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

2.14.1 Specification Reference

KDB 935210 D05, Clause 3.6

2.14.2 Standard Applicable

Limit refer to related FCC Rule Sections for each bands.

Out-of-Band/Out-of-Block and spurious emissions is tested according to KDB 935210 D05 Clause 3.6.

2.14.3 Equipment Under Test and Modification State

Serial No: 444002000024 (NU) and 247002000034 (CU) / Test Configuration A and B

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

February 17, 2020 / ZXY

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

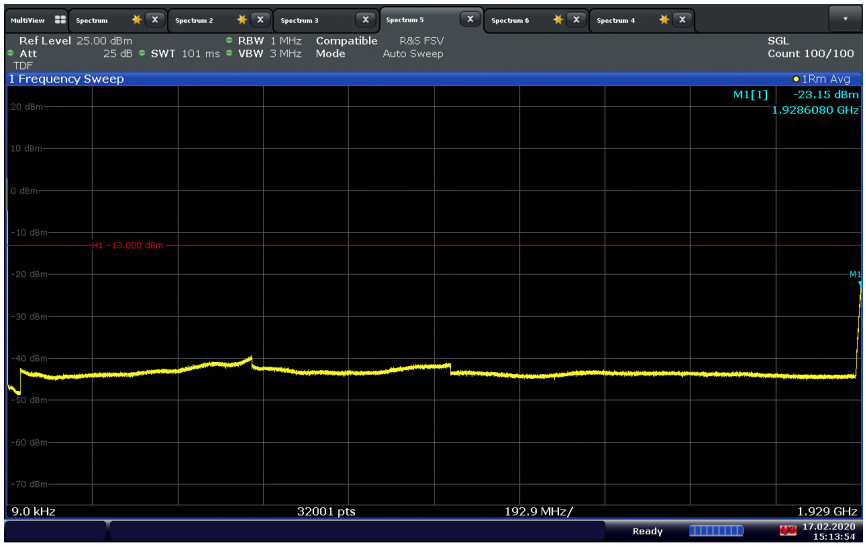
Ambient Temperature	23.0°C
Relative Humidity	40.6%
ATM Pressure	98.8kPa

2.14.7 Additional Observations

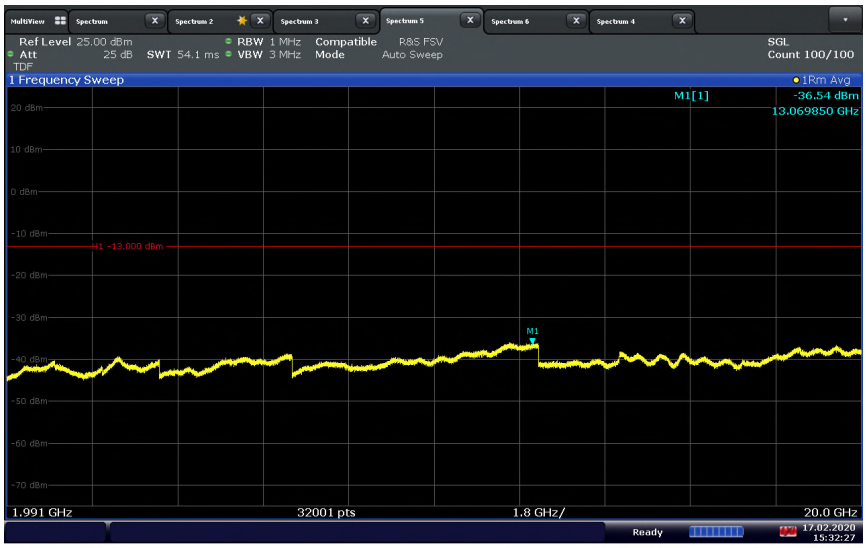
- The transducer factor (TDF) used is from the external attenuators and cables used.
- The signal generator is configured for LTE signal. For LTE Band 2 and 4, 20 MHz Bandwidth was tested as representative configuration, and for LTE Band 12, 10 MHz Bandwidth was tested as representative configuration.
- The Downlink and Uplink Gains are measured with a LTE signal injected to the device under test.
- RBW is 1 MHz or 100 kHz according to related FCC Rule Sections for each bands, VBW is > 3 x RBW.
- The spectrum analyzer was set to RMS detector and trace average is 100 traces.
- Both Downlink and Uplink are tested.
- Intermodulation-product spurious emission measurements are not required for single-channel boosters that can't accommodate two simultaneous signals within the pass band.

2.14.8 Test Results

LTE Band 2 Downlink (20 MHz BW) Low Channel / Spurious Emissions



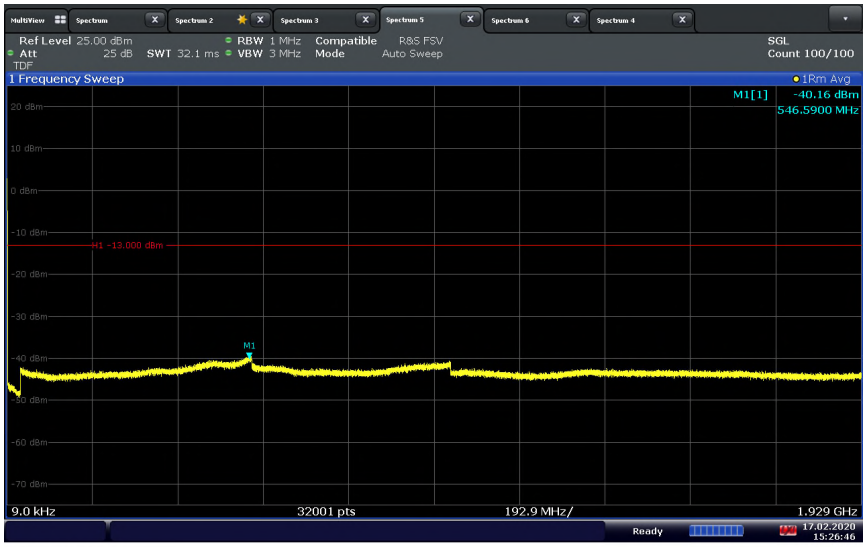
15:13:54 17.02.2020



15:32:28 17.02.2020

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

LTE Band 2 Downlink (20 MHz BW) Mid Channel / Spurious Emissions



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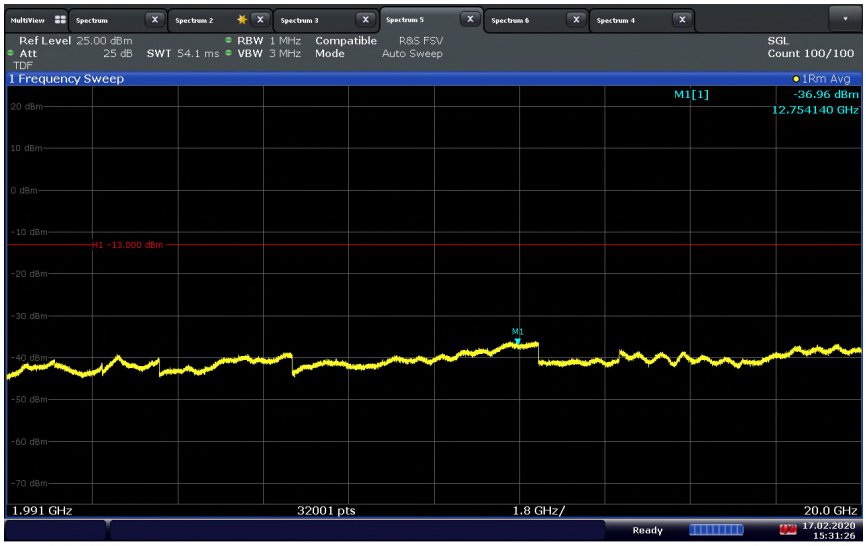
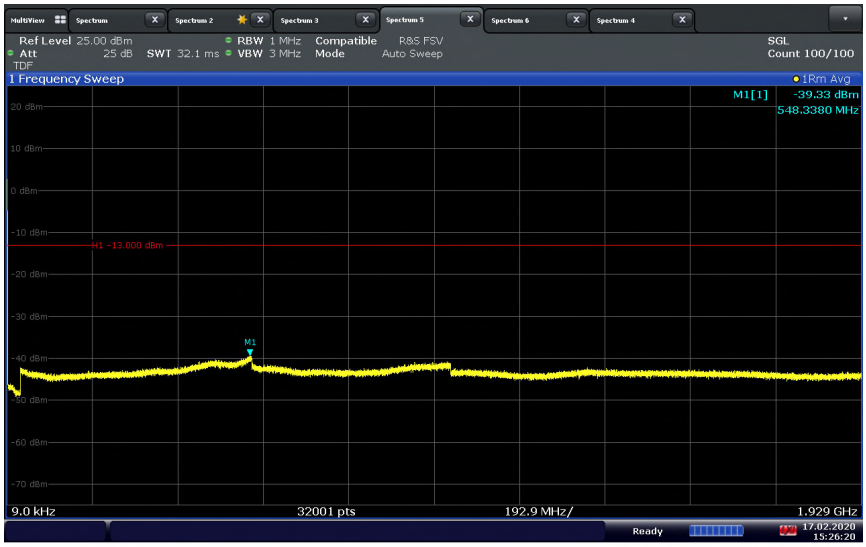


