Radio Testing of the

Nextivity Inc.
Industrial Signal Booster
Model: Cel-Fi G41
G41-CE
In accordance with

FCC CFR 47 Part 90
RSS-140 issue 1 (April 2018)
RSS-119 Issue 12 (May 2015), A1 (2022)
RSS-131 issue 4 (December 2022)

Product Service

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Nextivity Inc.
16550 West Bernardo Drive, Bldg 5, Suite 550,
San Diego, CA 92127, USA
Date: November 2023
Document Number: 72189913E Issue 01 | Version Number: 01

,

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Ferdinand S. Custodio	November 28, 2023	

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

EXECUTIVE SUMMARY
Test reports and supporting documents of this product was reviewed and the EUT in general was confirmed to be in compliance with FCC CFR 47 Part 90, RSS-140 issue 1 (April 2018), RSS-119 Issue 12 (May 2015), A1 (2022) and RSS-131 issue 4 (December 2022).

A2LA Cert. No. 2955.13

ACCREDITATION
Our A2LA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our A2LA Accreditation.

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REPORT ON	Radio Testing of the Nextivity Inc. Cel-Fi G41 Industrial Signal Booster
TEST REPORT NUMBER	72189913E
REPORT DATE	November 2023
PREPARED FOR	Nextivity Inc. 16550 West Bernardo Drive, Bldg 5, Suite 550, San Diego, CA 92127, USA
CONTACT PERSON	CK Li Sr. Principal Engineer, Regulatory (858) 485-9422 CLi@NextivityInc.com
PREPARED BY	Miguel Rabago **Name** Authorized Signatory Title: Jr EMC/Wireless Test Engineer
APPROVED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: Senior EMC Test Engineer / Wireless Team Lead

Revision History

72189913E
Nextivity Inc.
Cel-Fi G41 Industrial Signal Booster

DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
11/28/2023	—	Initial Release			Ferdinand S.Custodio

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TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
Cel-Fi G41 Industrial Signal Booster

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Nextivity Inc. Cel-Fi G41-CE to the requirements of FCC CFR 47 Part 90, RSS-140 issue 1 (April 2018), RSS-119 Issue 12 (May 2015), A1 (2022) and RSS-131 issue 4 (December 2022).

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Nextivity Inc.
Model Name	Cel-Fi G41
Model Number(s)	G41-CE
EUT	Industrial Signal Booster
FCC ID	YETG41-CE
IC ID	9298A-G41CE
Serial Number(s)	560311000026
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC CFR 47 Part 90 (October 1, 2022) • RSS-140 - Equipment Operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz (issue 1, April 2018) • RSS-119 – Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz (issue 12, May 2015, A1 April 2022) • RSS-131 – Zone Enhancers (issue 4, Updated December 2022) • SRSP-540 - Technical Requirements for Public Safety Broadband Systems in the Bands 758-768 MHz and 788-798 MHz (issue 1, April 2018) • SRSP-511 - Technical Requirements for Land Mobile Radio Services Operating in the Bands 768-776 MHz and 798-806 MHz (issue 2, December 2017) • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 5, November 2019 Amendment 1) • ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

Start of Test	September 14, 2023
Finish of Test	October 18, 2023
Name of Engineer(s)	Miguel Rabago Omar Castillo
Related Document(s)	• KDB971168 D01 Power Meas License Digital Systems v03r01 (Measurement Guidance for Certification of Licensed Digital Transmitters) • KDB412172 D01 Determining ERP and EIRP v01r01 (Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System) • KDB 935210 D05 v01r04 Measurements Guidance for Industrial and Non-Consumer Signal Booster, Repeater, And Amplifier Devices • Product Spec for RFQ_Sapporo G41-BE_US_v1.pdf • Supporting documents for EUT certification are separate exhibits. • 72189913G Nextivity G41-CE FCC Part 20 RSS-131 B2, 4, 5, 25 Test Report

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 90 is shown below:

Section	Part 2	Part 90	RSS-140	RSS-119	KDB 935210 D05/ RSS-131	Test Description	Result
2.1	2.1046	-	-	-	-/10.2	Transmitter Conducted Output Power	Compliant
2.2	2.1046	90.219(d)(3)(i) 90.219(e)(1)	4.3	5.4	-	Effective Radiated Power	Compliant
2.3	2.1049	90.219(e)(4)(ii)	RSS-Gen 6.7	5.5	-	Occupied Bandwidth	Compliant
2.4	-	-	4.3	-	-	Peak-Average Ratio	Compliant
2.5	-	90.543(e)(3)(5)	4.4	-	-	Band Edge	Compliant
2.6	2.1051	90.219(e)(3) 90.543(e)(2)(3)(4)(5) 90.543(c)(f)	4.4	5.8.9.2	4.7.3/10.6	Conducted Spurious Emissions	Compliant
2.7	2.1055	90.213 90.539(b)	4.2	5.9	4.8/ 9.4	Frequency Stability	Compliant
-	-	-	RSS-Gen 7.1		-	Receiver Spurious Emissions	N/A*
2.8	-	-	-	-	4.2/ -	AGC Threshold Level	Compliant
2.9	-	-	-	-	4.3/ 9.1	Out of Band Rejection	Compliant
2.10	-	90.219(e)(4)(ii)	-	-	4.4/ 9.2	Input-versus-output signal comparison	Compliant
-	-	90.219 (e)(4)(iii) 90.210 90.543(a)	-	5.8.9	4.4/ -	Emission Mask and Adjacent Channel Power	N/A**
2.11	-	90.219(e)(1)	-	-	4.5/ 10.3	Input / Output Power and Amplifier / Booster Gain	Compliant
2.12	-	90.219(e)(2)	-	-	4.6/10.4	Noise Figure	Compliant
2.13	2.1051	90.219(e)(3) 90.543(c)	4.4	5.8.9.2	4.7/ -	Out-of-band/out-of-block (Intermodulation) and Spurious Emissions	Compliant
2.14	2.1053	90.219(e)(3) 90.543(e)(1)(3)(f)	4.4	-	4.9/ -	Field Strength of Spurious Emissions	Compliant

N/A* Not required as per RSS-GEN 5.3. EUT is not a Stand-alone receiver.
N/A** The EUT is an equipment without audio low pass filter and mask C applies. The received signal is wideband LTE 14 20 MHz signal, and it does not meet the unwanted Emission Mask C limits of § 90.210 which is for narrow band. Therefore, emission mask is not applicable to the retransmitted output signals.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

Cel-Fi G41-CE is a single box LTE Provider Specific Signal Booster to improve voice and data cellular performance in indoor environments. Both Network Unit (NU), and the Coverage Unit (CU) are on a single PCB and installed metal/plastic housing. The NU comprises a transmitter and receiver which communicate with the cell tower. The CU comprises a transmitter and receiver which communicate with the wireless devices.
G41-CE includes Bluetooth LE and LAN connectivity. With the use of Nextivity smartphone application or the LAN, it allows user to register the product, update software, capture/display details metrics of the system.
EUT is powered by external 12VDC Power adaptor.

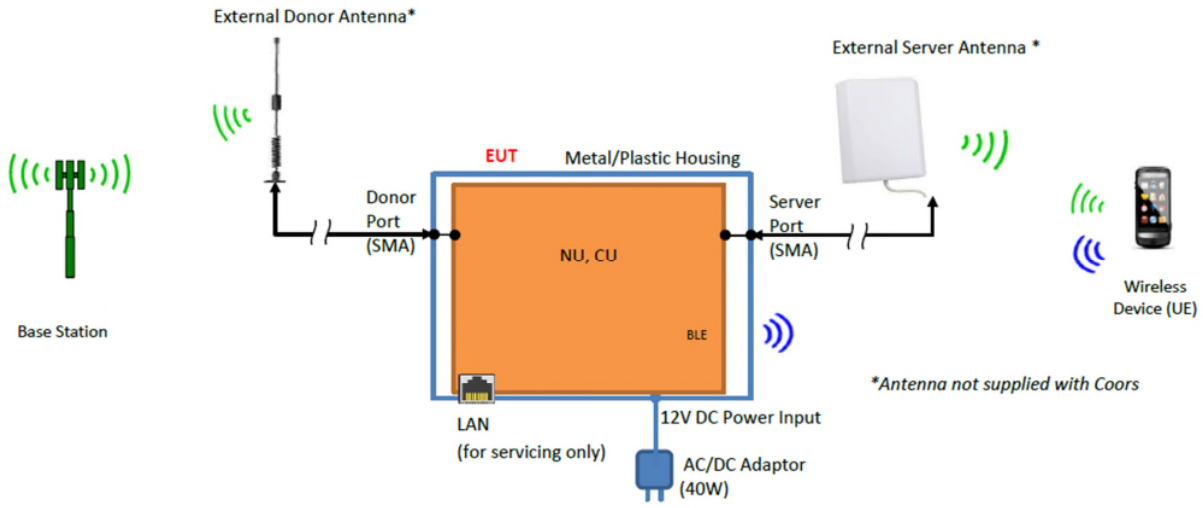
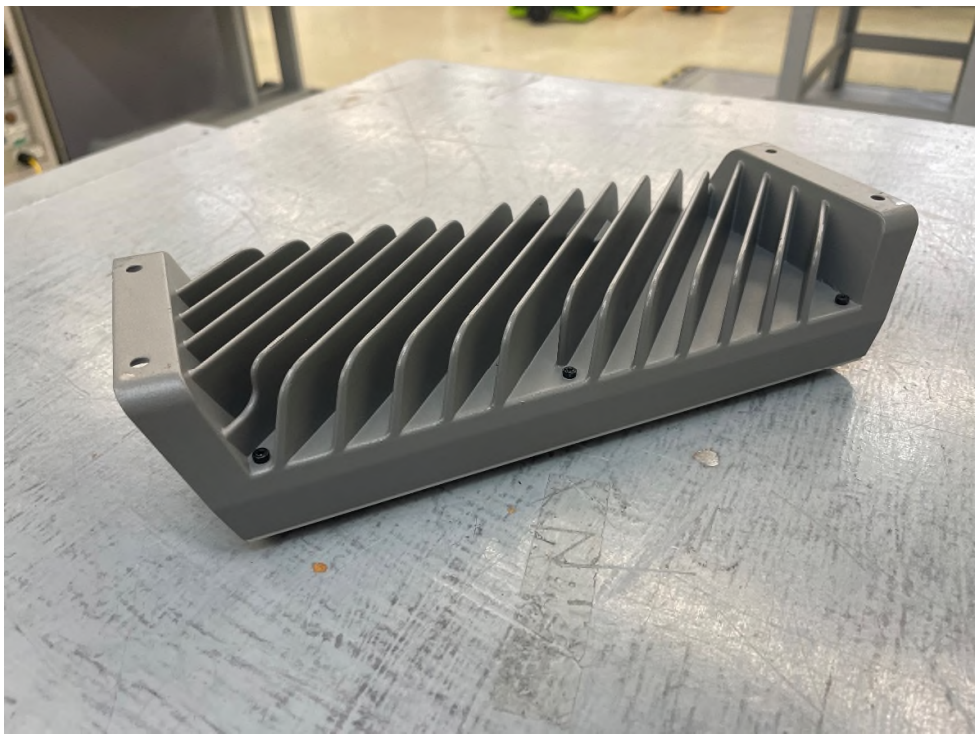


Figure 1: System Overview



Equipment under Test

1.3.2 EUT General Description

EUT Description	Industrial Signal Booster
Trade Name	Cel-Fi™
Model Name	Cel-Fi G41
Model Number(s)	G41-CE
Rated Voltage	12V DC via external AC/DC adaptor
Mode Verified	LTE Band 14
Frequency Bands	LTE Band 2: UL: 1850 - 1910MHz DL: 1930 - 1990MHz LTE Band 4: UL: 1710 - 1755MHz DL: 2110 - 2155MHz LTE Band 5: UL: 824 - 849MHz DL: 758 - 768 MHz LTE Band 14: UL: 788 - 798 MHz DL: 758 - 768 MHz LTE Band 25: UL:1850 – 1915 MHz DL: 1930 – 1995 MHz

Product Specifications

Signal Bandwidth (MHz)	LTE Band 2, 4, 25		LTE Band 5		LTE Band 14	
	DL (dBm)	UL (dBm)	DL (dBm)	UL (dBm)	DL (dBm)	UL (dBm)
5	Max. 16	22	Max. 16	20	N/A	
10					13 dBm	22
15			N/A		N/A	
20			N/A		N/A	

Power Tolerance (dBm)	± 2
Capability	LTE (Band 2, 4, 5,14, 25)
Primary Unit (EUT)	☐ Production ☐ Pre-Production ☒ Engineering
Environment	Fixed, Indoor
Manufacturer Declared Temperature Range	0°C to 40°C
Antenna Type	External Antenna (SMA Connectors)
Antenna Model	N/A

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Antenna gain N/A

Input and Output ports Impedance 50 Ohms

Gain

Frequency	Max System Gain
< 1 GHz	95 dB
>1 GHz	100 dB

Maximum Antenna System (Antenna + Cable) Gain.

Port	Max System (Antenna & Cable) Gain
Server Port	15.04
Donnor Port	17.6

Note: *Maximum System Gain was calculated to comply with MPE for Simultaneous Transmission.

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1.3.3 Transmit Frequency Table

Mode	Channel Bandwidth	Tx Frequency (MHz)	Emission Designator	Conducted Power	
				Max. Power Avg (dBm)	Max. Power Avg (W)
LTE Band 2 Downlink	5	1932.5 – 1987.5	4M63F9W	9.83	0.009616123
	10	1935 – 1985	8M96F9W	12.46	0.01761976
	15	1937 – 1982.5	13M4F9W	14.46	0.027925438
	20	1940 – 1980	17M9F9W	15.87	0.038636698
LTE Band 2 Uplink	5	1852.5 – 1907.5	4M47F9W	21.79	0.151008015
	10	1855 – 1905	8M98F9W	21.86	0.153461698
	15	1857.5 – 1902.5	13M4F9W	21.72	0.148593564
	20	1860 - 1900	17M9F9W	21.62	0.145211162
LTE Band 4 Downlink	5	2110 - 2155	4M72F9W	9.95	0.009885531
	10	2110 - 2155	9M31F9W	12.57	0.018071741
	15	2110 - 2155	13M6F9W	14.45	0.027861212
	20	2110 - 2155	18M4F9W	15.59	0.0362243
LTE Band 4 Uplink	5	1710 - 1755	4M64F9W	22.08	0.161435856
	10	1710 - 1755	9M26F9W	22.2	0.165958691
	15	1710 - 1755	13M6F9W	22.32	0.170608239
	20	1710 - 1755	18M4F9W	22.09	0.161808004
LTE Band 5 Downlink	5	871.4 – 891.6	4M73F9W	9.92	0.009817479
	10	871.4 – 891.6	9M24F9W	12.1	0.016218101
LTE Band 5 Uplink	5	826.4 – 846.6	4M73F9W	19.66	0.092469817
	10	826.4 – 846.6	9M24F9W	19.57	0.09057326
LTE Band 14 Downlink	10 MHz	758 - 768	8M86F9W	12.27	0.0168655303
LTE Band 14 Uplink	10 MHz	788 - 798	8M85F9W	21.08	0.1282330583
LTE Band 25 Downlink	5	1932.5 – 1992.5	4M63F9W	9.68	0.009289664
	10	1935 – 1990	8M96F9W	12.31	0.017021585
	15	1937.5 – 1987.5	13M4F9W	13.6	0.022908677
	20	1940 – 1985	17M9F9W	13.89	0.024490632
LTE Band 25 Uplink	5	1852.5 – 1912.5	4M47F9W	20.84	0.121338885

	10	1855 – 1910	8M98F9W	20.79	0.11994993
	15	1857.5 – 1907.5	13M4F9W	20.95	0.124451461
	20	1860 – 1905	17M9F9W	21.6	0.144543977

NOTE: CONDUCTED POWER MEASUREMENTS FOR BAND 2, 4, 5, AND 25 ARE FROM 72189913G NEXTIVITY G41-CE FCC PART 20 RSS-131 B2, 4, 5, 25 TEST REPORT

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Downlink. Input signal is applied to the antenna port of Donor (NU). Output is monitored from the antenna port of Server (CU).
B	Uplink. Input signal is applied to the antenna port of Server (CU). Output is monitored from the antenna port of Donor (NU).
C	Radiated test setup. Downlink. Input signal is applied to the antenna port of Donor (NU). The antenna port of Server (CU) is terminated with a 50Ω load or Signal Generator.
D	Radiated test setup. Uplink. Input signal is applied to the antenna port of Server (CU). The antenna port of Donor (NU) is terminated with a 50Ω load or Signal Generator.
E	Radiated test setup. Downlink. Input Singal is applied to the antenna port of Donor (NU). The antenna port Server (CU) is terminated with a 50Ω load or Singal Generator.
F	Radiated test setup. Uplink. Input signal is applied to the antenna port Server (CU). The antenna port of Donnor (NU) is terminated with a 50Ω load or Singal Generator.

1.4.2 EUT Exercise Software

Manufacturer Provided a Nextivity Chart Interface v2.0.0.16

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Lenovo	Support Laptop	M/N: 20AR-S4250S, S/N: PC-03DGHKK 125/02
Lenovo	Support Laptop AC Adapter	M/N: ADLX90NLC2A S/N: 11S45N0247Z1ZS9B6926Z5
Nextivity	Support USB cable x 1	Custom 1.0 meter shielded USB Type A to Micro B cable
SIMSUKIAN	AC/DC Adapter	M/N: SK03T1-1200250V S/N: 22080308000658 IP: 100-240VAC 50/60Hz 0.6A; OP: 12VDC 2.5A 30.0W

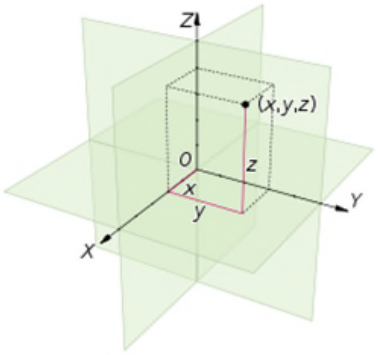
Rohde & Schwarz	Vector Signal Generator	M/N: SMBV100A, S/N: 259021
Agilent	ESG Vectot Signal Generator	S/N: MY47271206 M/N:E4438C
Aeroflex	Signal Generator	M/N: 3005, S/N: 3005A/09L

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report per Transmitter Conducted Output Power (Section 2.1 of this test report). This is for single channel verification. Otherwise, all three channels (Low, Middle and High) are verified:

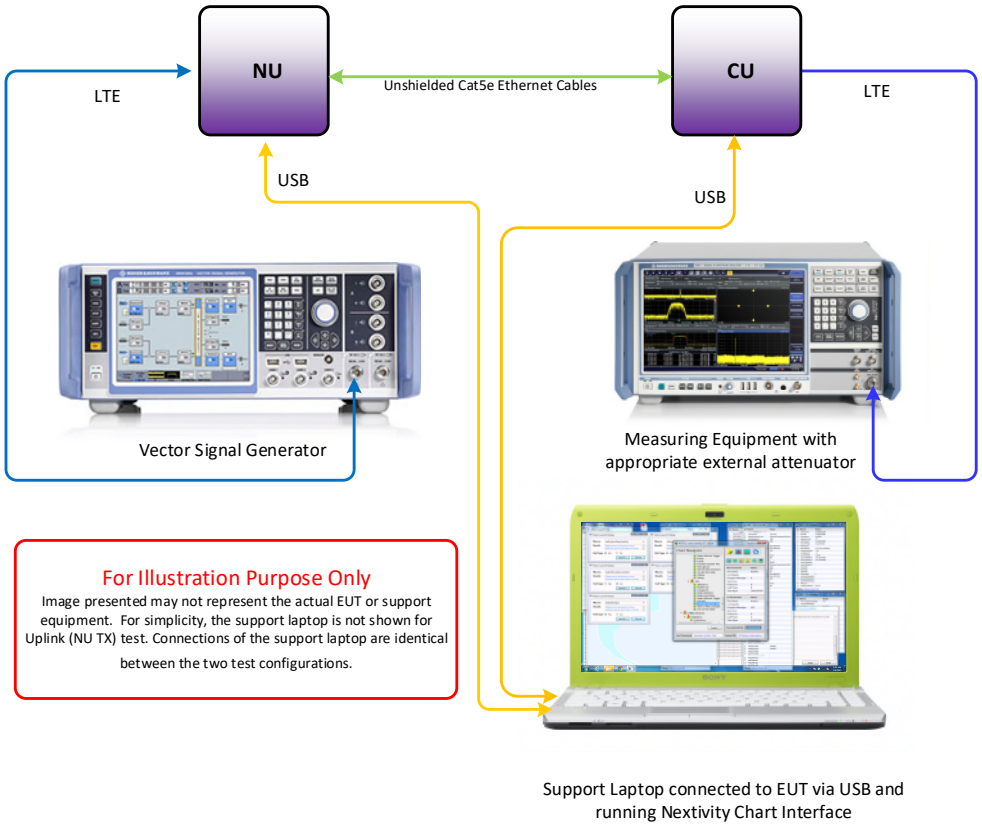
Mode	Bandwidth	Channel No.	Frequency
LTE Band 14 Downlink	10 MHz	Middle Channel 5330	763 MHz
LTE Band 14 Uplink	10 MHz	Middle Channel 23330	793 MHz

Final installation position is unknown at the time of verification. For radiated measurements X and Z orientations were verified since the EUT won't work on Y orientation. No major variation in emissions observed between the three (3) orientations. Verifications performed using "X" configuration.



