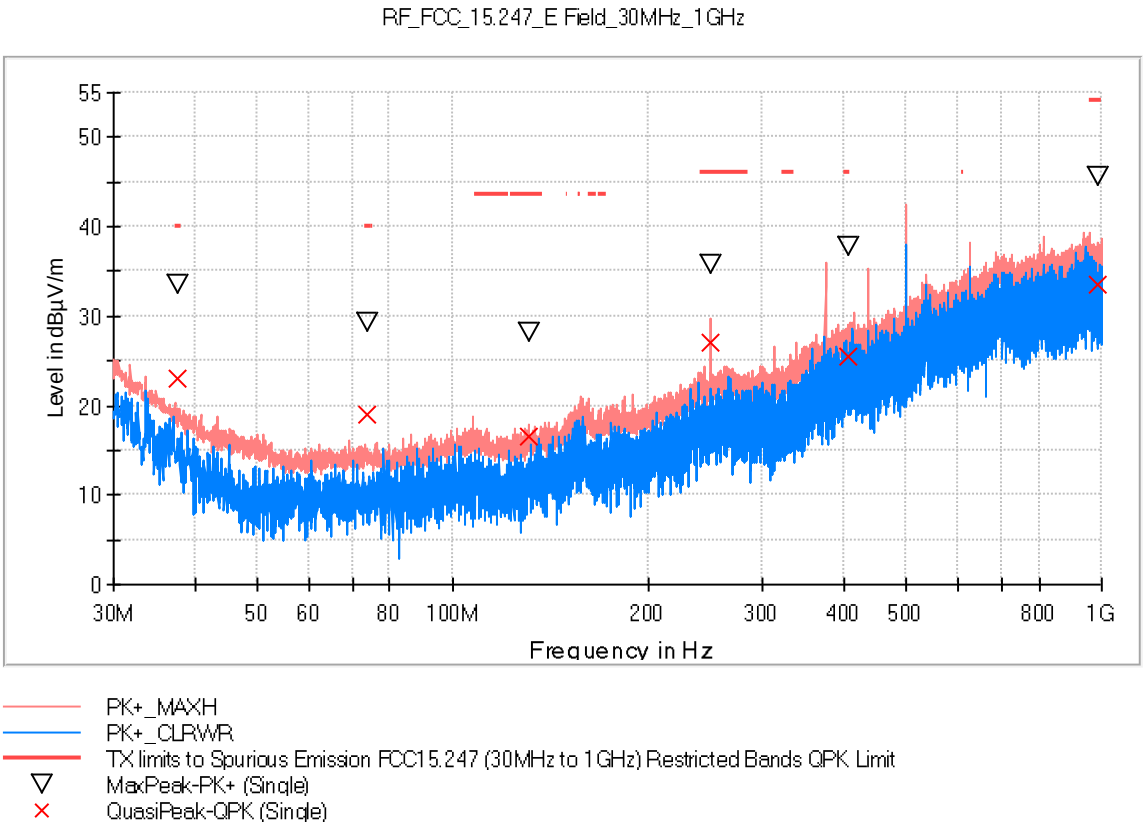
Radiated measurements setup f > 1-18 GHz



