

Test report No:
NIE: 69323REM.001A1

Test report

**FCC Rules and Regulations CFR 47, Part 15, Subpart B
(10-1-19 Edition) & ICES-003 Issue 7 (October 2020)**

(*) Identification of item tested	TCAM: Telematics and Connectivity Antenna Module
(*) Trademark	Continental
(*) Model and /or type reference	TCAM1NA2
Other identification of the product	FCC ID: KR5TCAM1NA2 IC: 7812D-TCAM1NA2 HW version: E4.4 SW version: 11.16.11
(*) Features	2G, 3G, LTE, GNSS, WLAN, BLE, ISM Receiver
Manufacturer	Continental Automotive GmbH Siemensstrasse 12, 93055 Regensburg, Germany
Test method requested, standard	FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López EMC Consumer & RF Lab. Manager  2021.11.17 11:55:28 +01'00'
Date of issue	2021-11-16
Report template No	FDT08_23 (*) "Data provided by the client"

Index

ACRONYMS3

COMPETENCES AND GUARANTEES3

GENERAL CONDITIONS4

UNCERTAINTY4

DATA PROVIDED BY THE CLIENT4

USAGE OF SAMPLES6

TEST SAMPLE DESCRIPTION7

IDENTIFICATION OF THE CLIENT9

TESTING PERIOD AND PLACE9

DOCUMENT HISTORY9

ENVIRONMENTAL CONDITIONS10

REMARKS AND COMMENTS11

TESTING VERDICTS11

LIST OF EQUIPMENT USED DURING THE TEST11

SUMMARY12

APPENDIX A: TEST RESULTS13

Acronyms

Acronym ID	Acronym Description
Code	EMC Test Code
Freq Rng	Frequency Range
OM	Operation Mode
S/	Sample
V	Verdict

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.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

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.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1000 MHz is $I = \pm 4,9$ dB for quasi-peak measurements, $I = \pm 4,6$ 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 26GHz is $I = \pm 2,6$ 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 TCAM: Telematics and Connectivity Antenna Module.

The TCAM1NA2 main parts are:

Antennas for cellular, WLAN, BLE, ISM receiver (RKE), SDARS with LNA

GNSS with LNA for Navigation: Beidou, Galileo, GPS, Glonass

Antenna selection via RF switches

TCAM internal antennas (all are TCAM internal, no extern antenna connections):

Tel1 ant: 2G, 3G, 4G/LTE1 (vehicle outside)

Tel2 ant: LTE2 (Rx only) (vehicle outside)

MIMO with LTE1- and LTE2-antenna. LTE2 is Rx only

Backup telephone antenna: 2G, 3G, 4G/LTE (vehicle inside)

Wi-Fi internal antenna (vehicle inside)

Wi-Fi external antenna (vehicle outside)

BLE antenna (vehicle outside)

Stacked patch antenna featuring GNSS

ISM receiver antenna

SDARS antenna

CAT4 NAD with 2G/3G/4G/LTE and GNSS, FCC certified

VoLTE

ISM receiver module (434MHz) for: RKE (Remote Keyless Entry), PASE (Passive Start and Entry, TPMS (Tire Pressure Monitoring System), FCC tested

Wi-Fi chip

BLE chip

1st internal embedded Sim-IC

Service calls

External interfaces:

Main power supply

External backup battery

External SIM card slot (2nd private customer SIM, optional)

External microphone in the OHC (Overhead Compartment)