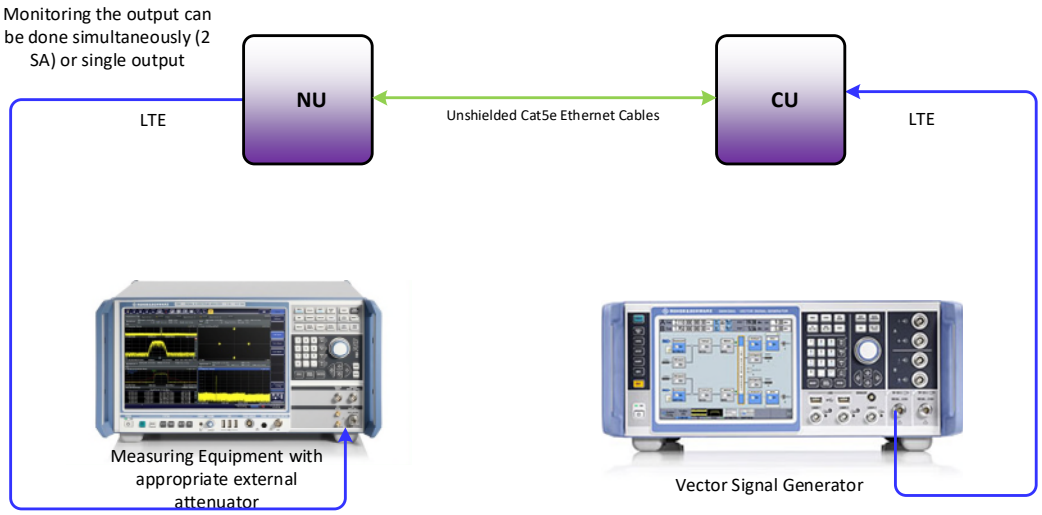
1.4.5 Simplified Test Configuration Diagram

Downlink (CU Tx) Conducted Test



Support Laptop connected to EUT via USB and running Nextivity Chart Interface

Uplink (NU Tx) Conducted Test



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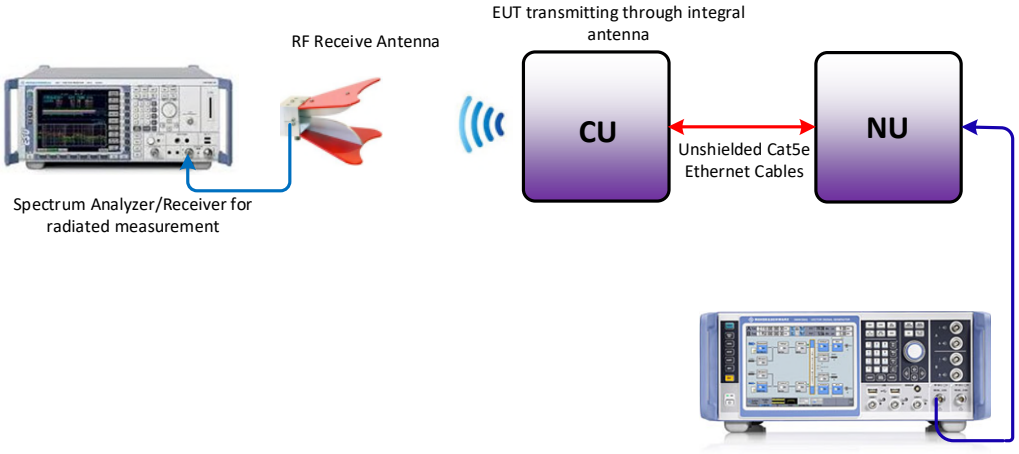
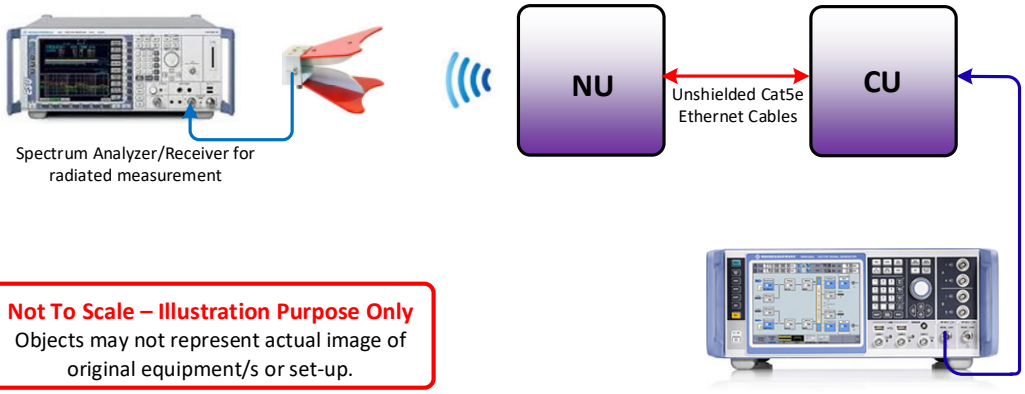
Radiated Testing (Downlink)



Radiated Testing (Uplink)



Not To Scale – Illustration Purpose Only
Objects may not represent actual image of original equipment/s or set-up.

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1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: 560311000026.	-	-

The table above details modifications made to the EUT during the test program. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.26 2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

For conducted (if applicable) and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.26-2015. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: (858) 678 1400 Fax: (858) 546 0364.

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: (858) 678 1400 Fax: (858) 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation No.: US1146

TÜV SÜD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Designation is US1146.

1.9.2 Innovation, Science and Economic Development Canada (IC) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 NCC (National Communications Commission - US0102)

TUV SUD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP002 for Low-Power RF Device type of testing.

1.9.5 VCCI – Registration No. A-0412 and A-0413

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

1.9.6 RRA – Identification No. US0102

TUV SUD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

1.9.7 OFCA – U.S. Identification No. US0102

TUV SUD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.

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SECTION 2

TEST DETAILS

Radio Test of the
Nextivity Inc.
Cel-Fi G41 Industrial Signal Booster

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

2.1 TRANSMITTER CONDUCTED OUTPUT POWER

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046
RSS-119, Clause 10.2

2.1.2 Standard Applicable

The conducted power mesurements were made in accordance to FCC Part 2 Clasue 2.1046:
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.
(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

RSS-131, 10.2: The output power of the zone enhancer shall comply with the transmitter output power of the equipment with which it is to be used and chall be within ±1.0 dB of the manifacturer's rated output power listed in zone enhancer equipment specifications.

2.1.3 Equipment Under Test and Modification State

Serial No: 560311000026/ Test Configuration A and B

2.1.4 Date of Test/Initial of Test Personnel who Performed the Test

September 14, 2023 / MARG

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.3°C
Relative Humidity	48.6%
ATM Pressure	99.7kPa

2.1.7 Additional Observations

- This is a conducted test using power meter.
- The path loss was measured and entered as a level offset.
- Both Peak and Average measurements presented.
- LTE Band 14 only supports 10 MHz bandwidth..

2.1.8 Test Results

LTE Band 14 Downlink						
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)	Limit According to Manufacturer (dBm)	RSS-131 Limit (dB)
10	-	-	-	-		
	5330	763.0	12.27	24.41	13	±1 Manufacturer declared
	-	-	-	-		

LTE Band 14 Uplink						
Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power (dBm)	PK Power (dBm)	Limit According to Manufacturer (dBm)	RSS-131 Limit (dB)
10	-	-	-	-		
	23330	793.0	21.08	30.46	22	±1 Manufacturer declared
	-	-	-	-		

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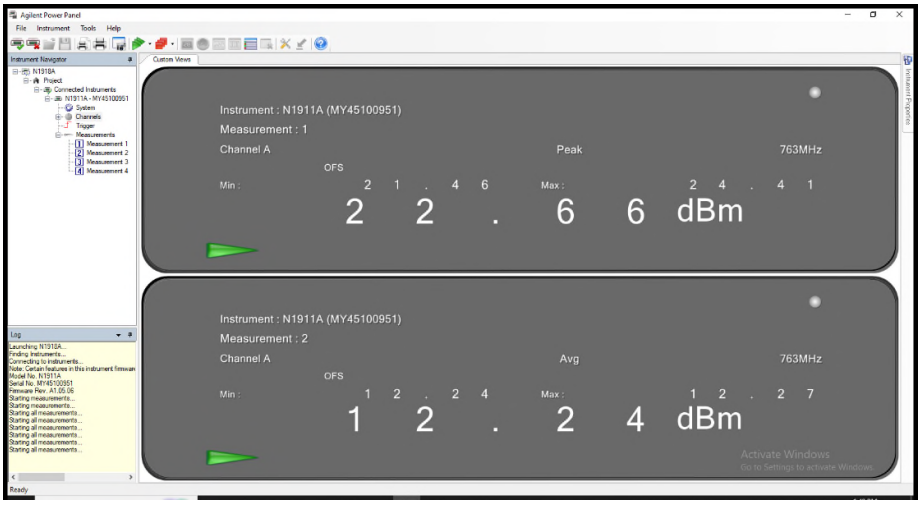
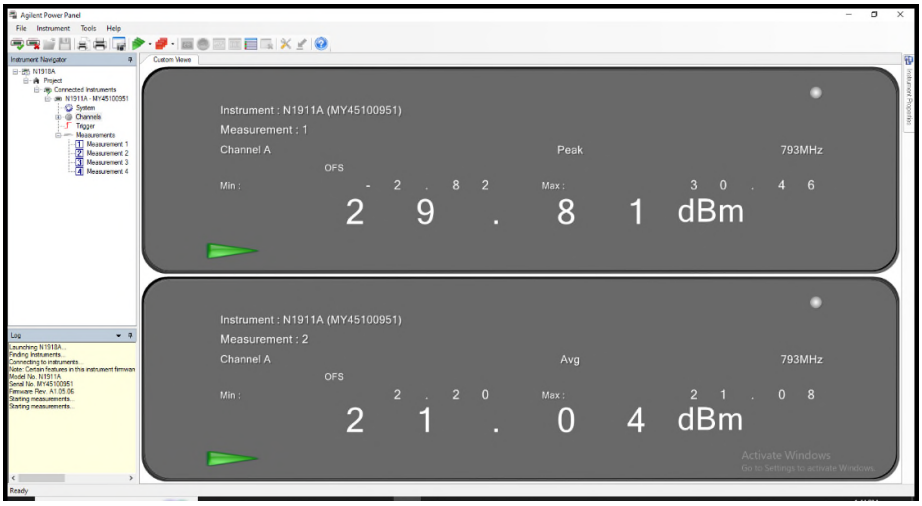
2.1.9 Sample Test Plot



LTE Band 14 DL 10 MHz Bandwidth Middle Channel



LTE Band 14 UL 10 MHz Bandwidth Middle Channel

2.2 EFFECTIVE RADIATED POWER

2.2.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.219(d)(3)(i),

2.2.2 Standard Applicable

FCC 47 CFR Part 90, Clause 90.219:
Except as set forth in paragraph (d)(3)(ii) of this section, signal boosters must be deployed such that the radiated power of each retransmitted channel, on the forward link and on the reverse link, does not exceed 5 Watts effective radiated power (ERP)

2.2.3 Equipment Under Test and Modification State

Serial No: 560311000026

2.2.4 Date of Test/Initial of Test Personnel who Performed the Test

September 14, 2023 / MARG

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.3°C
Relative Humidity	48.6%
ATM Pressure	99.7kPa

2.2.7 Additional Observations

- ERP and EIRP were calculated as per Section 1.2 and 1.3 of KDB412172 D01 (Determining ERP and EIRP v01).
- Calculation formula in logarithmic terms:

$$\textbf{ERP or EIRP} = P_T + G_T - L_C$$

Where:

P_T = transmitter output power, expressed in dBm (Section 2.1 of this test report)
G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
$G_T(dBd) = G_T(dBi) – 2.15$ dB
L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

2.2.8 Sample Computation

ERP = $P_T + G_T - L_C$ - 2.15dB
= 29.87 (Peak) + 0.13 (max. gain) – 3.84 (cable loss) -2.15
= 24.01 dBm

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2.2.9 Test Results

LTE Band 14 Downlink					
Bandwidth (MHz)	**Frequency (MHz)**	**Max Power Average (dBm)**	**Max System Gain (dBi)***	**ERP (dBm)**	**Limit (dBm)**
10	-	-	-	-	-
	763.0	**12.27**	**17.52**	**29.79**	**36.99**
	-	-	-	-	**-**

Note: *Maximum System Gain was used to comply with MPE when simultaneous transmission.

LTE Band 14 Uplink					
Bandwidth (MHz)	**Frequency (MHz)**	**Max Power Average (dBm)**	**Max System Gain (dBi)***	**ERP (dBm)**	**Limit (dBm)**
10	-	-	-	-	-
	793.0	**21.08**	**8.05**	**29.11**	**36.99**
	-	-	**-**	-	**-**

Note: *Maximum System Gain was used to comply with MPE when simultaneous transmission.

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2.3 OCCUPIED BANDWIDTH

2.3.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1049
RSS-GEN Issue 5, Clause 6.7

2.3.2 Standard Applicable

FCC Part 2.1049, RSS-GEN 6.7

The transmitted signal bandwidth shall be reported as the 99% emission bandwidth, that is the frequency bandwidth suuch that, below its lower and above its upper frequency limits, the mean powers radiated are eqch equal to 0.5 percent of the total mean power radiated by a give emission.

Using the occupied bandwidth meansurement function in the spectrum analyzer, the 99% occupied bandwith was measured.

2.3.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.3.4 Date of Test/Initial of test personnel who performed the test

September 14, 18, 2023 / MARG

2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	21.0 – 24.8°C
Relative Humidity	30.9 – 51.8%
ATM Pressure	98.6 – 99.3kPa

2.3.7 Additional Observations

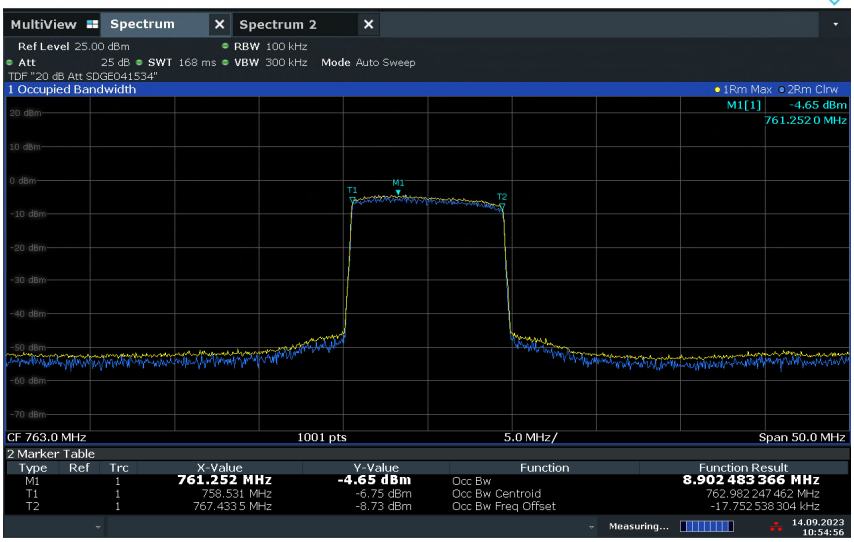
- This is a conducted test.
- Using the occupied bandwidth meansurement function in the spectrum analyzer, the 99% occupied bandwith was measured.
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The RBW is set to 1% of the OBW while the VBW is ≥3X RBW.
- The detector is peak and the trace mode is max hold.
- LTE Band 14 only supports 10 MHz bandwidth..

2.3.8 Test Results and Sample Test Plot

LTE Band 14 Downlink				
Bandwidth (MHz)	**Channel**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
10	-	-	-	-
	5330	763.0	8.92	9.46
	-	-	-	-

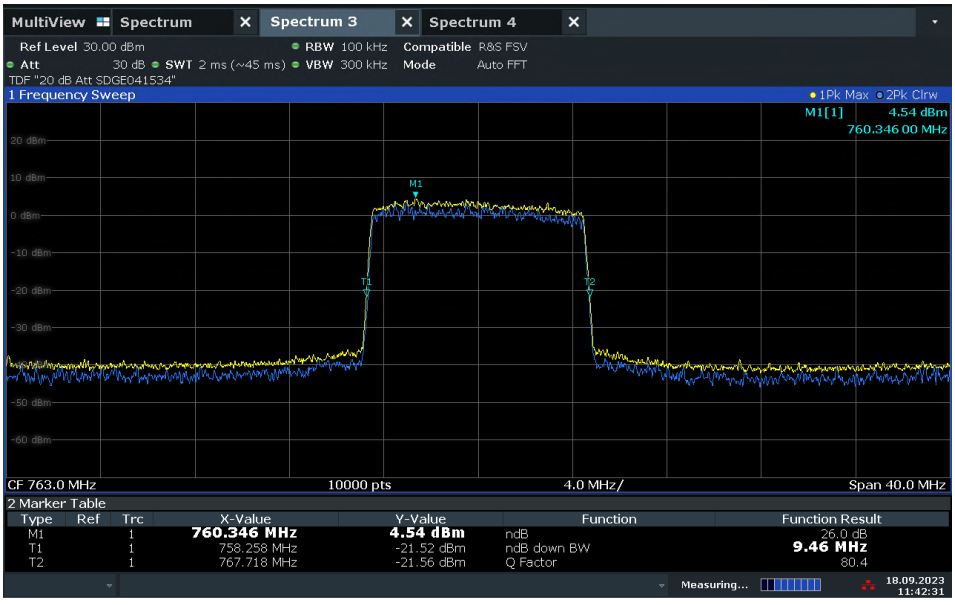
LTE Band 14 Uplink				
Bandwidth (MHz)	**Channel**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
10	-	-	-	-
	23330	793.0	8.89	9.42
	-	-	-	-

LTE Band 14 Downlink (10 MHz BW) / Middle Channel 763 MHz / 99%OBW



10:54:56 14.09.2023

LTE Band 14 Downlink (10 MHz BW) / Middle Channel 763 MHz / 26dB BW



11:42:32 18.09.2023

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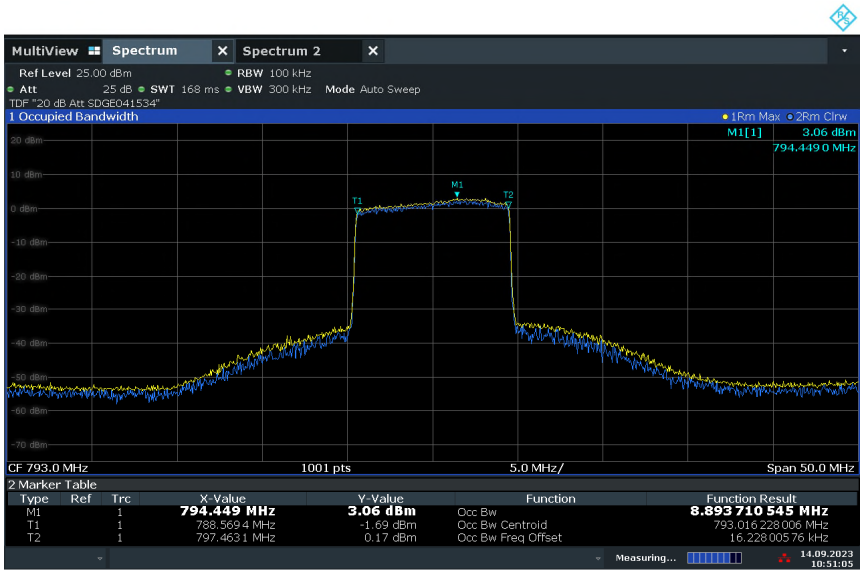
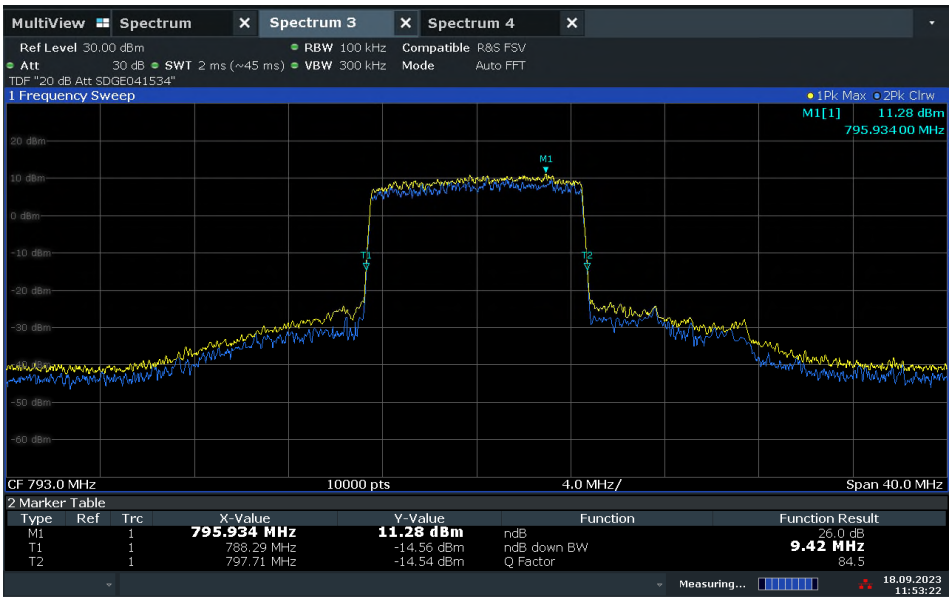
LTE Band 14 Uplink (10 MHz BW) / Middle Channel 793 MHz / 99%OBW



10:51:05 14.09.2023

LTE Band 14 Uplink (10 MHz BW) / Middle Channel 793 MHz / 26dB BW



11:53:23 18.09.2023

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2.4 PEAK-AVERAGE RATIO

2.4.1 Specification Reference

RSS-140 Issue 1, Clause 4.3

2.4.2 Standard Applicable

RSS-140 clause 4.3

The peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

2.4.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.4.4 Date of Test/Initial of Test Personnel who Performed the Test

September 14, 2023 / MARG

2.4.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.9°C
Relative Humidity	23.2%
ATM Pressure	98.6kPa

2.4.7 Additional Observations

- This is a conducted test.
- Measurement was done using the Spectrum Analyzer's Complementary Cumulative Distribution Function (CCDF) measurement profile. The built-in function is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth (crest factor or peak-to-average ratio) A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth.
- RBW was set to maximum the SA can support.
- There are no measured PAR levels greater than 13dB.