Radiated measurements setup f > 18 GHz



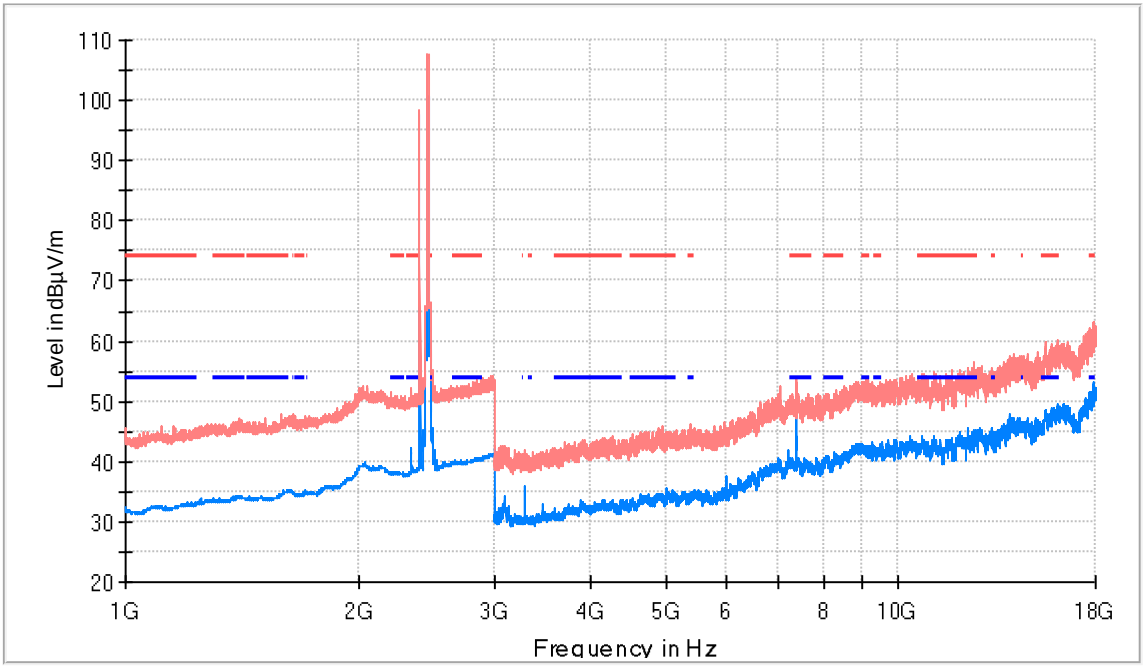
TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS :	30-1000 MHz



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)
37.663000	33.4	23.0	H	17.0	40.0
73.844000	29.4	19.0	V	21.0	40.0
131.268000	28.1	16.5	V	27.0	43.5
249.996000	35.8	27.1	V	18.9	46.0
405.875000	37.7	25.4	H	20.6	46.0
985.741000	45.6	33.5	V	20.5	54.0

TEST RESULTS (Cont.):	1-18 GHz

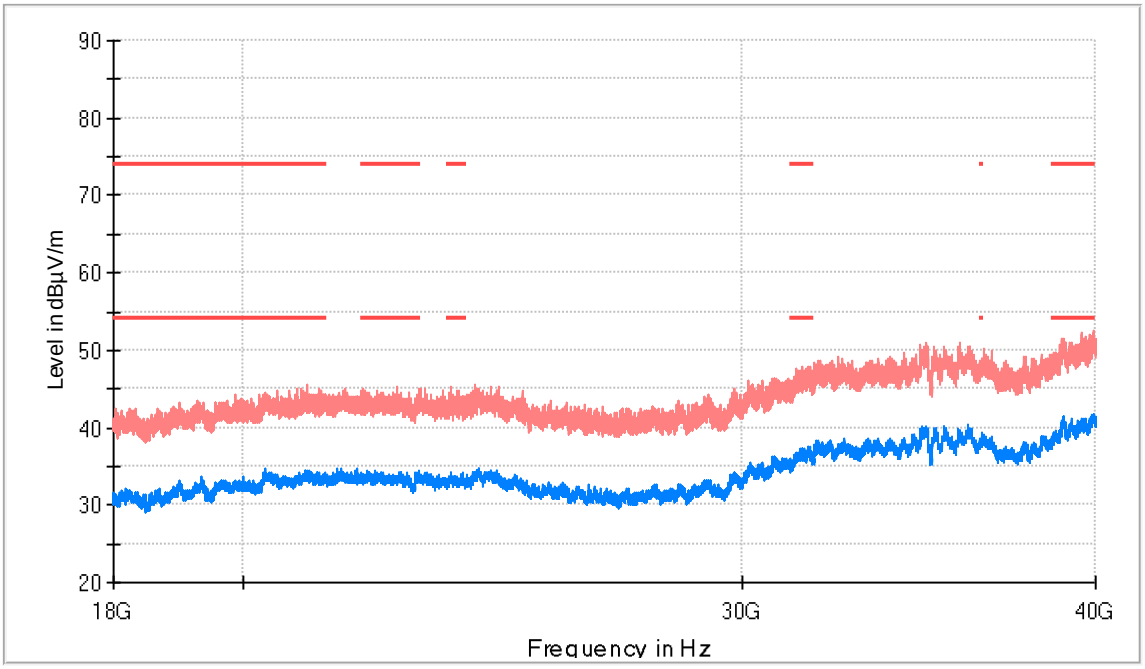


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands AVG Limit

Final Result

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2402.000000	98.2	97.6	H	---	---	BT Fundamental
2463.000000	107.5	100.7	H	---	---	Wi-Fi Fundamental
2488.000000	58.0	51.0	H	3.0	54.0	
7387.500000	53.7	47.1	H	6.9	54.0	
17936.000000	63.1	53.1	V	0.9	54.0	