15:31:27 17.02.2020

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

LTE Band 2 Downlink (20 MHz BW) High Channel / Spurious Emissions



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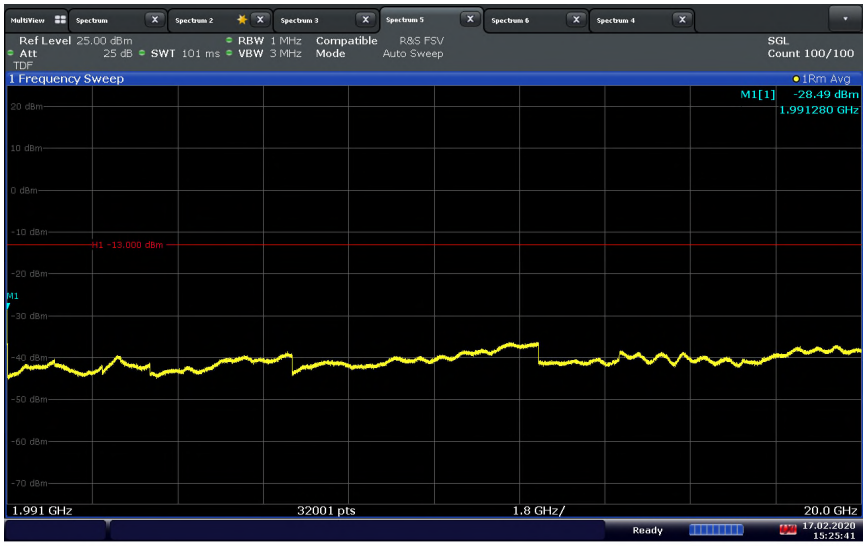
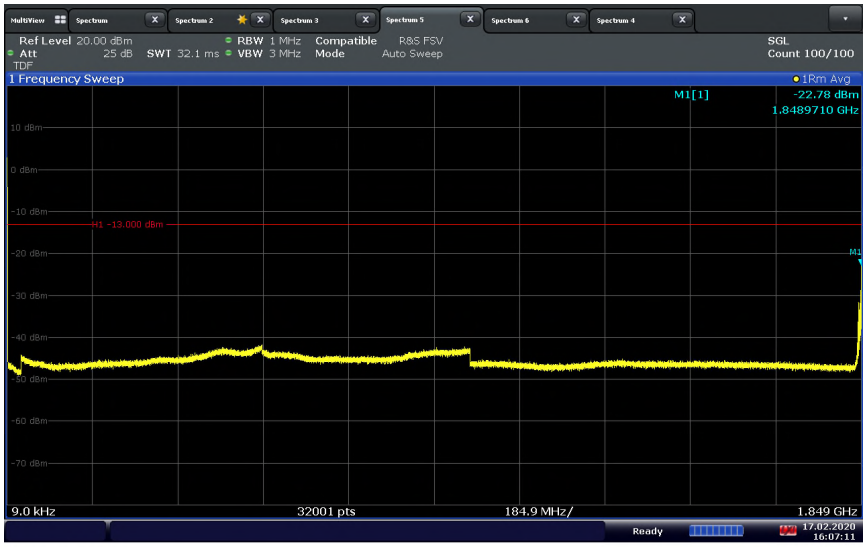


15:25:41 17.02.2020

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

LTE Band 2 Uplink (20 MHz BW) Low Channel / Spurious Emissions



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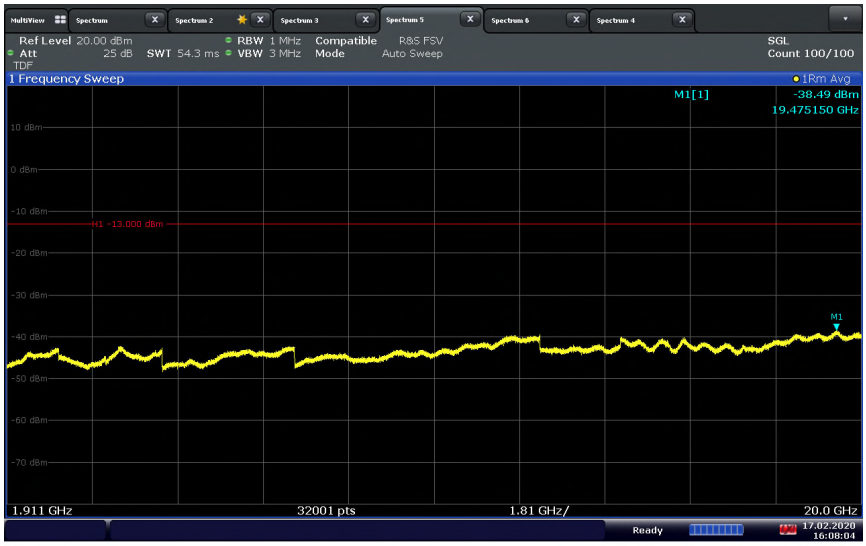
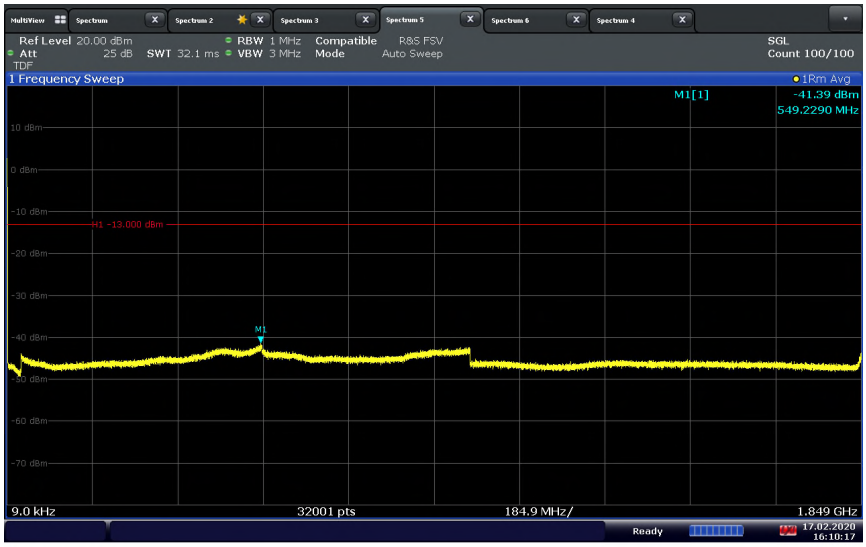


16:08:05 17.02.2020

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

LTE Band 2 Uplink (20 MHz BW) Mid Channel / Spurious Emissions



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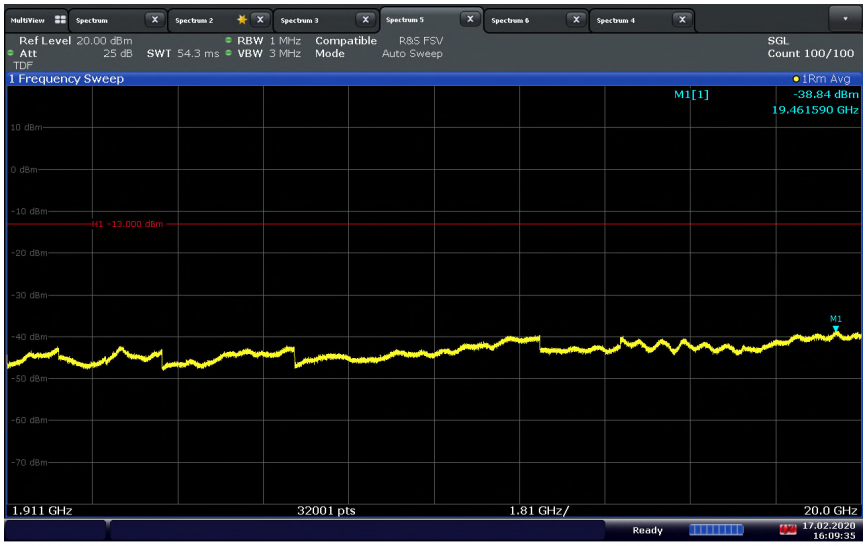
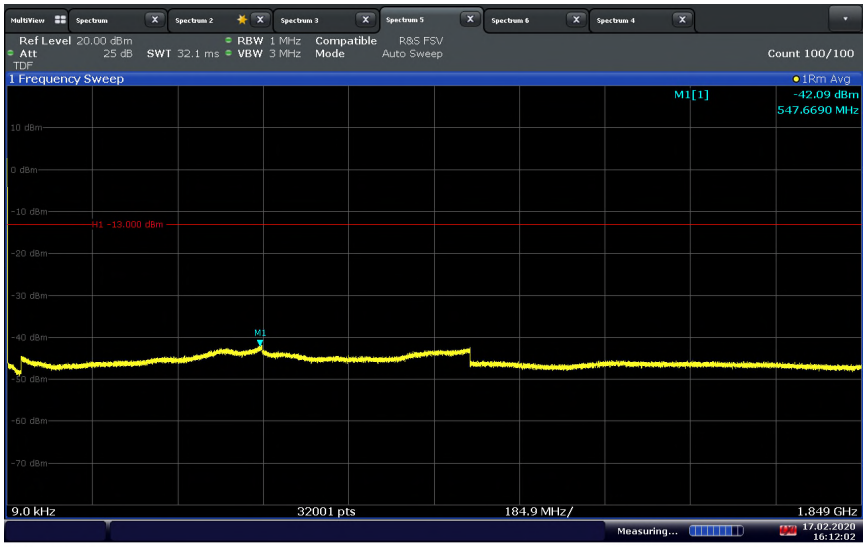


