Report On

Application for Grant of Equipment Authorization of the
Inseego Corp.
MD8800 Wireless Module

FCC CFR 47 Part 2 and 96

Report No. 72154463 Rev.01 **December 2019**

REPORT ON	Radio Testing of the Inseego Corp. MD8800 Wireless Module
TEST REPORT NUMBER	72154463 Rev.01
PREPARED FOR	Inseego Corp. 9605 Scranton Road, Suite 300 San Diego, CA 92121 USA
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APPROVED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: Senior EMC Test Engineer/Wireless Team Lead
DATED	December 17, 2019

Revision History

72154463 Rev.01 Inseego Corp. MD8800 Wireless Module					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
12/10/2019	—	Initial Release			Ferdinand Custodio
12/17/2019	Initial Release	Rev.01	Addition to Transmit Frequency EIRP table Section 1.3.3	9	Ferdinand Custodio

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Inseego Corp.
MD8800 Wireless Module

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 Inseego Corp. MD8800 Wireless Module to the requirements of the following:

- FCC CFR 47 Part 2 and 96

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	Inseego Corp.
Product Trademark/Brand	Inseego
Product Marketing Name	MD8800
Model Number(s)	MD8800
FCC ID Number	PKRISGMD8800
IC Number	3229A-MD8800
Serial Number(s)	FG090719C00005 and FJ220819C00056
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC CFR 47 Part 2 and 96 (October 1, 2018) • ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
Start of Test	November 22, 2019
Finish of Test	November 22, 2019
Name of Engineer(s)	Alex Chang
Related Document(s)	• TÜV SÜD America Radio Test Report ref. no. 72152860B_Inseego MIFI8000_FCC Part 96_LTE Band 42_Test report issued on October 28, 2019.pdf • Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2 and 96 with cross-reference to the corresponding ISED RSS standard is shown below.

Section	FCC Part Sections(s)	Test Description	Result
2.1	2.1046	Transmitter Conducted Output Power	Compliant**
2.2	2.1046 96.41(b)	Effective Isotropic Radiated Power and Power Spectral Density	Compliant**
2.3	96.41(g)	Peak-Average Ratio	For reference only*
2.4	2.1049 96.41(e)(3)	Occupied Bandwidth	Compliant**
2.5	2.1051 96.41(e)(1)(3)	Band Edge and Emission Mask	Compliant**
2.6	2.1051 96.41(e)(1)(2)(3)	Conducted Spurious Emissions	Compliant**
2.7	2.1053 96.41(e)	Field Strength of Spurious Radiation	Compliant
2.8	2.1055	Frequency Stability	Compliant**

* PAR requirement is for CBSD only. For end user device, PAR test data is for reference only.

** The module was previously tested in a host under model number MIFI8000. All the conducted measurement for LTE Band 42 were from the host and covered under test report 72152860B_Inseego MIFI8000_FCC Part 96_LTE Band 42_Test report issued on October 28, 2019.pdf.

1.3 PRODUCT INFORMATION

1.3.1 EUT General Description

The Equipment Under Test (EUT) was a Inseego Corp. MD8800 Wireless Module. The EUT is a Radio Module supporting 2G/3G/4G Technologies. The EUT comes with a USB Port.

1.3.2 Technical Description

EUT Description	Wireless Module
Product Marketing Name	MD8800
Model Number(s)	MD8800
Rated Voltage	3.7V, 4400mAh (Rechargeable Li-Ion battery pack) Input 100-240VAC, Output 5V (External AC-DC Power Adapter)
Mode Verified	LTE Band 42: 3550-3600 MHz
Capability	WCDMA Band 2, 5, LTE Band 2, 4, 5, 7, 13, 14, 42, 46, 48, 66
Primary Unit (EUT)	☒ Production ☐ Pre-Production ☐ Engineering
Manufacturer declared Rated Power (Client declaration, max. antenna gain covered under this test report)	23 dBm

LTE Bands	Frequency(ies)	Antenna Gains
Band 42	3550-3600 MHz	2.5 dBi

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1.3.3 Transmit Frequency Table

LTE Band 42					
Modulation	Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	EIRP / 10 MHz	
				Max Power (dBm)	Max Power (mWatts)
QPSK	5	3550 - 3600	4M51G7D	20.10	102.3
	10		8M98G7D	19.92	98.2
	15		13M4G7D	19.24	83.9
	20		17M9G7D	18.50	70.8
16QAM	5		4M53W7D	19.82	95.9
	10		8M98W7D	19.77	94.8
	15		13M4W7D	18.44	69.8
	20		17M8W7D	16.78	47.6

LTE Band 42					
Modulation	Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	Full EIRP	
				Max Power (dBm)	Max Power (mWatts)
QPSK	5	3550 - 3600	4M51G7D	20.10	102.3
	10		8M98G7D	19.92	98.2
	15		13M4G7D	20.78	119.7
	20		17M9G7D	21.18	131.2
16QAM	5		4M53W7D	19.82	95.9
	10		8M98W7D	19.77	94.8
	15		13M4W7D	19.96	99.1
	20		17M8W7D	19.49	88.9

Note: The 15 and 20MHz BW Full EIRP results calculation based on 26dB OBW; therefore, the example formula as below. Worst case channel presented.

Full EIRP = 10log(OBW/10) + EIRP/10MHz

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement. EUT Transmits at max power and is powered by the internal battery and/or USB via AC Adapter.
B	Radiated test setup / case spurious emissions. Antenna port terminated by the call box.

1.4.2 EUT Exercise Software

EUT is controlled by a CMW 500 Wideband Radio Communication Tester. There are no other test software used during verification.

1.4.3 Support Equipment and I/O cables

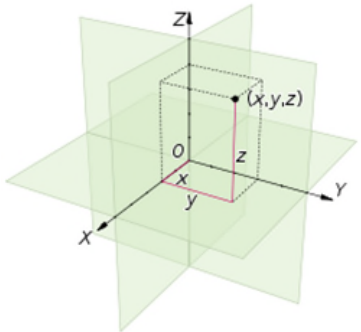
Manufacturer	Equipment/Cable	Description
Novatel Wireless	USB Cable	Standard USB Type A to USB Type C
Novatel Wireless	External AC-DC Power Adapter	Model: SSW-2783, PN: 40123126.01 Input: 100-240VAC, 50/60Hz, 0.5A Output: 5VDC, max. 2A

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per output power measurements:

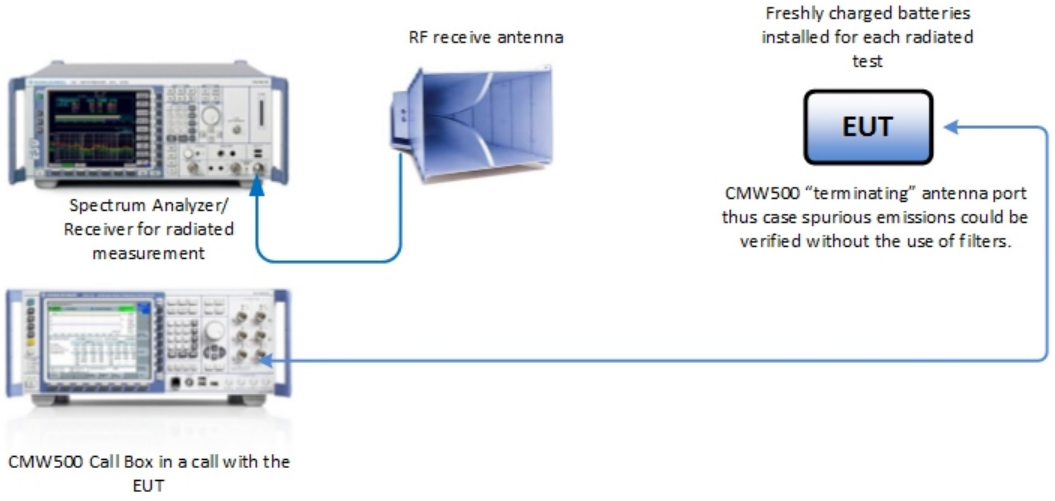
Band	Channel BW	Modulation	RB Size/Offset
Band 42(3550 – 3600 MHz)	15 MHz	QPSK	1/0

For radiated measurements X, Y, and Z orientations were verified. The verification was determined “Y” as worst case configuration.

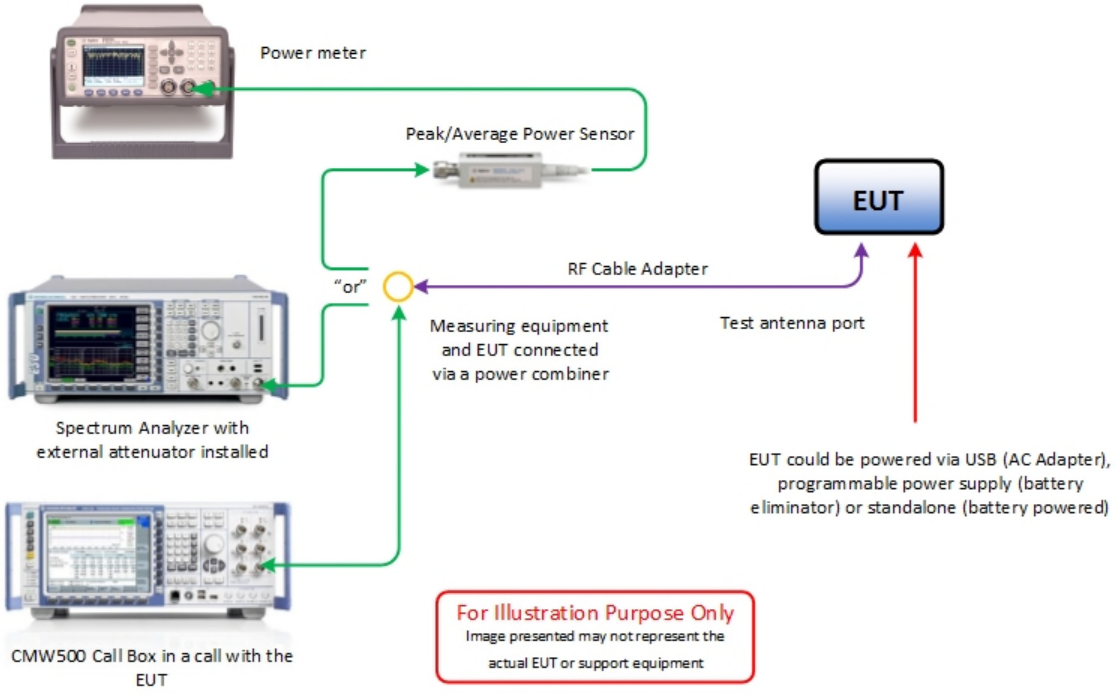


1.4.5 Simplified Test Configuration Diagram

Radiated Test Configuration



Conducted (Antenna Port) Test Configuration



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 FG090719C00005 and FJ220819C00056		
None	—	—