A2B

External backup speaker

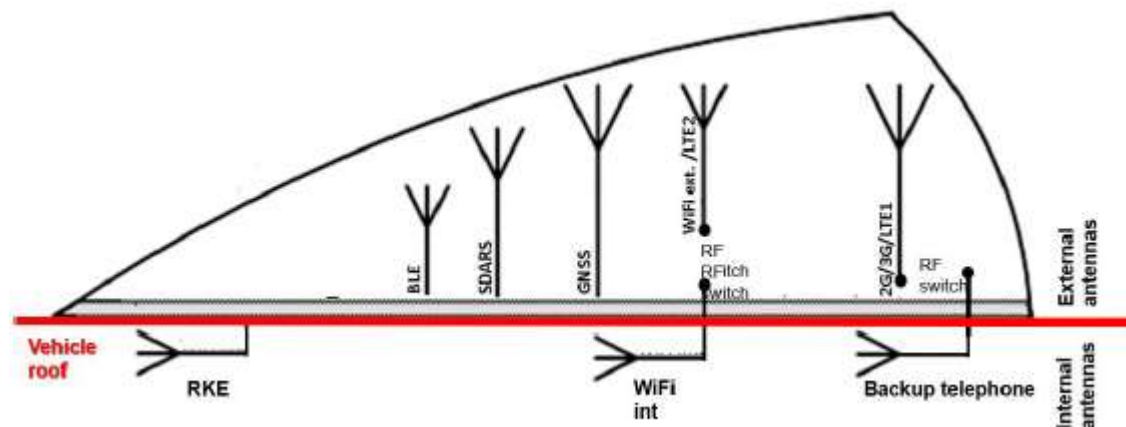
BroadR-Reach

CEM connection (K-Line)

Infotainment CAN

Airbag input

Debug interfaces (USB, UART)



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 results.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	69323_11.1	Antenna module (OTA main 2)	TCAM1NA2	00076376	2021-07-14	Element Under Test
S/01, S/02	69323_8.1	Harness	--	--	2021-07-13	Element Under Test
S/02	69323_5.1	Antenna module (OTA backup 2)	TCAM1NA2	00076359	2021-07-13	Element Under Test

Notes referenced to samples during the project.

Test sample description

Test Sample description (compulsory information for EMC and RF testing services)

Ports..... :	Port name and description		Cable				
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	USB diagnostic		~3m	[]	[]	[]	
	UART diagnostic		~3m	[]	[]	[]	
	BRR diagnostic		~3m	[]	[]	[]	
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[]	AC:	[]	[]	[]	[]	[]
	[X]	DC: 12 V					
	[]	DC:					
Rated Power	4.2 W dc (cellular, Wi-Fi, BLE, GNSS active)						
Clock frequencies.....	32.768kHz, 16MHz, 19.2MHz, 24MHz, 25MHz, 27.6MHz, 48MHz						
Other parameters	Operating temperature Range: -10°C to 55°C Supply Voltage Range: 8 V to 16 V DC						
Software version	11.16.11						
Hardware version	E4.4						
Dimensions in cm (W x H x D)	10.5cm x 15.5cm x 9cm						
Mounting position	[]	Table top equipment					
	[]	Wall/Ceiling mounted equipment					
	[]	Floor standing equipment					
	[]	Hand-held equipment					

	[X]	Other: Vehicular environment equipment	
Modules/parts.....:	Module/parts of test item	Type	Manufacturer
	Network Access Device (NAD), (cellular, GNSS)	Model: BL28NA-RD1	Continental Automotive Systems
	ISM/RKE 434 MHz RF receiver module	Model: A2C38291300	Continental Automotive Systems
Accessories (not part of the test item)	Description	Type	Manufacturer
	1-2 x test harnesses with USB 1 x test harness without USB (if necessary)		Continental
	Laptop (if necessary)	Elite Book	HP
	BLE eval board (if necessary)		TI
	Load boxes (if necessary)	Multiple	Multiple
Documents as provided by the applicant.....:	Description	File name	Issue date
	RF guide	21cw12_TCAM_Country_RF_Manual	
	Functional Guide	User Guide for Functional Testing on Component Level 2	
	Additional Guides (if necessary)	Multiple	

⁽³⁾ Only for Medical Equipment

Identification of the client

Continental Automotive GmbH
Siemensstrasse 12, 93055 Regensburg, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-08-06
Date (finish)	2021-08-09

Document history

Report number	Date	Description
69323REM.001	2021-11-04	First release
69323REM.001A1	2021-11-16	First modification due to typos and missing info. This modification test report cancels and replaces the test report 69323REM.001

Environmental conditions

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

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

Remarks and comments

The tests have been performed by the technical personnel: Lorena Oviedo Aranda.