16:09:36 17.02.2020

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

LTE Band 2 Uplink (20 MHz BW) High Channel / Spurious Emissions



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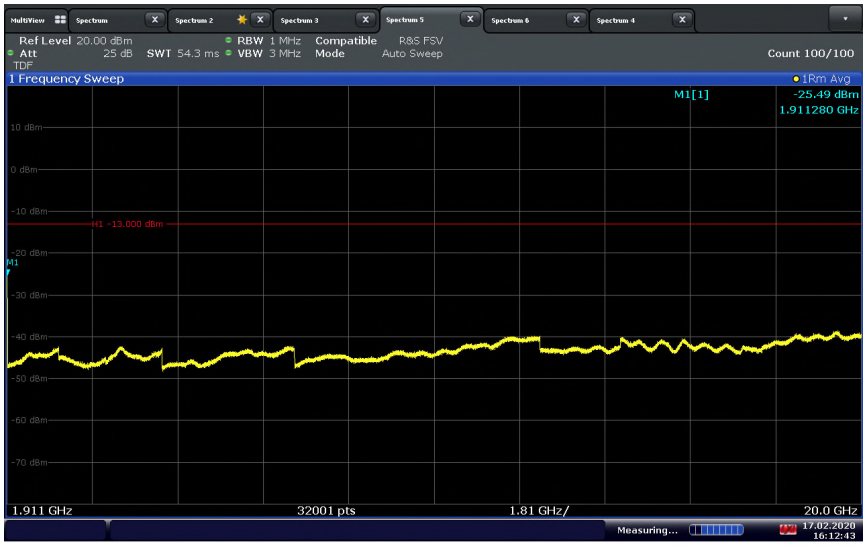
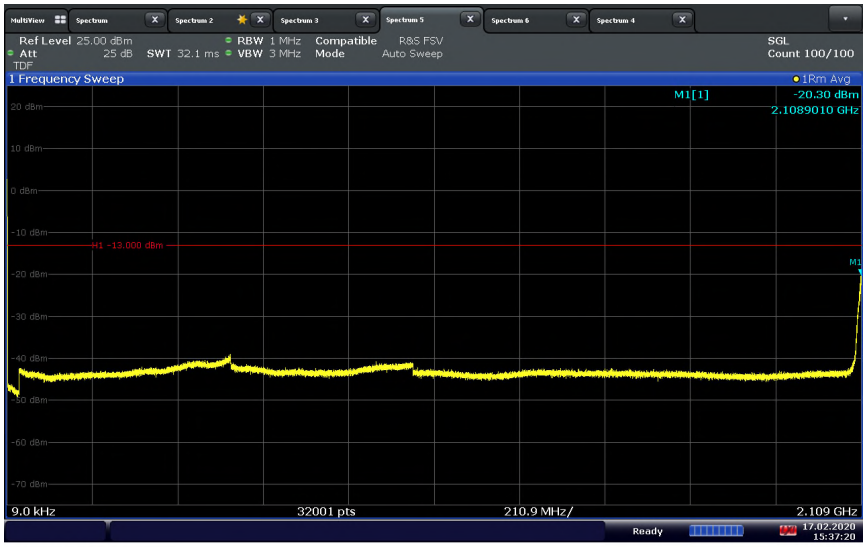


16:12:43 17.02.2020

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

LTE Band 4 Downlink (20 MHz BW) Low Channel / Spurious Emissions



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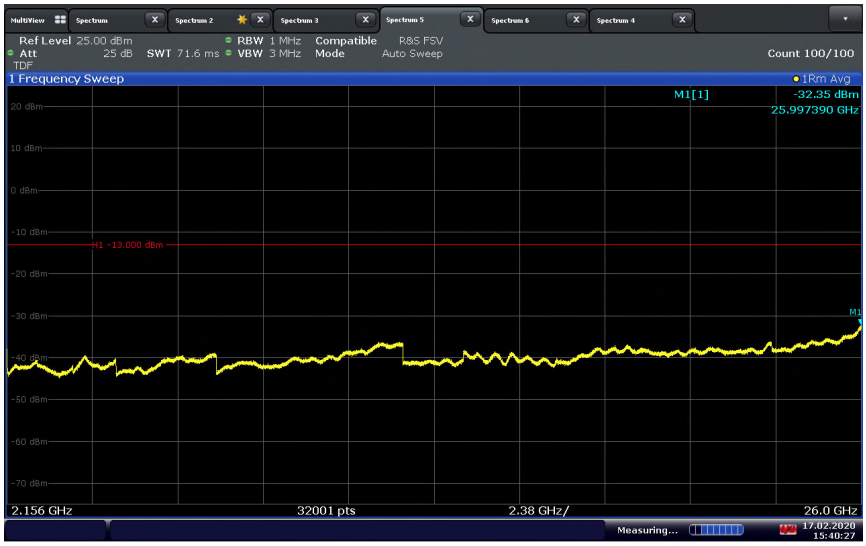

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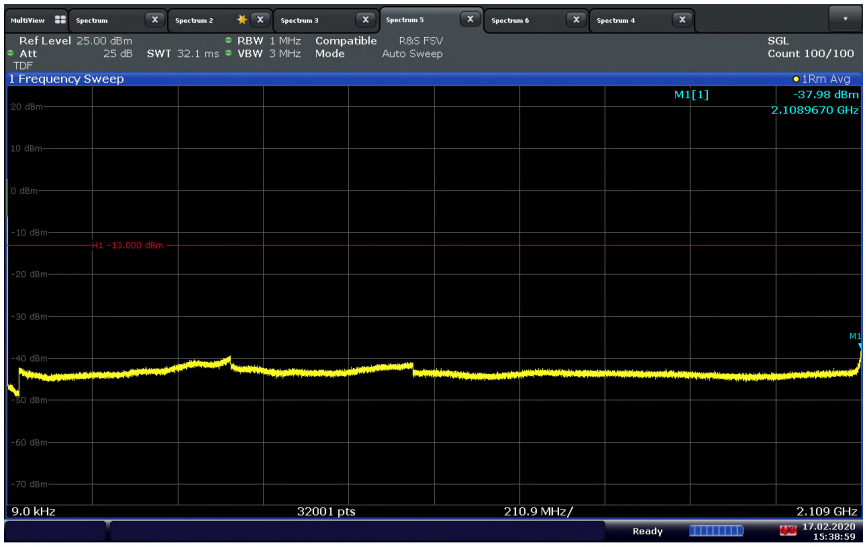
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 4 Downlink (20 MHz BW) Mid Channel / Spurious Emissions



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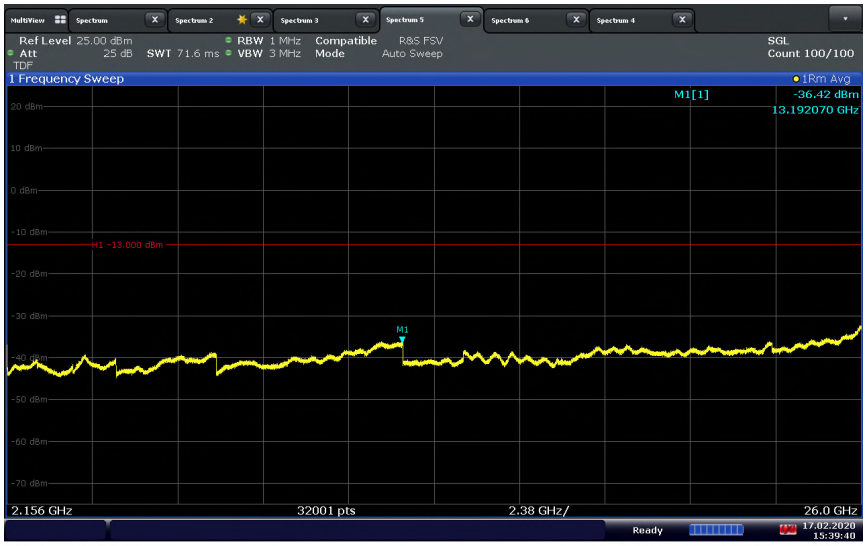
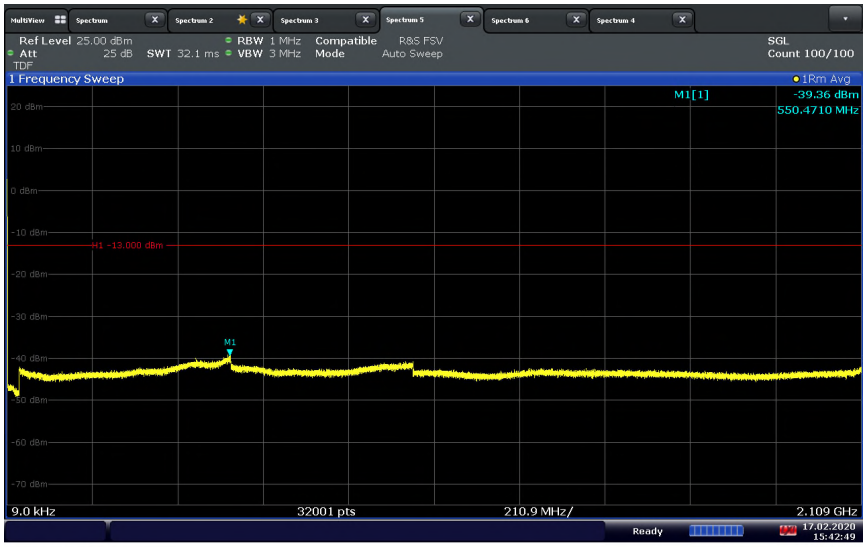


