DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
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C.I.F. A29 507 456

Test report No:
72779REM.002A1

Test report

FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)

(*) Identification of item tested	Telematic control unit with wireless technologies, used in automotive industry
(*) Trademark	VW AG
(*) Model and /or type reference	CONBOX HIGH RD
Other identification of the product	FCC ID: T8GCONBOXRD Contains FCC ID: QIPALAS66A-US IC: 6434A-CONBOXRD Contains IC: 7830A-ALAS66AUS
(*) Features	GSM, UMTS, LTE, GNSS, Wi-Fi, BTLE, BT_EDR HW version: 045 SW version: 0494
Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16 76307, KARLSBAD, GERMANY
Test method requested, standard	FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2023-04-12
Report template No	FDT08_24 (*) "Data provided by the client"

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Acronyms

Acronym ID	Acronym Description
Code	EMC Test Code
Freq Rng	Frequency Range
MP	Measurement Point
OM	Operation Mode
S/	Sample
V	Verdict
RE	Radiated Emission
LR	Low Range
HR	High Range

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.

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.
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Uncertainty

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

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1000 MHz is I = ± 4,9 dB for quasi-peak measurements, I = ± 4,6 dB for peak measurements (k= 2).

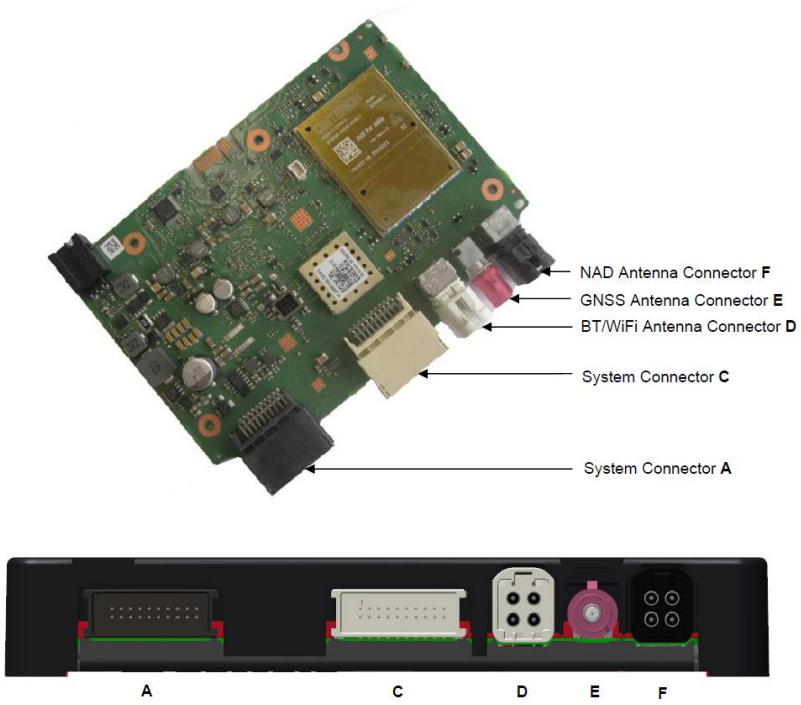
The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 1000 MHz to 26 GHz is I = ± 2,6 dB for peaks and average measurements (k = 2).

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 consists of a Telematics control unit with wireless technologies, used in automotive, equipped with one modem, OEM. This unit was designed for automotive usage and contains the following features: GSM, UMTS, LTE, GNSS, Wifi (a, b, g, n, ac), Bluetooth Low Energy (BTLE) and Bluetooth EDR.