TEST RESULTS (Cont.):	18 – 26 GHz

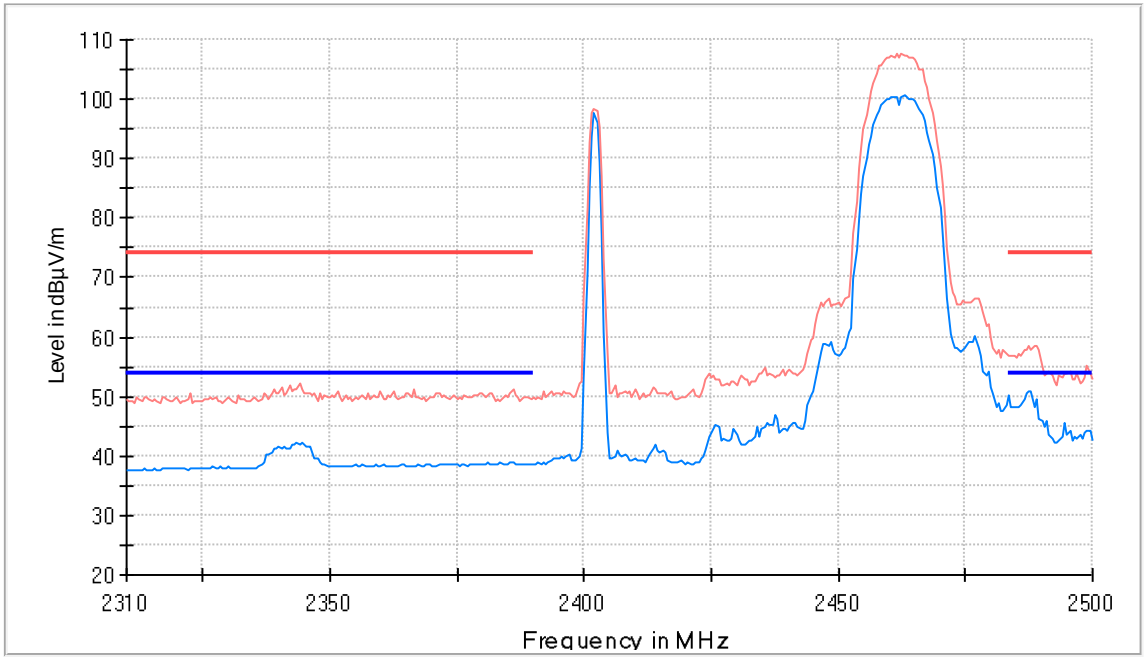


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.247 (1-40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.247 (1-40 GHz) Restricted Bands AVG Limit