15:39:41 17.02.2020

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

LTE Band 4 Downlink (20 MHz BW) High Channel / Spurious Emissions



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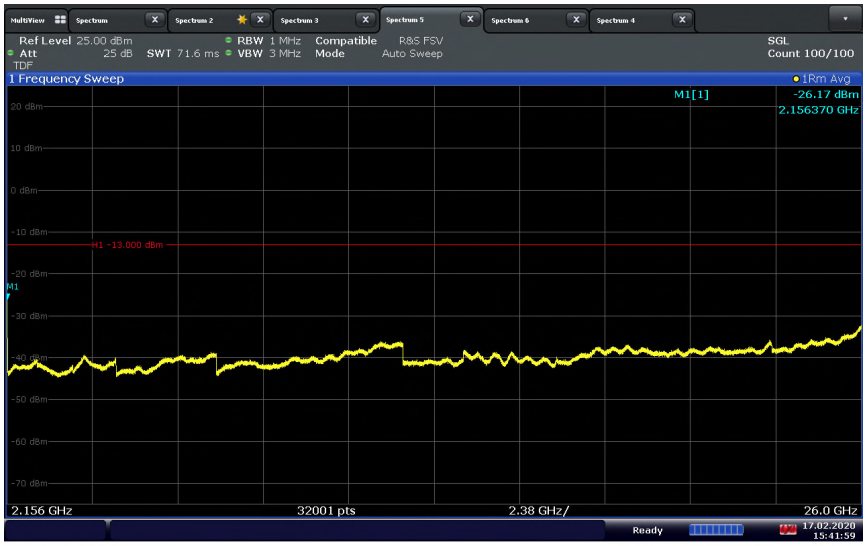

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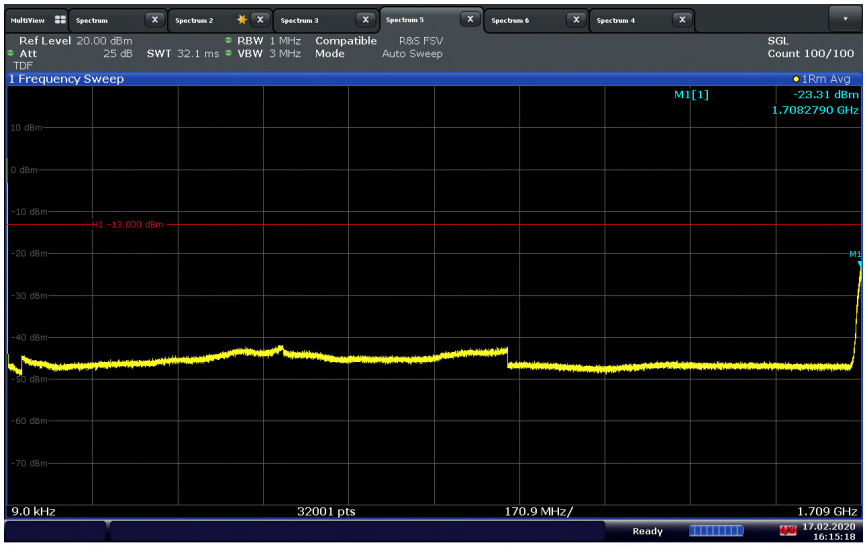
LTE Band 4 Uplink (20 MHz BW) Low Channel / Spurious Emissions



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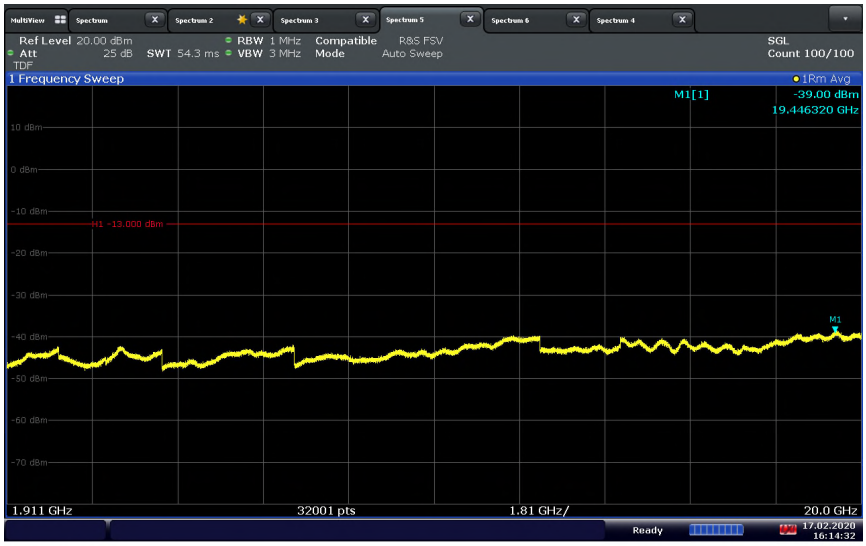

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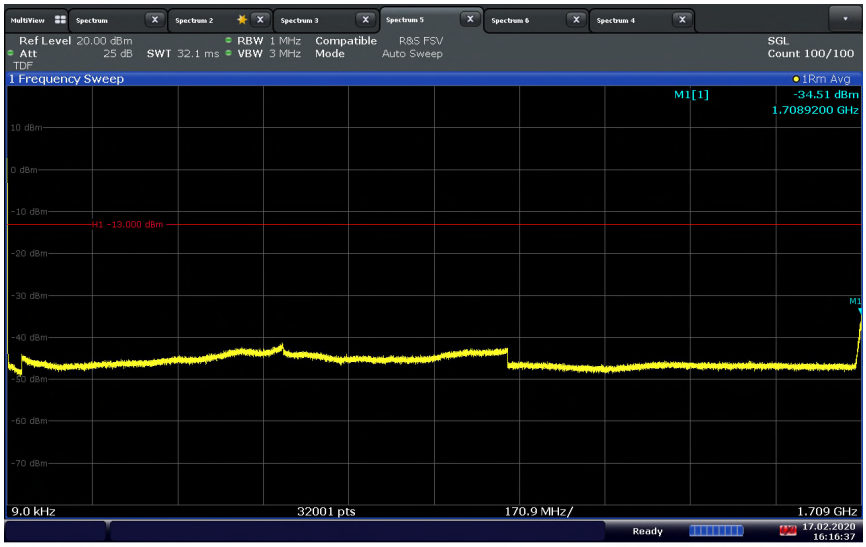
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

LTE Band 4 Uplink (20 MHz BW) Mid Channel / Spurious Emissions



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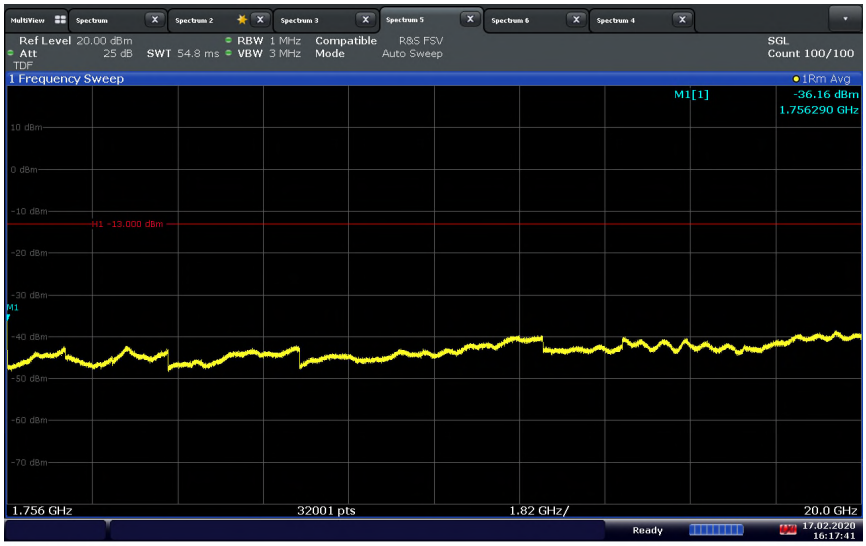