3. Declaration of Comparability

Declaration of Comparability

HARMAN BECKER
Automotive Systems GmbH
Becker-Göring-Str. 16
D-76307 Karlsbad, Germany

declares under our sole responsibility, that the product

Description of object	:	Telematic system with BT, WLAN, GNSS, GSM, UMTS, LTE
Brand/ Customer	:	VW-Group / VW AG/ Audi
Model name **Variant**	:	CONBOX-HIGH RD A970, A971, A972, A973, A974, A975, A976, A977, A978, A979, A980, A981, A982, A983, A984, P114, P115, P119
Hardware / Software version	:	045 / 0489 **(corresponds CL37)**

is comparable to:

Description of object	:	Telematic system with BT, WLAN, GNSS, GSM, UMTS, LTE
Customer / Brand	:	VW-Group / VW AG/ Audi
Model **Variant**	:	CONBOX-HIGH RD A970, A971, A972, A973, A974, A975, A976, A977, A978, A979, A980, A981, A982, A983, A984, P114, P115, P119
Hardware / SW	:	045 / 0494 **(corresponds CL37)**

We declare as authorized responsible person, that the products above have HW and SW changes which have no impact for the certification activities.

The HW version used on CONBOX-HIGH RD will have the same schematics, the same layout, with the same BT/WLAN-Module and the same country specific NAD module and the HW index will remain 045.

The application SW will be changed to 0494 version. These SW changes do not impact the following parameters: used frequency ranges / used frequency bands, the used modulation type, the maximum RF power, the circumstances under which the transmitter operates, the basic frequency and/or stabilizing circuitry, frequency multiplication stages, the basic modulator circuitry or maximum RF power, the field strength ratings, slew rates for clocking of output pins and drivers.

More details about the HW/SW updates are included in: "CON-BOX-HIGH-RD_temp_test_20230120".

In conclusion, we can say the new SW/HW configuration do not influence the type-approval for all variants (listed above) on CONBOX-High RD - Cluster 37 (045/0494).

Declared by: **checked by: Thomas Roesch (S-PM) / 28.03.2023**

Mr. STOICA Iulian, Product Compliance Expert

Bucharest	28.03.2023	
(Place)	(Date)	(Signature)

Mr. OLTEANU Marius, Product Compliance Expert.

Bucharest	28.03.2023	
(Place)	(Date)	(Signature)

HW Changes on TCU side

From HW perspective, the main modifications are :
- replacing of unnecessary coupling capacitors C5940/C5941 220nF in PCIe bus with 0 Ohm resistors
- coupling capacitors are already on Qisda NXP module, therefore not needed on main PCB
- no change is made on the layout of main PCB.

The HW version used on CONBOX-HIGH RD will have the same schematics, the same layout, with the same BT/WLAN-Module and the same country specific NAD module and the HW index will remain 045.

SW Changes on TCU side

From SW perspective, the main updates are :
- change of BT/Wifi driver
- change of PCIe speed

There have been:
- No changes of the used frequency ranges / bands
- No changes of the used modulation type
- No changes of the maximum RF power
- No changes of the circumstances under which the transmitter operates
- No changes of the basic frequency and/or stabilizing circuitry
- No changes of the frequency multiplication stages
- No changes of the basic modulator circuitry or maximum RF power
- No changes of the field strength ratings
- No changes of slew rates for clocking of output pins and drivers

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	72779_78.1	Telematic control unit	CONBOX HIGH RD	35199810517875	2022-10-22	Element Under Test
S/01	72779_76.1	Box with EMC setup	---	---	2022-10-19	Auxiliary Element

Notes referenced to samples during the project:

None.

Test sample description

Ports……:	Port name and description	Cable						
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)			
	RF connector – code		☐	☒	☐			
	RF connector – code		☒	☒	☐			
	RF connector – code		☒	☐	☐			
Supplementary information to the ports……:								
Rated power supply ..... :	Voltage and Frequency			Reference poles				
				L1	L2	L3	N	PE
	☐	AC:		☐	☐	☐	☐	☐
	☒	DC: 12V car battery (4.8 VDC inside of TCU)						
Rated Power..... :	12V DC							
Clock frequencies..... :	25MHz; 26MHz; 32,768kHz; 49,58MHz;							
Other parameters ..... :	See Technical description							
Software version..... :	0494							
Hardware version ..... :	045							
Dimensions in cm (W x H x D) ... :	--							
Mounting position ..... :	☐	Table top equipment						
	☐	Wall/Ceiling mounted equipment						
	☐	Floor standing equipment						
	☐	Hand-held equipment						
	☒	Other: automotive telematics control unit						
Modules/parts..... :	Module/parts of test item			Type		Manufacturer		
	--			-		-		
	--			-		-		
Accessories (not part of the test item) ..... :	Description			Type		Manufacturer		
	Cable Harness			-		-		
	2G/3G/4G/5G Antenna			-		Hirschmann/ Molex		
	eCall button/LED			-		-		
	SOS Loudspeaker			-		-		
	Wake-up unit Box			-		-		