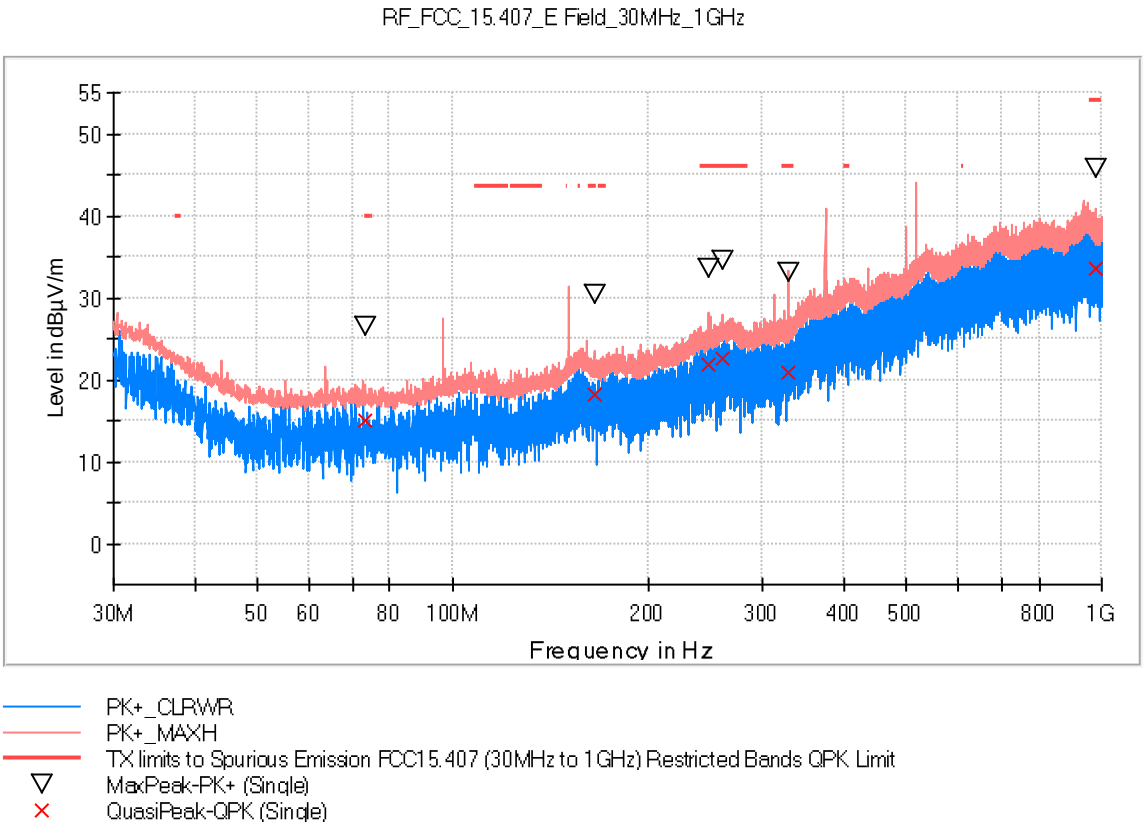
Final Result

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
39962.875000	50.3	41.8	V	12.2	54.0

TEST RESULTS (Cont.):	Restricted Bands (2.31 GHz – 2.5 GHz)



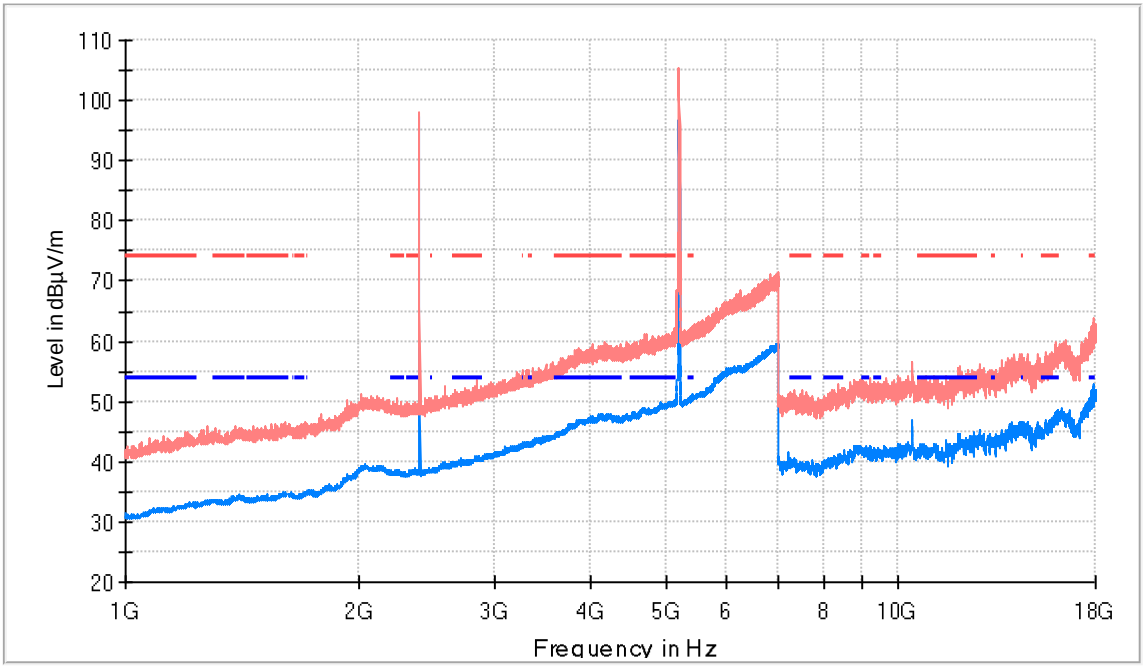
TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#02
TEST RESULTS :	30-1000 MHz