Testing verdicts

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

List of equipment used during the test

Control No.	Equipment	Model	Manufacturer	Next Calibration
4523	EMI TEST RECEIVER 20Hz-26.5GHz	ESU26	ROHDE AND SCHWARZ	2023-03-15
2942	EMI TEST RECEIVER 20Hz-40GHz	ESU40	ROHDE AND SCHWARZ	2021-09-17
6132	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2022-04-05
6126	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2022-04-05
4612	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2024-07-13
4657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
3541	HYBRID BILOG ANTENNA 30MHz-6GHz	JB6	SUNOL SCIENCES CORPORATION	2021-10-10
8856	PRE-AMPLIFIER G>30dB 18-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2023-09-08
7203	PREAMPLIFIER 30dB 500MHz-18GHz	AMF-3D-00501800-24-10P	NARDA	2022-01-14
6064	SEMIANECHOIC ABSORBER LINED CHAMBER	SAC-3	FRANKONIA	---
6329	SHIELDED ROOM	---	FRANKONIA	---

Summary

Test Specification.	Requirement – Test case	Verdict	Remark
FCC 47 CFR Part 15B	RE Radiated emission. Electromagnetic field measure	Pass	---
<u>Supplementary information and remarks:</u> None			

Appendix A: Test results

Appendix A content

DESCRIPTION OF THE OPERATION MODES	15
TEST STANDARDS VERSION APPLIED	16
TEST CASES DETAILS	17
<i>FCC CFR 47, Part 15, Subpart B</i>	17

Description of the operation modes

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

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. Bluetooth without communication established. GPS active and receiving positioning signal. SRD 433MHz active and receiving signal. WiFi 2.4 GHz not communication established. WiFi 5 GHz not communication established MS in IDLE mode. LTE Band 5. 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 (10-1-19 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	RE Radiated emission.

Test Cases Details

FCC CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020) RE Radiated emission. Electromagnetic field measure

Limits

Limits of interference Class B

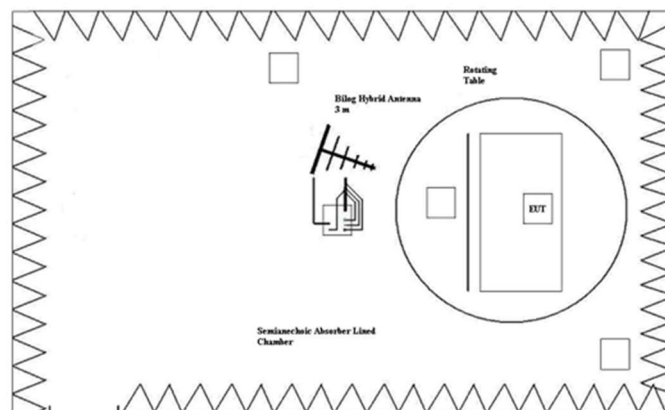
The applied limit for radiated emissions, 3 m distance, according to the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-19 Edition), Secs. 15.109 & ICES-003 Issue 7 (October 2020)

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
	(μ V/m)	(dB μ V/m)	(μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/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

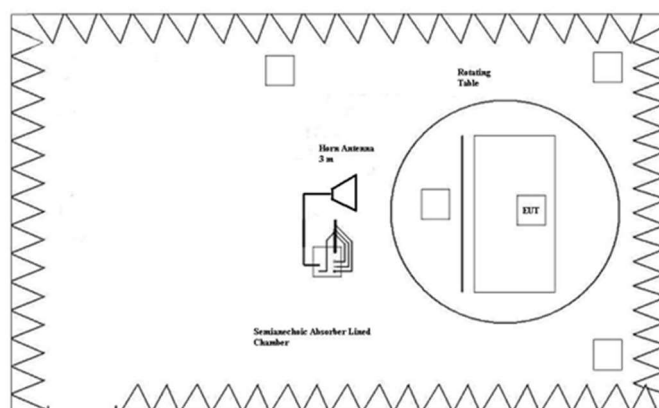
NOTE: FCC QP and AVG limits are in concordance with RSS-Gen Issue 5 (March 2019), Secs. 7.1 and 7.3.

Limits according to FCC Part 15B, equal to o 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	RE0101HR	[1000, 17000]	P
01	OM/01	RE0101HR2	[17000, 26000]	P
02	OM/01	RE0201LR	[30, 1000]	P
02	OM/01	RE0201HR	[1000, 17000]	P
02	OM/01	RE0201HR2	[17000, 26000]	P