Documents as provided by the applicant ..... :	Description	File name	Issue date
	Technical Description	-	-

(3) Only for Medical Equipment

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
BECKER-GOERING-STR. 16
76307, KARLSBAD, GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-10-20
Date (finish)	2022-10-20

Document history

Report number	Date	Description
72779REM.002	2022-12-07	First release
72779REM.002A1	2023-04-12	Second release. Modification due to typos.

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. = 860mbar Max. = 1060mbar

In the semianechoic 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. = 860mbar Max. = 1060mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860mbar Max. = 1060mbar

Remarks and comments

The tests have been performed by the technical personnel: Antonio Ruiz.

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P
Partial Passed	P*

List of equipment used during the test

Control No.	Equipment	Model	Manufacturer	Next Calibration
6064	SEMIANECHOIC ABSORBER LINED CHAMBER	SAC-3	FRANKONIA	N/A
6329	SHIELDED ROOM	---	FRANKONIA	N/A
6132	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2023-04-05
6126	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2023-04-05
8866	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2023-09-21
5641	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	EST LINDGREN	2024-09-15
4612	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2024-07-13
9360	PRE-AMPLIFIER G>40dB 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2023-05-11
2942	EMI TEST RECEIVER 20Hz-40GHz	ESU40	ROHDE AND SCHWARZ	2023-11-22
4657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
8856	PRE-AMPLIFIER G>30dB 17-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2023-11-02
4848	MEASUREMENT SOFTWARE EMC/RF	EMC32	ROHDE AND SCHWARZ	N/A

Summary

Test Specification.	Requirement – Test case	Verdict	Remark
FCC CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	RE Radiated emission. Electromagnetic field measure	P	--
	CE Continuous Conducted Emission	N/A	(1)

Supplementary information and remarks:

(1) Not applicable according to standard. The equipment is powered in DC.

Appendix A: Test results

Appendix A content

Description of the operation modes

The operation modes described in this paragraph constitute a functionality of the sample under test for itself.

The operation modes used by the samples to which the present report refers, are shown in the following table:

Id	Description
OM/01	EUT ON. USB transferring data (music input). Display showing the playlist. Bluetooth, WiFi 2.4GHz and WiFi 5GHz OFF. Cellular searching network. GNSS active. Power supply: 12Vdc

Test standards version applied

The product standards and test standards applied for each test cases are shown in the following table:

Product Test Standard	Test standard	Requirement – Test case
FCC CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	RE Radiated emission.

Test Cases Details

RE Radiated emission. Electromagnetic field measure

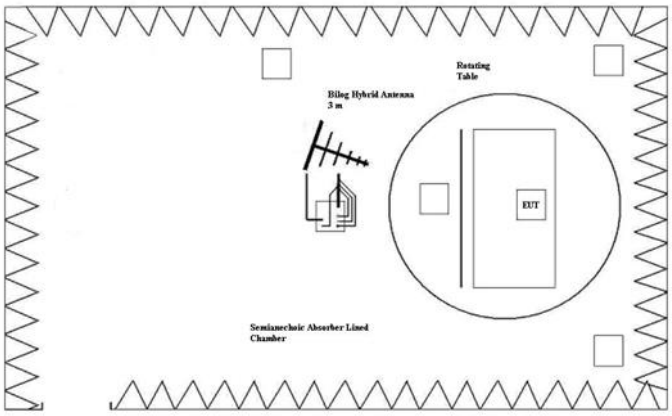
Limits of interference Class B

The applied limit for radiated emissions, 3 m distance, according to the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-21 Edition), Secs. 15.109 & ICES-003 Issue 7 (October 2020)