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)
73.359000	26.4	15.0	V	-180.0	25.0
164.830000	30.2	18.1	V	-180.0	25.4
248.347000	33.6	21.8	V	133.0	24.2
260.132500	34.4	22.6	V	133.0	23.4
328.760000	33.1	20.9	H	-46.0	25.1
980.939500	45.7	33.6	V	133.0	20.4

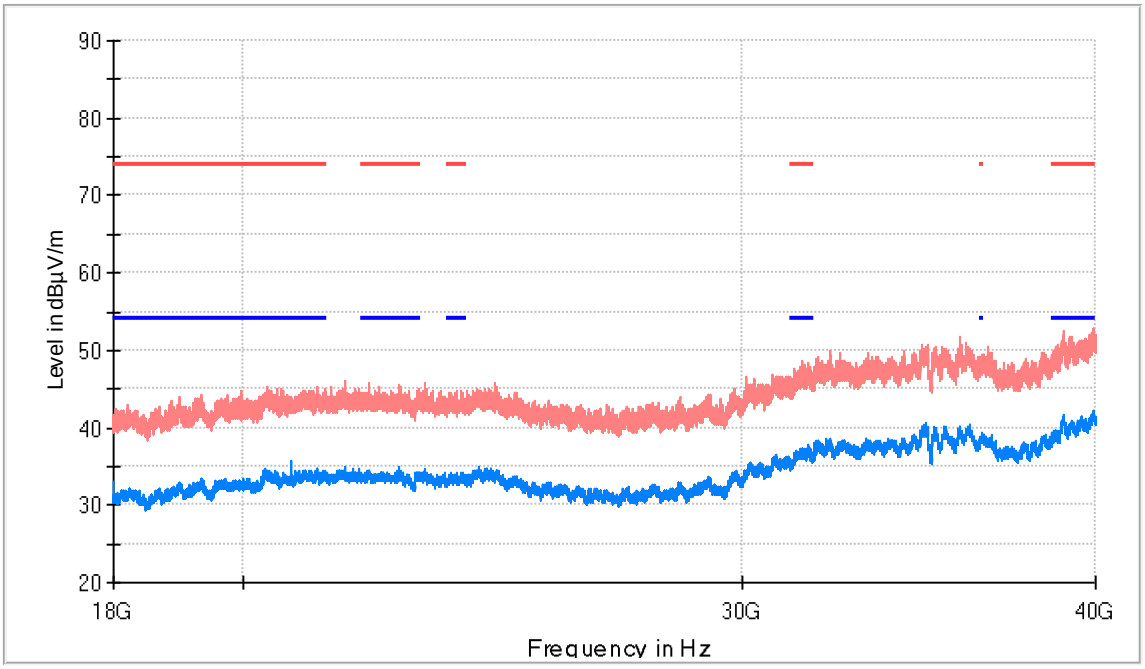
TEST RESULTS (Cont.):	1-18 GHz



Final Result

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2402.000000	98.2	97.5	H	---	---	BT Fundamental
5195.000000	105.5	95.1	H	---	---	Wi-Fi Fundamental
17916.500000	62.2	52.7	H	1.3	54.0	