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2.4.8 Test Results

LTE Band 14 Downlink			
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**PAR (dB)**
10 MHz	-	-	-
	5330	763.0	11.05
	-	-	-

LTE Band 14 Uplink			
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**PAR (dB)**
10 MHz	-	-	-
	23330	793.0	9.18
	-	-	-

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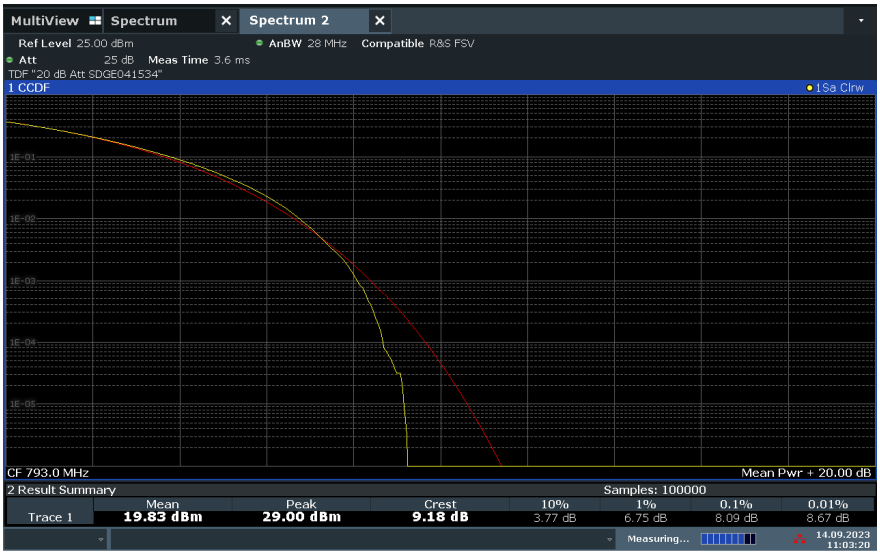
2.4.9 Sample Test Plot

LTE Band 14 Downlink (10 MHz BW) / Middle Channel 763 MHz

11:02:03 14.09.2023

LTE Band 14 Uplink (10 MHz BW) / Middle Channel 793 MHz



11:03:21 14.09.2023

2.5 BAND EDGE

2.5.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 90.543 (e)(3)(5)
RSS-140, Clause 4.4
KDB971168 Clause 6.1

2.5.2 Standard Applicable

FCC 47 CFR Part 90, Clause 90.543:
(e) For operations in the 758–768 MHz and the 788–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
(3) On any frequency between 775–788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.
(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

RSS-140:
4.4 Transmitter unwanted emissions limits
The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:
a. For any frequency between 769-775 MHz and 799-806 MHz:
i 76 + 10 log (p), dB in a 6.25 kHz band for fixed and base station equipment
ii 65 + 10 log (p), dB in a 6.25 kHz band for mobile and portable/hand-held equipment

b For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz: 43 + 10 log (p), dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

2.5.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.5.4 Date of Test/Initial of Test Personnel who Performed the Test

September 14, 2023 / MARG

2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.9°C
Relative Humidity	25.2%
ATM Pressure	99.7kPa

2.5.7 Additional Observations

- This is a conducted test. Test guidance is per Section 6.1 of KDB971168 (D01 Power Meas License Digital Systems v03r01).
- The path loss was measured and entered as a Transducer Factor
- For LTE Band 14, RBW was set to 30 kHz and the limit for emissions 100 kHz outside of the low frequency edge and the high frequency edge of each frequency block range(s) was set to:

  Limit = -13dBm + 10lg(30/100) = -18.23 dBm

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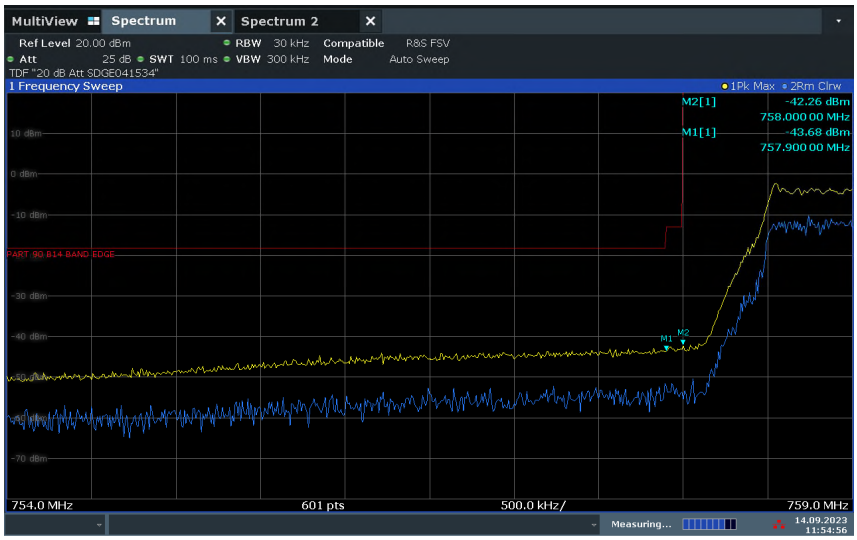
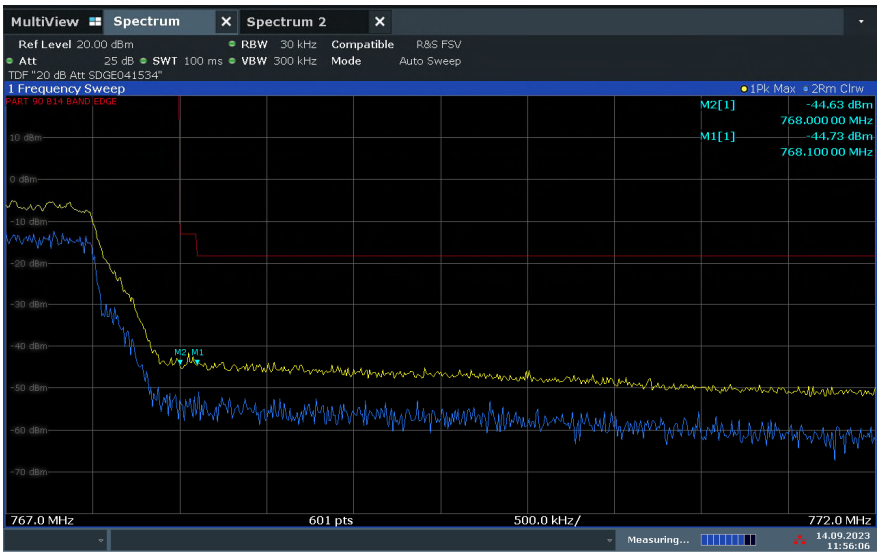
2.5.8 Test Results

LTE Band 14 Downlink 10MHz Bandwidth Middle Channel Low Band Edge



11:54:56 14.09.2023

LTE Band 14 Downlink 10MHz Bandwidth Middle Channel High Band Edge



11:56:06 14.09.2023

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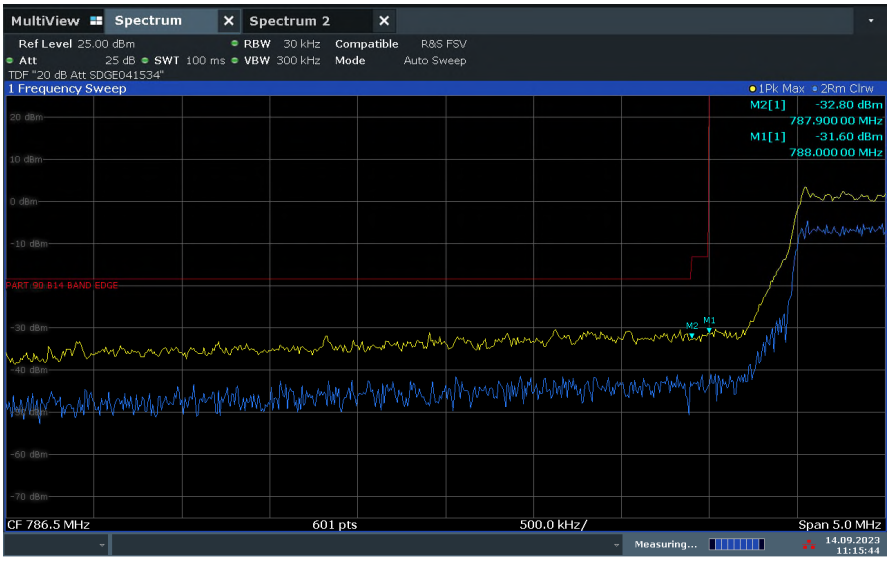
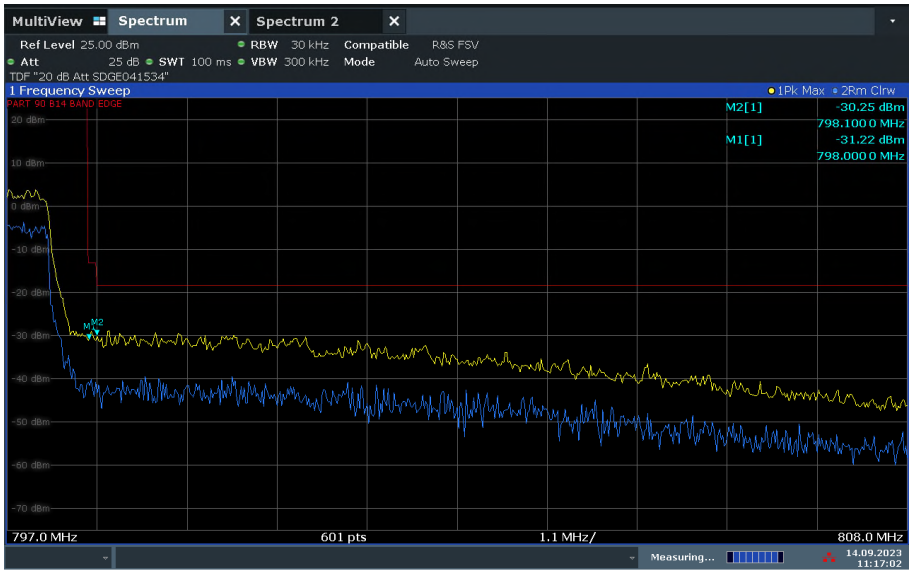
LTE Band 14 Uplink 10MHz Bandwidth Middle Channel Low Band Edge



11:15:45 14.09.2023

LTE Band 14 Uplink 10MHz Bandwidth Middle Channel High Band Edge



11:17:03 14.09.2023

2.6 CONDUCTED SPURIOUS EMISSIONS

2.6.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 90, Clause 90.219(e)(3)
FCC 47 CFR Part 90, Clause 90.543(e)(2)(3)(4)(5)(f)
RSS-140, Clause 4.4
RSS-131, Clause 10.6
KDB935210 D05, Clause 4.73

2.6.2 Standard Applicable

FCC 47 CFR Part 90, Clause 90.219(e)(3)
Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.

FCC 47 CFR Part 90, Clause 90.543:
(e) For operations in the 758–768 MHz and the 788–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775–788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

(f) For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

RSS-140, Clause 4.4:
4.4 Transmitter unwanted emissions limits
The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:
a. For any frequency between 769-775 MHz and 799-806 MHz:
i 76 + 10 log (p), dB in a 6.25 kHz band for fixed and base station equipment
ii 65 + 10 log (p), dB in a 6.25 kHz band for mobile and portable/hand-held equipment

b For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz: 43 + 10 log (p), dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and

adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

In addition, the equivalent isotropically radiated power (e.i.r.p.) of all emissions, including harmonics in the band 1559-1610 MHz, shall not exceed −70 dBW/MHz for wideband emissions, and −80 dBW/kHz for discrete emissions of less than 700 Hz bandwidth.

RSS-131, Clause 10.6:
Zone enhancers shall meet the following requirements;

1. Minor departures from the exact reference frequencies of the input signals atre permitted provided the retransmitted signals meet the frequency stability limit specified in RSS-119 for the equipment with which the zone enhancer is to be used.
2. The rentrasnmitted signals shall meet the unwanted emissions limits in RSS-119 that applies to the equipment with which the zone enhancer is to be used,

2.6.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.6.4 Date of Test/Initial of Test Personnel who Performed the Test

September 14, 2023 / MARG

2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

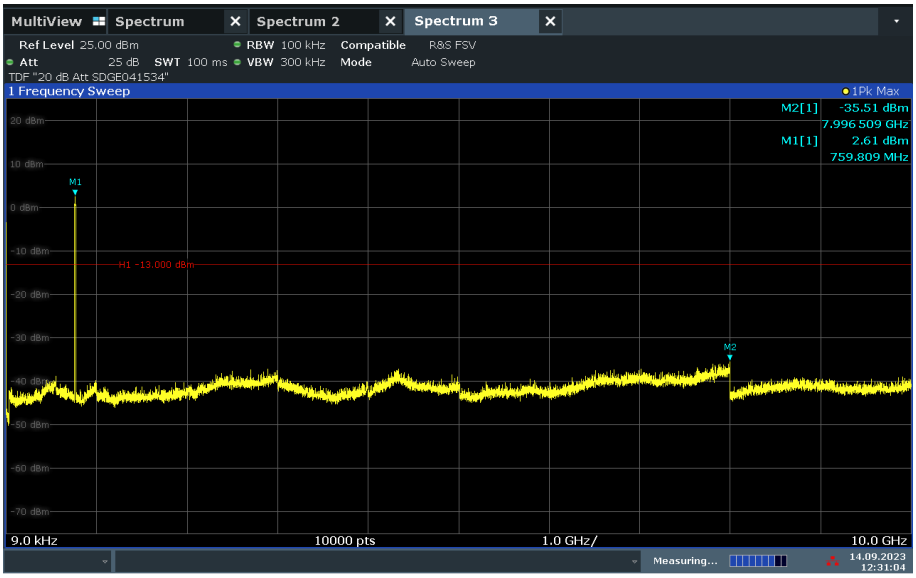
Ambient Temperature	20.9 – 24.9°C
Relative Humidity	23.2 – 50.2%
ATM Pressure	98.6 – 99.7kPa

2.6.7 Additional Observations

- This is a conducted test. Test guidance is per Section 4.7.3 of KDB935210 (Measurements Guidance for Industrial and Non-Consumer Signal Booster, Repeater, And Amplifier Devices D05 v01r04).
- The transducer factor (TDF) used is from the external attenuators and cables used.
- Detector is peak and trace is set to max hold as the worst case setting.
- The spectrum was searched from 9 kHz to up to the 10th harmonic
- All low, middle and high channels for all supporting bandwidths were verified and only middle channel presented in this test report as representative configuration.

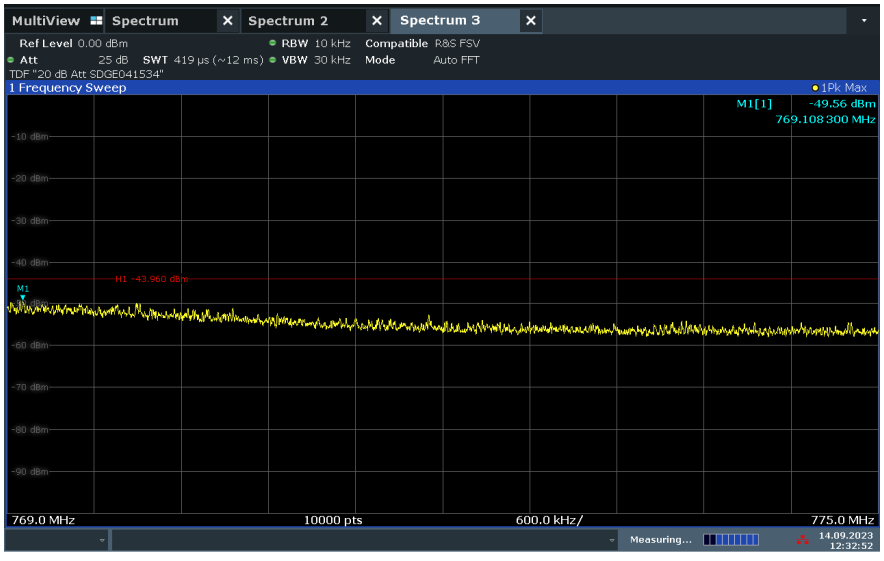
2.6.8 Test Results

LTE Band 14 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions



12:31:04 14.09.2023

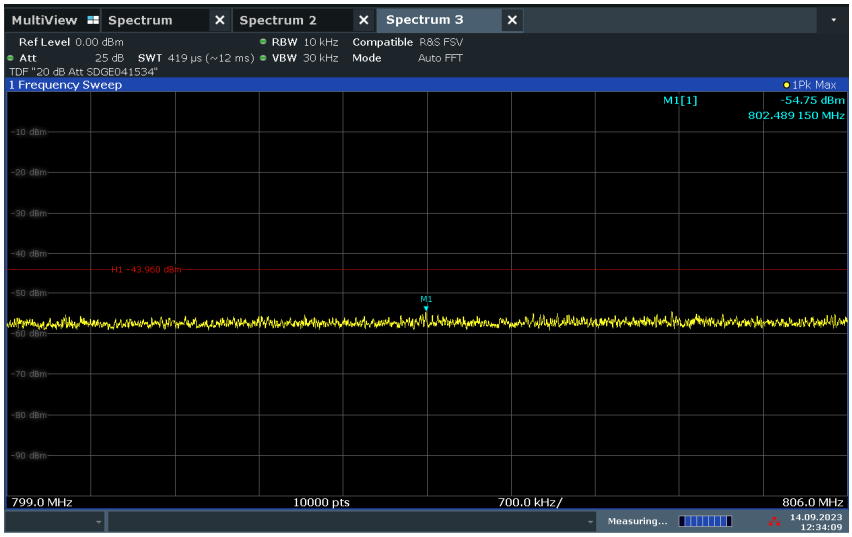
LTE Band 14 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 769 – 775 MHz



12:32:53 14.09.2023

Limit = -46 + 10lg (10/6.25) = -43.96 dBm

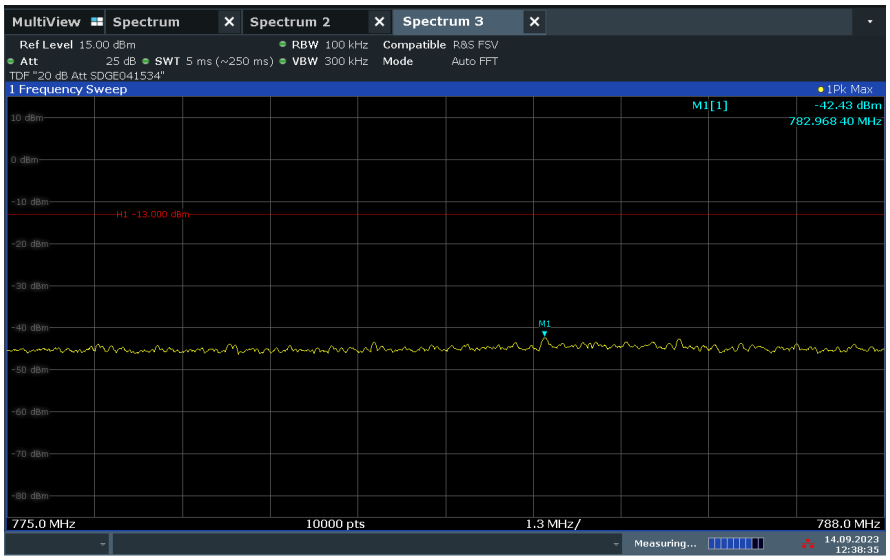
LTE Band 14 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 799 – 806 MHz



12:34:10 14.09.2023

Limit = -46 + 10lg (10/6.25) = -43.96 dBm

LTE Band 14 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 775 – 788 MHz



12:38:35 14.09.2023

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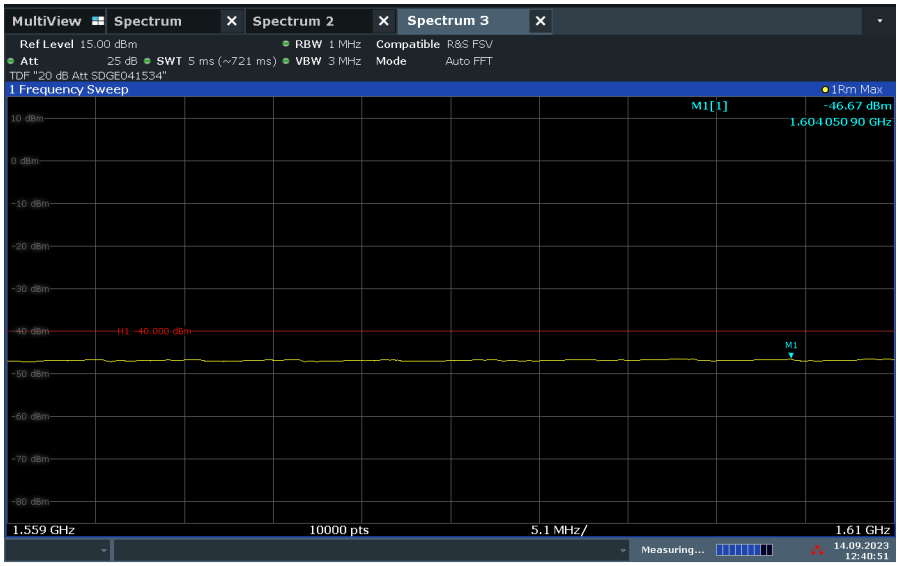
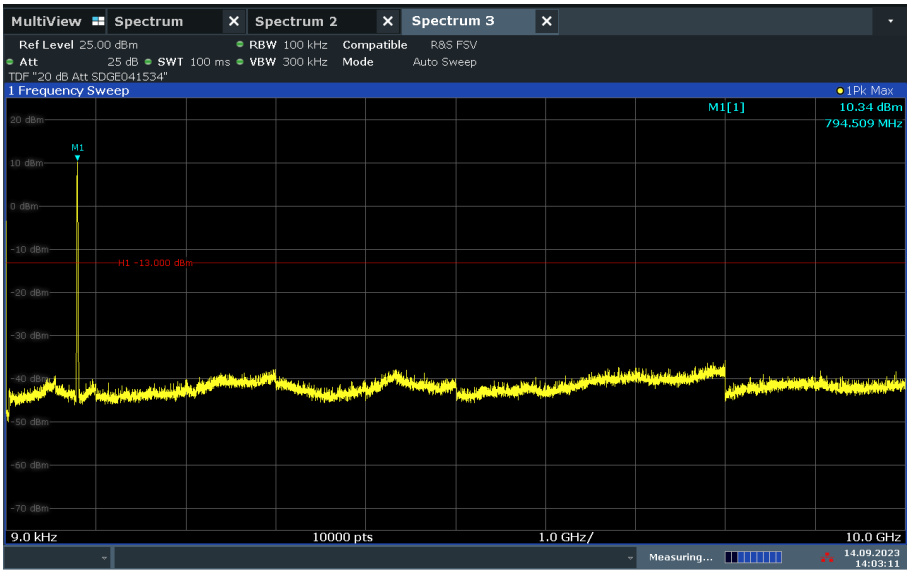
LTE Band 14 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 1559 – 1610 MHz (EIRP)



12:40:51 14.09.2023

LTE Band 14 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions



14:03:12 14.09.2023

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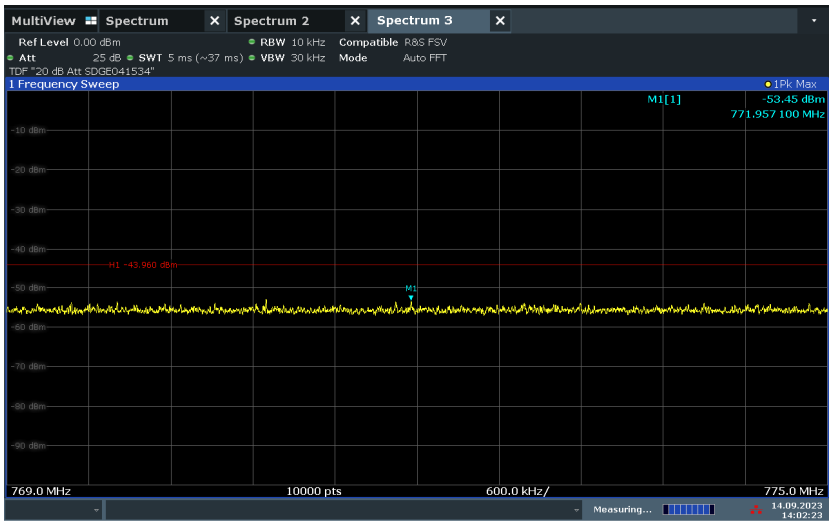
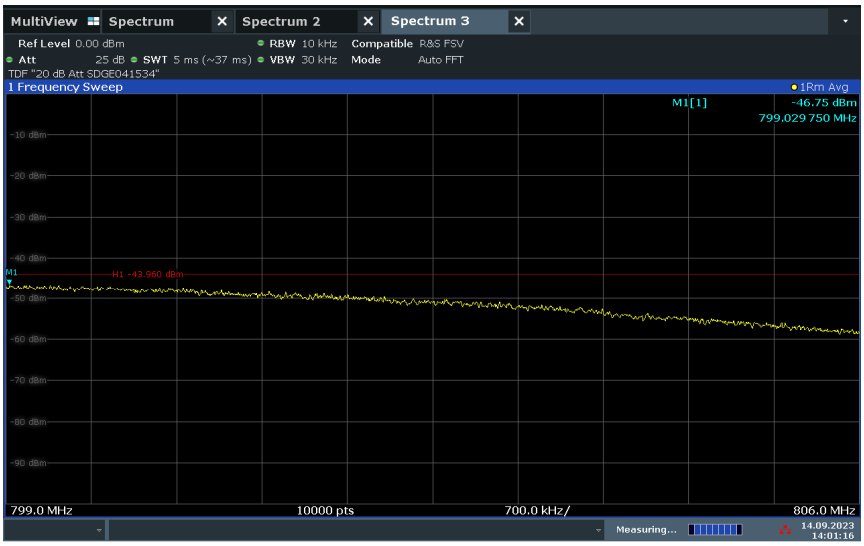
LTE Band 14 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 769 – 775 MHz