The table above details modifications made to the EUT during the test programme. 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 and radiated emissions, the equipment under test (EUT) was configured to measure its highest possible emission level. 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 TÜV SÜD 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 TÜV SÜD 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)

TÜV 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)

TÜV SÜD 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-0280 and A-0281

TÜV SÜD 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

TÜV SÜD 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

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

1.10 SAMPLE CALCULATIONS

1.10.1 LTE Emission Designator (QPSK)

Emission Designator = 4M51G7D
G = Phase Modulation
7= Quantized/Digital Info
D = Data Transmission, telemetry, telecommand

1.10.2 LTE Emission Designator (16QAM)

Emission Designator = 4M50W7D
W = Frequency Modulation
7= Quantized/Digital Info
D = Data Transmission, telemetry, telecommand

1.10.3 Spurious Radiated Emission (below 1GHz)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**11.8**

1.10.4 Spurious Radiated Emission – Substitution Method

Example = 84dBµV/m @ 1413 MHz (numerical sample only)

The field strength reading of 84dBµV/m @ 1413 MHz (2nd Harmonic of 706.5 MHz) is the maximized measurement when the EUT is on the turntable measured at 3 meters. The gain of the substituted antenna is 7.8dBi while the transmit cable loss is 1.0 dB (cable between signal generator and the substituted antenna). The signal generator level is adjusted until the 84dBµV/m level at the receiving end is replicated (identical test setup, i.e. same antenna, cable/s and preamp). If the adjusted signal generator level is -18dBm, then we have the following for both EIRP and ERP as required:

P_{EIRP} = -18 dBm + 7.8 dBi – 1dB
= 11.2 dBm
P_{ERP} = P_{EIRP} – 2.15 dB
= 11.2 dBm – 2.15 dB
= 9.05 dBm

SECTION 2

TEST DETAILS

Radio Testing of the
Inseego Corp.
MD8800 Wireless Module

2.1 TRANSMITTER CONDUCTED POWER MEASUREMENTS

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046

2.1.2 Standard Applicable

The conducted power mesurements were made in accordance to FCC Part 2 Clasue 2.1046

2.1.3 Equipment Under Test and Modification State

Serial No: FJ220819C00056 / Test Configuration A

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

October 15, 2019 / AC

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	24.8 °C
Relative Humidity	43.2 %
ATM Pressure	98.8 kPa

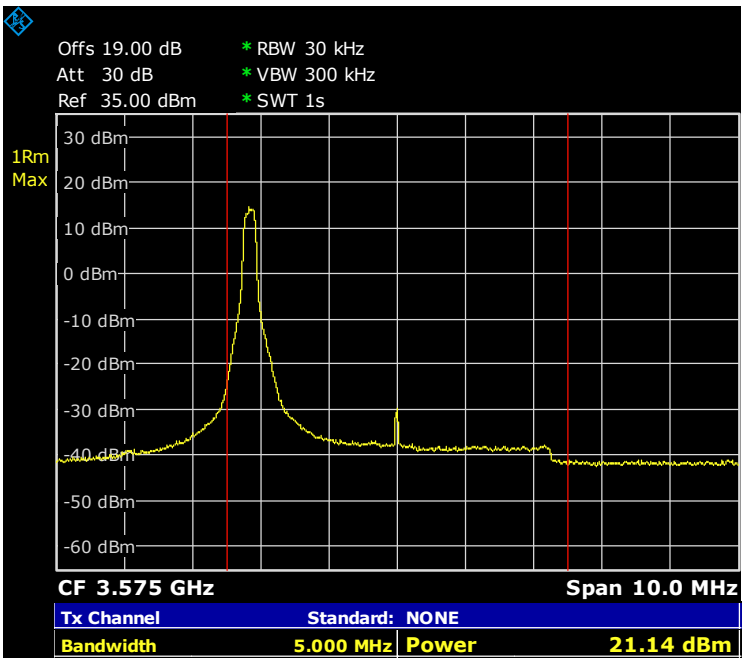
2.1.7 Additional Observations

- This is a conducted test using spectrum analyzer.
- The path loss were measured and entered as a level offset.
- Low, Middle and High channels for all bandwidths with different RB size and RB offset and modulations were verified and reported.

2.1.8 Test Results

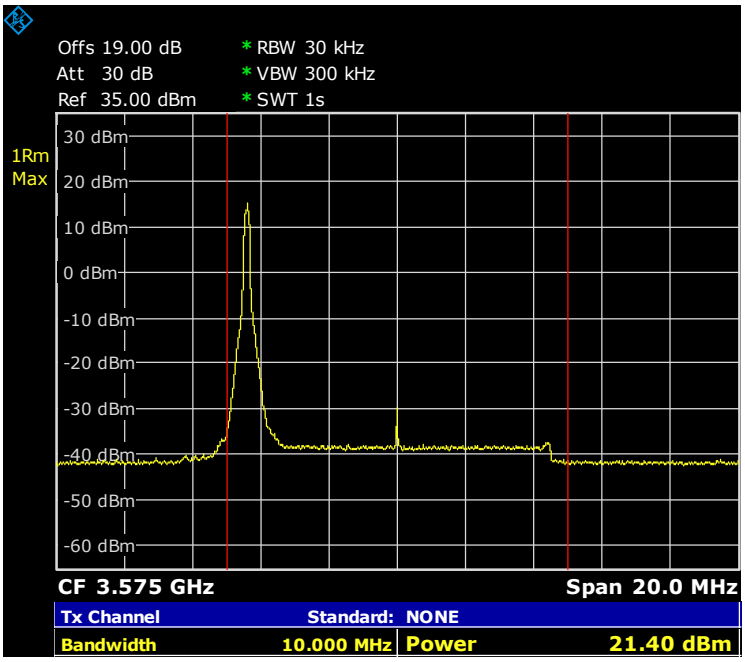
LTE Band 42 (3550-3600 MHz) according to FCC Part 96						
Bandwidth (MHz)	**Channel**	**Frequency (MHz)**	**Modulation**	**No. RB**	**RB Start**	**Average Power (dBm)**
5.0	43115	3552.5	QPSK	1	0	21.03
	43340	3575				21.14
	43565	3597.5				21.39
	43115	3552.5	16QAM	1	0	20.13
	43340	3575				20.08
	43565	3597.5				20.66
10	43140	3555	QPSK	1	0	21.25
	43340	3575				21.40
	43540	3595				21.75
	43140	3555	16QAM	1	0	20.42
	43340	3575				19.93
	43540	3595				20.31
15	**43165**	**3557.5**	**QPSK**	**1**	**0**	**21.35**
	43340	**3575**				**21.49**
	43515	**3592.5**				**21.96**
	43165	3557.5	16QAM	1	0	20.10
	43340	3575				21.03
	43515	3592.5				20.46
20	43190	3560	QPSK	1	0	21.90
	43340	3575				21.91
	43490	3590				21.67
	43190	3560	16QAM	1	0	21.05
	43340	3575				20.46
	43490	3590				20.78

2.1.9 Sample Test Measurement Screen



Date: 15.OCT.2019 14:30:39

LTE Band 42 (3573 MHz)_5M Bandwidth Middle Chanel QPSK 1RB 0 Offset



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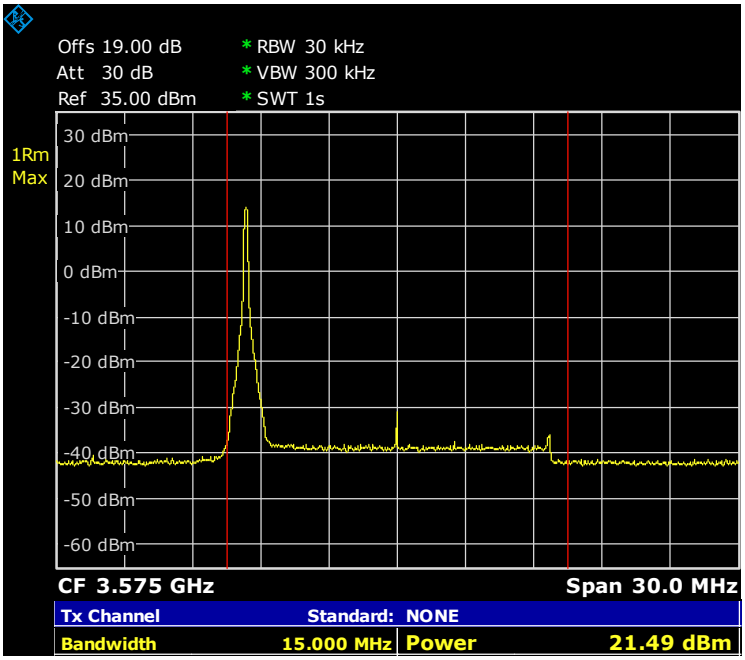
LTE Band 42 (3573 MHz)_10M Bandwidth Middle Chanel QPSK 1RB 0 Offset



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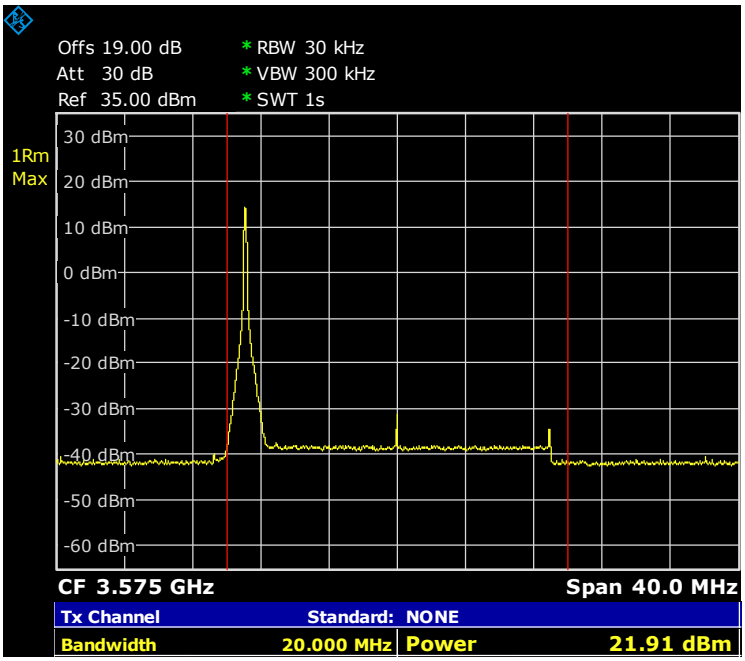
LTE Band 42 (3573 MHz)_15M Bandwidth Middle Chanel QPSK 1RB 0 Offset