Verdict

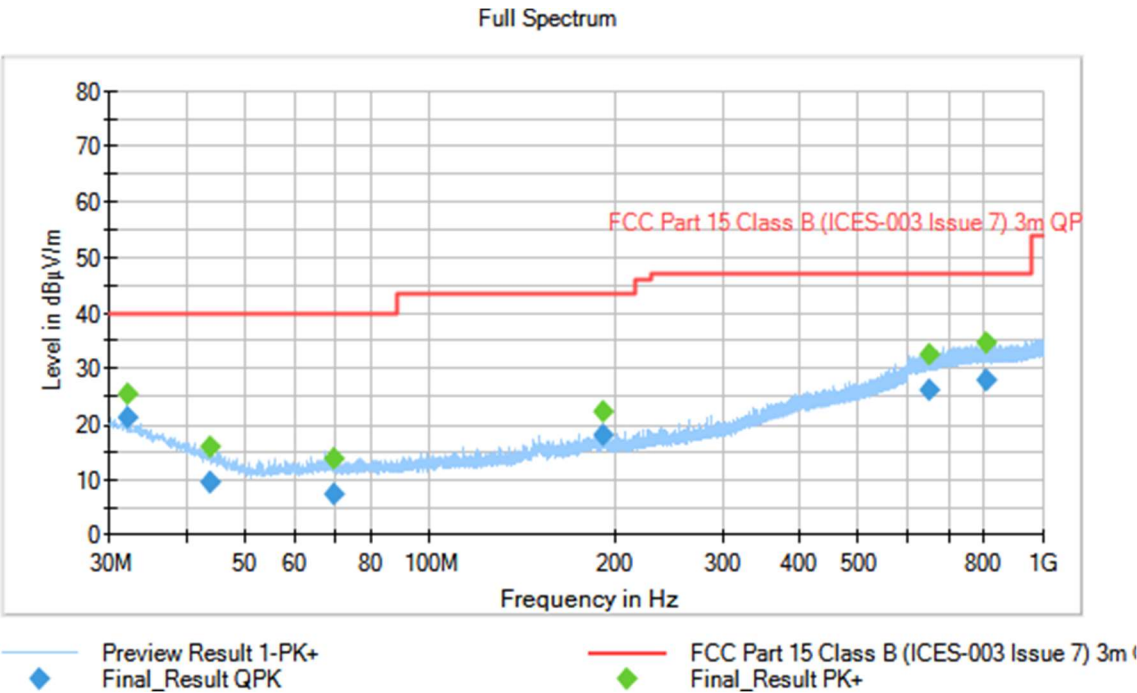
Pass

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

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth without communication established. GPS active and receiving positioning signal. SRD 433MHz active and receiving signal. WiFi 2.4 GHz not communication established. WiFi 5 GHz not communication established MS in IDLE mode. LTE Band 5. Power supply: 12Vdc

Images:



Documents:

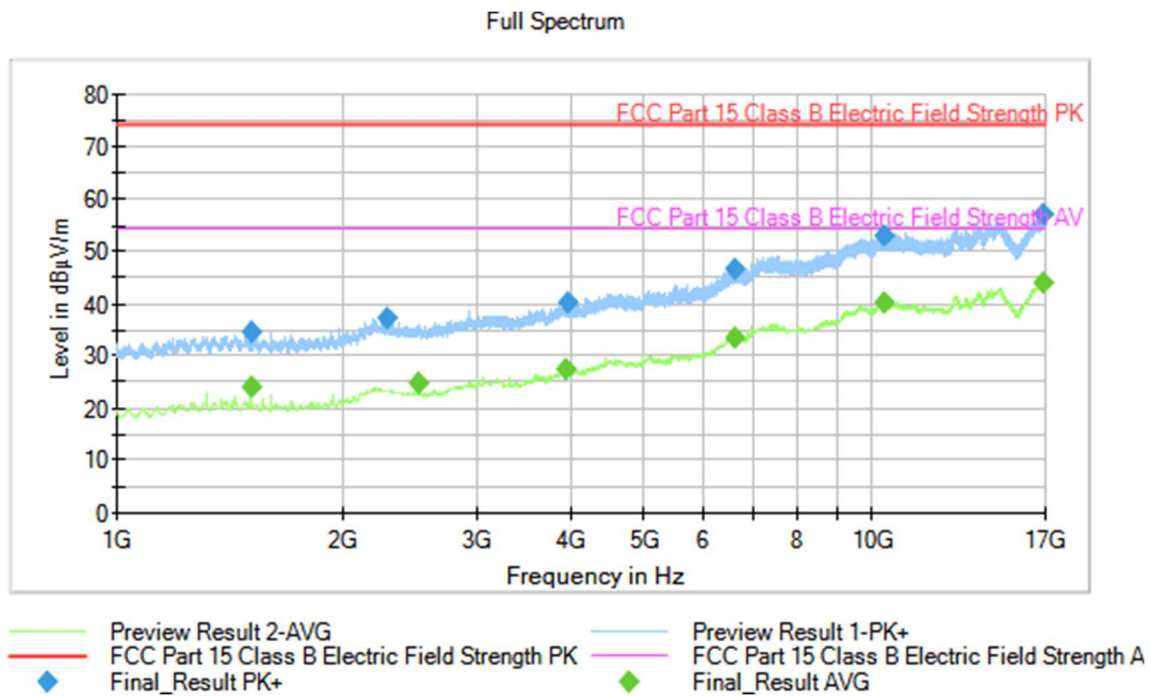
Frequency(MHz)	QuasiPeak(dBµV/m)	MaxPeak(dBµV/m)	Limit(dBµV/m)	Margin(dB)	Height(cm)	Pol	Azimuth(deg)
32.010000	21.16	---	40.00	18.84	114.0	V	6.0
32.010000	---	25.46	---	---	114.0	V	6.0
43.693000	9.58	---	40.00	30.42	384.0	V	59.0
43.693000	---	15.93	---	---	384.0	V	59.0
69.645000	7.52	---	40.00	32.48	209.0	H	57.0
69.645000	---	13.84	---	---	209.0	H	57.0
191.991000	---	22.17	---	---	118.0	H	86.0
191.991000	17.92	---	43.52	25.60	118.0	H	86.0
649.344000	26.33	---	47.00	20.67	395.0	V	34.0
649.344000	---	32.50	---	---	395.0	V	34.0
805.628000	---	34.80	---	---	236.0	H	147.0
805.628000	27.95	---	47.00	19.05	236.0	H	147.0