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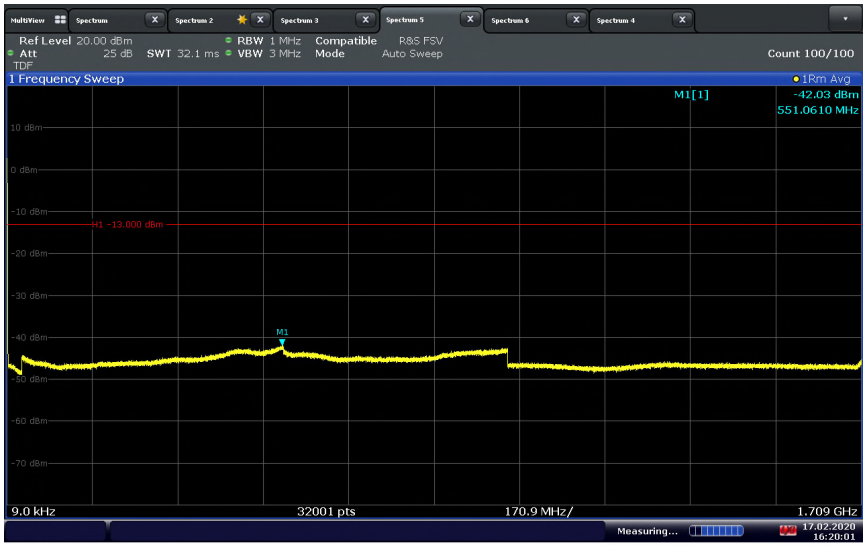
LTE Band 4 Uplink (20 MHz BW) High Channel / Spurious Emissions



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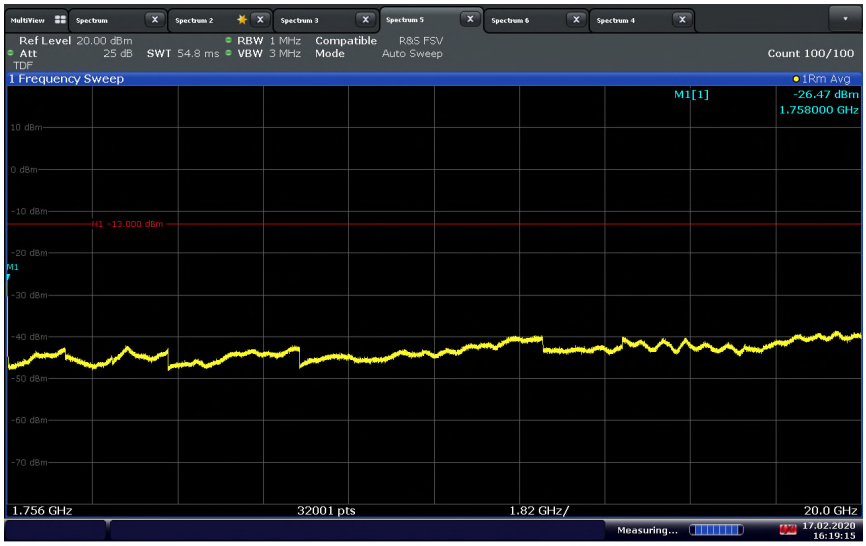
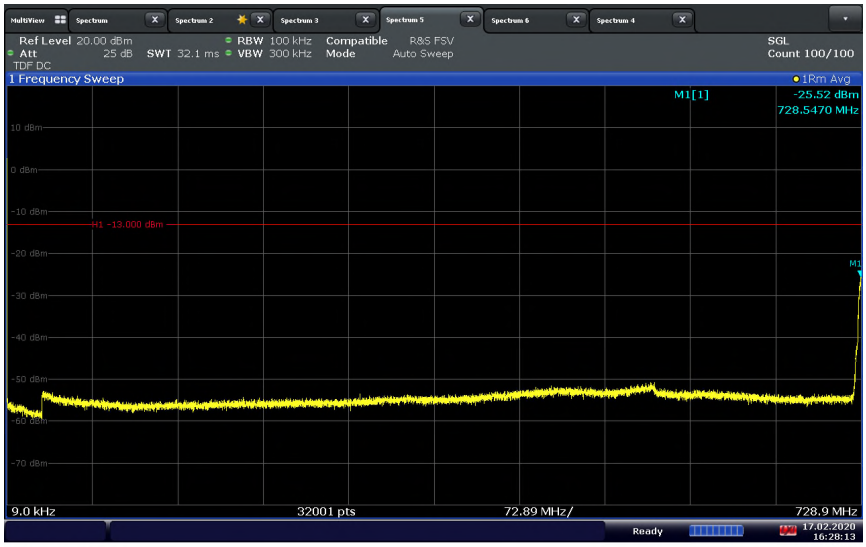