Date: 15.OCT.2019 15:01:58

LTE Band 42 (3573 MHz)_20M Bandwidth Middle Chanel QPSK 1RB 0 Offset

2.2 EFFECTIVE ISOTROPIC RADIATED POWER AND POWER SPECTRAL DENSITY

2.2.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046
FCC 47 CFR Part 96, Clause 41(b)

2.2.2 Standard Applicable

FCC 47 CFR Part 96, Clause 96.41:
(b) Unless othewise specified in this sectin, the maximum effective isotropic radiated power (EIRP) and maximum Power Sepctral Density (PSD) of any CBSD and End User Device must comply with the limits show in the table below:

Device	Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
End User Device	23	N/A
Category A CBSD	30	20
Category B CBSD	47	37

2.2.3 Equipment Under Test and Modification State

Serial No: FJ220819C00056 / Test Configuration A

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

October 28, 2019 / AC

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	24.8 °C
Relative Humidity	43.2 %
ATM Pressure	98.8 kPa

2.2.7 Additional Observations

- EIRP was calculated as per Section 1.2 and 1.3 of KDB412172 D01 (Determining ERP and EIRP v01r01).
- Calculation formula in logarithmic terms:

$$\mathbf{EIRP = P_T + G_T - L_C}$$

Where:

P_T = transmitter conducted output power dBm (Section 2.1 of this test report)
G_T = gain of the transmitting antenna, in dBi (EIRP);
L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB (EUT posees an internal Antenna. The loss between the EUT and the antenna port is considered negligible).

- The path loss were measured and entered as a level offset.
- Low, Middle and High channels for all modulations were verified and reported.

2.2.8 Test Results

LTE Band 42 (3550 – 3650 MHz) EIRP/10 MHz according to FCC Part 96									
Modulation	**Bandwidth (MHz)**	**RB Size/Offset**	**Channels**	**Frequency (MHz)**	**Average Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**Limit (dBm)**	**Compliance**
QPSK	5	25 / 0	43115	3552.5	16.59	2.5	19.09	23	Yes
		25 / 0	43340	3575	17.60	2.5	20.10	23	Yes
		25 / 0	43565	3597.5	16.59	2.5	19.09	23	Yes
	10	50 / 0	43140	3555	17.42	2.5	19.92	23	Yes
		50 / 0	43340	3575	17.33	2.5	19.83	23	Yes
		50 / 0	43540	3595	17.35	2.5	19.85	23	Yes
	15	75 / 0	43165	3557.5	16.48	2.5	18.98	23	Yes
		75 / 0	43340	3575	16.32	2.5	18.82	23	Yes
		75 / 0	43515	3592.5	16.74	2.5	19.24	23	Yes
	20	100 / 0	43190	3560	15.97	2.5	18.47	23	Yes
		100 / 0	43340	3575	16.00	2.5	18.50	23	Yes
		100 / 0	43490	3590	15.53	2.5	18.03	23	Yes
16QAM	5	25 / 0	43115	3552.5	17.04	2.5	19.54	23	Yes
		25 / 0	43340	3575	15.84	2.5	18.34	23	Yes
		25 / 0	43565	3597.5	17.32	2.5	19.82	23	Yes
	10	50 / 0	43140	3555	16.91	2.5	19.41	23	Yes
		50 / 0	43340	3575	17.21	2.5	19.71	23	Yes
		50 / 0	43540	3595	17.27	2.5	19.77	23	Yes
	15	75 / 0	43165	3557.5	15.61	2.5	18.11	23	Yes
		75 / 0	43340	3575	15.94	2.5	18.44	23	Yes
		75 / 0	43515	3592.5	15.50	2.5	18.00	23	Yes
	20	100 / 0	43190	3560	14.06	2.5	16.56	23	Yes
		100 / 0	43340	3575	13.35	2.5	15.85	23	Yes
		100 / 0	43490	3590	14.28	2.5	16.78	23	Yes

2.2.9 Sample Test Measurement Screen

LTE Band 42 (3550 – 3600 MHz) 15 MHz Bandwidth Middle Channel 3575 MHz QPSK EIRP/10 MHz

2.3 PEAK-AVERAGE POWER RATIO

2.3.1 Specification Reference

FCC 47 CFR Part 96, Clause 96.41 (g)

2.3.2 Standard Applicable

FCC 47 CFR Part 96.41(g):
Power measurement. The peak-toaverage power ratio (PAPR) of any CBSD transmitter output power must not exceed 13 dB. PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

2.3.3 Equipment Under Test and Modification State

Serial No: FJ220819C00056 / Test Configuration A

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

October 15, 2019 / AC

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	24.8 °C
Relative Humidity	43.2 %
ATM Pressure	98.8 kPa

2.3.7 Additional Observations

- This is a conducted test.
- As per FCC KDB 971168 D01 v03r01 clause 5.7, the PAPR was measured in accorance with ANSI C63.26 clause 5.2.3.4.
- 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.
- Low, Middle and High channels for all bandwidths and modulations were verified.
- The path loss for was measured and entered as a level offset.
- PAR requirement is for CBSD only. The test results are just for reference only.
- There are no measured PAR levels greater than 13dB. EUT complies.

2.3.8 Test Results

LTE Band 42					
Bandwidth (MHz)	**Channel**	**Frequency (MHz)**	**Modulation**	**PAR (dB)**	**Limit for PAR (dB)**
5	43115	3552.5	QPSK	8.16	13
	43340	3575		8.28	13
	43565	3597.5		8.00	13
	43115	3552.5	16QAM	9.60	13
	43340	3575		9.89	13
	43565	3597.5		9.24	13

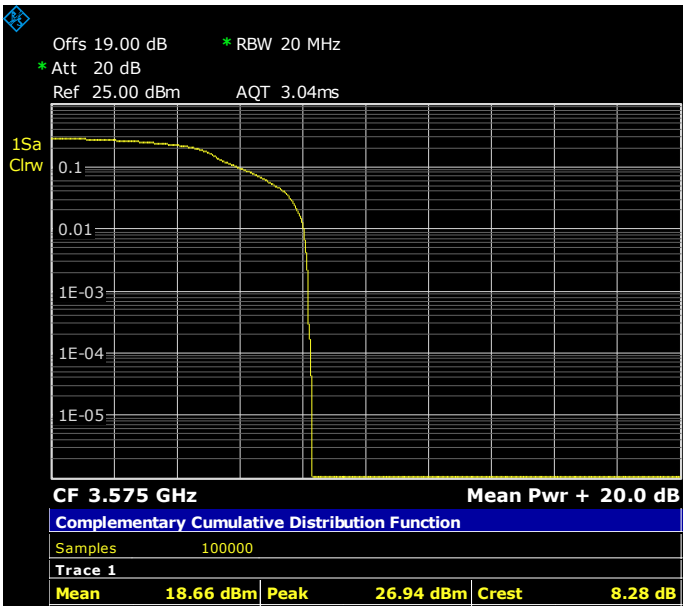
LTE Band 42					
Bandwidth (MHz)	**Channel**	**Frequency (MHz)**	**Modulation**	**PAR (dB)**	**Limit for PAR (dB)**
10	43140	3555	QPSK	8.18	13
	43340	3575		8.23	13
	43540	3595		8.19	13
	43140	3555	16QAM	9.83	13
	43340	3575		9.99	13
	43540	3595		9.83	13

LTE Band 42					
Bandwidth (MHz)	**Channel**	**Frequency (MHz)**	**Modulation**	**PAR (dB)**	**Limit for PAR (dB)**
15	43165	3557.5	QPSK	8.25	13
	43340	3575		8.13	13
	43515	3592.5		8.55	13
	43165	3557.5	16QAM	9.96	13
	43340	3575		10.02	13
	43515	3592.5		9.69	13

LTE Band 42					
Bandwidth (MHz)	**Channel**	**Frequency (MHz)**	**Modulation**	**PAR (dB)**	**Limit for PAR (dB)**
20	43190	3560	QPSK	8.26	13
	43340	3575		8.12	13
	43490	3590		8.11	13
	43190	3560	16QAM	9.82	13
	43340	3575		9.78	13
	43490	3590		9.38	13