EMC Test Code = RE0101HR, Frequency Range MHz = [1000, 17000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth without communication established. GPS active and receiving positioning signal. SRD 433MHz active and receiving signal. WiFi 2.4 GHz not communication established. WiFi 5 GHz not communication established MS in IDLE mode. LTE Band 5. Power supply: 12Vdc

Images:



Documents:

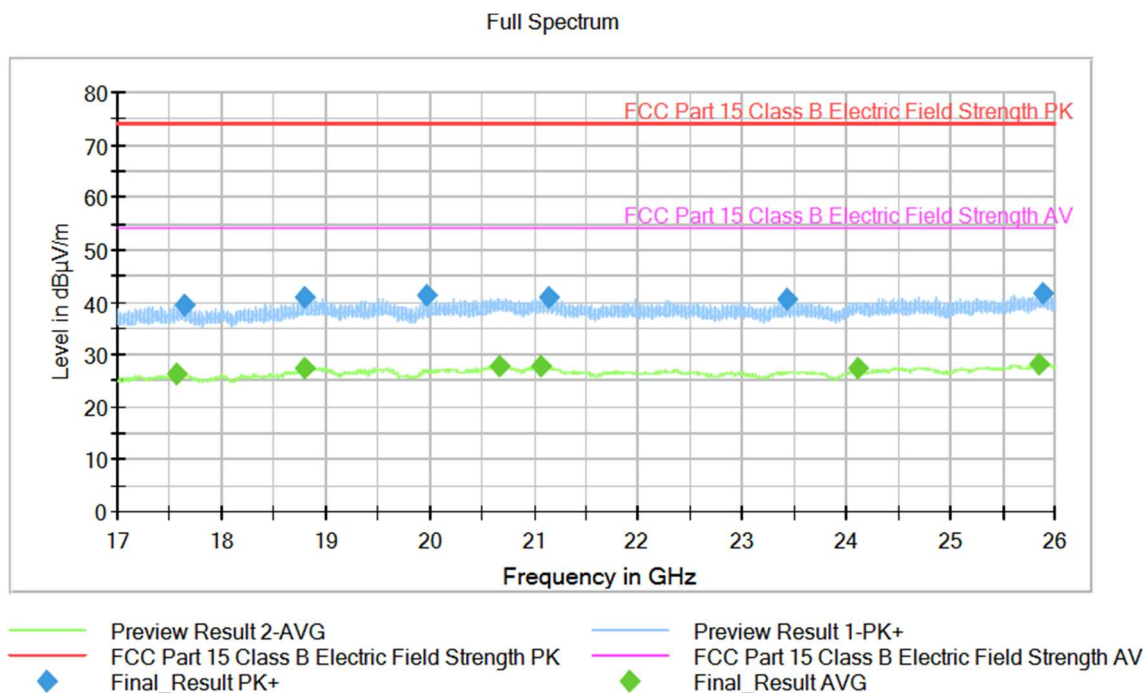
Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
1500.000000	---	23.90	53.97	30.07
1500.400000	34.44	---	73.97	39.53
2280.800000	37.28	---	73.97	36.69
2500.000000	---	24.96	53.97	29.01
3937.600000	---	27.27	53.97	26.70
3951.600000	40.37	---	73.97	33.60
6575.600000	46.49	---	73.97	27.48
6579.600000	---	33.45	53.97	20.52
10360.800000	53.11	---	73.97	20.86
10362.400000	---	40.17	53.97	13.80
16937.600000	---	44.09	53.97	9.88
16938.800000	57.08	---	73.97	16.89