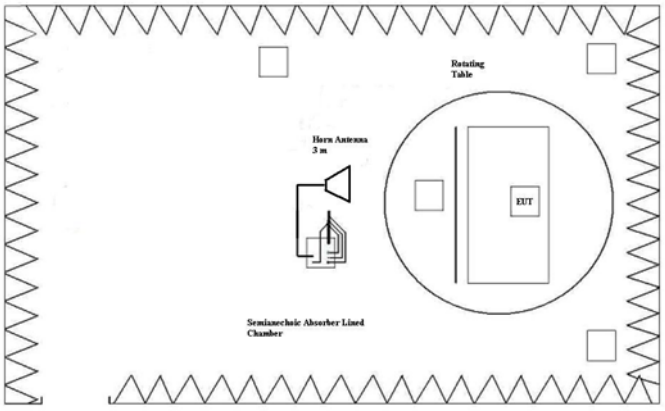
Frequency range (MHz)	FCC Part 15B		ICES-003 Issue 7		FCC Part 15B & ICES-003 Issue 7	
	QP Limit for 3 m		QP Limit for 3 m		PK Limit for 3 m	AVG Limit for 3 m
	(μV/m)	(dBμV/m)	(μV/m)	(dBμV/m)	(dBμV/m)	(dBμV/m)
30 to 88	100	40	100	40	---	---
88 to 216	150	43.5	150	43.5	---	---
216 to 230	200	46	200	46	---	---
230 to 960	200	46	224	47		
960 to 1000	500	54	500	54	---	---
Above 1000	---	---	---	---	74	54

Limits according to FCC Part 15B, are equal or more stringent than those of ICES-003 Issue 7.

Setup for measurements



Setup for measurements < 1GHz.



Setup for measurements > 1GHz.

Results

S/	OM	Code	Freq Rng (MHz)	V
01	OM/01	RE0101LR	[30, 1000]	P
01	OM/01	RE0101HR1	[1000, 17000]	P
01	OM/01	RE0101HR2	[17000, 26000]	P

Verdict

Pass

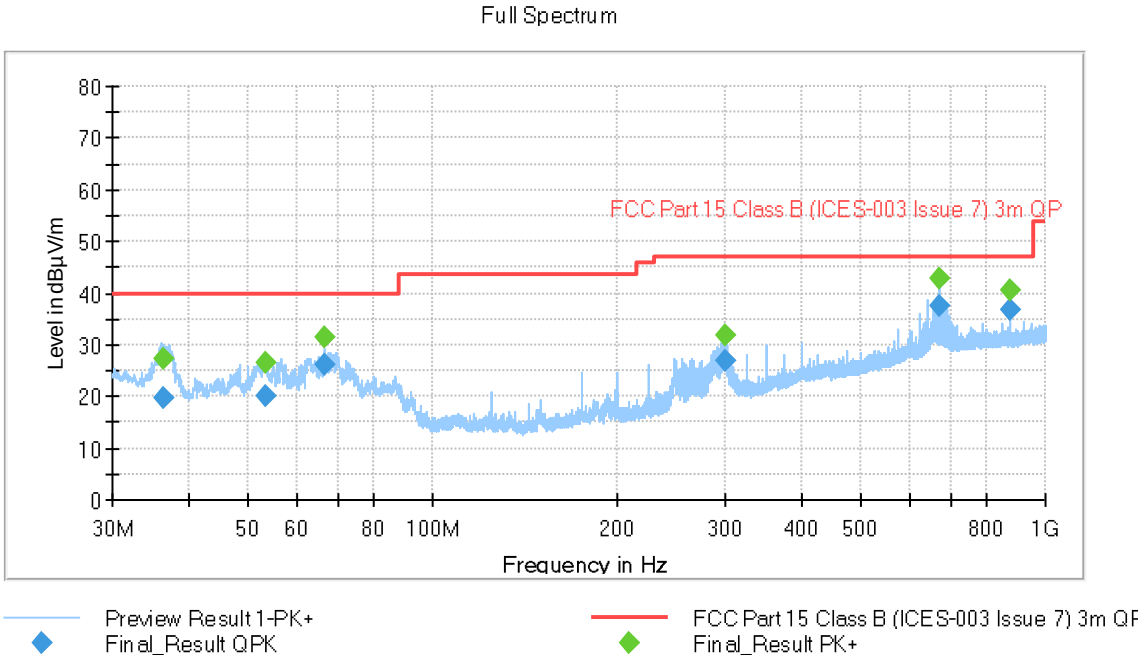
Attachments

EMC Test Code = RE0101LR, Frequency Range MHz = [30, 1000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. USB transferring data (music input). Display showing the playlist. Bluetooth, WiFi 2.4GHz and WiFi 5GHz OFF. Cellular searching network. GNSS active. Power supply: 12Vdc