14:02:24 14.09.2023

Limit = -46 + 10lg (10/6.25) = -43.96 dBm

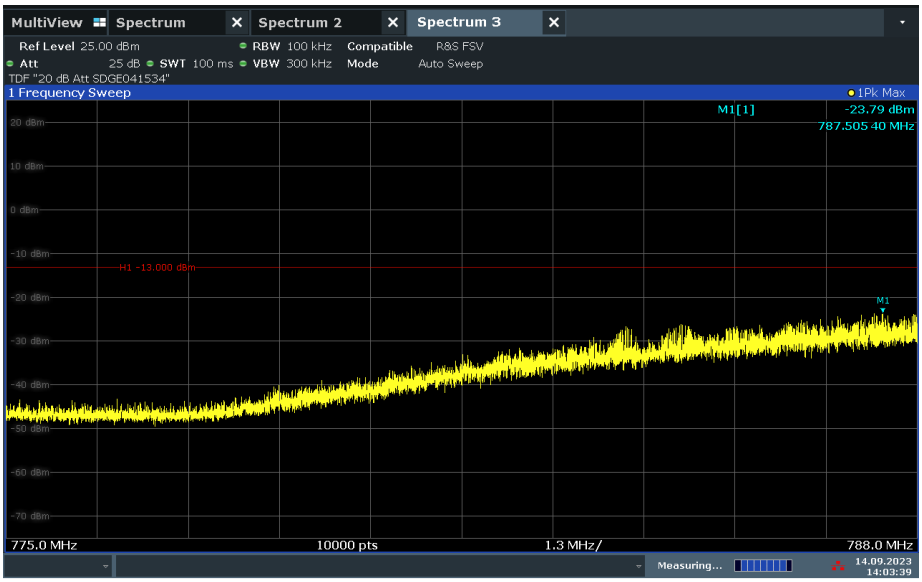
LTE Band 14 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 799 – 806 MHz



14:01:17 14.09.2023

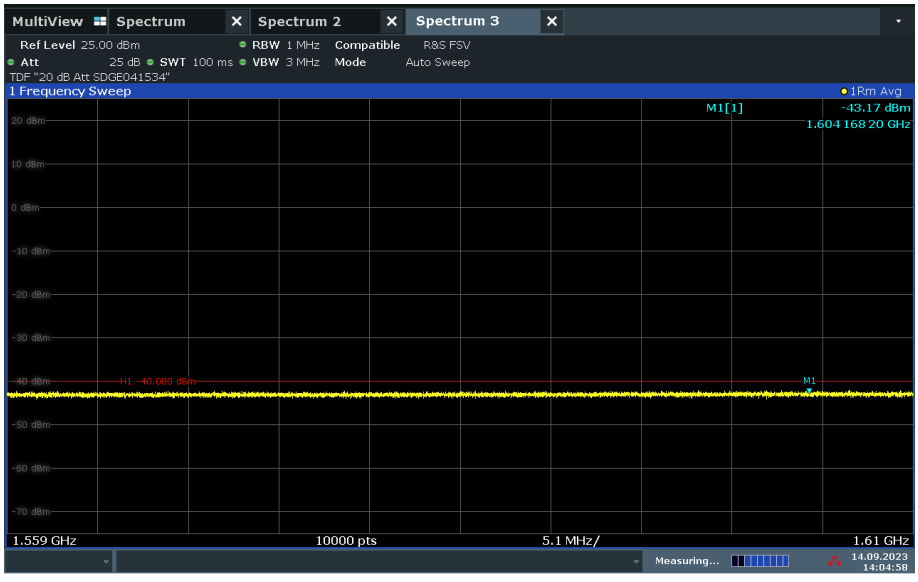
Limit = -46 + 10lg (10/6.25) = -43.96 dBm

LTE Band 14 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 775 – 788 MHz



14:03:40 14.09.2023

LTE Band 14 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions 1559 – 1610 MHz (EIRP)



14:04:59 14.09.2023

2.7 FREQUENCY STABILITY

2.7.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055
FCC 47 CFR Part 90, Clause 90.539(b)
RSS-140, Clause 4.2
KDB935210 D05, Clause 4.8.
RSS-131, Clause 9.4
RSS-119, Clause 5.9

2.7.2 Standard Applicable

FCC 47 CFR Part 2, Clause 2.1055:
(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From -30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

FCC 47 CFR Part 90, Clause 90.539(b):
Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the frequency stability requirements in this section.
(b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.

FCC 47 CFR Part 90, Clause 90.213:
(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table:

MINIMUM FREQUENCY STABILITY

[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1 2 3] 100	100	200
25–50	20	20	50
72–76	5	.....	50
150–174	[5 11] 5	[6] 5	[4 6] 50
216–220	1.0	.....	1.0
220–222 [12]	0.1	1.5	1.5
421–512	[7 11 14] 2.5	[8] 5	[8] 5
806–809	[14] 1.0	1.5	1.5
809–824	[14] 1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	[14] 0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928 [13]	2.5	2.5	2.5
929–930	1.5	.....	.....
935–940	0.1	1.5	1.5
1427–1435	[9] 300	300	300
Above 2450 [10]	.....	.....	.....

RSS-140, Clause 4.2:
The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the tmperature and supply voltage variations specified in RSS-Gen.

RSS-119, Clause 5.9:
The frequency error of frequency difference shall not exceed the limits specified in Table 18

Table 18 – Transient Frequency Behaviour

Channel Bandwidth (kHz)	Time Intervals (Notes 1, 2)	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
			138-174 MHz	406.1-512 MHz
25	t_1	±25	5	10
	t_2	±12.5	20	25
	t_3	±25	5	10
12.5	t_1	±12.5	5	10
	t_2	±6.25	20	25
	t_3	±12.5	5	10
6.25	t_1	±6.25	5	10
	t_2	±3.125	20	25
	t_3	±6.25	5	10

RSS-131, Clause 9.4:
Industrial zone enhancers shall comply with the frequency stability given in the RSS that applies to the equipment with which the zone enhancer is to be used. In cases where the frequency stability limit is not given in the applicable RSS, the equipment shall comply with a frequency stability of ± 1.5 ppm.

For zone enhancers with no input signal processing capability such as modulation, or if the zone enhancer does not incorporate an internal oscillator circuit component, the frequency stability measurement in this section is not required.

2.7.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.7.4 Date of Test/Initial of Test Personnel who Performed the Test

September 15, October 18, 2023/ MARG

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.4 – 25.3°C
Relative Humidity	30.9 – 50.3%
ATM Pressure	98.6 – 99.0kPa

2.7.7 Additional Observations

- This is a conducted test.
- The EUT was operated at 120.0VAC nominal voltage and was placed in the temperature chamber for the series of evaluations performed.
- For LTE band 14, test performed in 10 MHz Bandwidth Middle channel as the representative configuration. Input Type "Tones" was selected and the EUT was injected a CW signal from a Signal Generator and maximum frequency error was monitored using the spectrum analyser.
- The Temperature was reduced to -30°C and allowed to sit for 1 hour to allow the equipment and chamber temperature to stabilize. The measurements on both downlink and uplink were then performed. The temperature was then increased by 10°C steps and allowed to settle before taking the next set of measurements. The EUT was tested over the temperature -30°C to +50°C.
- Voltage variation was also performed at 85% and 115% of the nominal voltage.

2.7.8 Test Results Summary

LTE B14 Downlink – 10 MHz BW Middle Channel				
Voltage (VDC)	**Temperature (°C)**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
120	-30	0	0	-
	-20	0	0	-
	-10	0	0	-
	0	0	0	-
	+10	0	0	-
	+20	0	0	-
	+30	0	0	-
	+40	0	0	-
	+50	0	0	-
102	+20	0	0	-
138		0	0	-

LTE B14 Downlink Frequency Range					
Channel	**Temperature (°C)**	**Voltage (VAC)**	**F_L (MHz)**	**F_H (MHz)**	**Limit (MHz)**
Low Channel	-30	120	758.5432	-	>758
	+20	102	758.5403	-	
		120	758.5436	-	
		138	758.5383	-	
	+50	120	758.5400	-	
High Channel	-30	120	-	767.43527	<768
	+20	102	-	767.4341	
		120	-	767.4388	
		138	-	767.4321	
	+50	120	-	767.4284	

The frequency stability of the EUT is sufficient to keep it within the authorized frequency ranges at any temperature interval and voltage variations across the measured range.

LTE B14 Uplink – 10 MHz BW Middle Channel				
Voltage (VDC)	**Temperature (°C)**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
120	-30	0	0	-
	-20	0	0	-
	-10	0	0	-
	0	0	0	-
	+10	0	0	-
	+20	0	0	-
	+30	0	0	-
	+40	0	0	-
	+50	0	0	-
102	+20	0	0	-
138		0	0	-

LTE B14 Uplink Frequency Range					
Channel	**Temperature (°C)**	**Voltage (VAC)**	**F_L (MHz)**	**F_H (MHz)**	**Limit (MHz)**
Low Channel	-30	120	788.5557	-	>788
	+20	102	788.5601	-	
		120	788.5593	-	
		138	788.5627	-	
	+50	120	788.5577	-	
High Channel	-30	120	-	797.4662	<798
	+20	102	-	797.4624	
		120	-	797.4544	
		138	-	797.4605	
	+50	120	-	797.4594	

The frequency stability of the EUT is sufficient to keep it within the authorized frequency ranges at any temperature interval and voltage variations across the measured range.

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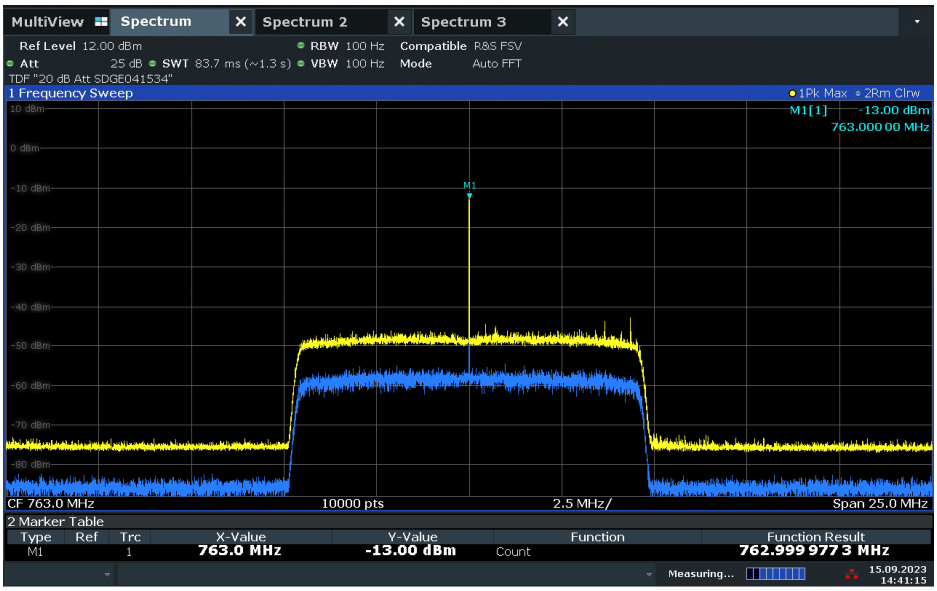
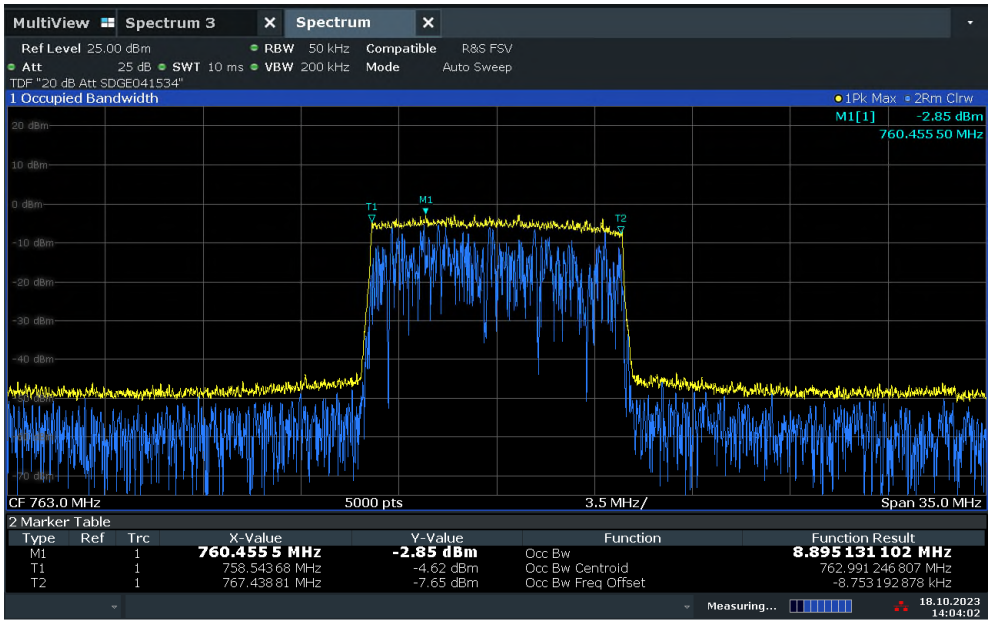
2.7.9 Sample Test Plots



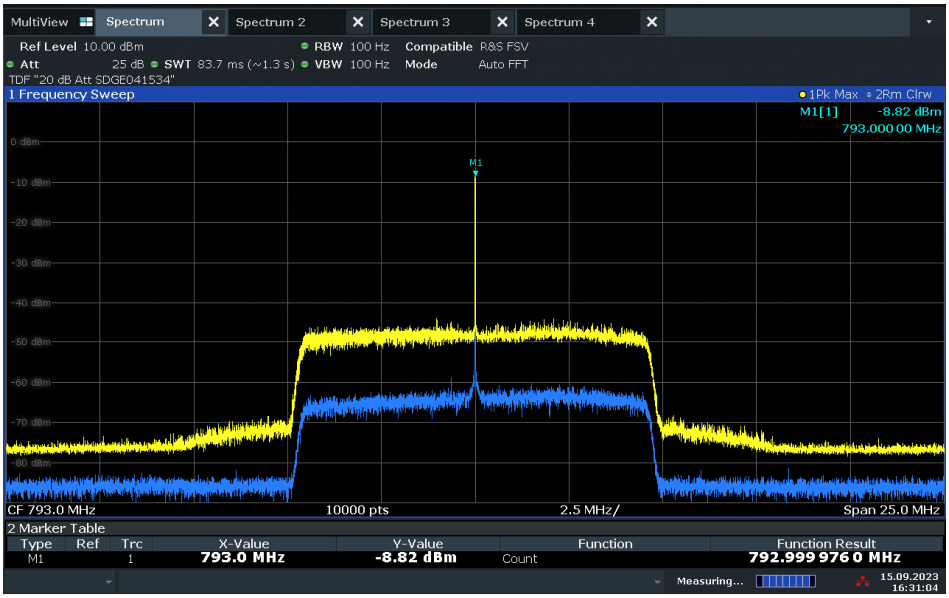
14:41:15 15.09.2023

LTE Band 14 Downlink Middle Channel 120VAC @ 20°C



14:04:02 18.10.2023

LTE B14 Downlink Middle Channel Low Edge and High Edge @ 20°C Nominal Voltage



16:31:04 15.09.2023

LTE Band 14 Uplink Middle Channel 120VAC @ 20°C

11:34:51 18.10.2023

LTE B14 Uplink Middle Channel Low Edge and High Edge @ 20°C Nominal Voltage

2.8 AGC THRESHOLD LEVEL

2.8.1 Specification Reference

KDB 935210 D05, Clause 4.2

2.8.2 Standard Applicable

AGC Threshold Level is tested according to KDB 935210 D05, Clause 4.2:

The AGC threshold shall be determined by applying the procedure of 3.2 (of the current KDB), but with the signal generator configured to produce a test signal defined in Table 1, a CW input signal or a digitally modulated signal, consistent with the discussion about signal type in 4.1.

Devices intended for used in 700 MHz Public Safety Broadband spectrum shall be tested using representative band-limited AWGN signal (99% OBW of 4.1 MHz) or the applicable signal type (e.g., LTE)

2.8.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.8.4 Date of Test/Initial of Test Personnel who Performed the Test

September 14, 2023 / MARG

2.8.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.9°C
Relative Humidity	50.2%
ATM Pressure	99.3kPa

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2.8.7 Additional Observations

- This is a conducted test.
- For LTE Band 14 LTE, 10 MHz bandwidth Signal was used as the applicable test signal type, a power meter was used according to method 4.5.4 of this KDB, and a spectrum analyser was used according to method 4.5.3 with setting as below when testing input power of the EUT:
    a) RBW = 100 kHz, VBW ≥ 3 x RBW
    b) Peak Detector, Trace mode to Max Hold
    c) Span is at least 1 MHz
- The AGC threshold level was recorded when increasing the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.
- Both downlink and uplink are tested.

2.8.8 Test Results

LTE Band 14						
Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power		AGC Threshold Level (dBm)
				(dBm)	(W)	
Downlink	10	5330	763.0	12.27	0.01686553	-82.3
Uplink	10	23330	793.0	21.08	0.128233058	-73.2

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2.9 OUT-OF-BAND REJECTION

2.9.1 Specification Reference

KDB 935210 D05, Clause 4.3
RSS-131, Clause 9.1

2.9.2 Standard Applicable

RSS-131, Clause 9.1:
The gain-versus-frequency response and the 20 dB passband bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other signals outside the passband of the zone enhancer.

Out-of-Band Rejection is tested according to KDB 935210 D05, Clause 4.3.

2.9.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.9.4 Date of Test/Initial of Test Personnel who Performed the Test

September 18, October 17, 2023 / MARG

2.9.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.5 - 25.3°C
Relative Humidity	43.6 - 44.9%
ATM Pressure	98.8 - 99.3kPa

2.9.7 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as a Transducer Factor
- A swept CW signal whose frequency range is ±250% of the manufacturer's specified pass band is configured for the testing.
- The internal gain control of the EUT is set to the maximum gain. The input signal type is set to tones (CW).
- The CW is 3 dB below the ACG threshold (determined according to section 3.2 and 4.2 of the current KDB), and doesn't activate the AGC threshold throughout the test.
- Dwell time is 10 ms.
- Frequency Step is 50 kHz.
- RBW is between 1% and 5% of the manufacturer's rated pass band.
- VBW is 3 x RBW.
- Detector is peak and trace is max hold.
- The peak amplitude frequency f_0 is determined and two additional -20 dB markers are determined using the marker-delta method).

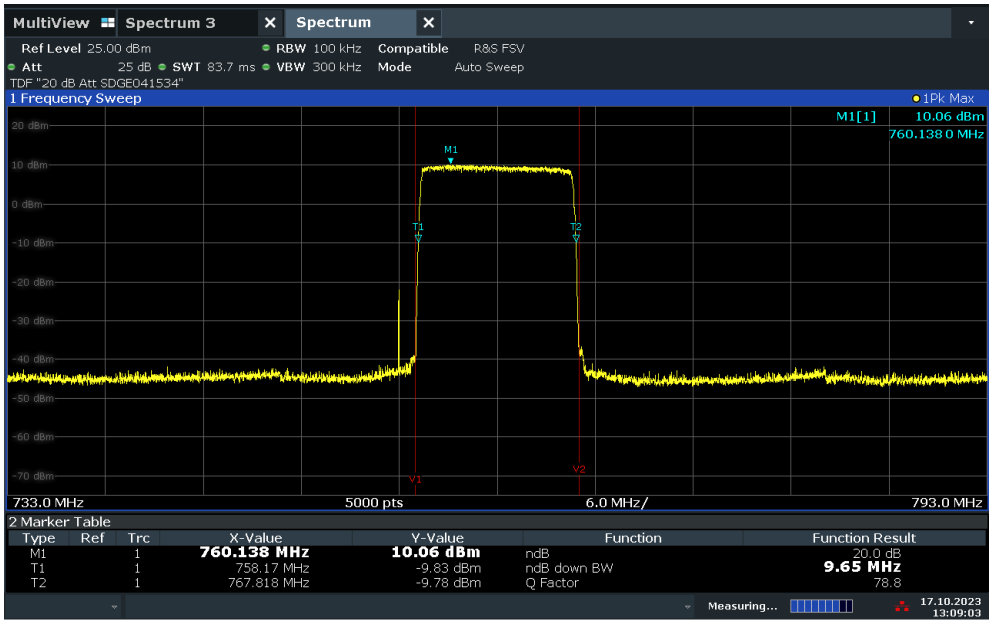
- The 20dB Bandwidth plot is recorded as the out-of-band rejection frequency response.
- Both downlink and uplink are tested.

2.9.8 Test Results

LTE Band 14						
Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	-20 dBc Point		20 dB BW (MHz)
				T1 (MHz)	T2 (MHz)	
Downlink	10	5330	763.0	758.17	767.818	9.65
Uplink	10	23330	793.0	788.17	797.806	9.64

2.9.9 Sample Test Plots

LTE Band 14 Downlink (10 MHz BW) Middle Chl / Out-of-Band Rejection



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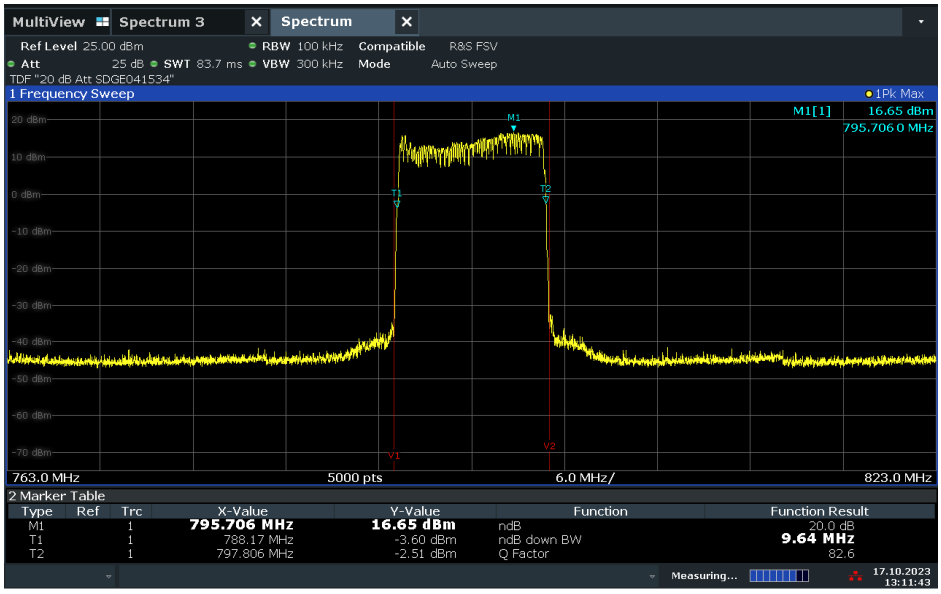
LTE Band 14 Uplink (10 MHz BW) M Channel / Out-of-Band Rejection



13:11:44 17.10.2023

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2.10 INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

2.10.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.219 (e)(4)(ii)
RSS-131, Clause 9.2
KDB 935210 D05, Clause 4.4

2.10.2 Standard Applicable

FCC 47 CFR Part 90, Clause 90.219 (e)(4):
(ii) There is no change in the occupied bandwidth of the retransmitted signals.