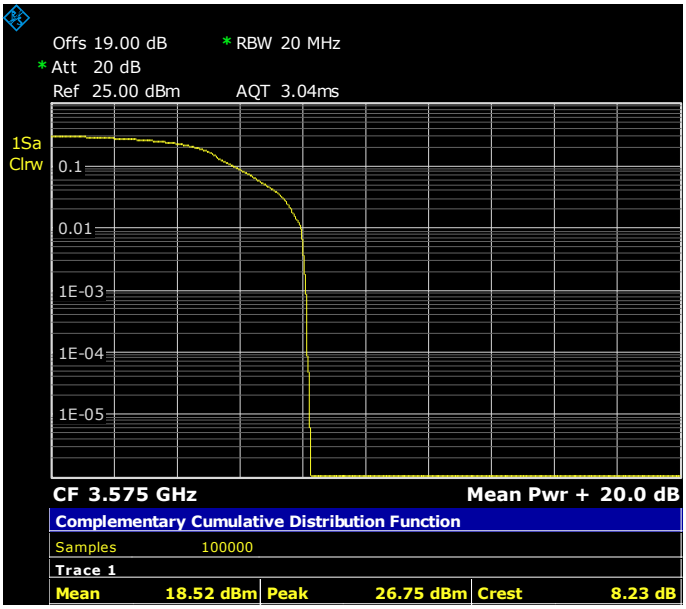
2.3.9 Example Test Plots

LTE Band 42 (5 MHz BW) / Middle Channel 3575 MHz / QPSK



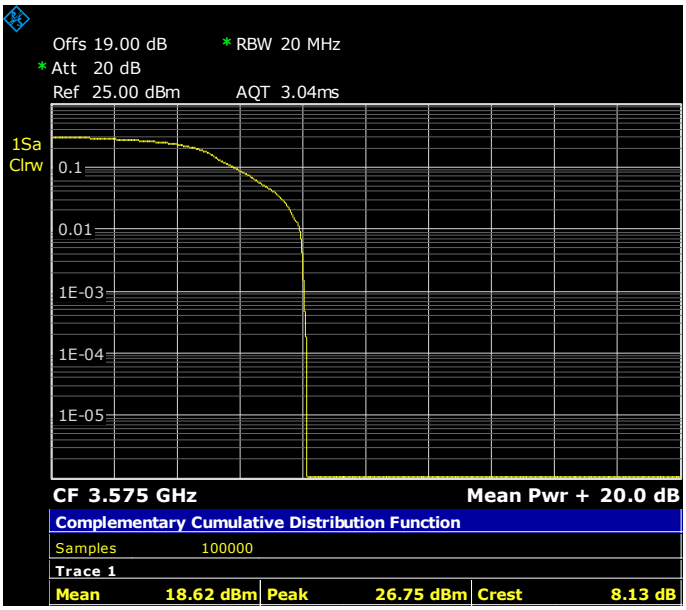
Date: 15.OCT.2019 15:28:31

LTE Band 42 (10 MHz BW) / Middle Channel 3575 MHz / QPSK



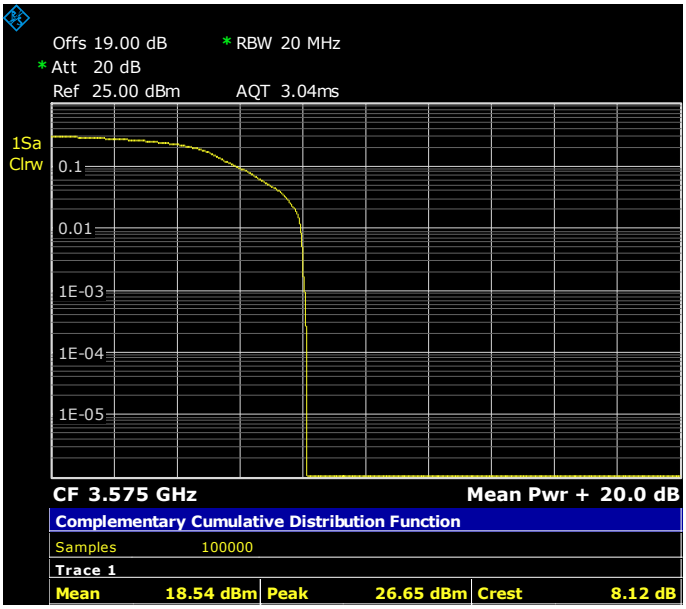
Date: 15.OCT.2019 15:32:19

LTE Band 42 (15 MHz BW) / Middle Channel 3575 MHz / QPSK



Date: 15.OCT.2019 15:36:38

LTE Band 42 (20 MHz BW) / Middle Channel 3575 MHz / QPSK



Date: 15.OCT.2019 15:24:00

2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1049
FCC 47 CFR Part 96, Clause 96.41 (e)(3)

2.4.2 Standard Applicable

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.

26dB Bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated by at least 26 dB below the transmitter power.

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

In addition, the 26dB bandwidth was measured in accorance with FCC KDB 971168 D01 v03r01 Clause 4.1 using the ndB measurement function in the spectrum analyzer.

2.4.3 Equipment Under Test and Modification State

Serial No: FJ220819C00056 / Test Configuration A

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

October 15, 2019 / AC

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	24.8 °C
Relative Humidity	43.2 %
ATM Pressure	98.8 kPa

2.4.7 Additional Observations

- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.
- Using the occupied bandwidth meansurement function in the spectrum analyzer, the 99% occupied bandwith was measured.
- The 26dB bandwidth was measured in accorance with ANSI C63.26 clause 5.4.3 using the ndB measurement function in the spectrum analyzer.
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

2.4.8 Test Results

LTE Band 42					
Modulation	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**99% OBW (MHz)**	**26dB BW (MHz)**
QPSK	5	43115	3552.5	4.49	4.97
		43340	3575	4.49	4.77
		43565	3597.5	4.51	4.97
16QAM		43115	3552.5	4.53	4.99
		43340	3575	4.49	4.99
		43565	3597.5	4.51	4.93

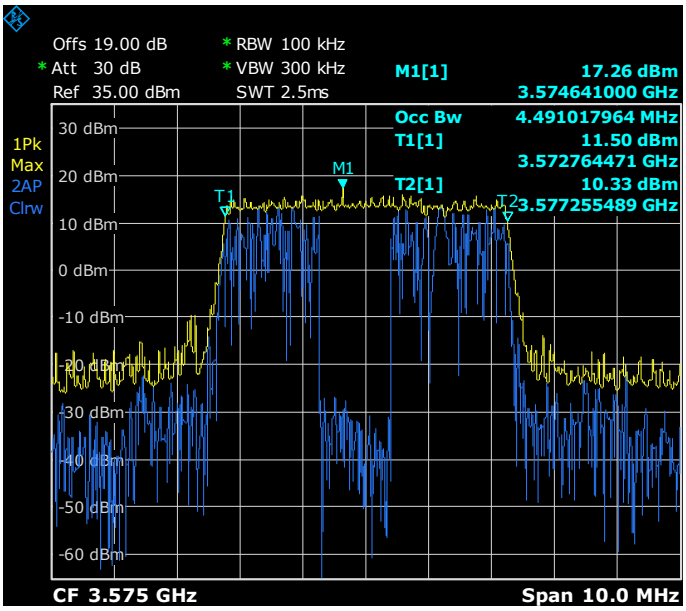
LTE Band 42					
Modulation	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**99% OBW (MHz)**	**26dB BW (MHz)**
QPSK	10	43140	3555	8.98	9.50
		43340	3575	8.94	9.62
		43540	3595	8.98	9.74
16QAM		43140	3555	8.94	9.46
		43340	3575	8.98	9.46
		43540	3595	8.94	9.46

LTE Band 42					
Modulation	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**99% OBW (MHz)**	**26dB BW (MHz)**
QPSK	15	43165	3557.5	13.41	14.25
		43340	3575	13.41	14.01
		43515	3592.5	13.41	14.25
16QAM		43165	3557.5	13.41	14.07
		43340	3575	13.41	14.19
		43515	3592.5	13.47	14.25

LTE Band 42					
Modulation	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**99% OBW (MHz)**	**26dB BW (MHz)**
QPSK	20	43190	3560	17.88	18.92
		43340	3575	17.96	18.52
		43490	3590	17.88	18.76
16QAM		43190	3560	17.88	18.84
		43340	3575	17.88	18.60
		43490	3590	17.88	18.68