Images:



Tables:

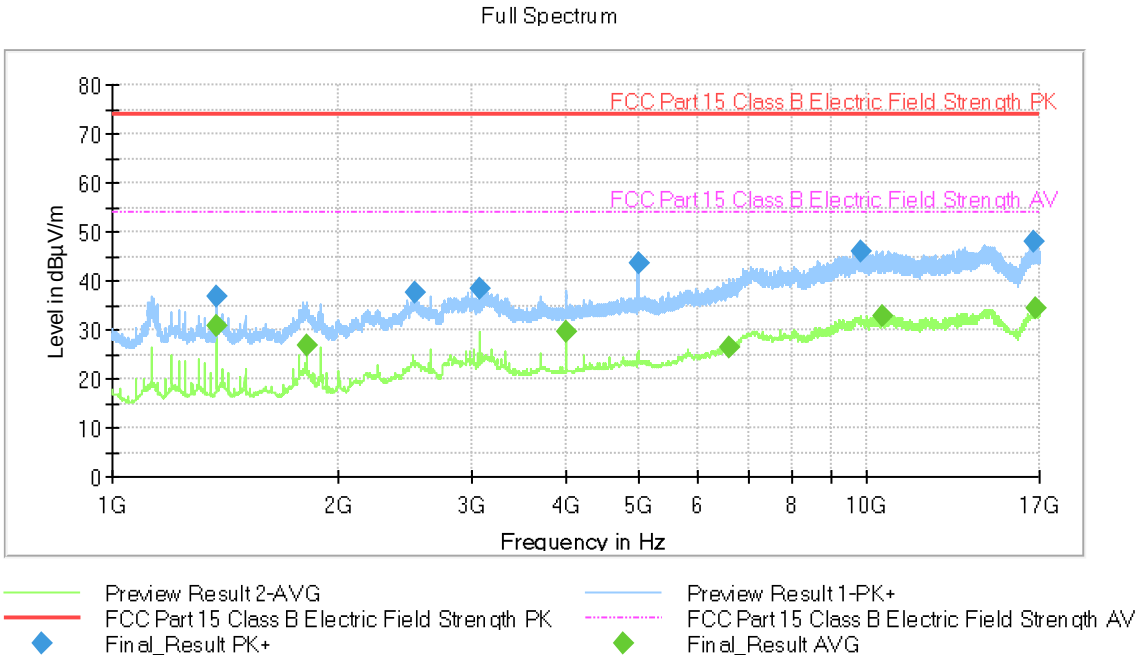
Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
36.265000	---	27.21	---	---	132.0	V	95.0
36.265000	19.53	---	40.00	20.47	132.0	V	95.0
53.445000	---	26.61	---	---	215.0	V	-180.0
53.445000	20.24	---	40.00	19.76	215.0	V	-180.0
66.796000	26.31	---	40.00	13.69	135.0	V	-123.0
66.796000	---	31.37	---	---	135.0	V	-123.0
299.102000	---	31.95	---	---	121.0	H	-34.0
299.102000	26.92	---	47.00	20.08	121.0	H	-34.0
672.658000	---	43.03	---	---	155.0	V	-87.0
672.658000	37.42	---	47.00	9.58	155.0	V	-87.0
875.005000	36.81	---	47.00	10.19	121.0	H	10.0
875.005000	---	40.45	---	---	121.0	H	10.0

EMC Test Code = RE0101HR1, Frequency Range MHz = [1000, 17000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. USB transferring data (music input). Display showing the playlist. Bluetooth, WiFi 2.4GHz and WiFi 5GHz OFF. Cellular searching network. GNSS active. Power supply: 12Vdc