RSS-131, Clause 9.2
The spectral growth of the 26 dB bandwidth or occupied bandwidth of the output signal shall be less than 5% of the input signal spectrum.

Input-versus-Output Signal Comparison is tested according to KDB 935210 D05, Clause 4.4.

2.10.3 Equipment Under Test and Modification State

Serial No: 560311000026/ Test Configuration A and B

2.10.4 Date of Test/Initial of Test Personnel who Performed the Test

September 18, 2023 / MARG

2.10.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.9°C
Relative Humidity	50.2%
ATM Pressure	99.4kPa

2.10.7 Additional Observations

- The path loss was measured and entered as an Transducer factor
- For LTE Band 14, the signal generator is configured to transmit LTE 10 MHz Bandwidth signal.
- The signal amplitude is just below the ACG threshold (determined according to section 3.2 and 4.2 of the current KDB), and not more than 0.5 dB below.
- Span is between 2 times to 5 times the emission bandwidth (EBW) or alternatively, the OBW.
- RBW is 1% to 5% of the anticipated OBW, VBW is > 3 x RBW.
- Set the reference level of spectrum analyser to accommodate the maximum input amplitude level.
- Detector is positive peak and trace is max hold.
- The peak amplitude frequency f_0 is determined and the 99% occupied bandwidth was measured with the OBW function of spectrum analyser.
- Repeat the testing with the input signal connected directly to the spectrum analyser.
- Compare the spectral plot of the input signal to the output signal.
- Repeat the testing with input signal amplitude set to 3 dB above AGC threshold.
- Both downlink and uplink are tested.

2.10.8 Test Results

Compliant. There is no spectral growth of OBW and 26 dB bandwidth that is more than than 5% of the input signal spectrum.

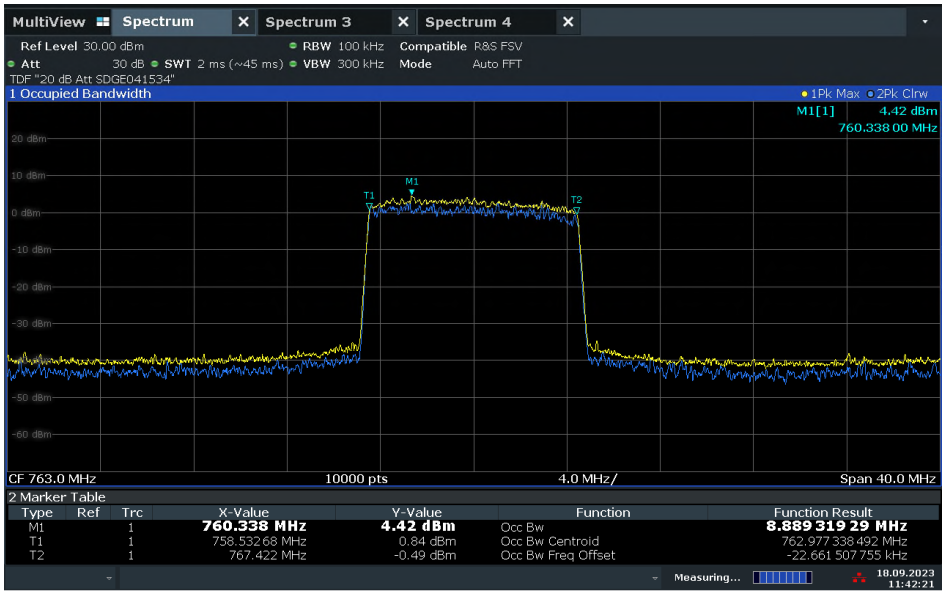
LTE Band 14 Downlink							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	10	5330	763.0	8.88	8.97	9.46	9.93
AGC + 3 dB Level				8.88	8.96	9.47	9.98

* Since the AGC Threshold level and AGC + 3 dB level for downlink are as low as -82.3 dBm, which is about the noise floor, the input levels are adjusted to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 14 Uplink							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	10	23330	793.0	8.89	8.97	9.42	9.97
AGC + 3 dB Level				8.89	8.97	9.43	9.96

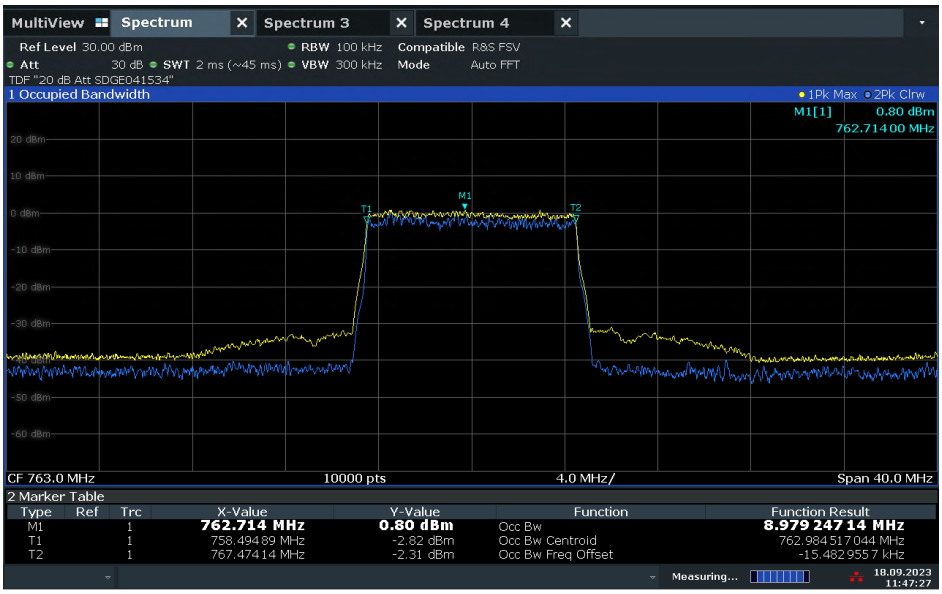
* Since the AGC Threshold level and AGC + 3 dB level for Uplink are as low as -78.2 dBm, which is close to the noise floor, the input levels are adjusted to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 14 Downlink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level



11:42:22 18.09.2023

LTE Band 14 Downlink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)



11:47:28 18.09.2023

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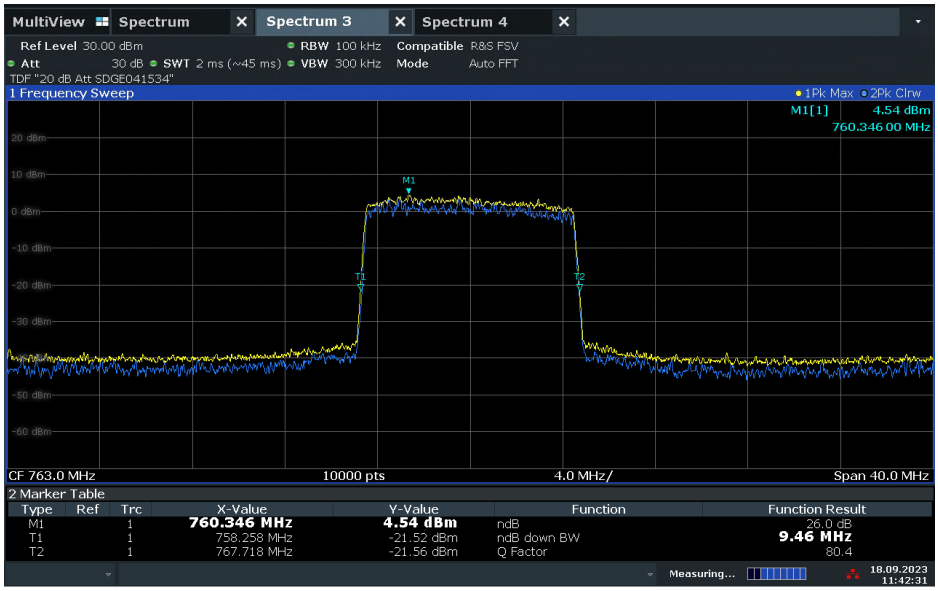
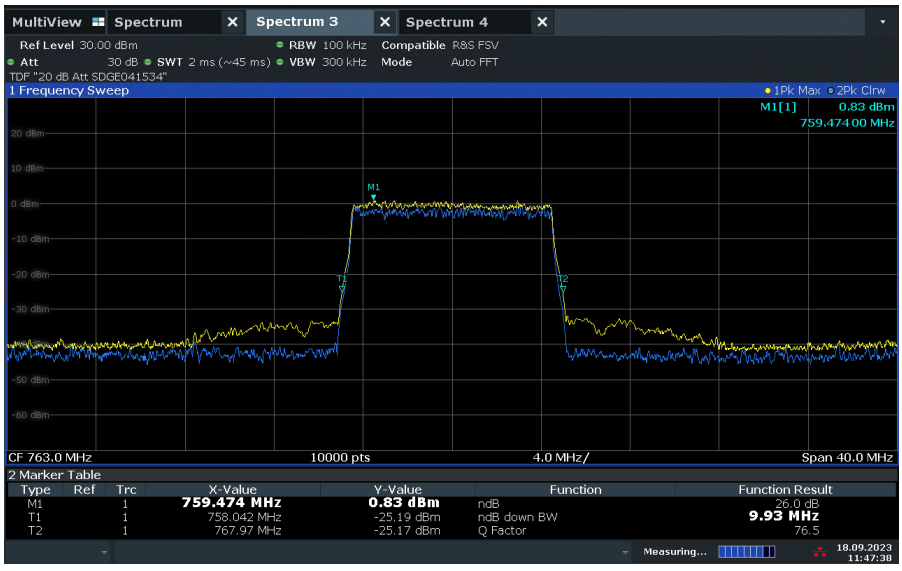
LTE Band 14 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level



11:42:32 18.09.2023

LTE Band 14 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



11:47:38 18.09.2023

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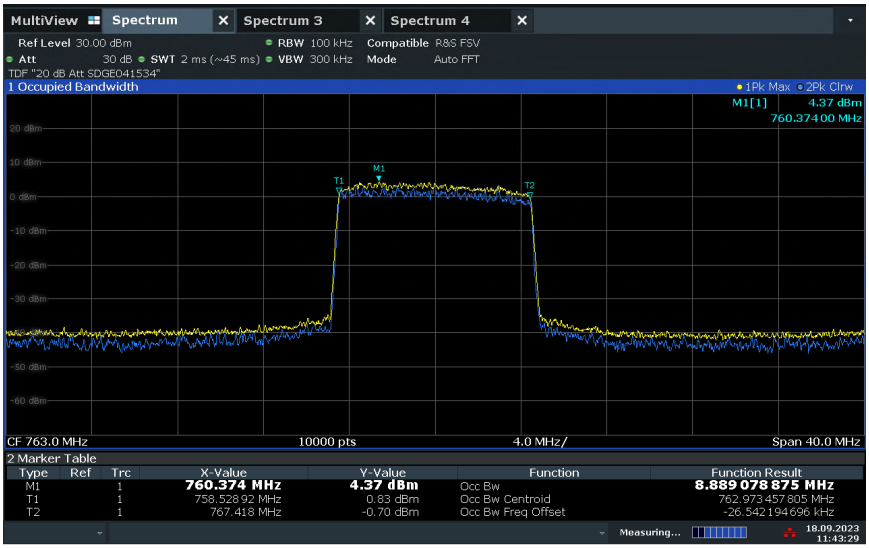
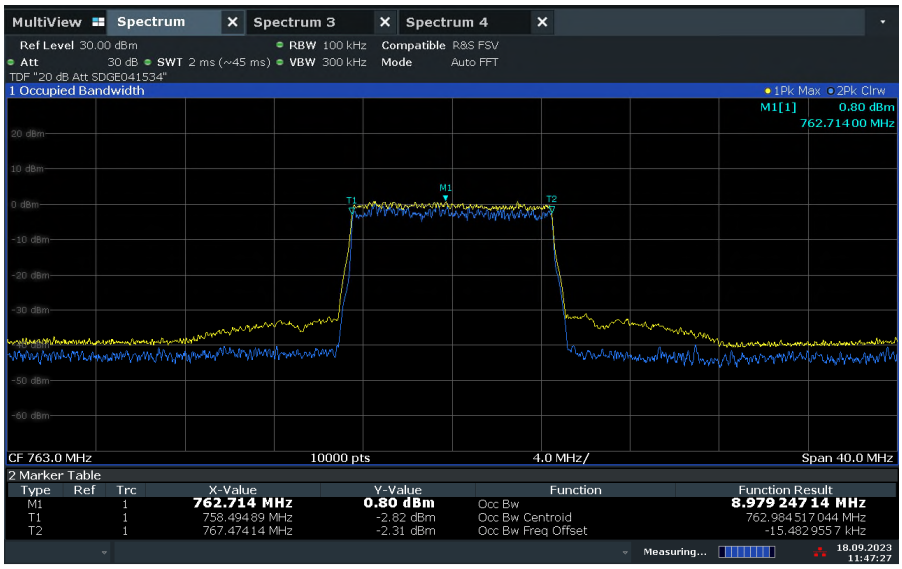
LTE Band 14 Downlink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level



11:43:29 18.09.2023

LTE Band 14 Downlink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)



11:47:28 18.09.2023

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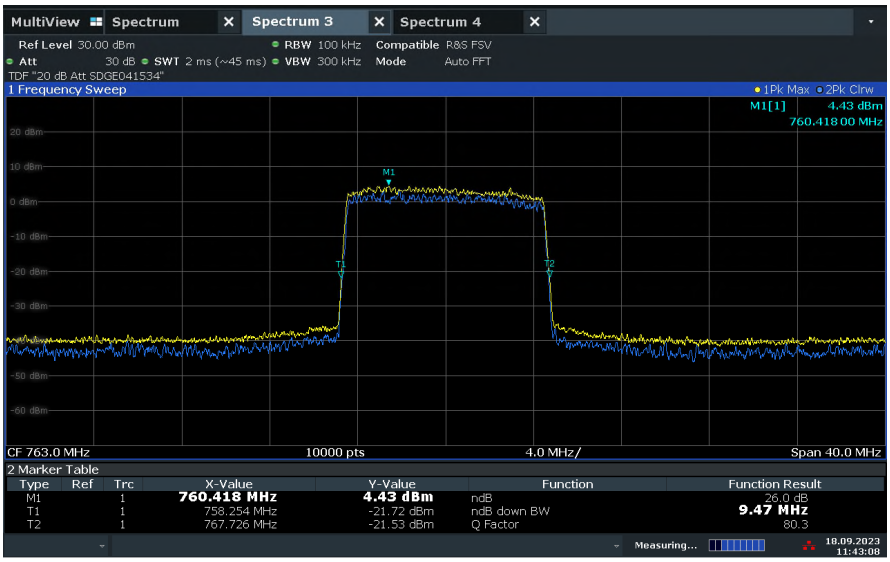
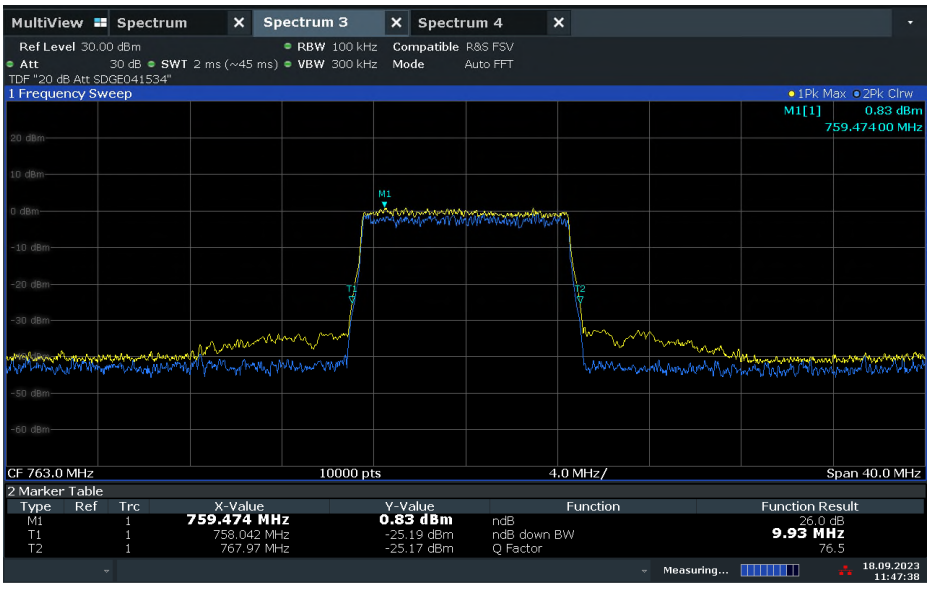
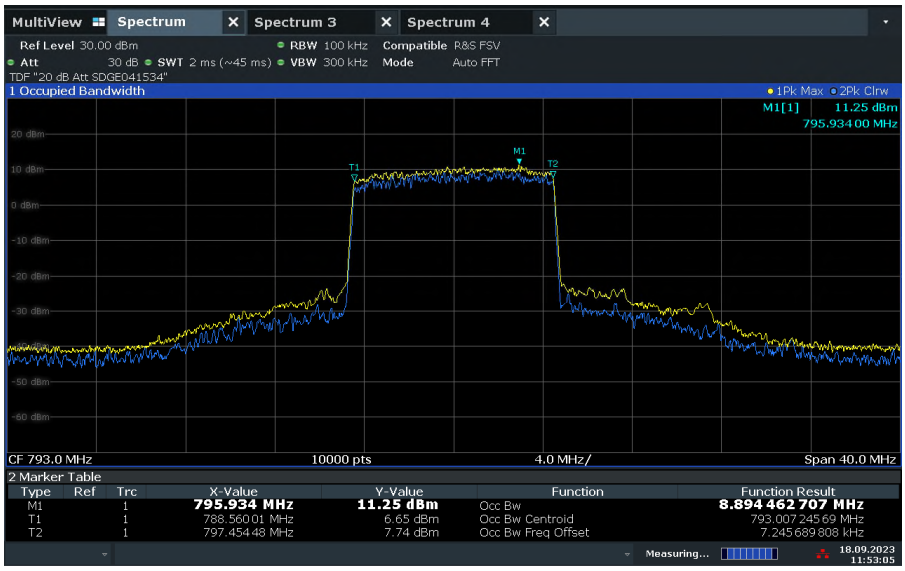
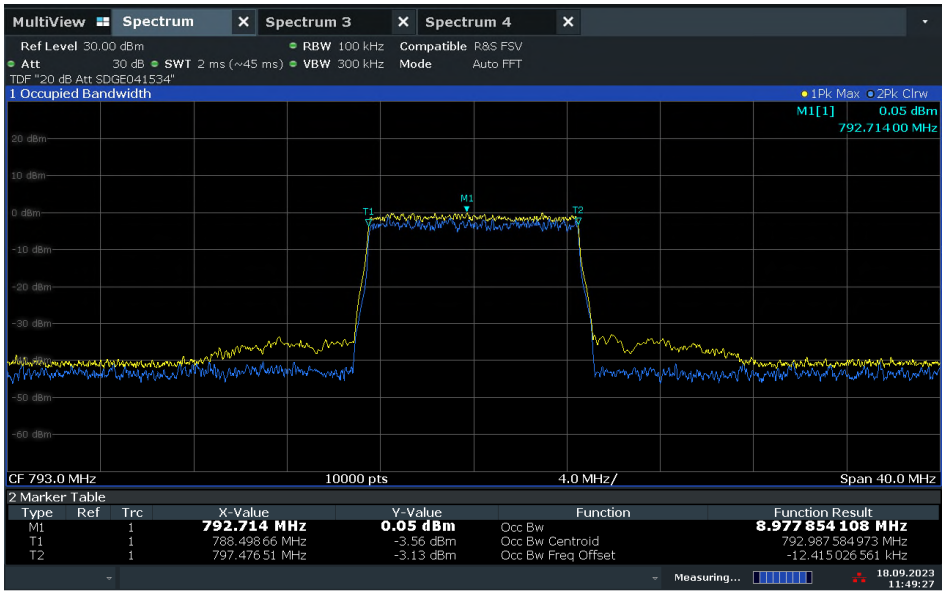
LTE Band 14 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level
 11:43:09 18.09.2023
LTE Band 14 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)
 11:47:38 18.09.2023

LTE Band 14 Uplink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level



11:53:05 18.09.2023

LTE Band 14 Uplink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)



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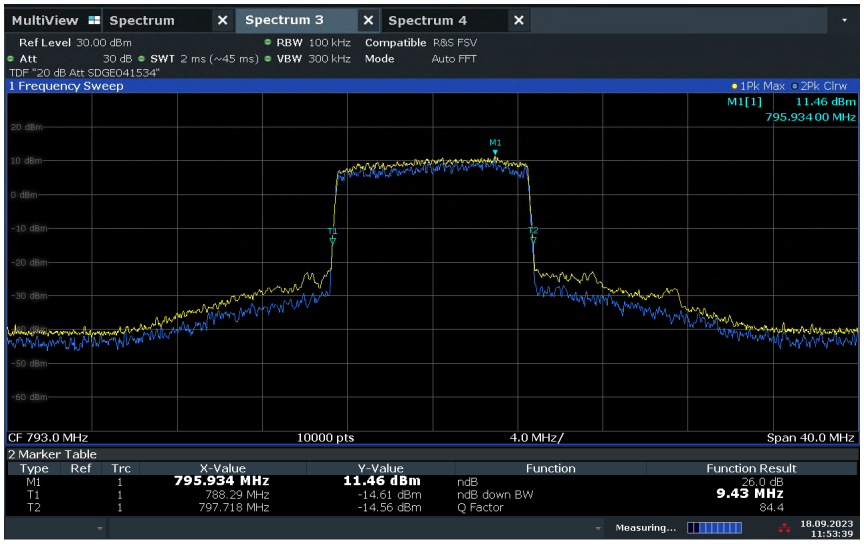
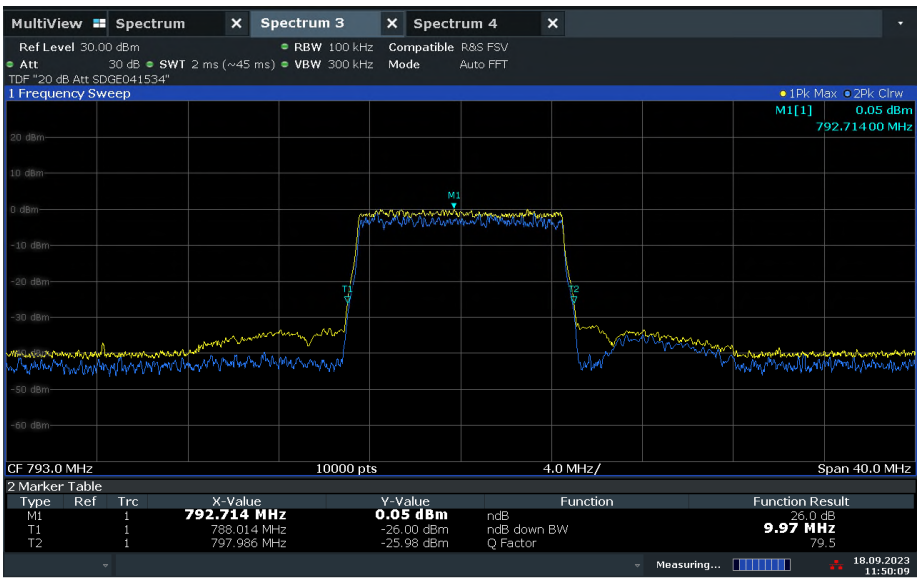
LTE Band 14 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level