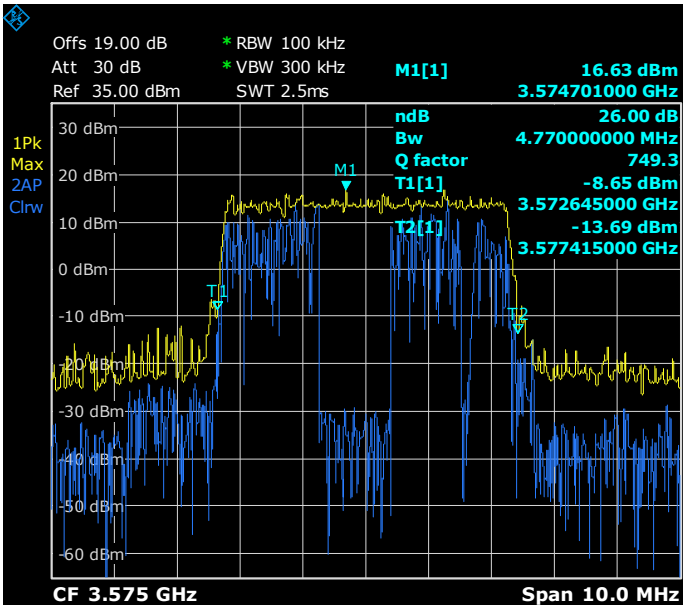
2.4.9 Example Test Plots

LTE Band 42_5 MHz BW / Middle Channel 3575 MHz / QPSK / 99%OBW



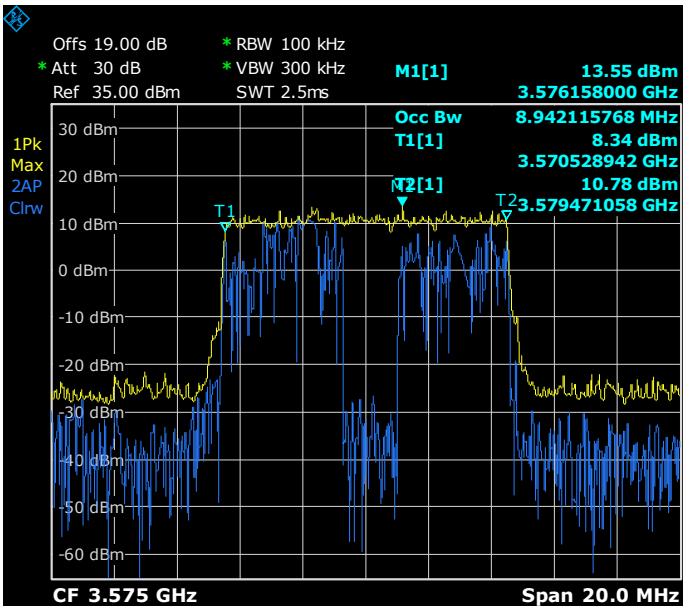
Date: 15.OCT.2019 15:53:18

LTE Band 42_5 MHz BW / Middle Channel 3575 MHz / QPSK / 26dB BW



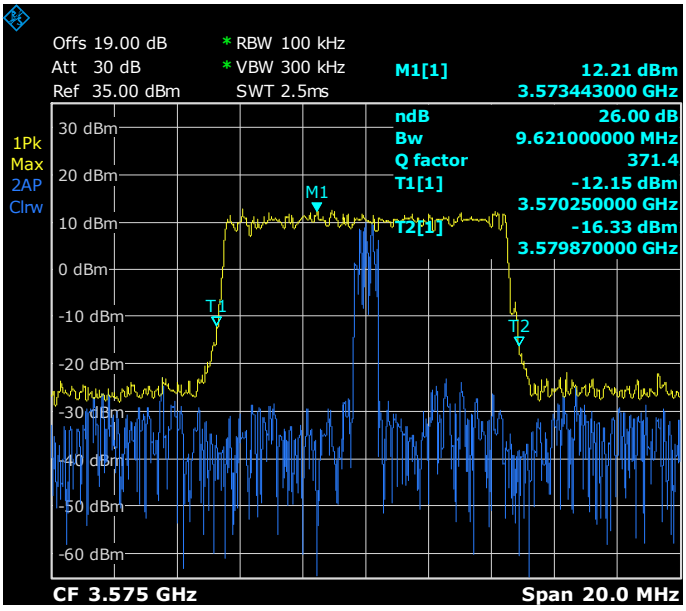
Date: 15.OCT.2019 18:23:52

LTE Band 42_10 MHz BW / Middle Channel 3575 MHz / QPSK / 99%OBW



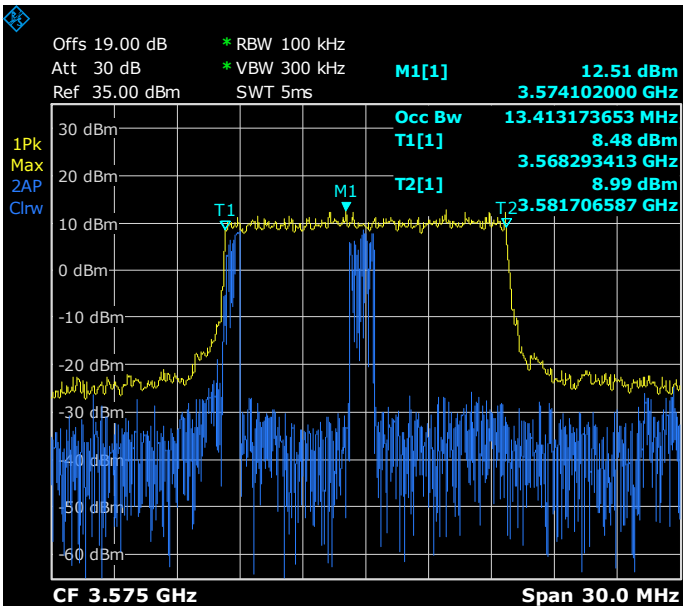
Date: 15.OCT.2019 15:59:02

LTE Band 42_10 MHz BW / Middle Channel 3575 MHz / QPSK / 26dB BW



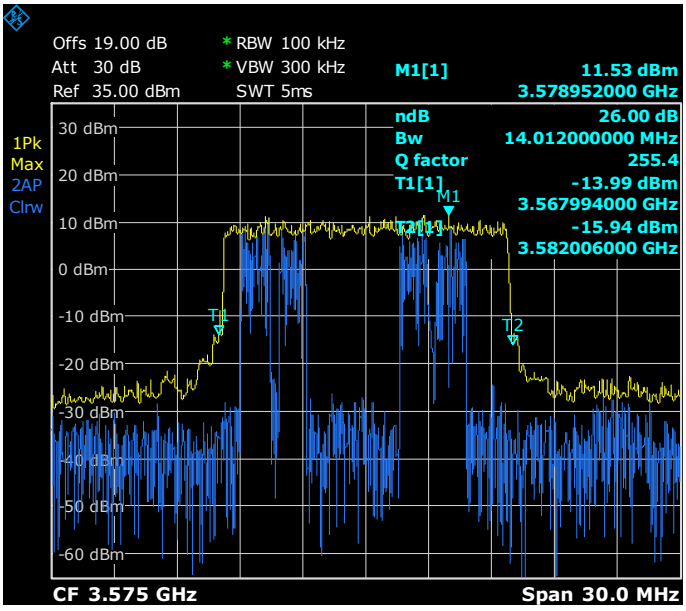
Date: 15.OCT.2019 18:33:38

LTE Band 42_15 MHz BW / Middle Channel 3575 MHz / QPSK / 99%OBW



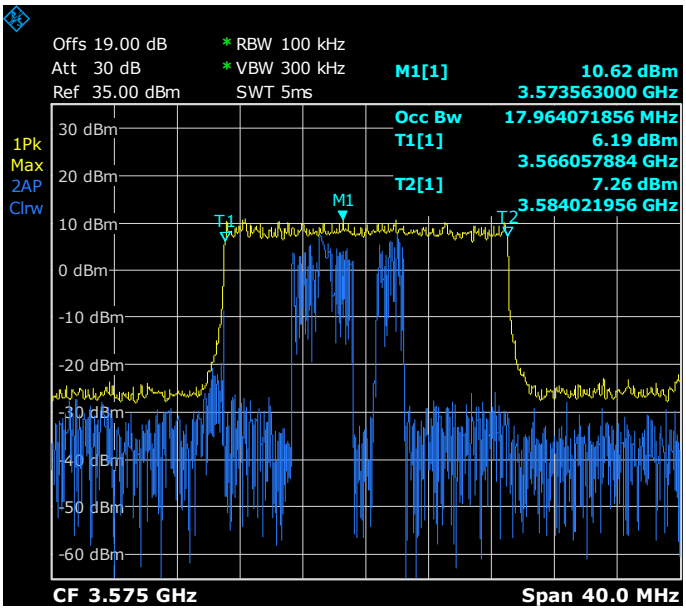
Date: 15.OCT.2019 18:02:54

LTE Band 42_15 MHz BW / Middle Channel 3575 MHz / QPSK / 26dB BW



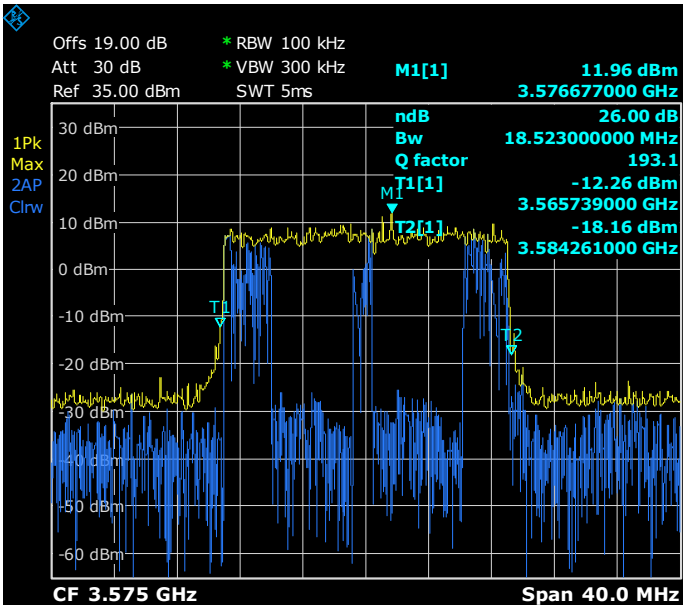
Date: 15.OCT.2019 18:44:32

LTE Band 42_20 MHz BW / Middle Channel 3575 MHz / QPSK / 99%OBW



Date: 15.OCT.2019 18:18:20

LTE Band 42_20 MHz BW / Middle Channel 3575 MHz / QPSK / 26dB BW



Date: 15.OCT.2019 18:50:42

2.5 BAND EDGE

2.5.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 96, Clause 96.41(e)(1)(3)

2.5.2 Standard Applicable

FCC 47 CFR Part 96.41:
(e) 3.5 GHz Emissions and Interference Limits - (1) General protection levels. Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the uper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed -25 dBm/MHz. The upper and lower SAS assigned channel edges are the upper and lower limits of any channel assigned to a CBSD by an SAS, or in the case of multiple contiguous channels, the upper and lower limits of the combined contiguous channels.

2.5.3 Equipment Under Test and Modification State

Serial No: FJ220819C00056 / Test Configuration A

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

October 28, 2019 / AC

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

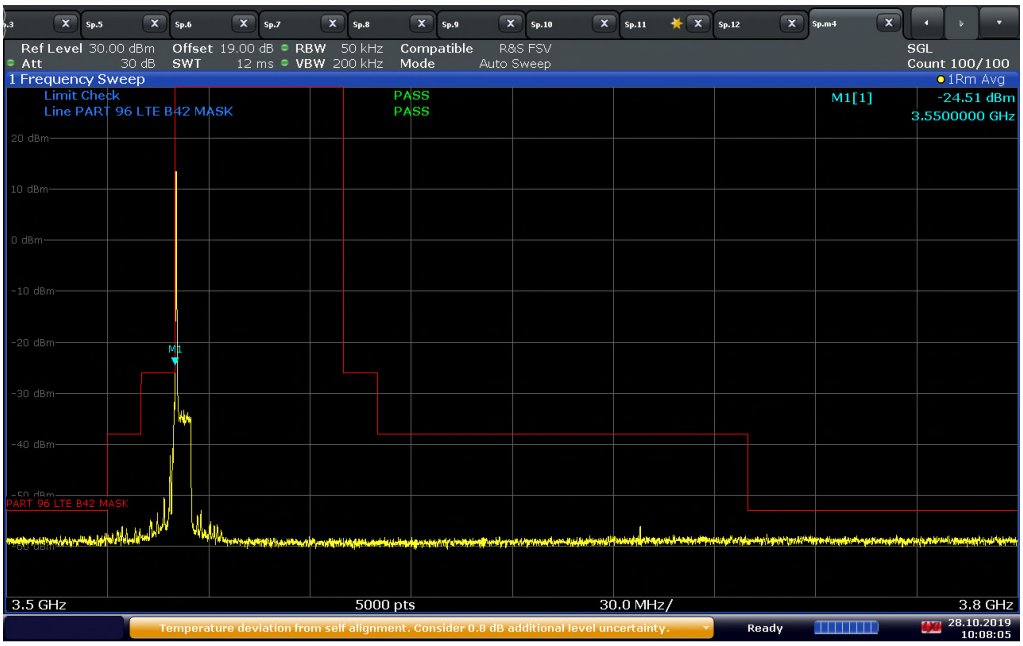
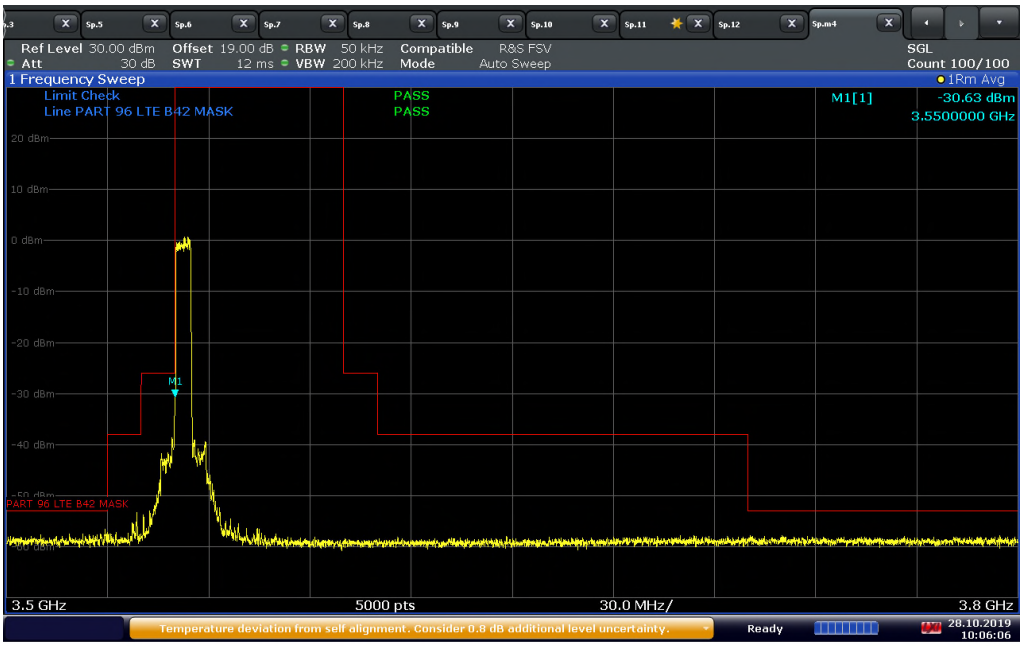
Ambient Temperature	24.8 °C
Relative Humidity	43.2 %
ATM Pressure	98.8 kPa