Images:



Tables:

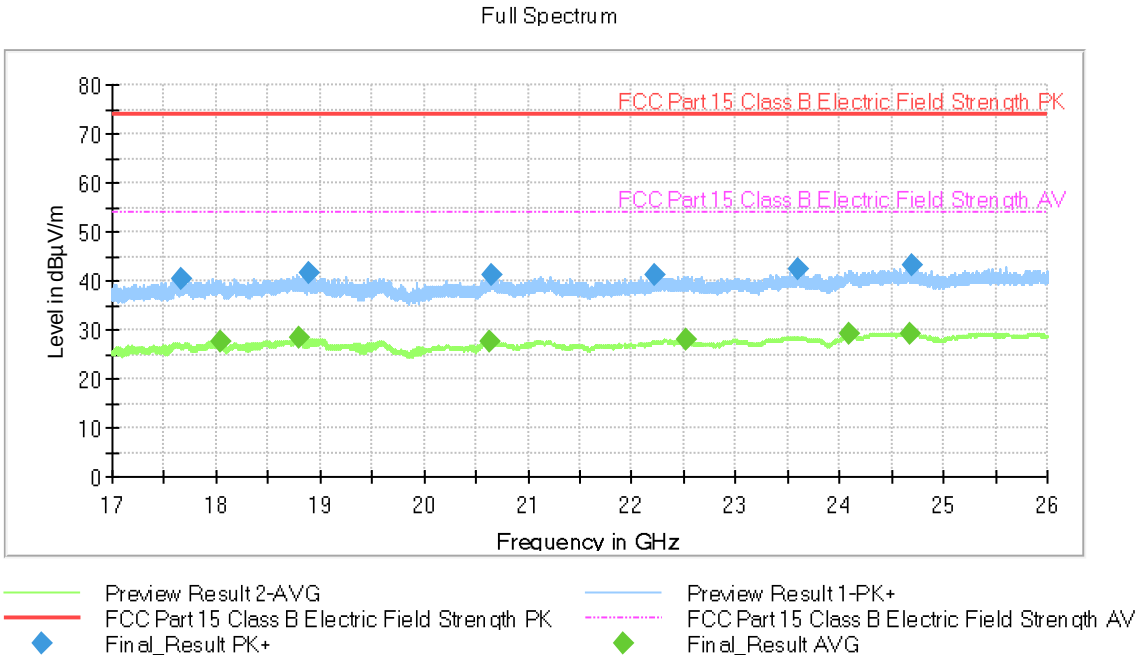
Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
1375.000000	---	30.95	53.97	23.02
1375.000000	36.81	---	73.97	37.16
1812.500000	---	26.92	53.97	27.05
2518.500000	37.54	---	73.97	36.43
3078.500000	38.25	---	73.97	35.72
4000.000000	---	29.76	53.97	24.21
4997.500000	43.73	---	73.97	30.24
6577.000000	---	26.56	53.97	27.41
9833.250000	46.08	---	73.97	27.89
10520.000000	---	32.74	53.97	21.23
16691.250000	48.11	---	73.97	25.86
16840.250000	---	34.23	53.97	19.74

EMC Test Code = RE0101HR2, Frequency Range MHz = [17000, 26000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. USB transferring data (music input). Display showing the playlist. Bluetooth, WiFi 2.4GHz and WiFi 5GHz OFF. Cellular searching network. GNSS active. Power supply: 12Vdc

Images:



Tables:

Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
17665.500000	40.45	---	73.97	33.52
18031.500000	---	27.59	53.97	26.38
18787.500000	---	28.34	53.97	25.63
18889.250000	41.41	---	73.97	32.56
20636.500000	---	27.74	53.97	26.23
20656.000000	41.38	---	73.97	32.59
22215.000000	41.25	---	73.97	32.72
22520.500000	---	27.91	53.97	26.06
23600.500000	42.25	---	73.97	31.72
24098.500000	---	29.38	53.97	24.59
24668.500000	---	29.38	53.97	24.59
24699.250000	43.01	---	73.97	30.96