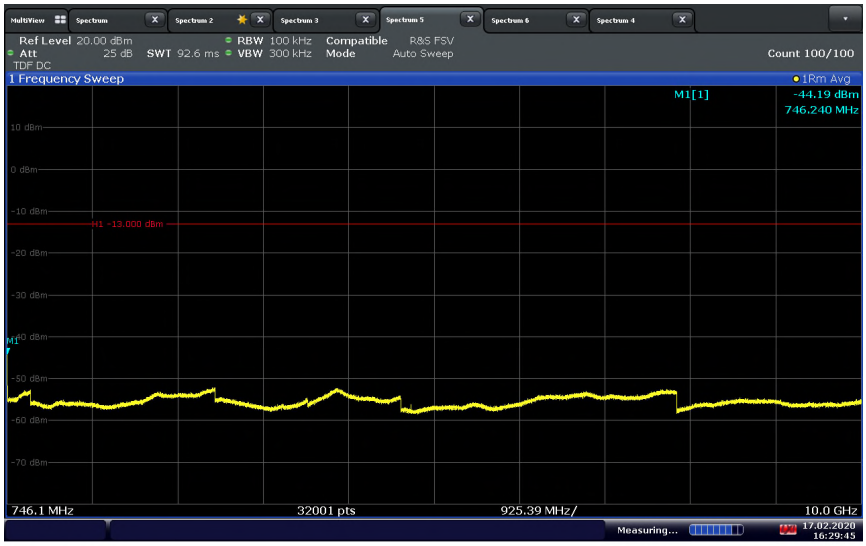
16:19:16 17.02.2020

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

LTE Band 12 Downlink (10 MHz BW) Low Channel / Spurious Emissions



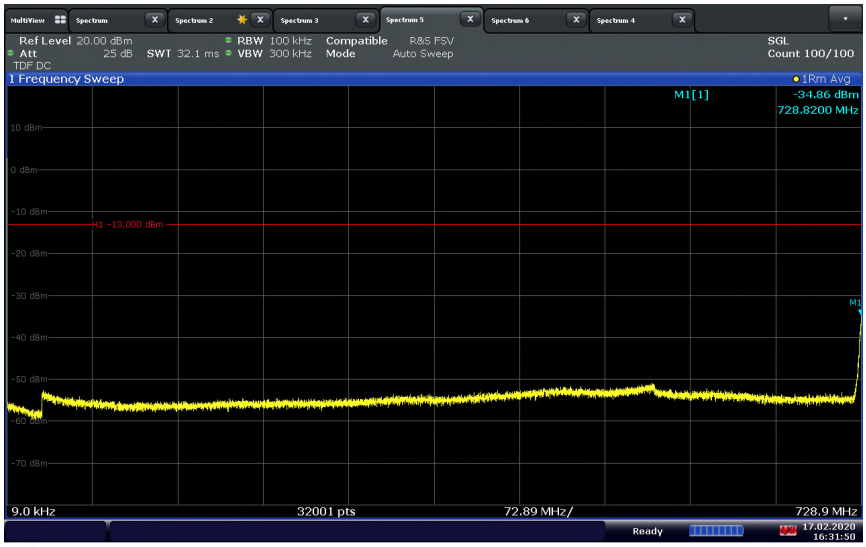
16:28:13 17.02.2020



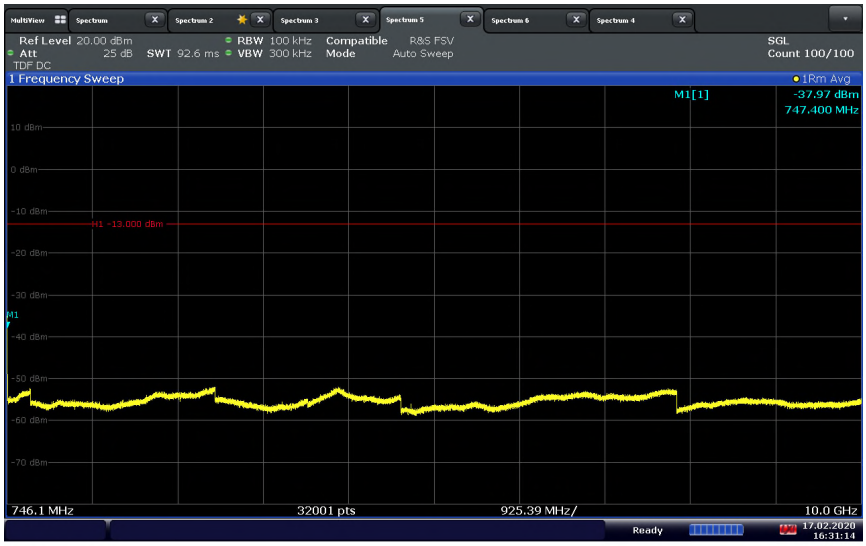
16:29:45 17.02.2020

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

LTE Band 12 Downlink (10 MHz BW) Mid Channel / Spurious Emissions



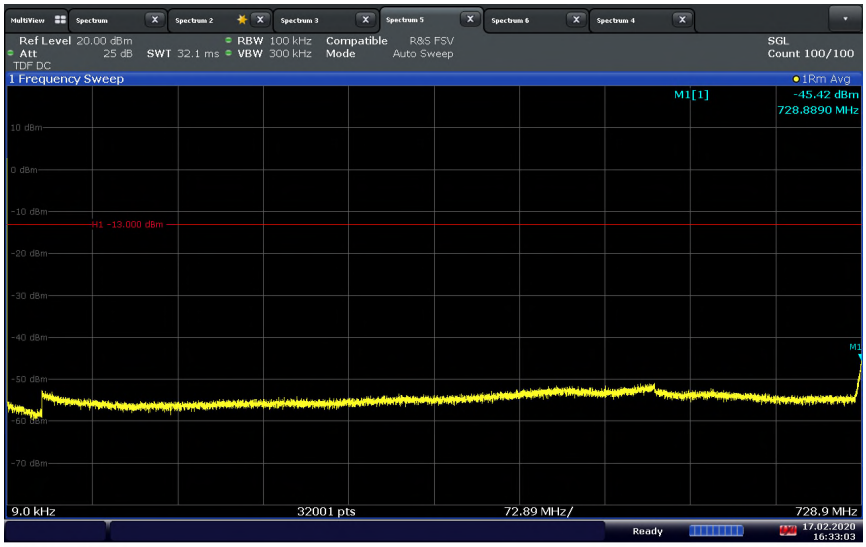
16:31:50 17.02.2020



16:31:15 17.02.2020

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

LTE Band 12 Downlink (10 MHz BW) High Channel / Spurious Emissions



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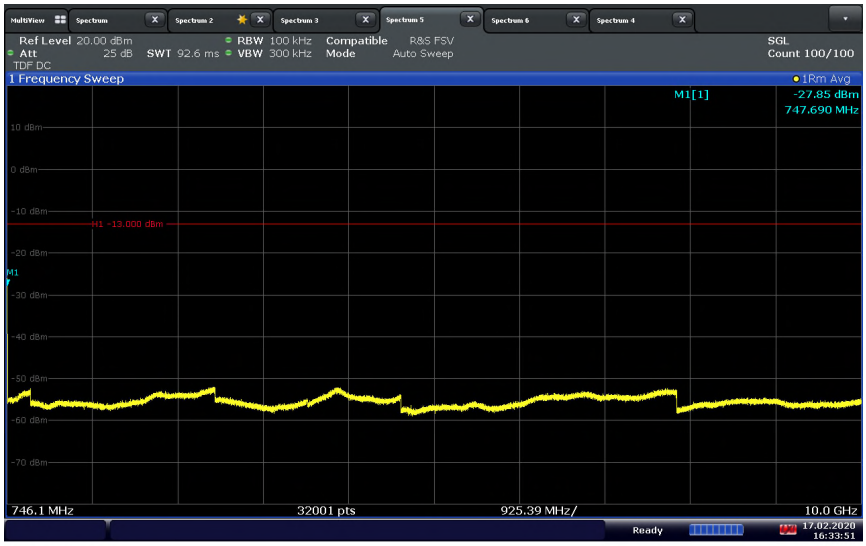
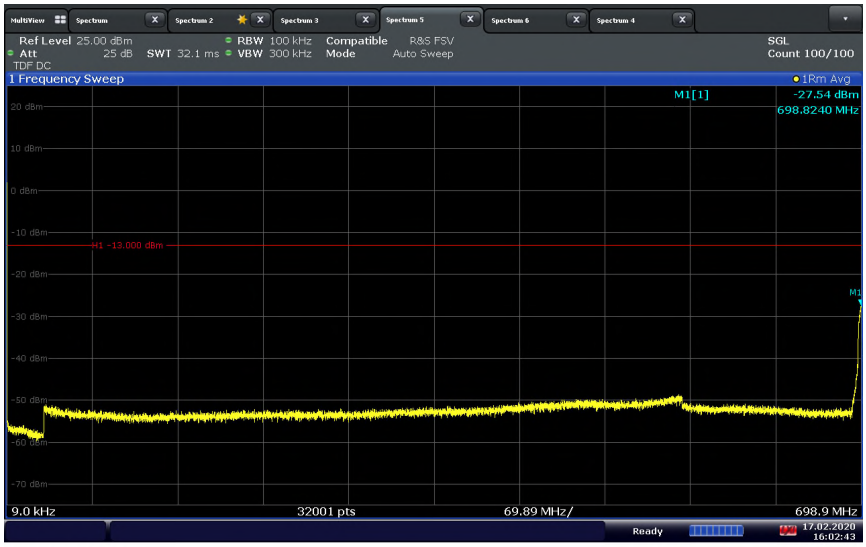


16:33:52 17.02.2020

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

LTE Band 12 Uplink (10 MHz BW) Low Channel / Spurious Emissions



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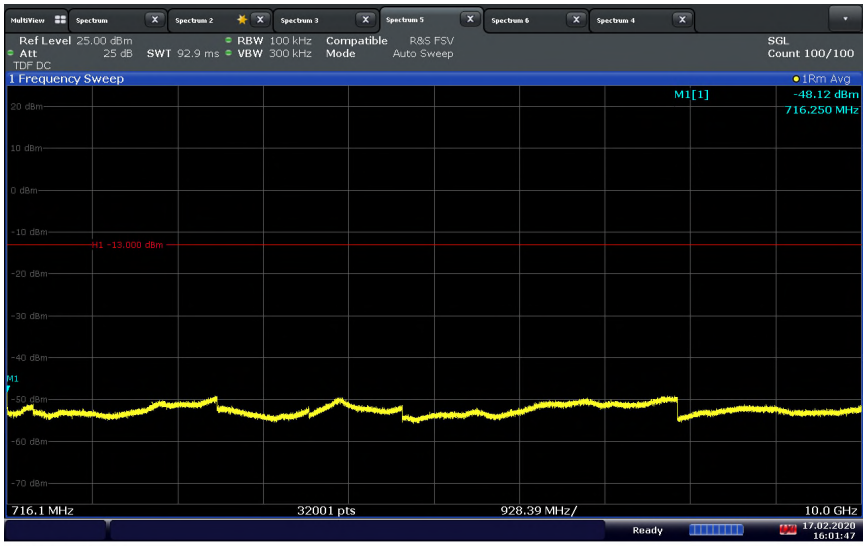
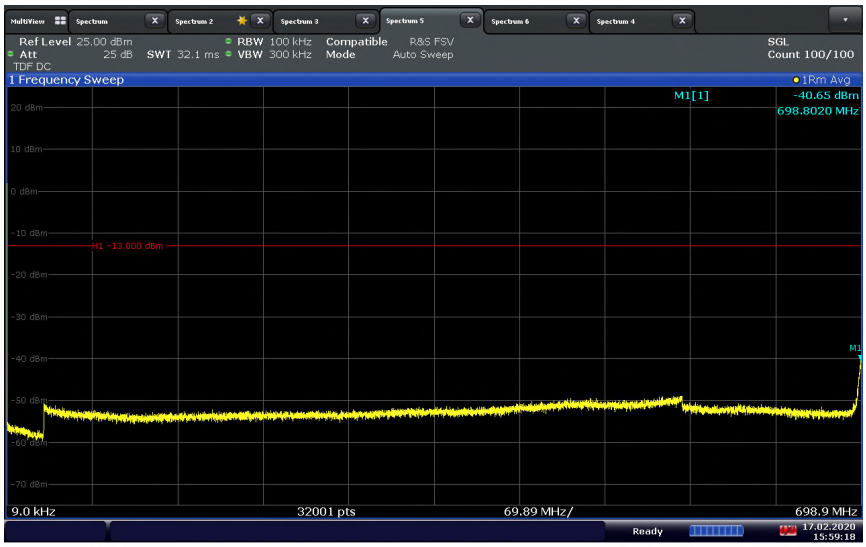