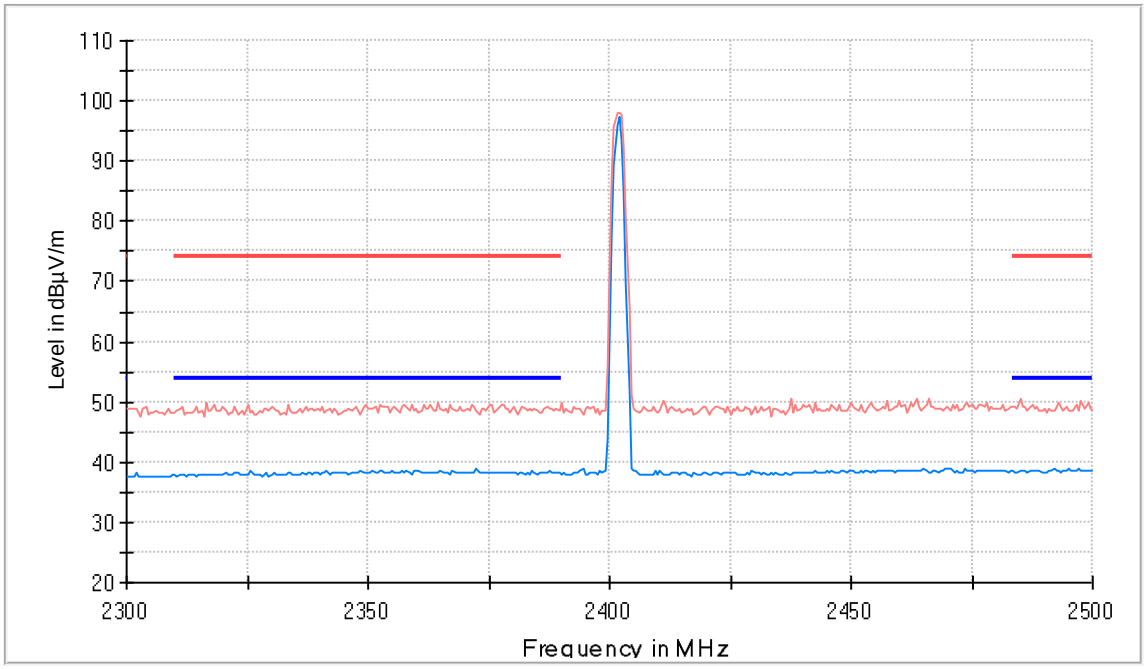
TEST RESULTS (Cont.):	18 – 40 GHz



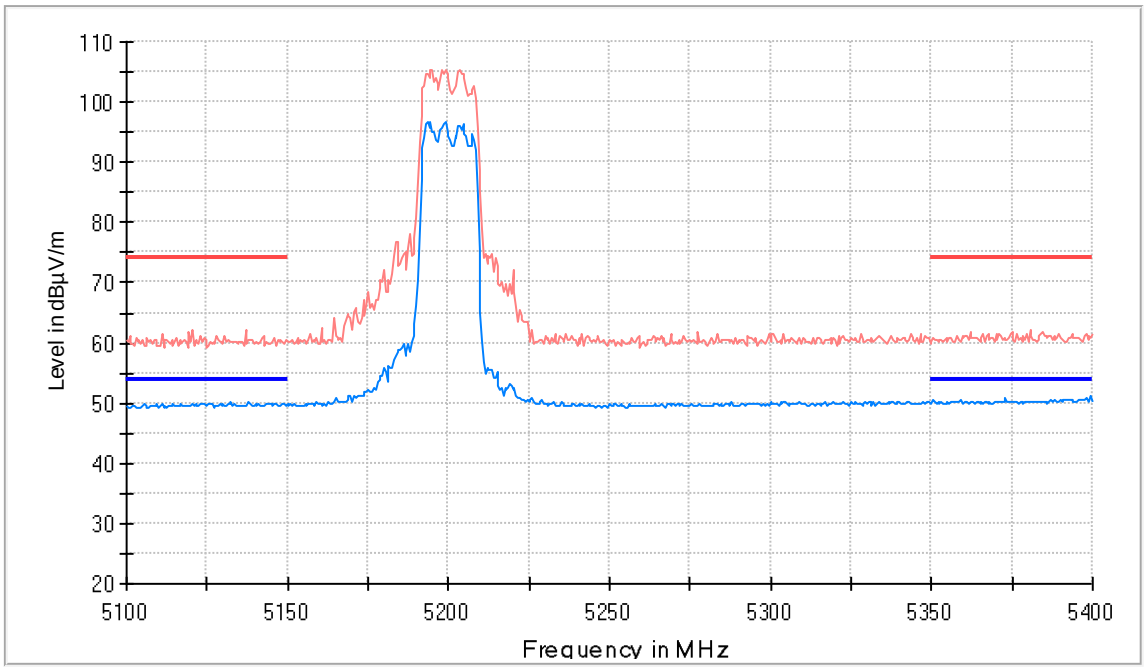
Final Result

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
39929.187500	50.4	42.4	H	11.6	54.0

TEST RESULTS (Cont.):	Restricted Bands (2.3 GHz – 2.5 GHz)



TEST RESULTS (Cont.):	Restricted Bands (5.1 GHz – 5.4 GHz)



AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.407 (1 GHz to 40 GHz) Restricted Bands PK Limit
TX limits to Spurious Emission FCC15.407 (1 GHz to 40 GHz) Restricted Bands AVG Limit