11:53:40 18.09.2023

LTE Band 14 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



11:50:10 18.09.2023

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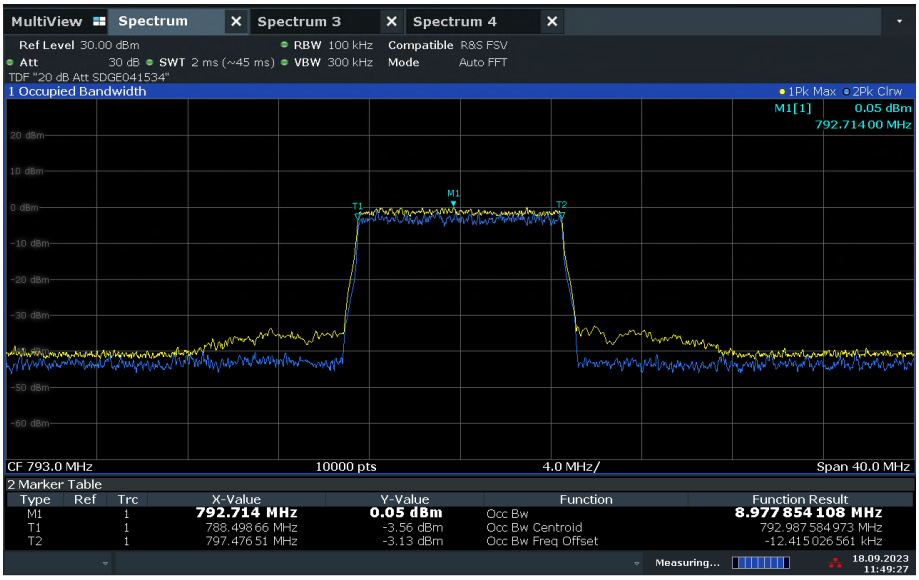
LTE Band 14 Uplink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level

11:53:59 18.09.2023

LTE Band 14 Uplink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)



11:49:27 18.09.2023

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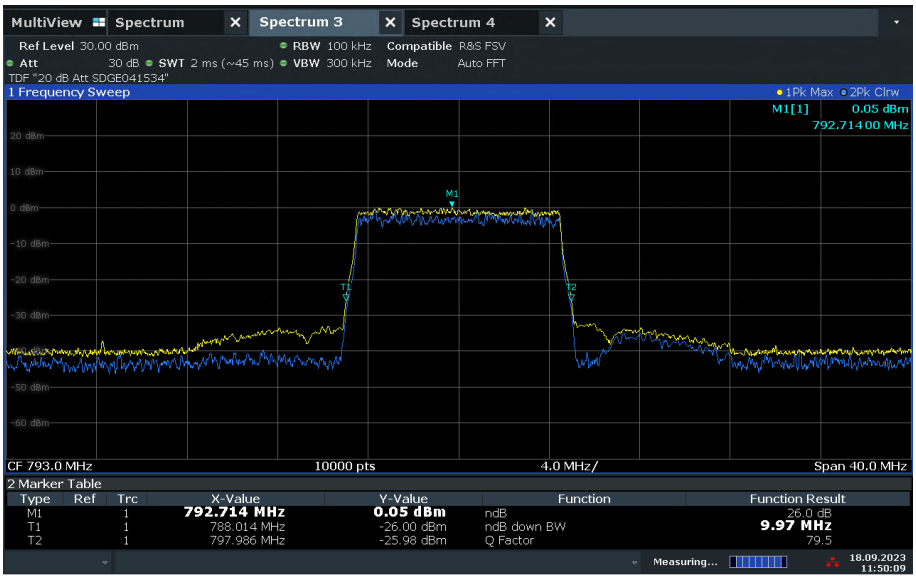
LTE Band 14 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level

11:53:40 18.09.2023

LTE Band 14 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



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2.11 INPUT AND OUTPUT POWER AND AMPLIFIER/BOOSTER GAIN

2.11.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.219(e)(1)
RSS-131, Clause 9.3
KDB 935210 D05, Clause 4.5

2.11.2 Standard Applicable

FCC 47 CFR Part 90, Clause 90.219(e):
(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

RSS-131, Clause 9.3
The zone enhancer gain shall not exceed the nominal gain (i.e the maximum gain at any frequency within the zone enhancer's passband) by more than 1.0 dB. Outside of the 20 dB passband bandwidth, the gain shall not exceed the gain at the 20 dB point.

2.11.3 Equipment Under Test and Modification State

Serial No: 560311000026/ Test Configuration A and B

2.11.4 Date of Test/Initial of test Personnel Who Performed The Test

September 18, 2023 / MARG

2.11.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.11.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.9°C
Relative Humidity	50.2%
ATM Pressure	99.3kPa

2.11.7 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as an offset.
- The internal gain control of the EUT is adjusted to the maximum gain.
- The input power levels (uplink and downlink) are set to maximum input ratings, and confirm the device is not capable of operating in saturation (non-linear mode) during the test.
- For LTE B14, the signal generator was configured for LTE 10 MHz signal as the intended operating signal type.
- A power meter was used to measure the power according to KDB 935210 D05 clause 4.5.3.
- Both downlink and uplink are tested.

2.11.8 Test Results

Compliant. The booster gain does not exceed the nominal gain (95 dB for LTE B14) by more than 1.0 dB.

LTE Band 14 Input and Output Power and Gain						
Mode	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	10	5330	763.0	-82.3	12.27	94.57
Uplink	10	23330	793.0	-73.2	21.08	94.28

LTE Band 14 Input and Output Power and Gain						
Mode	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**AGC Threshold + 3dB Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	10	5330	763.0	-79.3	12.85	92.15
Uplink	10	23330	793.0	-70.2	21.07	91.27

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2.12 NOISE FIGURE

2.12.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.219 (e)(2)
KDB 935210 D05, Clause 4.6
RSS-131, Clause 10.4

2.12.2 Standard Applicable

FCC Part 90.219 (e)(2):
The noise figure of a signal booster must not exceed 9 dB in either direction.

RSS-131, Clause 10.4:
Zone enhancers working with equipment certified under RSS-119 shall comply with the following noise limits:

The noise figure of a zone enhancer shall not exceed 9 dB in either direction.

2.12.3 Equipment Under Test and Modification State

Serial No: 560311000026/ Test Configuration A and B

2.12.4 Date of Test/Initial of Test Personnel who Performed the Test

September 18, 2023 / MARG

2.12.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.12.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.0°C
Relative Humidity	44.8%
ATM Pressure	99.1kPa

2.12.7 Additional Observations

- The path loss was measured and entered as an offset.
- For LTE Band 14, 10 MHz Bandwidth LTE was tested as representative configuration. The Downlink and Uplink Gains are measured with a LTE signal injected to the device under test.
- The input of the EUT is terminated when measuring the noise output.
- The spectrum analyser was set to 100 trace average in RMS mode.
- RBW is 1 MHz, VBW is > 3 x RBW.
- Channel power was recorded.
- The noise figure was calculated using the following formula:

  Noise Figure (NF) = N – Gain + 174 dB – $10\lg_{10}$(B)

  - N = Noise Power Output in dBm/MHz
  - Gain = Gain of the device under test
  - B = Resolution Bandwidth of spectrum analyzer in Hz
  - 174 = Thermal noise for 1 Hz RBW at room temperature

- Both Downlink and Uplink are tested.

2.12.8 Test Results

LTE Band 14 Booster Gain					
Mode	**Bandwidth (MHz)**	**Frequency (MHz)**	**Input Power (dBm)**	**Output Power (dBm/MHz)**	**Gain (dB)**
Downlink	10	763.0	-82.3	12.27	94.57
Uplink	10	793.0	-73.2	21.08	94.28

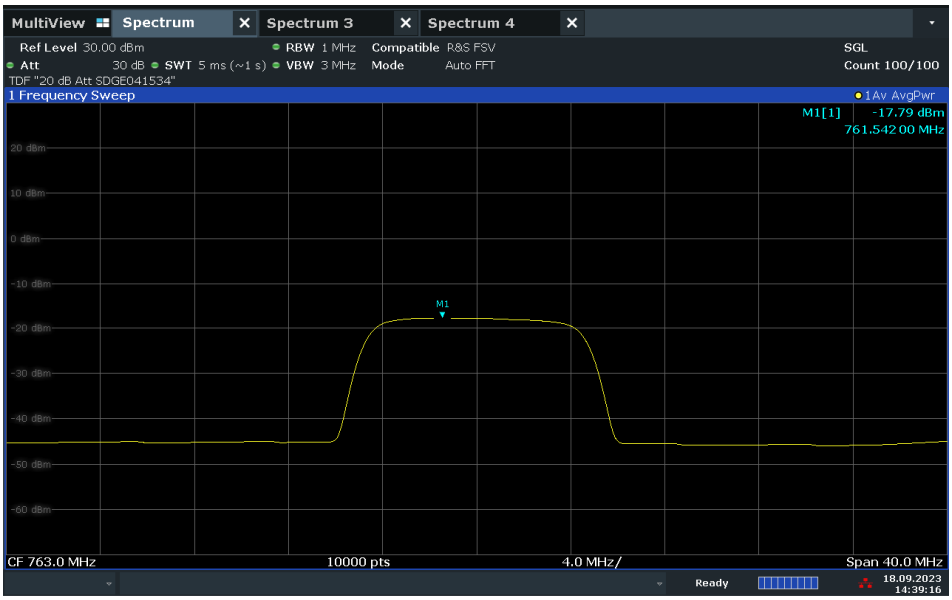
LTE Band 14 Noise Figure							
Mode	**Bandwidth (MHz)**	**Frequency (MHz)**	**RBW (MHz)**	**Noise Output (dBm/MHz)**	**Booster Gain (dB)**	**Noise Figure (dB)**	**Limit (dB)**
Downlink	10	763.0	1	-17.79	94.57	3.93	9
Uplink	10	793.0	1	-18.08	94.28	3.64	9

.

Downlink Noise Figure = N – Gain + 174 dB – $10\lg_{10}$(B)
= -15.93 – 94.52 + 174 dB – $10\lg_{10}$(B)
= 3.55 dB

Uplink Noise Figure = N – Gain + 174 dB – $10\lg_{10}$(B)
= -16.18 – 94.69 + 174 dB – $10\lg_{10}$(B)
= 3.13 dB

LTE Band 14 Downlink (10 MHz BW) Middle Channel / Noise Output



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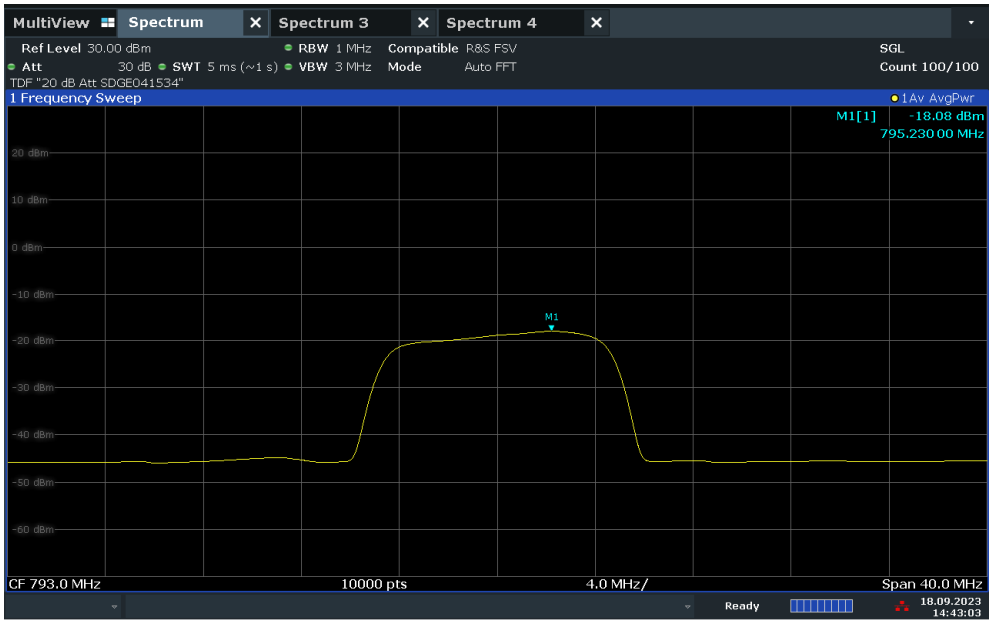
LTE Band 14 Uplink (10 MHz BW) Middle Channel / Noise Output



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2.13 OUT-OF-BAND/OUT-OF-BLOCK (INTERMODULATION) AND SPURIOUS EMISSIONS

2.13.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 90, Clause 90.219(e)(3)
FCC 47 CFR Part 90, Clause 90.543(c)
RSS-140, Clause 4.4
RSS-119, Clause 5.8.9.2
KDB 935210 D05, Clause 4.7
RSS-131, Clause 10.3.

2.13.2 Standard Applicable

FCC 47 CFR Part 90.219(e):
(3) Spurious emission from a signal booster must not exceed -13 dBm within any 100kHz measureemnt bandwith.

FCC 47 CFR Part 90.543:
(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10 log (p) dB in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

RSS-140, Clause 4.4 Transmitter unwanted emissions limits:
The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:
a. For any frequency between 769-775 MHz and 799-806 MHz:
i 76 + 10 log (p), dB in a 6.25 kHz band for fixed and base station equipment
ii 65 + 10 log (p), dB in a 6.25 kHz band for mobile and portable/hand-held equipment

b For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz: 43 + 10 log (p), dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

In addition, the equivalent isotropically radiated power (e.i.r.p.) of all emissions, including harmonics in the band 1559-1610 MHz, shall not exceed −70 dBW/MHz for wideband emissions, and −80 dBW/kHz for discrete emissions of less than 700 Hz bandwidth.
For LTE Band 41, out-of-Band/Out-of-Block and spurious emissions is tested according to KDB 935210 D05, Clause 3.6.

RSS-119, Clause 5.8.9.2 Out-of-Band Emission Limit:
On any frequency outside of the ranges specified in the ACP tables 13 to 16, the power of any emission shall be attenuated below the mean output power P (dBW) by at least 43 + 10 log10(p), measured in a 100 kHz bandwidth for frequencies less than or equal to 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

In addition, for operations in the bands 768-776 MHz and 798-806 MHz, all emissions (including harmonics in the band 1559-1610 MHz), shall not exceed:
-70 dBW/MHz equivalent isotropically radiated power (e.i.r.p.) for wideband emissions, and
-80 dBW/kHz e.i.r.p. for discrete emissions of less than 700 Hz bandwidth

RSS-131, Clause 10.3:
The effective radiated power (ERP) of the intermodulation products shall not exceed -30 dBm in a 10 KHz measurement bandwidth.

2.13.3 Equipment Under Test and Modification State

Serial No: 560311000026/ Test Configuration A and B

2.13.4 Date of Test/Initial of Test Personnel who Performed the Test

September 14, 2023 / MARG

2.13.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.13.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.9°C
Relative Humidity	51.6%
ATM Pressure	98.9kPa

2.13.7 Additional Observations

- The path loss or the transducer factor (TDF) from the external attenuators and cables was measured and entered as an offset.
- 10 MHz Bandwidth was tested as representative configuration for LTE Band 14
- For spurious emissions, the spectrum analyser was set to peak detector and trace is max hold.
- RBW is 100 kHz, VBW is > 3 x RBW.
- Intermodulation-product spurious emission measurements are not required for LTE Band 14 since it only support single-channel boosters and can't accommodate two simultaneous signals within the pass band.
- Both Downlink and Uplink are tested.

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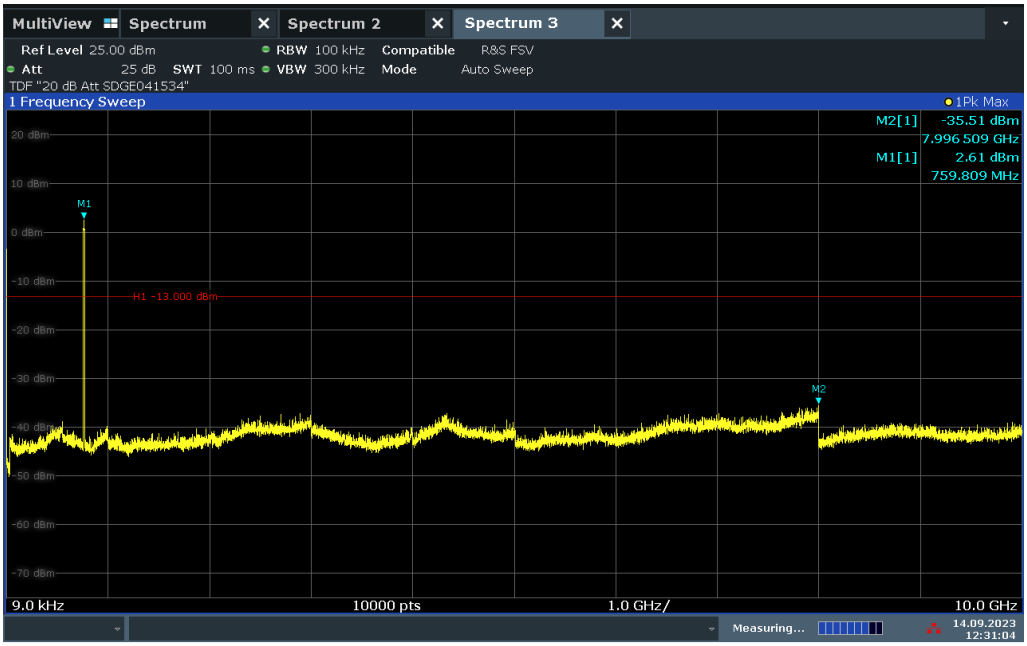
2.13.8 Test Results

LTE Band 14 Downlink (10 MHz BW) Middle Channel / Spurious Emissions



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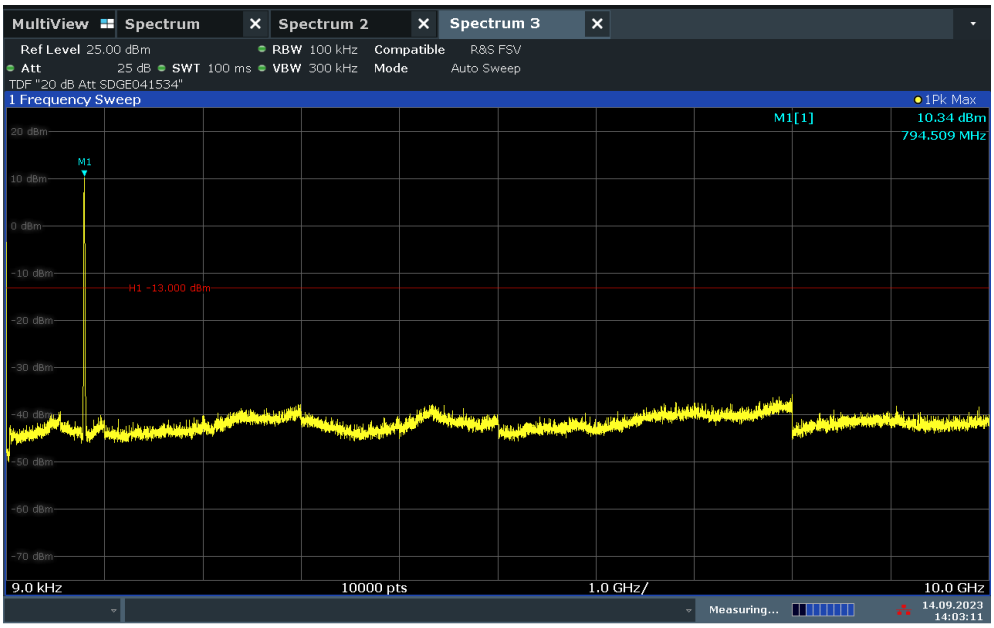
LTE Band 14 Uplink (10 MHz BW) Middle Channel / Spurious Emissions



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2.14 FIELD STRENGTH OF SPURIOUS EMISSIONS

2.14.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 90, Clause 90.219(e)(3)
FCC 47 CFR Part 90, Clause 90.543(e)(1)(3)(f)
KDB 935210 D05, Clause 4.9

2.14.2 Standard Applicable

FCC 47 CFR Part 90, Clause 90.219(e)(3)

(e) Device Specifications. In addition to the general rules for equipment certification in § 90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.

FCC 47 CFR Part 90, Clause 90.543(e)(1)(3)(f)

(e) For operations in the 758–768 MHz and the 788–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

(3) On any frequency between 775–788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(f) For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

2.14.3 Equipment Under Test and Modification State.

Serial No: 560311000026 / Test Configuration E and F

2.14.4 Date of Test/Initial of test personnel who performed the test.

August 04 and 05, 2023 / OC

2.14.5 Test Equipment Used.

The major items of test equipment used for the above tests are identified in Section 3.1.

2.14.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.9°C
Relative Humidity	51.6%
ATM Pressure	98.9kPa

2.14.7 Additional Observations

- This is a radiated test. The spectrum was searched covering 30MHz up to the 10th harmonic of the highest frequency radio from each configuration.
- EUT was tested on two different configurations (worst case configurations):
  - BLE and LTE (Downlink) B4 and B12 radios transmitting simultaneously.
  - BLE and LTE (Uplink) B4 and B12 radios transmitting Simultaneously.
- Measurement was done using EMC 32 automated software for radiated method. Reported level is the actual level with all the correction factors factored in. the Correction Factor column is for informational purposes only.
- Fundamental from Bluetooth and LTE radios are ignored.
- Representative FCC Part 27 limits are presented in plots, which are identical as Part 90.
- All test results were confirmed against FCC Part 15.209 limits (more stringent limits compared to Part 90).

2.14.8 Limit Conversion Example.

-13dBm erp to Field strength at 3m

Using equation: E (dBµV/m) = ERP (dBm) - 20log(D) + 104.8 + 2.15; where D is the measurement distance (in the far field region) in m.

-13dBm ERP = 84.4 dBµV/m at 3m distance.