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

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth without communication established. GPS active and receiving positioning signal. SRD 433MHz active and receiving signal. WiFi 2.4 GHz not communication established. WiFi 5 GHz not communication established MS in IDLE mode. LTE Band 5. Power supply: 12Vdc

Images:



Documents:

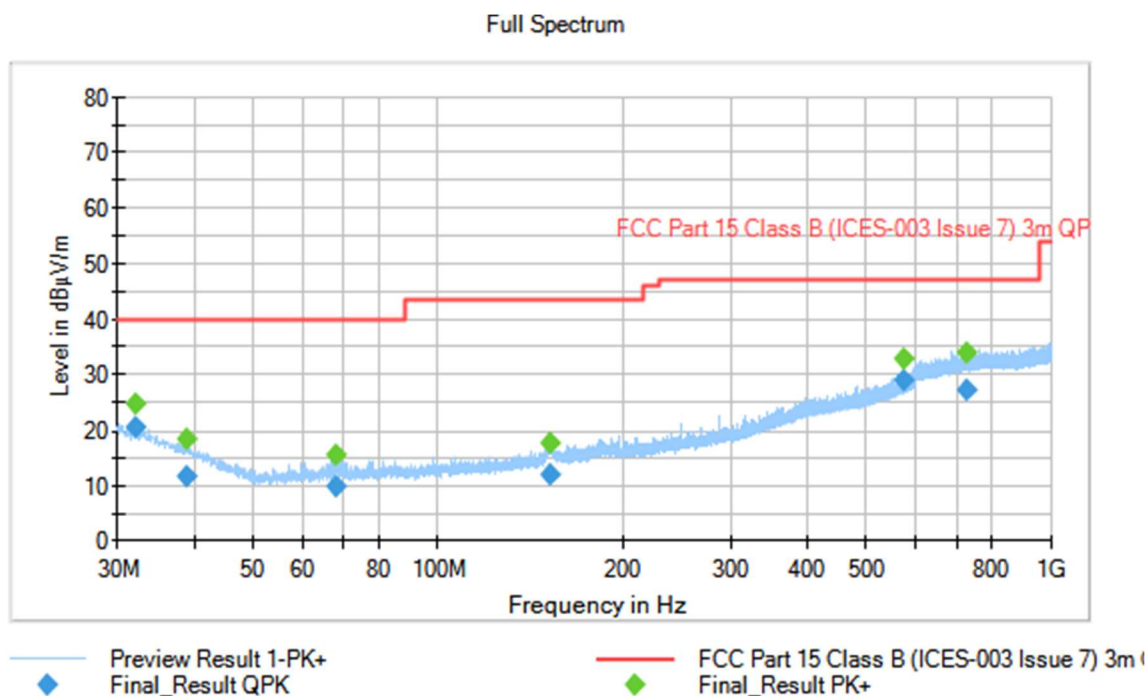
Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
17567.600000	---	26.31	53.97	27.66
17636.000000	39.38	---	73.97	34.59
18788.000000	40.87	---	73.97	33.10
18798.800000	---	27.55	53.97	26.42
19968.800000	41.25	---	73.97	32.72
20661.600000	---	27.82	53.97	26.15
21069.200000	---	27.61	53.97	26.36
21131.600000	40.80	---	73.97	33.17
23430.000000	40.69	---	73.97	33.28
24101.200000	---	27.31	53.97	26.66
25848.400000	---	28.30	53.97	25.67
25884.400000	41.59	---	73.97	32.38

EMC Test Code = RE0201LR, Frequency Range MHz = [30, 1000]