2.5.7 Additional Observations

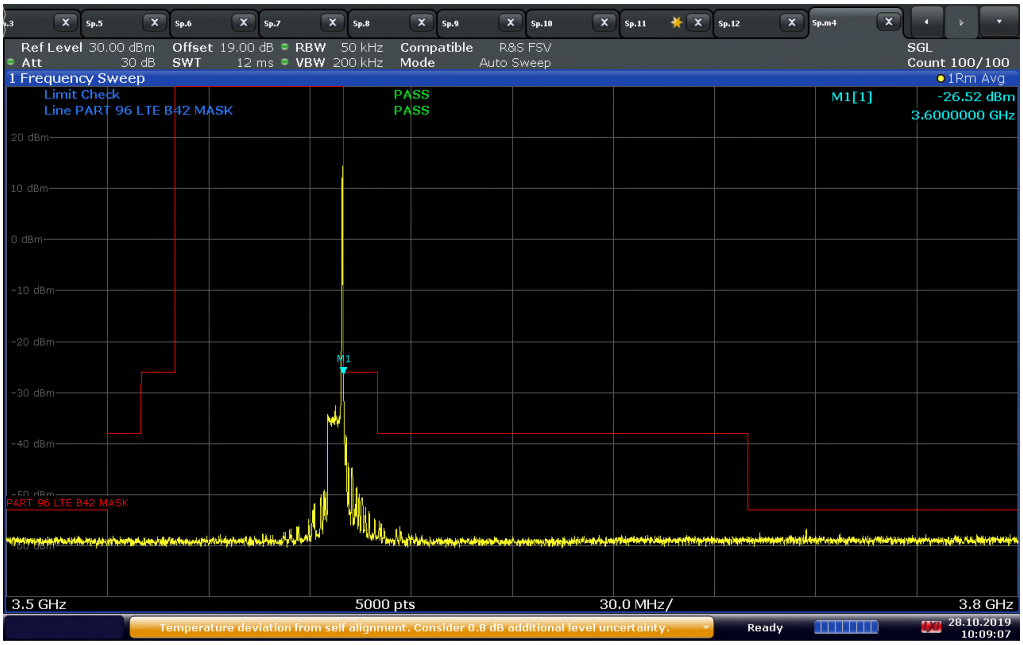
- This is a conducted test.
- The path loss were measured and entered as a level offset.
- All channel bandwidth, RB Size and offset and modulation are verified. Only the worst case modulation (QPSK) for band edge verification presented in this test report.

2.5.8 Test Results

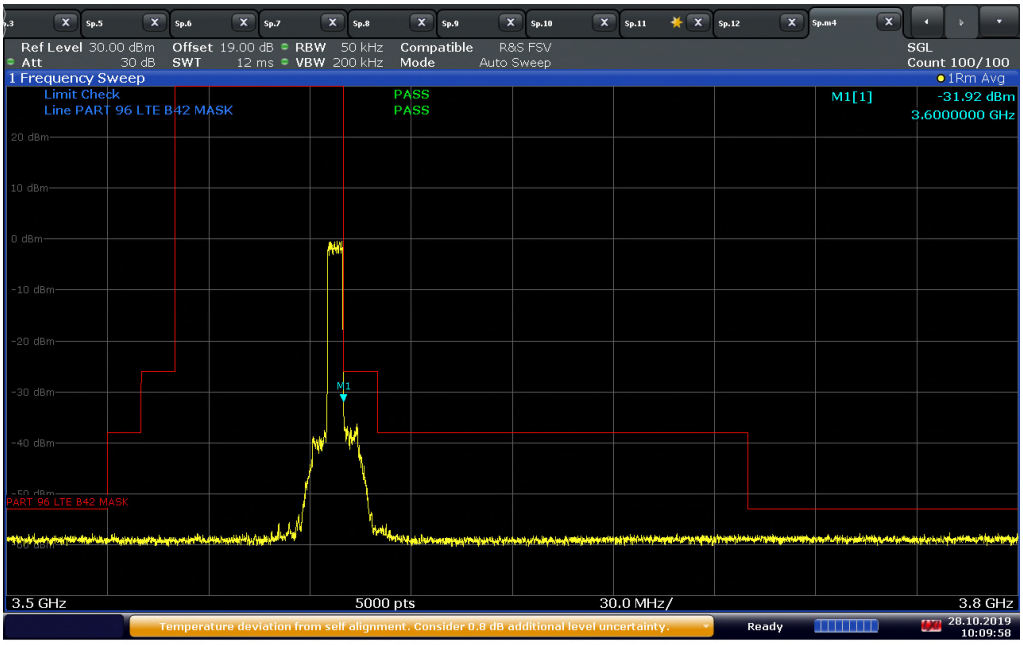
See attached test plots.

LTE Band 42_5 MHz BW / QPSK / Low Channel 3552.5 MHz 1 RB 0 offset Low Band Edge

LTE Band 42_5 MHz BW / QPSK / Low Channel 3552.5 MHz Full RB Low Band Edge


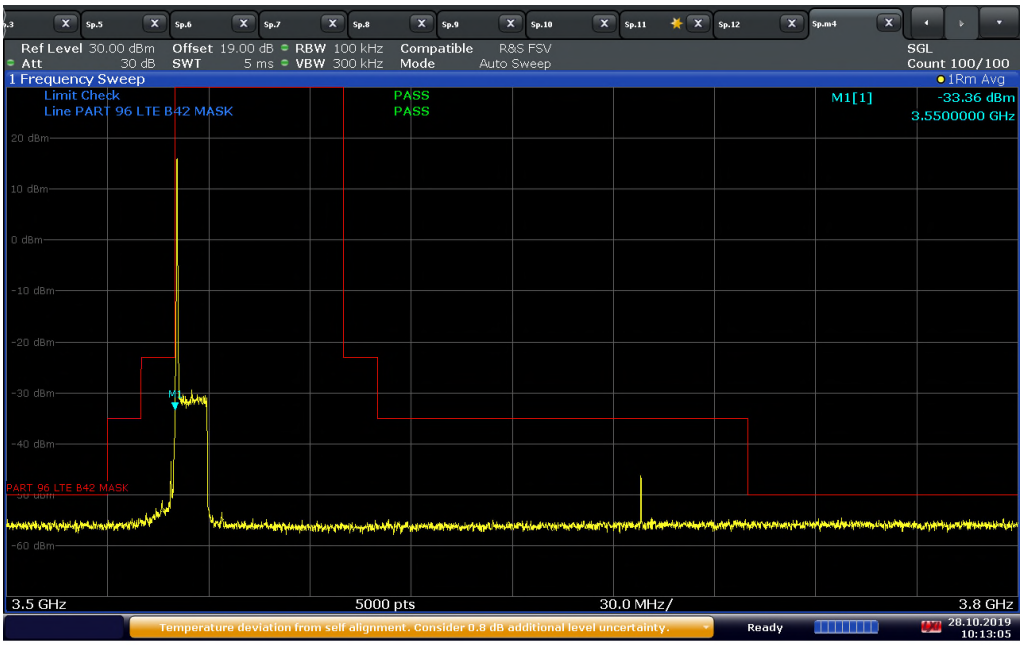
LTE Band 42_5 MHz BW / QPSK / High Channel 3597.5 MHz 1 RB 24 offset
High Band Edge



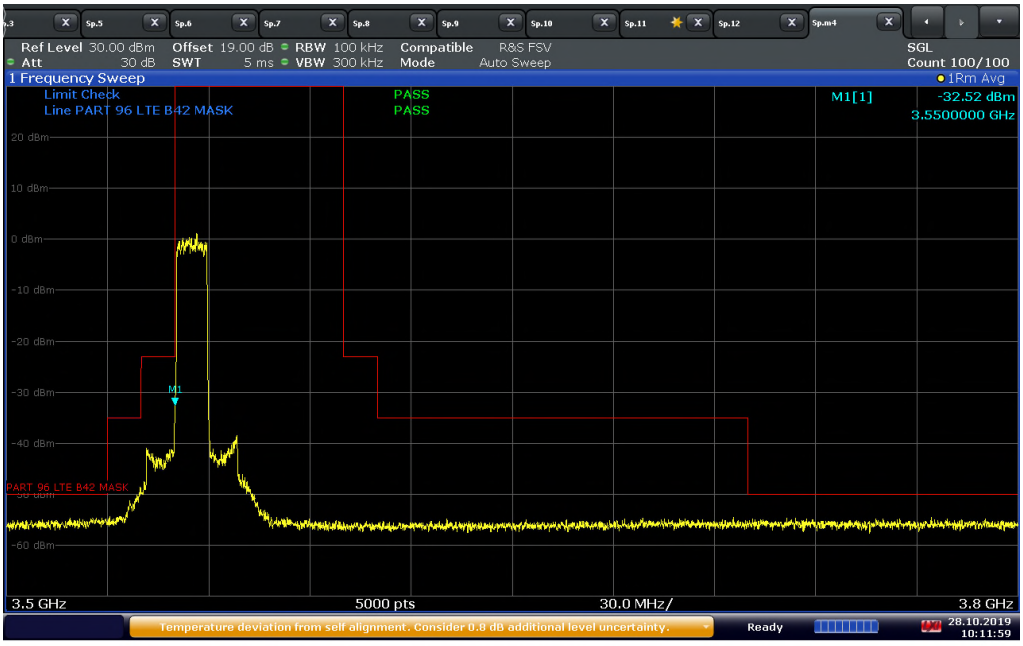
LTE Band 42_5 MHz BW / QPSK / High Channel 3597.5 MHz Full RB
High Band Edge