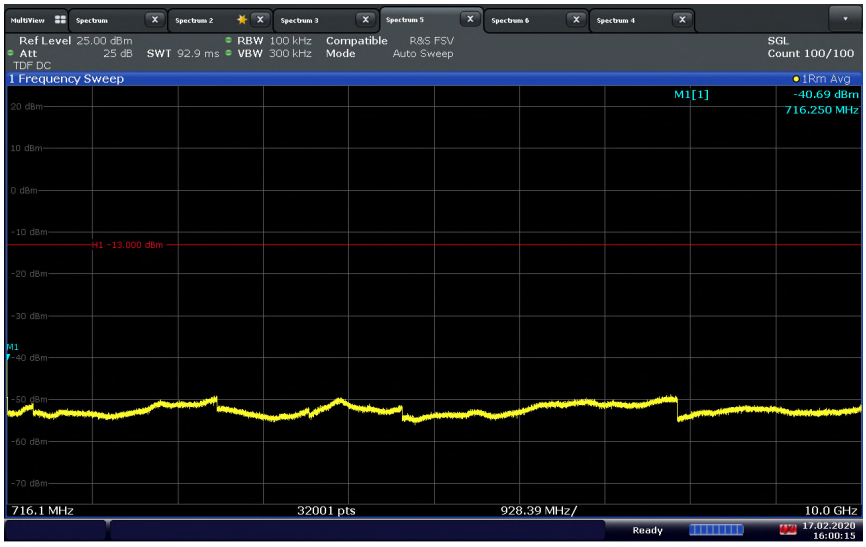
16:01:47 17.02.2020

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

LTE Band 12 Uplink (10 MHz BW) Mid Channel / Spurious Emissions

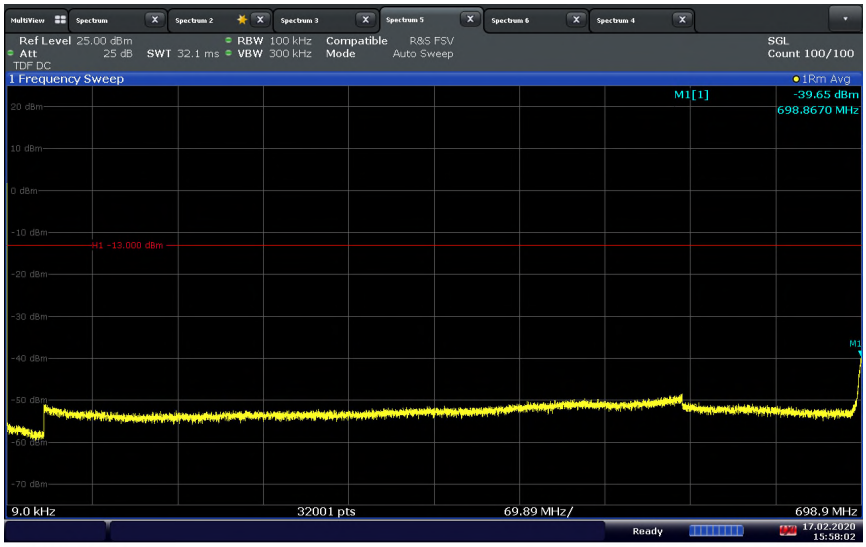


15:59:19 17.02.2020

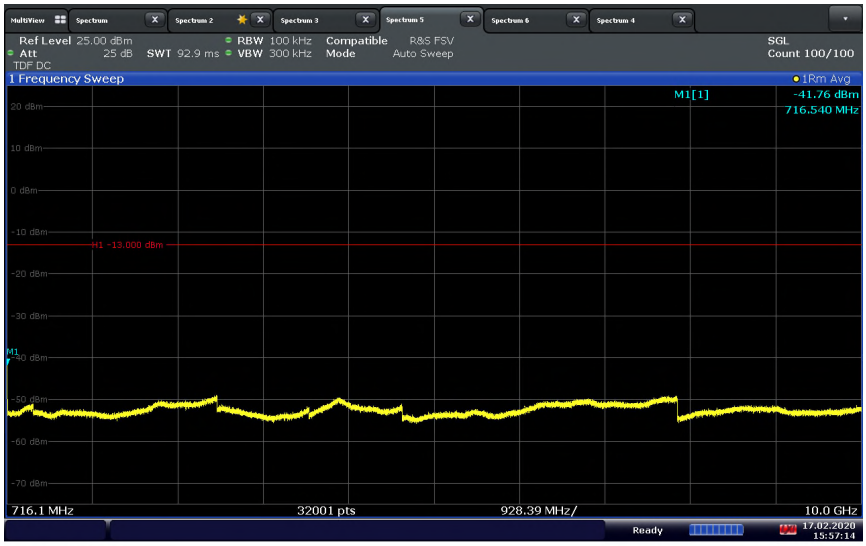


16:00:16 17.02.2020

LTE Band 12 Uplink (20 MHz BW) High Channel / Spurious Emissions



15:58:03 17.02.2020



15:57:14 17.02.2020

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

SECTION 4

TEST EQUIPMENT USED

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

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7662	P-Series Power Meter	N1911A	MY45100951	Agilent	06/28/19	06/28/20
7661	50MHz-18GHz Wideband Power Sensor	N1921A	MY45241383	Agilent	07/24/19	07/24/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/10/19	10/10/21
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/22/20	01/22/21
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7608 and 7582	
Radiated Test Setup						
1033	Bilog Antenna	3142C	00044556	EMCO	09/05/19	09/05/21
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/16/18	06/16/20
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/26/20	02/26/21
1016	Pre-amplifier	PAM-0202	187	A.H. Systems, Inc.	02/26/20	02/26/21
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/11/19	10/11/20
7620	EMI Test Receiver	ESU	100399	Rhode & Schwarz	10/18/19	10/18/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/10/19	10/10/21
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/22/20	01/22/21
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7608 and 7582	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7608 and 7582	
Miscellaneous						
43003	True RMS Multimeter	85 III	96880143	Fluke	10/07/19	10/07/20
7579	Temperature Chamber	115	151617	TestQuity	09/09/19	09/09/20
7619	Barometer/Temperature/ Humidity Transmitter	iBTHX-W	15250268	Omega	06/18/19	06/18/20
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

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

3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 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	0.08	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**

3.2.2 RADIATED MEASUREMENTS (BELOW 1GHZ)

	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	Attenuation: antenna-receiver	0.20	dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75	dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	0.45	dB	Normal, k=2	2.000	0.23	0.05
5	Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50	dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95	dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10	dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12	dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00	dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00	dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.76	dB	Triangular	2.449	1.54	2.36
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77	dB	Rectangular	1.732	0.44	0.20
18	Table height at 3 m	0.10	dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00	dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00	dB				0.00
	Combined standard uncertainty			Normal		2.95	dB
	Expanded uncertainty			Normal, k=2		**5.90**	**dB**

3.2.3 RADIATED EMISSION MEASUREMENTS (ABOVE 1GHZ)

	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	Attenuation: antenna-receiver	0.30	dB	Normal, k=2	2.000	0.15	0.02
3	Preamplifier Gain	0.20	dB	Normal, k=2	2.000	0.10	0.01
4	Antenna factor AF	0.37	dB	Normal, k=2	2.000	0.19	0.03
5	Sinewave accuracy	0.57	dB	Normal, k=2	2.000	0.29	0.08
6	Instability of preamp gain	1.21	dB	Rectangular	1.732	0.70	0.49
7	Noise floor proximity	0.70	dB	Rectangular	1.732	0.40	0.16
8	Mismatch: antenna-preamplifier	1.41	dB	U-shaped	1.414	1.00	0.99
9	Mismatch: preamplifier-receiver	1.30	dB	U-shaped	1.414	0.92	0.85
10	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
11	Directivity difference at 3 m	1.50	dB	Rectangular	1.732	0.87	0.75
12	Phase center location at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
13	Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
14	Site imperfections VSWR (Method 2)	3.00	dB	Triangular	2.449	1.22	1.50
15	Effect of setup table material	1.15	dB	Rectangular	1.732	0.87	0.75
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Table height at 3 m	0.00	dB	Normal, k=2	2.000	0.00	0.00
	Combined standard uncertainty			Normal	2.45	dB	
	Expanded uncertainty			Normal, k=2	**4.90**	**dB**	

3.2.4 CONDUCTED MEASUREMENTS

	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	LISN-receiver attenuation	0.10	dB	Normal, k=2	2.000	0.05	0.00
3	LISN voltage division factor	0.30	dB	Normal, k=2	2.000	0.15	0.02
4	Receiver sinewave accuracy	0.36	dB	Normal, k=2	2.000	0.18	0.03
5	Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.00	dB	Rectangular	1.732	0.00	0.00
8	AMN VDF frequency interpolation	0.10	dB	Rectangular	1.732	0.06	0.00
9	Mismatch	0.07	dB	U-shaped	1.414	0.05	0.00
10	LISN impedance	2.65	dB	Triangular	2.449	1.08	1.17
11	Effect of mains disturbance	0.00	dB			0.00	0.00
12	Effect of the environment						
	Combined standard uncertainty			Normal	1.66	dB	
	Expanded uncertainty			**Normal, k=2**	**3.31**	**dB**	