Sample ID: S/02

Operation Mode: OM/01. EUT ON. Bluetooth without communication established. GPS active and receiving positioning signal. SRD 433MHz active and receiving signal. WiFi 2.4 GHz not communication established. WiFi 5 GHz not communication established MS in IDLE mode. LTE Band 5. Power supply: 12Vdc

Images:



Documents:

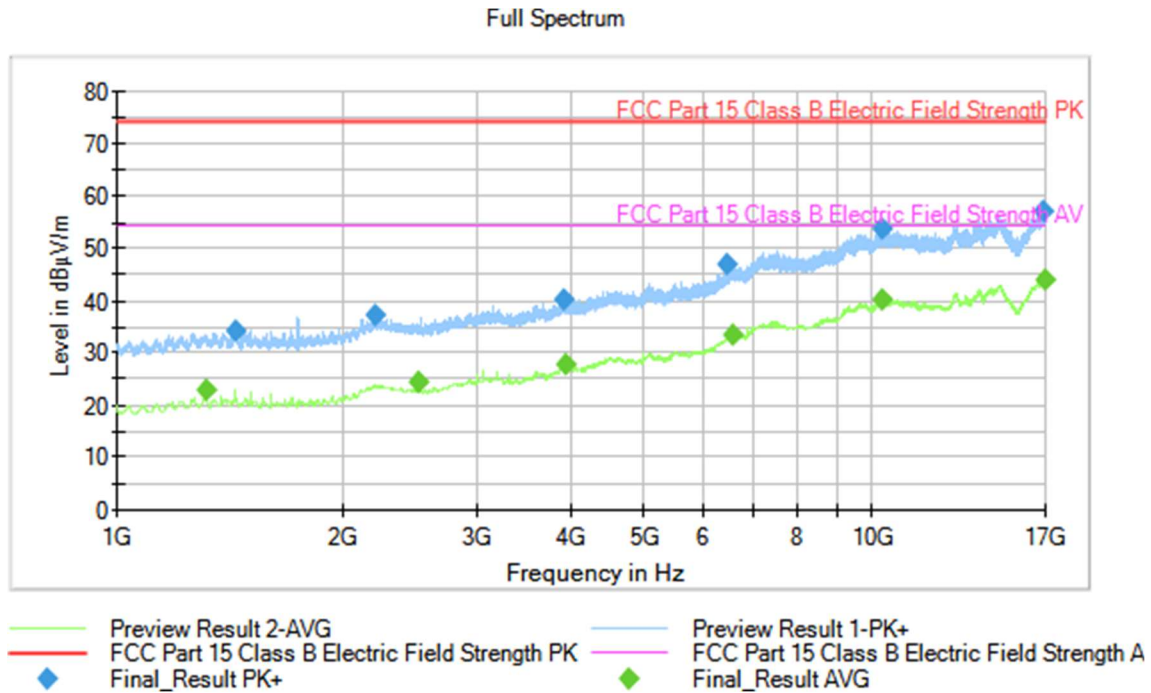
Frequency(MHz)	QuasiPeak(dBµV/m)	MaxPeak(dBµV/m)	Limit(dBµV/m)	Margin(dB)	Height(cm)	Pol	Azimuth(deg)
32.014000	20.49	---	40.00	19.51	115.0	V	-26.0
32.014000	---	24.95	---	---	115.0	V	-26.0
38.771000	11.72	---	40.00	28.28	400.0	V	-13.0
38.771000	---	18.36	---	---	400.0	V	-13.0
68.156000	---	15.47	---	---	179.0	V	101.0
68.156000	10.04	---	40.00	29.96	179.0	V	101.0
152.527000	---	17.62	---	---	136.0	V	-180.0
152.527000	11.94	---	43.52	31.58	136.0	V	-180.0
576.009000	---	33.04	---	---	149.0	H	-90.0
576.009000	29.13	---	47.00	17.87	149.0	H	-90.0
730.179000	---	34.06	---	---	138.0	H	-18.0
730.179000	27.43	---	47.00	19.57	138.0	H	-18.0

EMC Test Code = RE0201HR, Frequency Range MHz = [1000, 17000]

Sample ID: S/02

Operation Mode: OM/01. EUT ON. Bluetooth without communication established. GPS active and receiving positioning signal. SRD 433MHz active and receiving signal. WiFi 2.4 GHz not communication established. WiFi 5 GHz not communication established MS in IDLE mode. LTE Band 5. Power supply: 12Vdc