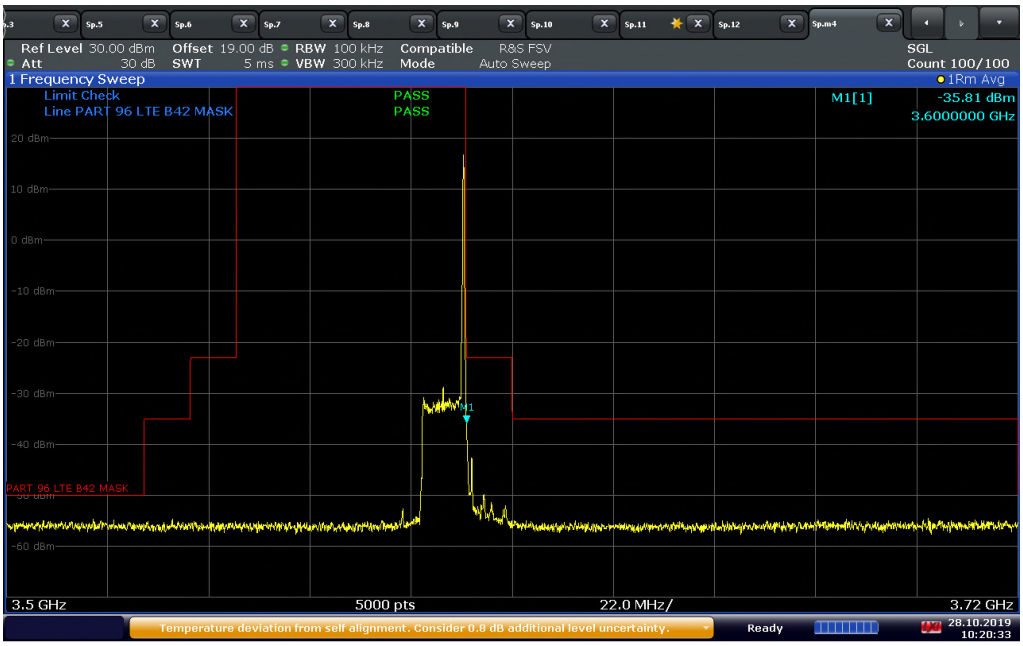
LTE Band 42_10 MHz BW / QPSK / Low Channel 3555 MHz 1 RB 0 offset
Low Band Edge



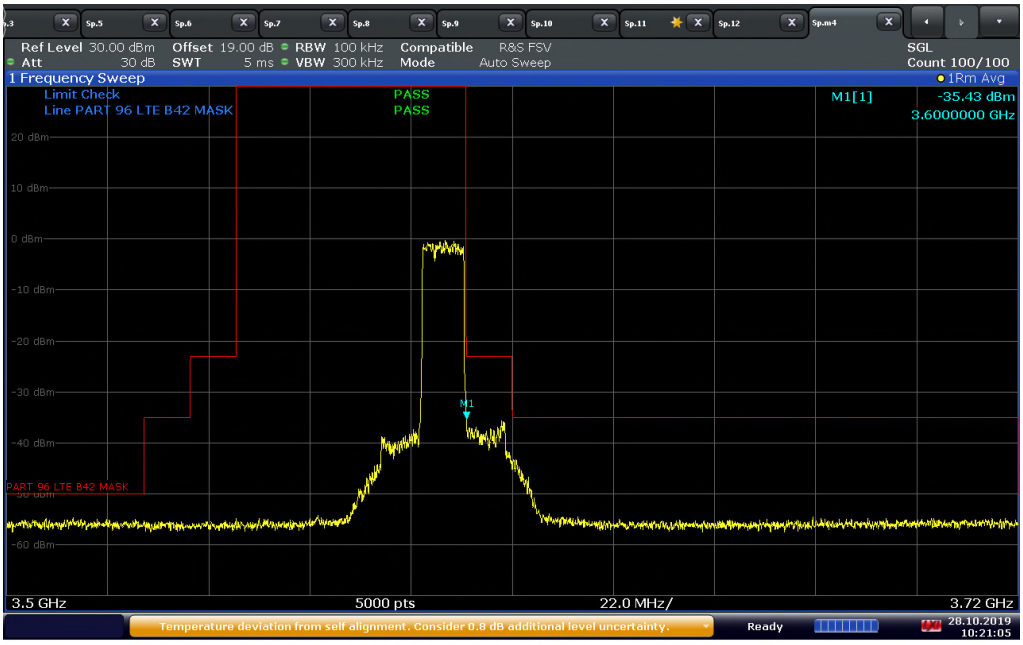
LTE Band 42_10 MHz BW / QPSK / Low Channel 3555 MHz Full RB
Low Band Edge

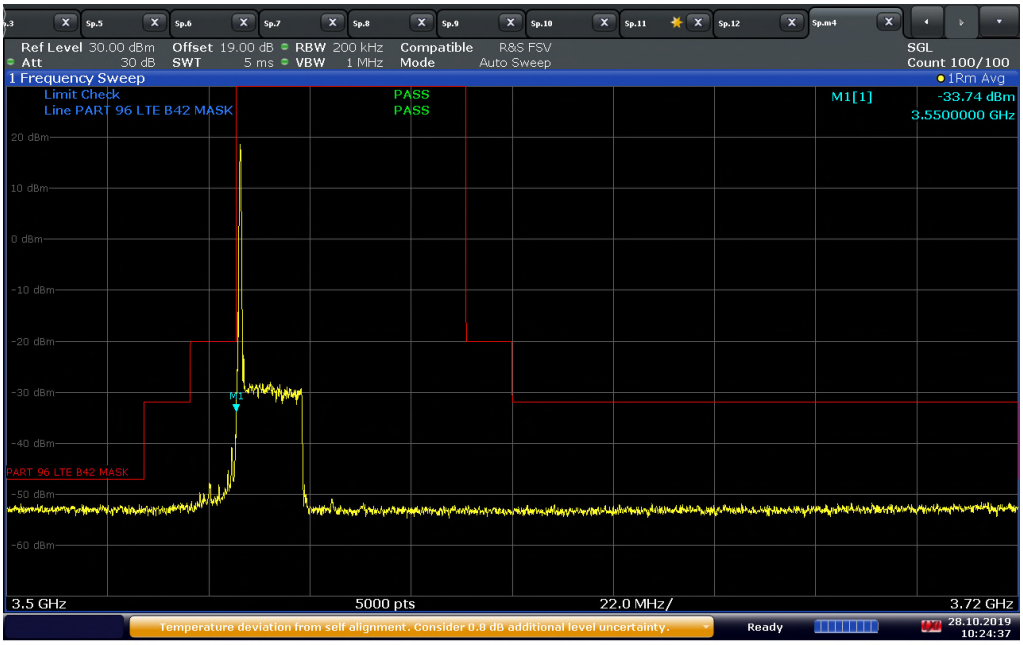


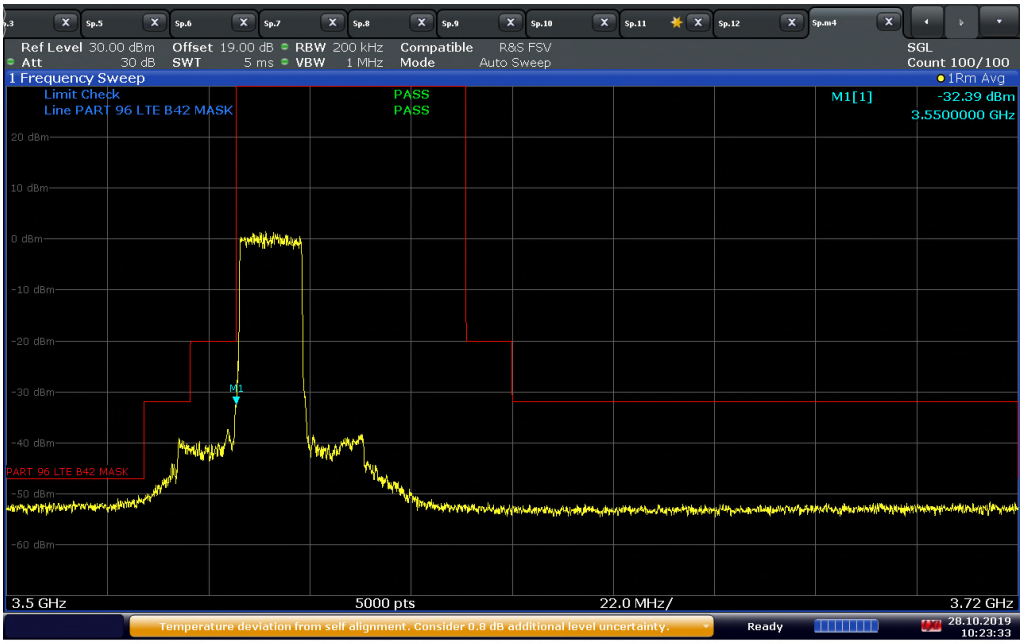
LTE Band 42_10 MHz BW / QPSK / High Channel 3595 MHz 1 RB 49 offset
High Band Edge



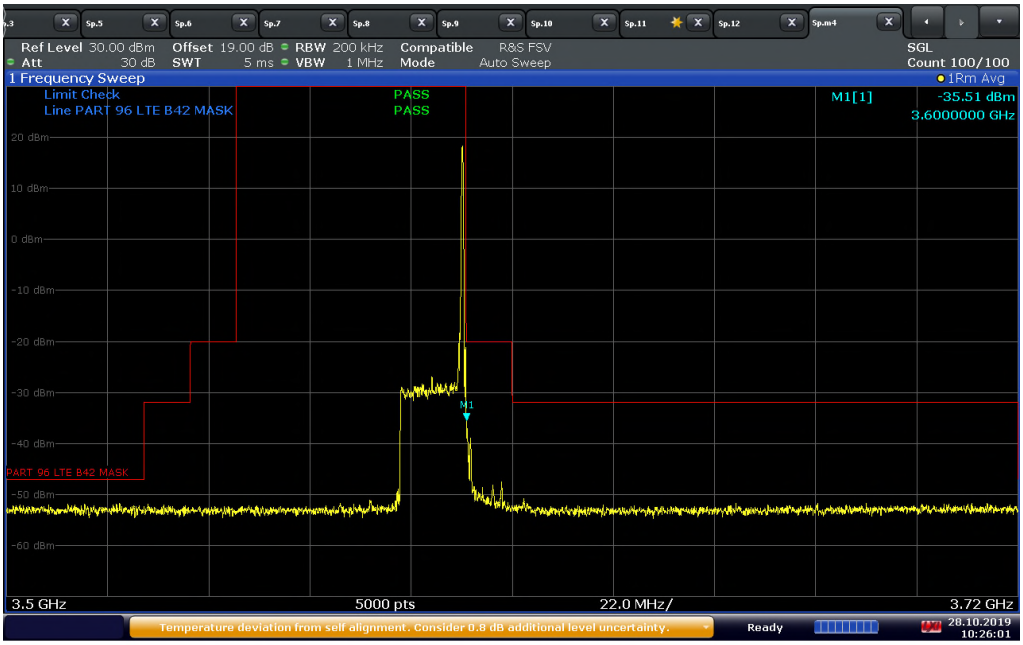
LTE Band 42_10 MHz BW / QPSK / High Channel 3595 MHz Full RB
High Band Edge