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SECTION 5

DIAGRAM OF TEST SETUP

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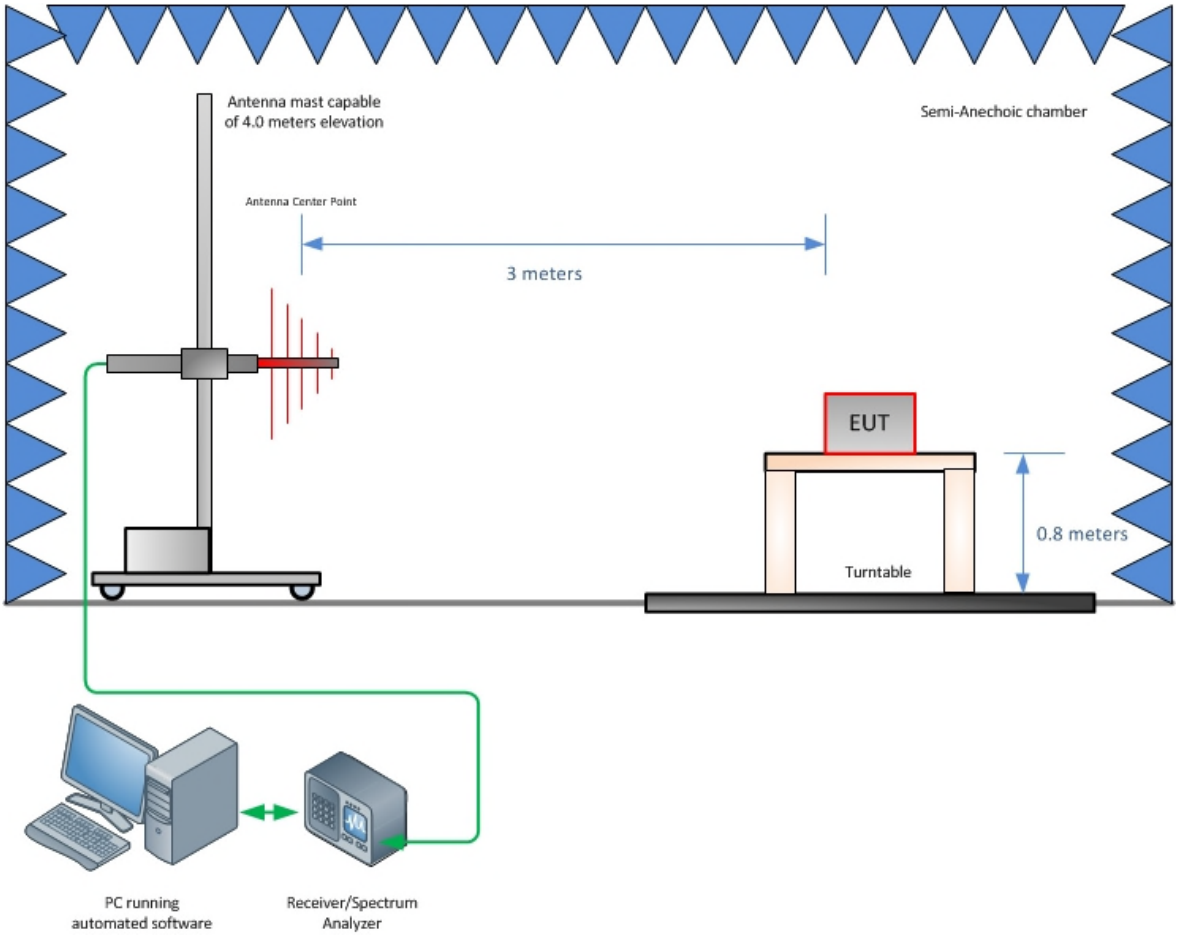
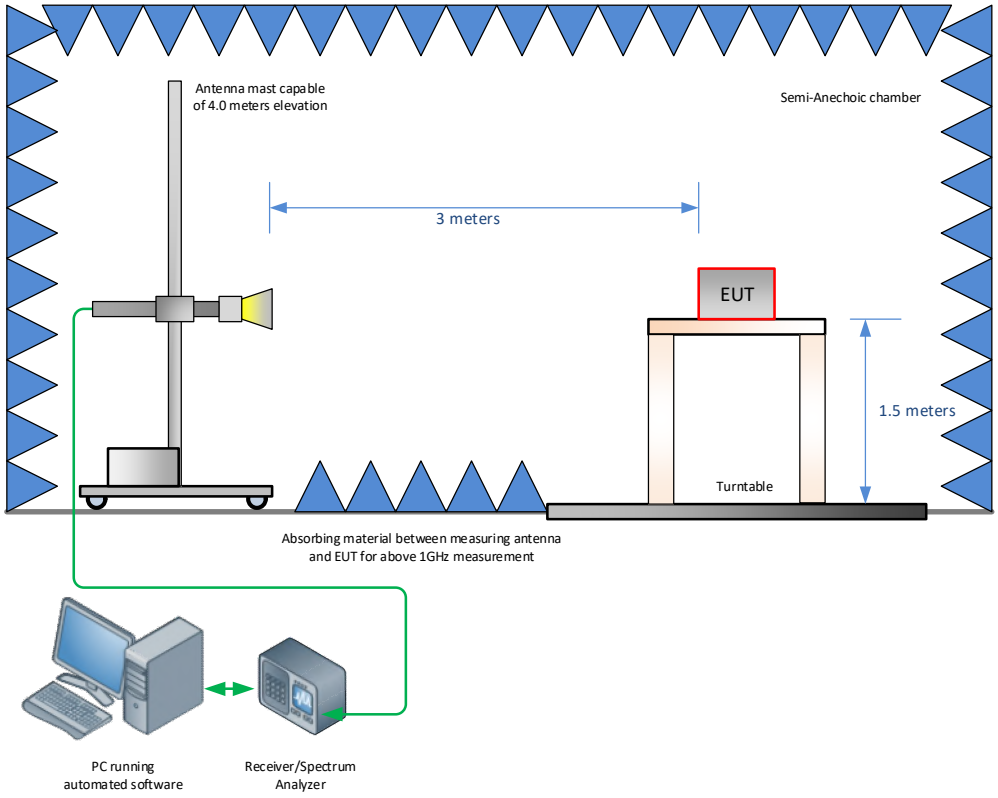
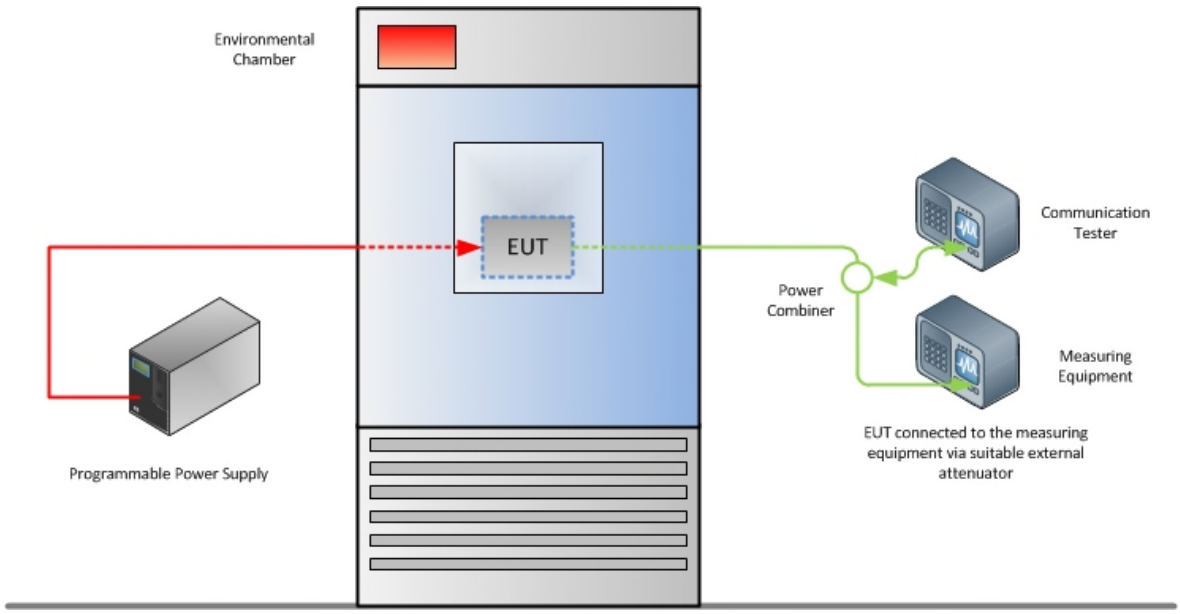
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Frequency Stability Test Comfiguration

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SECTION 6

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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