2.14.9 Sample Computation (Radiated Emission 30 MHz to 1 GHz).

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB/m)	Asset# 1026 (cable)	0.8	-7.0
	Asset# 1057 (cable)	0.2	
	Asset# 1016 (preamplifier)	-30.8	
	Asset# 8850 (cable)	0.2	
	Asset# 1033 (antenna)	17.2	
	Asset# 8771 (6-dB attenuator)	5.4	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**17.4**

2.14.10 Sample Computation (Radiated Emissions above 1 GHz).

Measuring equipment raw measurement (dbµV) @ 2629 MHz			37.59
Correction Factor (dB/m)	Asset# 1016 (preamplifier)	-31.9	3
	Asset# 1175(cable)	2.5	
	Asset# 7631 (antenna)	32.4	
Reported Peak Final Measurement (dbµV/m) @ 30MHz			**40.59**

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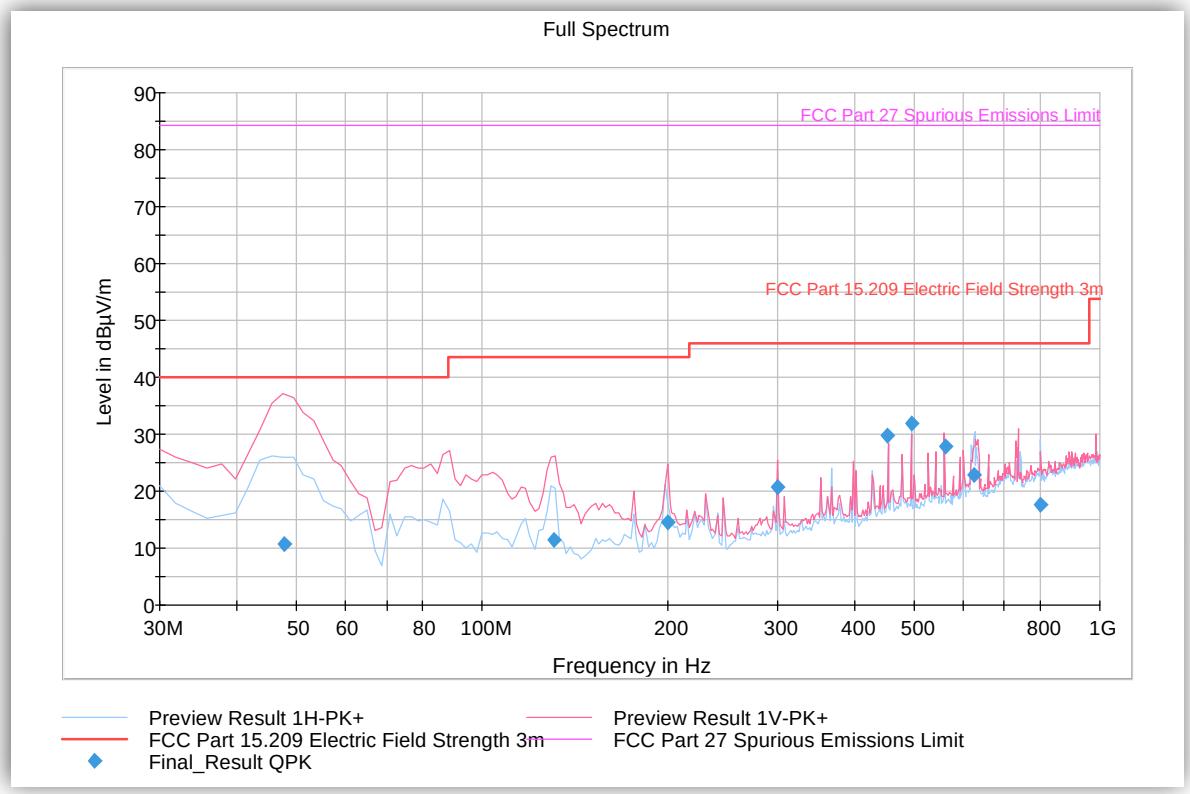
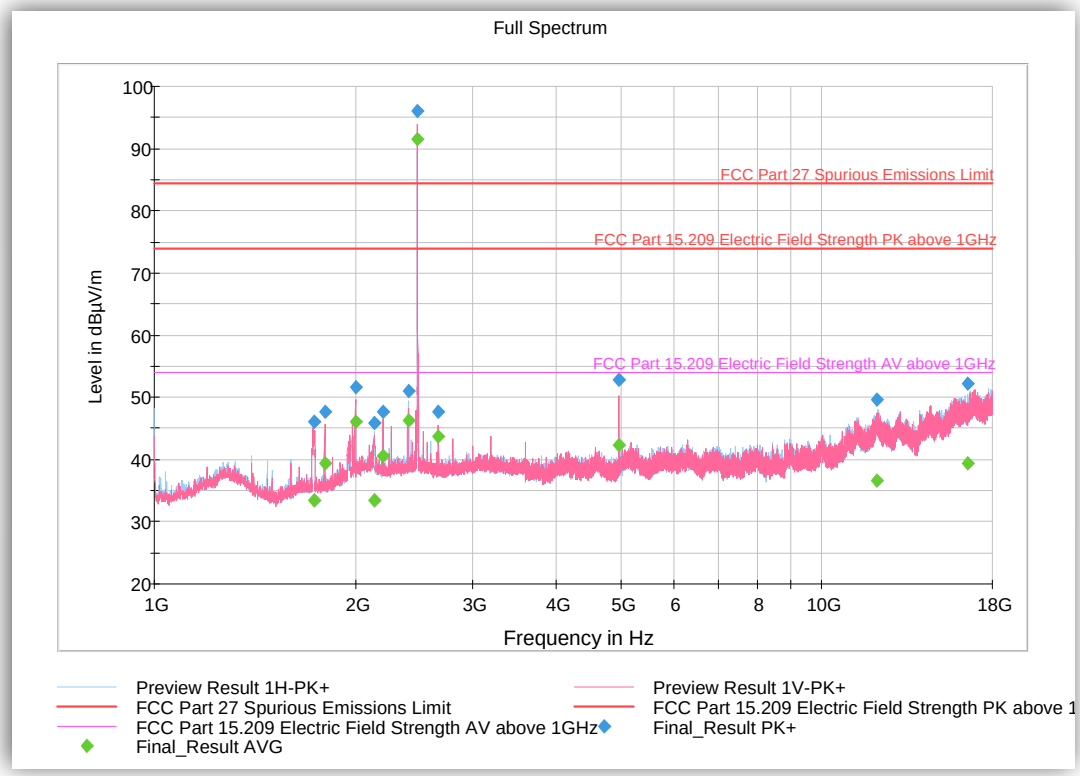
2.14.11 Testo Results 30 MHz to 1 GHz (BLE Mid channel – Downlink config for LTE B4 Mid channel 20MHz BW and LTE B 12 Mid channel 10MHz BW).



Quasi Peak Data (§15.209 Limit)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
47.794990	10.76	40.00	29.24	1000.0	120.000	98.0	V	180.0	-16.3
130.582164	11.53	43.50	31.97	1000.0	120.000	102.0	V	171.0	-16.3
199.978236	14.51	43.50	28.99	1000.0	120.000	111.0	V	234.0	-12.9
299.980401	20.82	46.00	25.18	1000.0	120.000	103.0	V	150.0	-8.4
452.547535	29.79	46.00	16.21	1000.0	120.000	150.0	H	211.0	-4.8
495.009178	31.92	46.00	14.08	1000.0	120.000	150.0	H	218.0	-3.5
560.981363	27.76	46.00	18.24	1000.0	120.000	101.0	V	200.0	-2.6
625.633547	22.89	46.00	23.11	1000.0	120.000	360.0	H	15.0	-1.2
802.023447	17.62	46.00	28.38	1000.0	120.000	124.0	H	171.0	1.5

2.14.12 Test Results 1GHz to 18GHz (BLE Mid channel – Downlink config for LTE B4 Mid channel 20MHz BW and LTE B 12 Mid channel 10MHz BW).



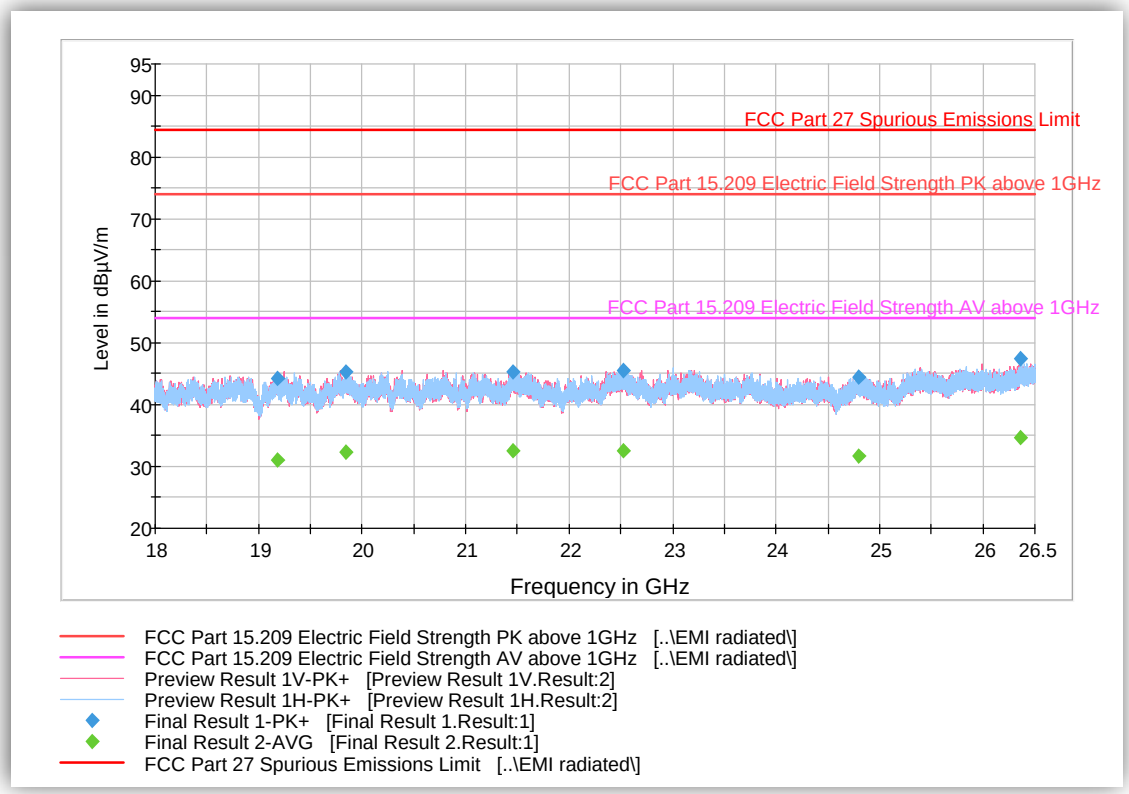
Peak Data (§15.209 Limits)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1732.300000	46.03	73.90	27.87	1000.0	1000.000	250.0	H	14.0	-4.4
1800.133333	47.61	73.90	26.29	1000.0	1000.000	227.0	V	291.0	-3.6
2000.000000	51.61	73.90	22.29	1000.0	1000.000	114.0	V	273.0	-2.0
2133.600000	45.95	73.90	27.95	1000.0	1000.000	384.0	V	74.0	-1.6
2200.033333	47.59	73.90	26.31	1000.0	1000.000	108.0	V	226.0	-1.6
2400.066667	51.10	73.90	22.80	1000.0	1000.000	152.0	H	301.0	-0.9
2479.966667	BLE Fundamental			1000.0	1000.000	152.0	V	256.0	-0.2
2666.800000	47.62	73.90	26.28	1000.0	1000.000	244.0	V	259.0	-0.1
4960.433333	52.85	73.90	21.05	1000.0	1000.000	158.0	V	253.0	4.3
12086.100000	49.57	73.90	24.33	1000.0	1000.000	392.0	V	149.0	15.6
16516.800000	52.11	73.90	21.79	1000.0	1000.000	379.0	H	289.0	20.7

Average Data (§15.209 Limits)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1732.300000	33.34	53.90	20.56	1000.0	1000.000	250.0	H	14.0	-4.4
1800.133333	39.41	53.90	14.49	1000.0	1000.000	227.0	V	291.0	-3.6
2000.000000	46.10	53.90	7.80	1000.0	1000.000	114.0	V	273.0	-2.0
2133.600000	33.46	53.90	20.44	1000.0	1000.000	384.0	V	74.0	-1.6
2200.033333	40.55	53.90	13.35	1000.0	1000.000	108.0	V	226.0	-1.6
2400.066667	46.20	53.90	7.70	1000.0	1000.000	152.0	H	301.0	-0.9
2479.966667	BLE fundamental			1000.0	1000.000	152.0	V	256.0	-0.2
2666.800000	43.64	53.90	10.26	1000.0	1000.000	244.0	V	259.0	-0.1
4960.433333	42.34	53.90	11.56	1000.0	1000.000	158.0	V	253.0	4.3
12086.100000	36.54	53.90	17.36	1000.0	1000.000	392.0	V	149.0	15.6
16516.800000	39.40	53.90	14.50	1000.0	1000.000	379.0	H	289.0	20.7

2.14.13 Test Results 18 GHz to 26 GHz (BLE Mid channel – Downlink config for LTE B4 Mid channel 20MHz BW and LTE B 12 Mid channel 10MHz BW).



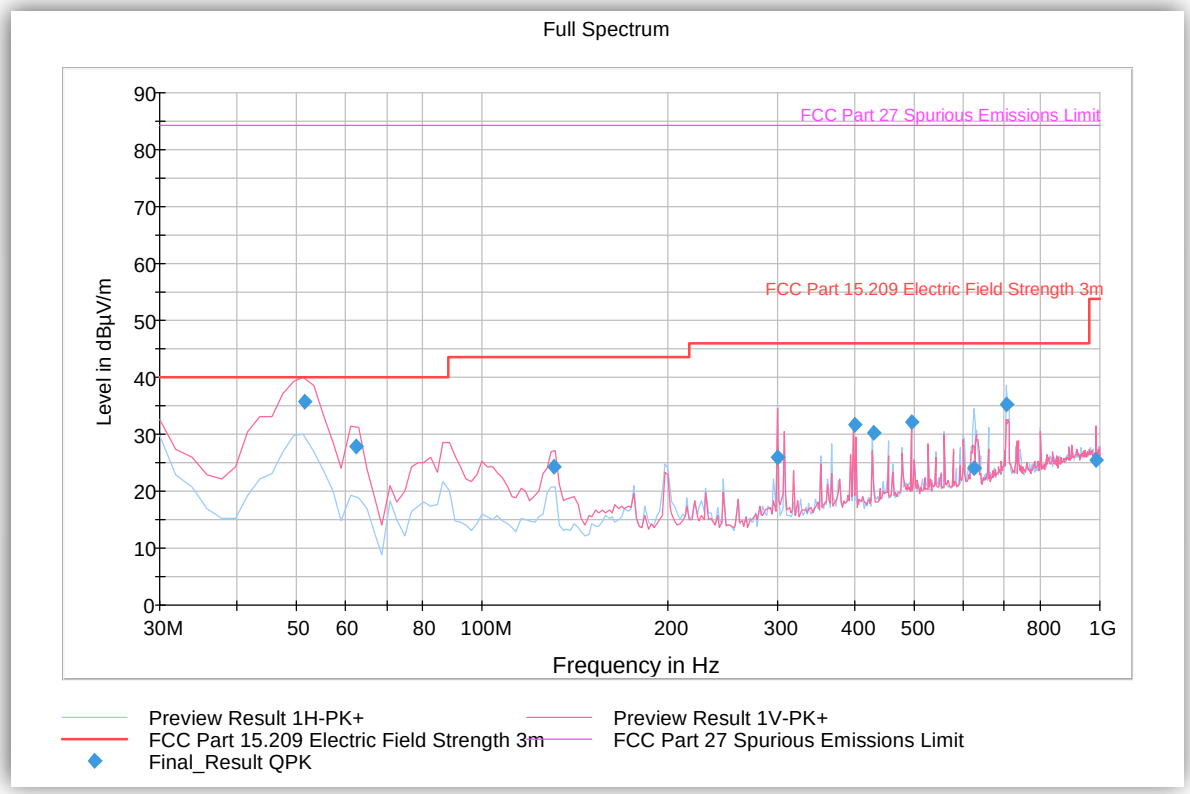
Peak Data (§15.209 Limits)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time	Bandwidth	Height (cm)	Polarization	Azimuth	Corr.	Margin (dB)	Limit (dBµV/
19177.116667	44.3	1000.0	1000.0	142.7	H	32.0	-2.8	29.6	73.9
19840.116667	45.2	1000.0	1000.0	160.7	V	226.0	-2.2	28.7	73.9
21454.933333	45.3	1000.0	1000.0	136.7	V	10.0	-0.9	28.6	73.9
22528.716667	45.6	1000.0	1000.0	127.7	H	281.0	0.2	28.3	73.9
24800.000000	44.5	1000.0	1000.0	164.6	V	308.0	-0.1	29.4	73.9
26361.966667	47.3	1000.0	1000.0	148.7	V	132.0	3.1	26.6	73.9

Average Data (§15.209 Limits)

Frequency (MHz)	Average (dBµV/m)	Meas. Time	Bandwidth	Height (cm)	Polarization	Azimuth	Corr.	Margin (dB)	Limit (dBµV/
19177.116667	31.0	1000.0	1000.0	142.7	H	32.0	-2.8	22.9	53.9
19840.116667	32.4	1000.0	1000.0	160.7	V	226.0	-2.2	21.5	53.9
21454.933333	32.6	1000.0	1000.0	136.7	V	10.0	-0.9	21.3	53.9
22528.716667	32.6	1000.0	1000.0	127.7	H	281.0	0.2	21.3	53.9
24800.000000	31.6	1000.0	1000.0	164.6	V	308.0	-0.1	22.3	53.9
26361.966667	34.7	1000.0	1000.0	148.7	V	132.0	3.1	19.2	53.9

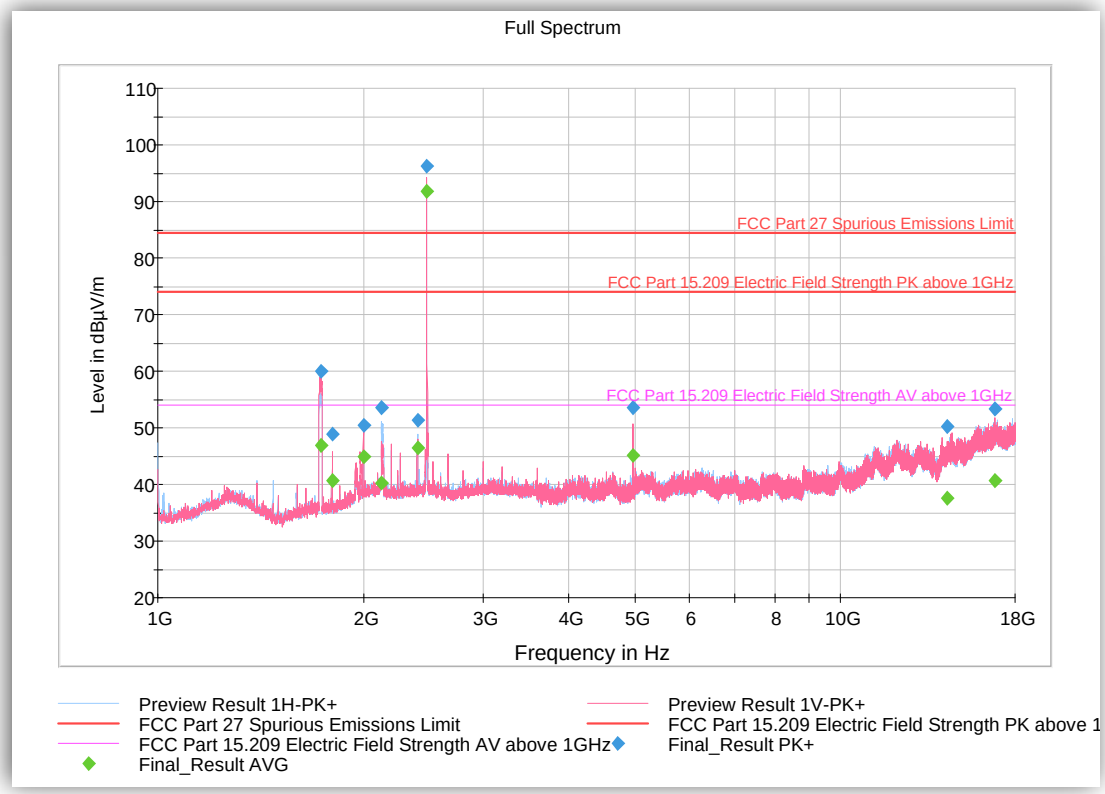
2.14.14 Test Results 30 MHz to 1 GHz (BLE Mid channel – Uplink config for LTE B4 Mid channel 20MHz BW and LTE B12 Mid channel 10MHz BW).



Quasi Peak Data (§15.209 Limit)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
51.442766	35.68	40.00	4.32	1000.0	120.000	106.0	V	144.0	-16.9
62.306092	27.87	40.00	12.13	1000.0	120.000	109.0	V	67.0	-17.8
130.542164	24.29	43.50	19.21	1000.0	120.000	119.0	V	242.0	-16.3
299.980401	26.00	46.00	20.00	1000.0	120.000	153.0	H	161.0	-8.4
399.998677	31.68	46.00	14.32	1000.0	120.000	103.0	V	262.0	-6.4
428.996994	30.20	46.00	15.80	1000.0	120.000	100.0	H	161.0	-5.7
495.009178	32.11	46.00	13.89	1000.0	120.000	101.0	V	266.0	-3.5
624.489659	24.01	46.00	21.99	1000.0	120.000	303.0	H	317.0	-1.1
705.132946	35.14	46.00	10.86	1000.0	120.000	105.0	H	49.0	0.8
983.468898	25.58	53.90	28.32	1000.0	120.000	110.0	H	7.0	4.9

2.14.15 Test Results 1 GHz to 18 GHz (BLE Mid channel – Uplink config for LTE B4 Mid channel 20MHz BW and LTE B 12 Mid channel 10MHz BW).