Images:



Documents:

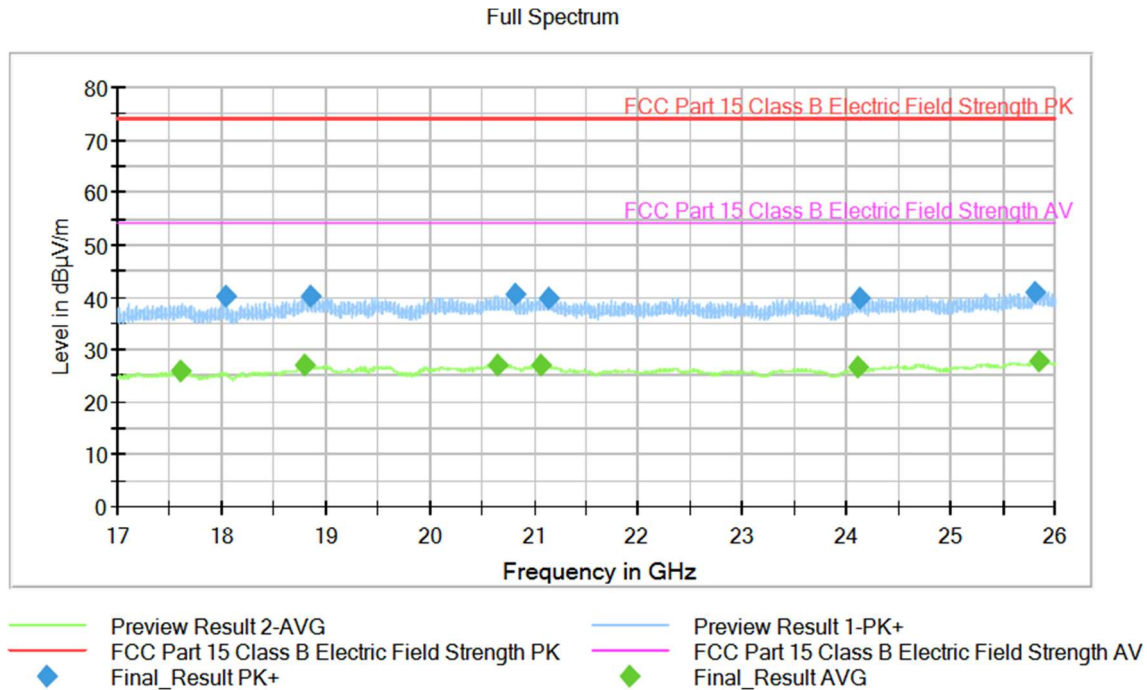
Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
1310.400000	---	22.86	53.97	31.11
1436.800000	34.11	---	73.97	39.86
2200.000000	37.00	---	73.97	36.97
2500.000000	---	24.59	53.97	29.38
3897.200000	40.06	---	73.97	33.91
3937.600000	---	27.89	53.97	26.08
6438.400000	46.80	---	73.97	27.17
6532.400000	---	33.44	53.97	20.53
10319.600000	53.77	---	73.97	20.20
10360.000000	---	40.11	53.97	13.86
16911.600000	57.18	---	73.97	16.79
16950.000000	---	44.00	53.97	9.97

EMC Test Code = RE0201HR2, Frequency Range MHz = [17000, 26000]

Sample ID: S/02

Operation Mode: OM/01. EUT ON. Bluetooth without communication established. GPS active and receiving positioning signal. SRD 433MHz active and receiving signal. WiFi 2.4 GHz not communication established. WiFi 5 GHz not communication established MS in IDLE mode. LTE Band 5. Power supply: 12Vdc

Images:



Documents:

Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
17613.200000	---	25.83	53.97	28.14
18041.200000	40.02	---	73.97	33.95
18802.400000	---	27.09	53.97	26.88
18845.200000	40.15	---	73.97	33.82
20650.400000	---	27.13	53.97	26.84
20815.200000	40.61	---	73.97	33.36
21074.000000	---	26.91	53.97	27.06
21140.800000	39.80	---	73.97	34.17
24101.200000	---	26.75	53.97	27.22
24131.600000	39.96	---	73.97	34.01
25802.800000	40.98	---	73.97	32.99
25850.000000	---	27.91	53.97	26.06