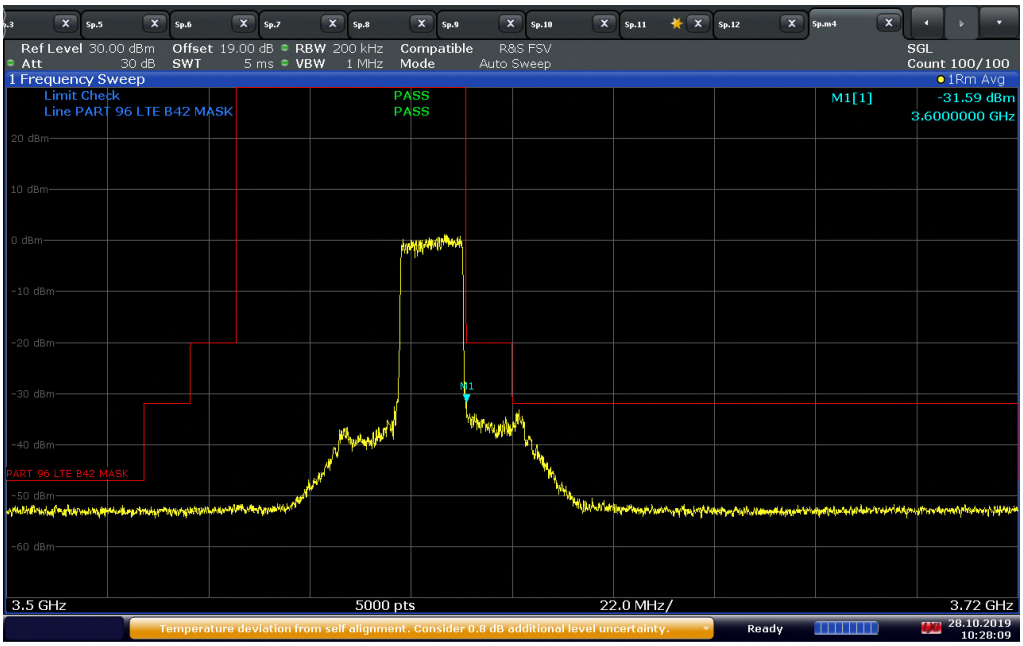
LTE Band 42_15 MHz BW / QPSK / Low Channel 3557.5 MHz 1 RB 0 offset Low Band Edge


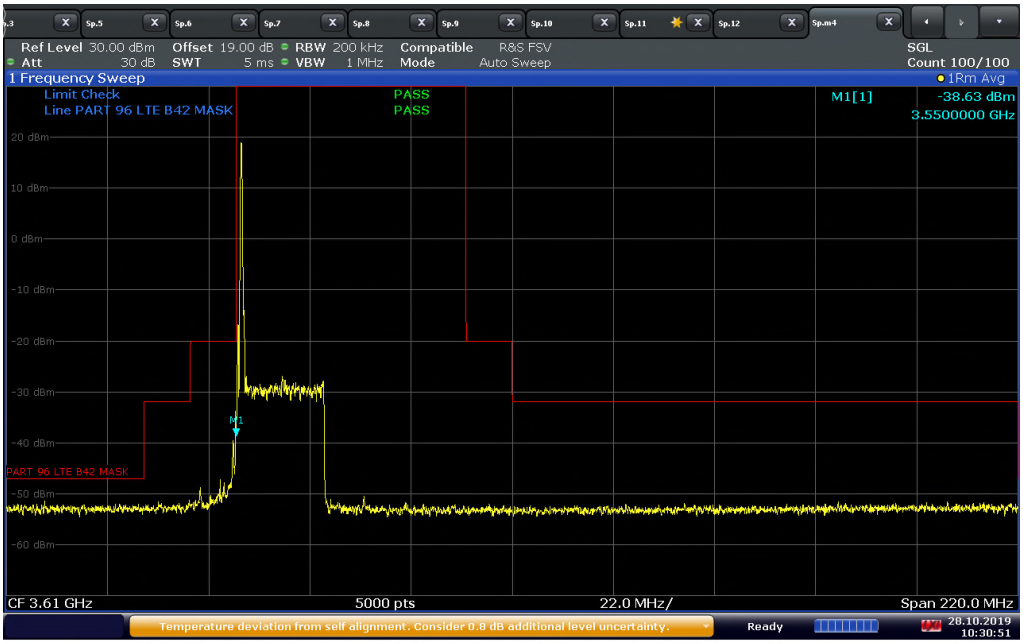
LTE Band 42_15 MHz BW / QPSK / Low Channel 3557.5 MHz Full RB Low Band Edge


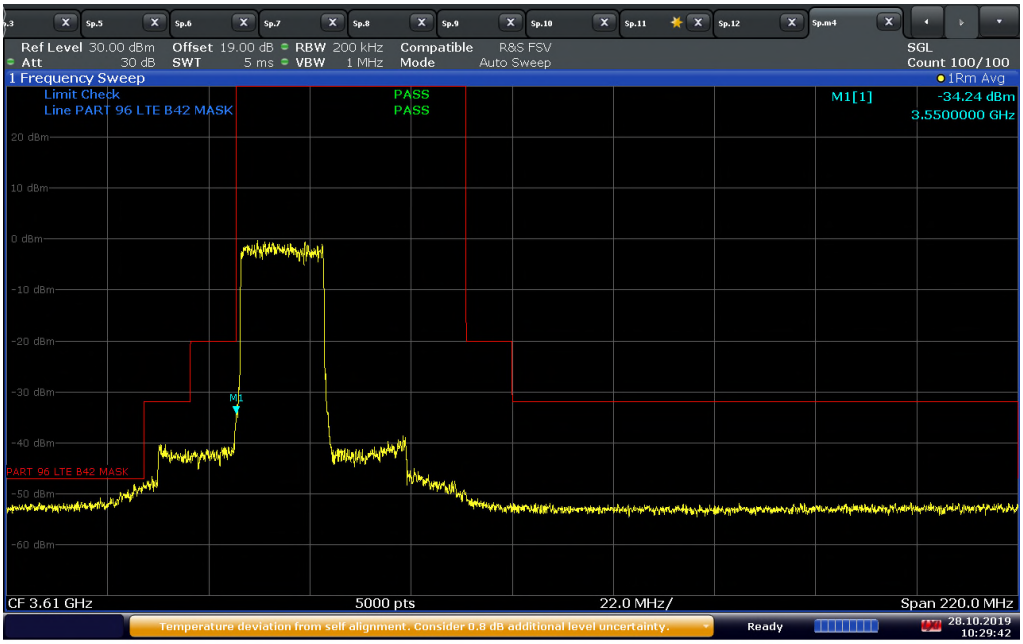
LTE Band 42_15 MHz BW / QPSK / High Channel 3592.5 MHz 1 RB 74 offset
High Band Edge

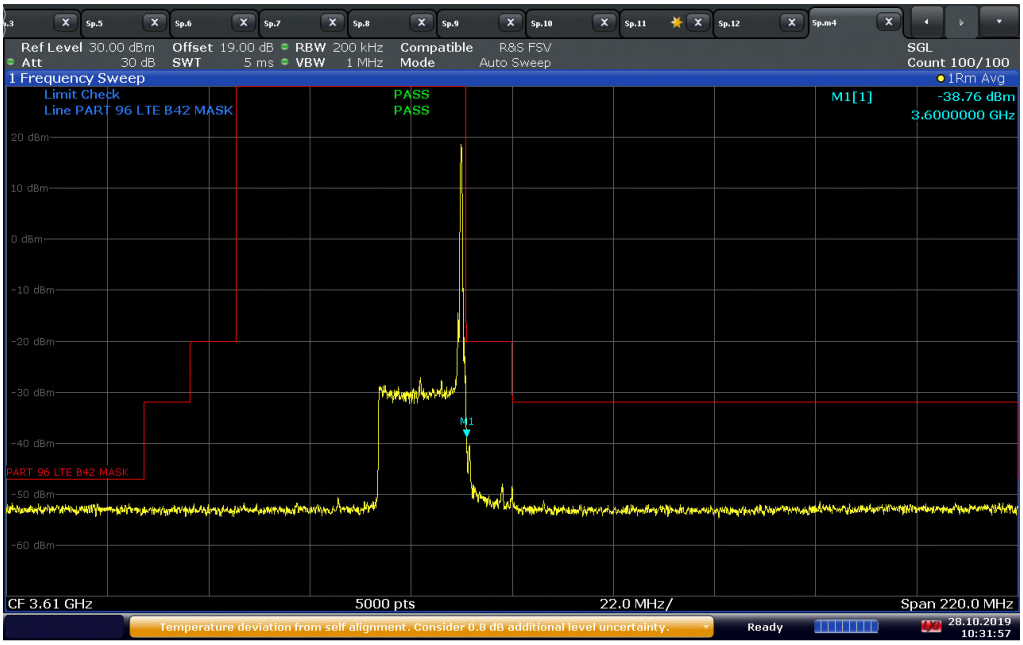


LTE Band 42_15 MHz BW / QPSK / High Channel 3592.5 MHz Full RB
High Band Edge



LTE Band 42_20 MHz BW / QPSK / Low Channel 3560 MHz 1 RB 0 offset Low Band Edge


LTE Band 42_20 MHz BW / QPSK / Low Channel 3560 MHz Full RB Low Band Edge


LTE Band 42_20 MHz BW / QPSK / High Channel 3590 MHz 1 RB 99 offset High Band Edge

LTE Band 42_20 MHz BW / QPSK / High Channel 3590 MHz Full RB High Band Edge