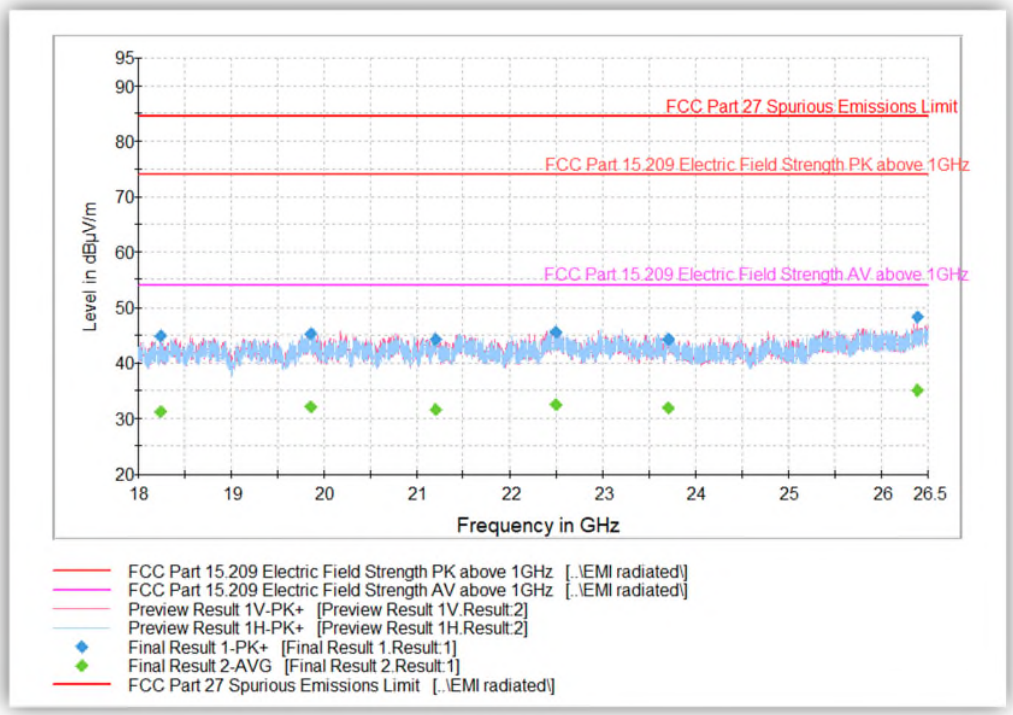
Peak Data (§15.209 Limits)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1731.733333	59.96	73.90	13.94	1000.0	1000.000	407.0	V	271.0	-4.4
1799.966667	48.85	73.90	25.05	1000.0	1000.000	152.0	V	288.0	-3.6
2000.000000	50.49	73.90	23.41	1000.0	1000.000	139.0	V	241.0	-2.0
2128.400000	53.52	73.90	20.38	1000.0	1000.000	127.0	H	313.0	-1.6
2400.066667	51.33	73.90	22.57	1000.0	1000.000	150.0	H	298.0	-0.9
2479.966667	BLE Fundamental			1000.0	1000.000	152.0	V	247.0	-0.2
4959.933333	53.52	73.90	20.38	1000.0	1000.000	226.0	V	249.0	4.3
14303.800000	50.21	73.90	23.69	1000.0	1000.000	401.0	V	159.0	17.4
16801.833333	53.30	73.90	20.60	1000.0	1000.000	350.0	V	307.0	21.4

Average Data (§15.209 Limits)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1731.733333	46.99	53.90	6.91	1000.0	1000.000	407.0	V	271.0	-4.4
1799.966667	40.73	53.90	13.17	1000.0	1000.000	152.0	V	288.0	-3.6
2000.000000	44.81	53.90	9.09	1000.0	1000.000	139.0	V	241.0	-2.0
2128.400000	40.30	53.90	13.60	1000.0	1000.000	127.0	H	313.0	-1.6
2400.066667	46.50	53.90	7.40	1000.0	1000.000	150.0	H	298.0	-0.9
2479.966667	BLE Fundamental			1000.0	1000.000	152.0	V	247.0	-0.2
4959.933333	45.18	53.90	8.72	1000.0	1000.000	226.0	V	249.0	4.3
14303.800000	37.45	53.90	16.45	1000.0	1000.000	401.0	V	159.0	17.4
16801.833333	40.77	53.90	13.13	1000.0	1000.000	350.0	V	307.0	21.4

2.14.16 Test Results 18 GHz to 26 GHz (BLE Mid channel – Downlink config for LTE B4 Mid channel 20MHz BW and LTE B 12 Mid channel 10MHz BW).



Peak Data (§15.209 Limits)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time	Bandwidth	Height (cm)	Polarization	Azimuth	Corr.	Margin (dB)	Limit (dBµV/
18238.683333	44.8	1000.0	1000.0	160.6	H	186.0	-2.4	29.1	73.9
19853.283333	45.3	1000.0	1000.0	127.7	V	10.0	-2.1	28.6	73.9
21203.933333	44.3	1000.0	1000.0	167.1	H	324.0	-1.3	29.6	73.9
22495.483333	45.5	1000.0	1000.0	151.6	H	-10.0	0.1	28.4	73.9
23698.800000	44.1	1000.0	1000.0	175.0	H	241.0	-0.1	29.8	73.9
26390.016667	48.2	1000.0	1000.0	156.1	V	331.0	3.2	25.7	73.9

Average Data (§15.209 Limits)

Frequency (MHz)	Average (dBµV/m)	Meas. Time	Bandwidth	Height (cm)	Polarization	Azimuth	Corr.	Margin (dB)	Limit (dBµV/
18238.683333	31.2	1000.0	1000.0	160.6	H	186.0	-2.4	22.7	53.9
19853.283333	32.2	1000.0	1000.0	127.7	V	10.0	-2.1	21.7	53.9
21203.933333	31.8	1000.0	1000.0	167.1	H	324.0	-1.3	22.1	53.9
22495.483333	32.5	1000.0	1000.0	151.6	H	-10.0	0.1	21.4	53.9
23698.800000	31.8	1000.0	1000.0	175.0	H	241.0	-0.1	22.1	53.9
26390.016667	35.1	1000.0	1000.0	156.1	V	331.0	3.2	18.8	53.9

SECTION 3

TEST EQUIPMENT USED

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3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

3.1.1 Conducted Emissions Test Equipment

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date
Antenna Conducted Port Setup					
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10-03-2025
7582	Signal/Spectrum Analyzer	FSW26	101614	Rohde & Schwarz	12-21-2023
-	Power Splitter	ZN2PD2-50-S+	SUU27701207	Mini Circuits	Verified with (7608) and (7582)
7610	DFS Radar Simulator and Analyzer*	Aeroflex 3005	30050A/09L	Aeroflex	NCR (for signaling purposes only)
-	20dB Attenuator	5W DC-18GHz 20dB (ATX3518-20)	N/A	MCL	Verified by 7608 and 7582
7662	Power Meter	N1911A	MY451000951	Agilent	04-04-2024
7605	Wideband Power Meter	N1921A	MY51100054	Agilent	04-14-2024
8848	Step Attenuator	RSP	834500/009	Rhode & Schwarz	Verified by 7608 and 7582
-	Directional Coupler	4226-20	N/A	Narda	Verified by 7608 and 7582
Radiated Spurious Emissions					
1033	BiConiLog Antenna	3142C	00044556	ETS Lindgren	10/05/23
1040	EMI Test Receiver	ESIB40	100292	Rohde & Schwarz	10/26/23
51235	RF Pre-Amp (9kHz to 1GHz)	310	412802	Sonoma	09/30/23
1049	EMI Test Receiver	ESU40	100133	Rohde & Schwarz	04/03/23
7575	1-18GHz DRG Horn	3117	155511	ETS-Lindgren	08/0824
8628	Pre-Amplifier	QLJ-01182835-JO	8986002	Quinstar	03/22/24
9001	Horn antenna (18-26.5GHz)	HO42S	101	Custom Microwave	09/23/23
40815	18GHz to 40GHz Low Noise Amplifier	SLKKa-30-6	19D18	Spacek Labs	08/21/23
Miscellaneous					
43003	True RMS Multimeter	85 III	96880143	Fluke	01-09-2024
7579	Temperature Chamber	115	151617	TestQuity	12-21-23
6672	D.C. Power Supply	E3611A	KR73012637	Hewlett Packard	NCR
-	Test Software	EMC32	V11.50.0	Rhode & Schwarz	NCR

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SECTION 4

TEST EQUIPMENT USED

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4.1 MEASUREMENT UNCERTAINTY

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

4.1.1 CONDUCTED ANTENNA PORT MEASUREMENT

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Cable attenuation	1.00	dB	Normal, k=2	2.000	0.50	0.25
3	Received sinewave accuracy	0.07	dB	Normal, k=2	2.000	0.04	0.00
4	Receiver pulse amplitude	0.00	dB	Rectangular	1.732	0.00	0.00
5	Receiver pulse repetition rate	0.00	dB	Rectangular	1.732	0.00	0.00
6	Noise floor proximity	0.00	dB	Rectangular	1.732	0.00	0.00
7	Frequency interpolation	0.10	dB	Rectangular	1.732	0.06	0.00
8	Mismatch	0.07	dB	U-shaped	1.414	0.05	0.00
	Combined standard uncertainty			Normal		0.52	dB
	Expanded uncertainty			Normal, k=2		**1.03**	**dB**

4.1.2 Radiated Measurements (30MHz to 1 GHz).

Input Quantity (Contribution) Xi	Value		Prob. Dist.	Divisor	ui(x)	ui(x)2
Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
Attenuation: antenna-receiver	0.20	dB	Normal, k=2	2.000	0.10	0.01
Antenna factor AF	0.75	dB	Normal, k=2	2.000	0.38	0.14
Receiver sinewave accuracy	1.10	dB	Normal, k=2	2.000	0.55	0.30
Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
Noise floor proximity	0.50	dB	Rectangular	1.732	0.29	0.08
Mismatch: antenna-receiver	0.95	dB	U-shaped	1.414	0.67	0.45
AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
AF height deviations	0.10	dB	Rectangular	1.732	0.06	0.00
Directivity difference at 3 m	3.12	dB	Rectangular	1.732	1.80	3.24
Phase center location at 3 m	1.00	dB	Rectangular	1.732	0.58	0.33
Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
Balance	0.00	dB	Rectangular	1.732	0.00	0.00
Site imperfections	3.64	dB	Triangular	2.449	1.49	2.21
Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
Effect of setup table material	0.40	dB	Rectangular	1.732	0.23	0.05
Table height at 3 m	0.10	dB	Normal, k=2	2.000	0.05	0.00
Near-field effects	0.00	dB	Triangular	2.449	0.00	0.00
Effect of ambient noise on OATS	0.00	dB				0.00
Combined standard uncertainty			Normal	2.95	dB	
Expanded uncertainty			Normal, k=2	5.89	dB	

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4.1.3 Radiated Emissions Measurements (Above 1GHz).

Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
Attenuation: antenna-receiver	0.30	dB	Normal, k=2	2.000	0.15	0.02
Preamplifier Gain	0.20	dB	Normal, k=2	2.000	0.10	0.01
Antenna factor AF	0.37	dB	Normal, k=2	2.000	0.19	0.03
Sinewave accuracy	0.57	dB	Normal, k=2	2.000	0.29	0.08
Instability of preamp gain	1.21	dB	Rectangular	1.732	0.70	0.49
Noise floor proximity	0.70	dB	Rectangular	1.732	0.40	0.16
Mismatch: antenna-preamplifier	1.41	dB	U-shaped	1.414	1.00	0.99
Mismatch: preamplifier-receiver	1.30	dB	U-shaped	1.414	0.92	0.85
AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
Directivity difference at 3 m	1.50	dB	Rectangular	1.732	0.87	0.75
Phase center location at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
Site imperfections VSWR (Method 2)	4.16	dB	Triangular	2.449	1.70	2.89
Effect of setup table material	1.15	dB	Rectangular	1.732	0.66	0.44
Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
Table height at 3 m	0.00	dB	Normal, k=1	2.000	0.00	0.00
Combined standard uncertainty			Normal	2.66	dB	
Expanded uncertainty			Normal, k=2	5.32	dB	

SECTION 5

DIAGRAM OF TEST SETUP

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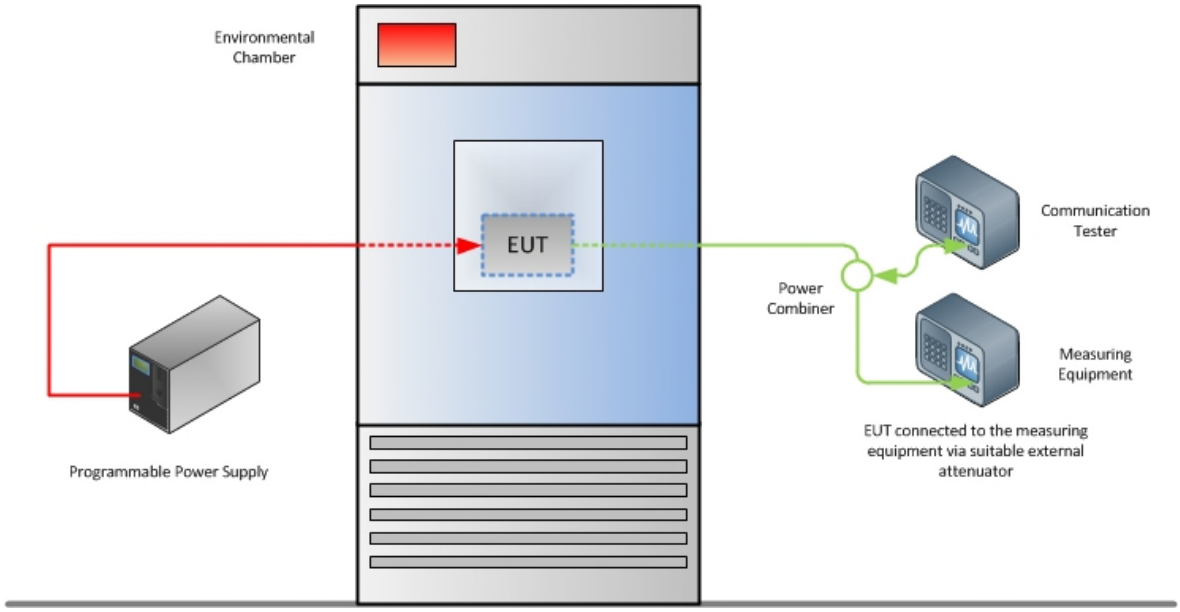
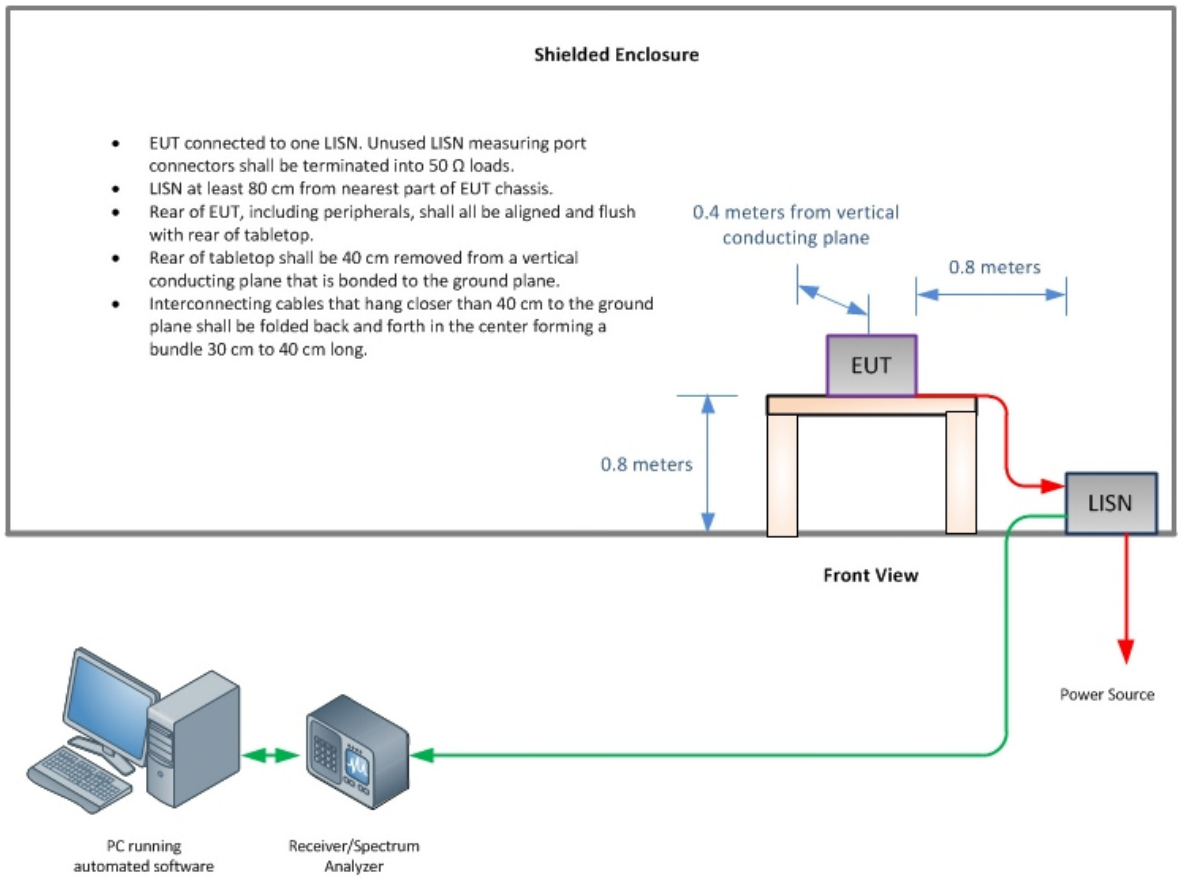
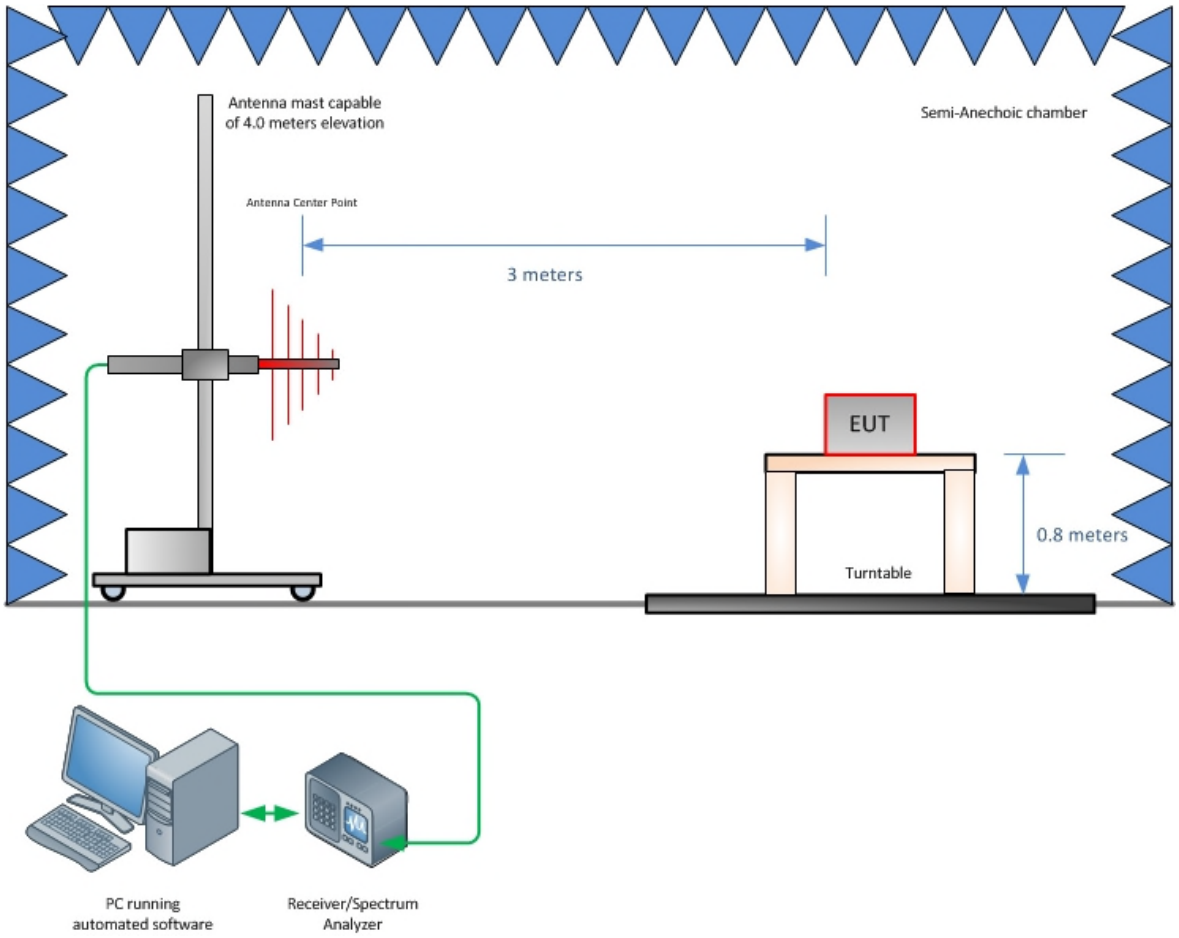
5.1 TEST SETUP DIAGRAM



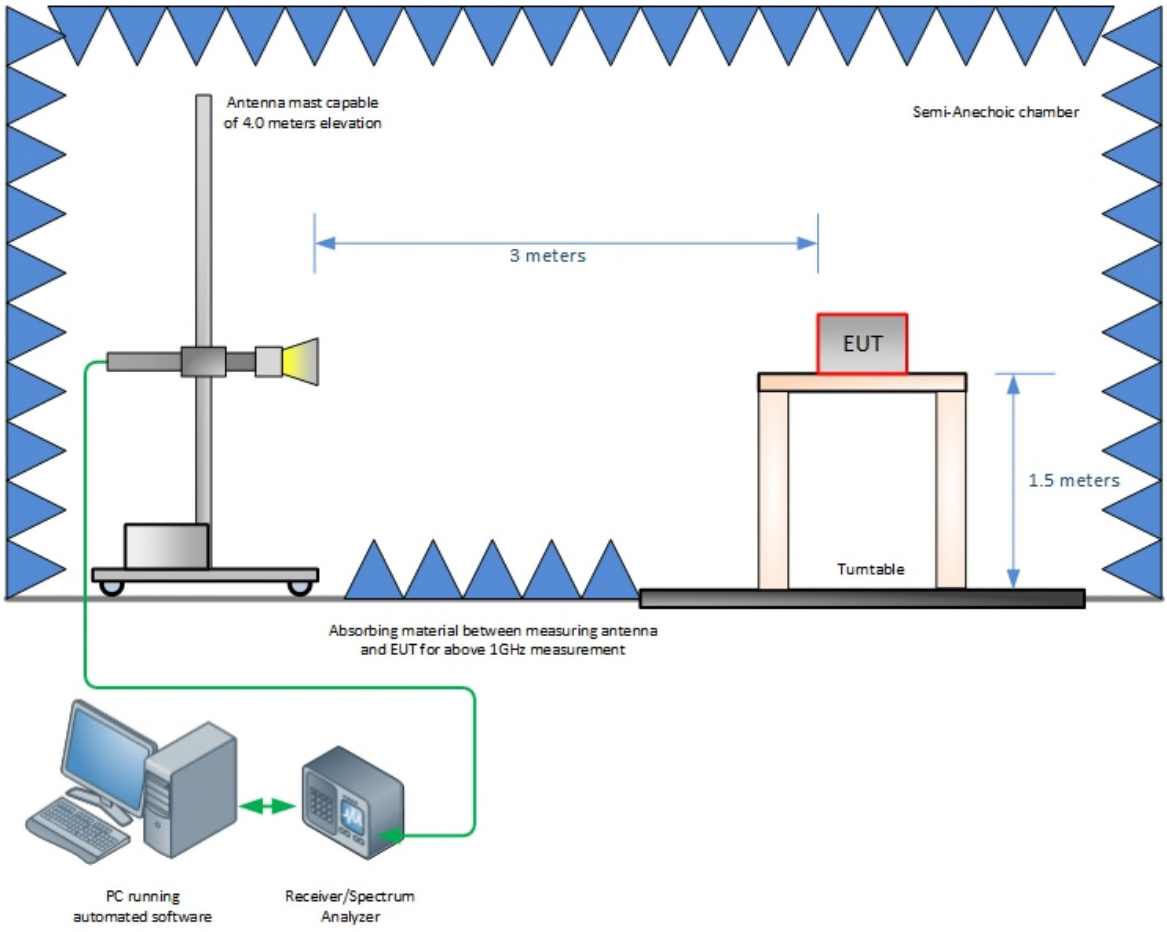
Frequency Stability Test Configuration



Conducted Emissions Test Configuration (if applicable)



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

SECTION 6

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