MOTOROLA SOLUTIONS

MS ISO/IEC 17025
TESTING
SAMM No. 0825

MOTOROLA PENANG ADV. COMM. LABORATORY
Motorola Solutions Malaysia Sdn Bhd,
Innoplex Plot 2A, Medan Bayan Lepas,
Mukim 12 S.W.D, 11900 Bayan Lepas,
Penang, Malaysia.

FCC / IC TEST REPORT
Report Revision : Rev.B

Date/s Tested	:	19-Nov-2017 - 8-Mar-2018
Manufacturer/Location	:	Motorola Solutions – Penang
Requestor	:	RONI KOZIEL
Product Type	:	LEX L11 Mission Critical LTE Device
Model Number	:	LEX L11n
Frequency Band	:	Refer to section 1.4
Applicant Name	:	Motorola Solutions, Inc
Applicant Address	:	8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322
FCC Registrations	:	461337
IC Registrations	:	109AK

The equipment was tested accordance to the requirement listed below:

(LTE Band 5) **FCC 47 CFR Part 2 / 22** **ISED RSS GEN Issue 4, November 2014** **ISED RSS 132 Issue 3, January 2013**	**PASS**

This report shall not be reproduced without written approval from an officially designated representative of the Motorola Penang Adv. Comm. Laboratory. The results and statements contained in this report pertain only to the device(s) evaluated.

Prepared By:

Maheshvaran Rajagopal
Technician

Approved By:

Goh Aik Hong
Responsible Engineer

Table of Contents

1.0. Summary of Test Results 3
1.1. Measurement Uncertainty 3
1.2. Equipment List 3
1.3. General Information 4
1.4. Channel number and frequency info 5
1.5. Test Mode Applicability and Tested Channel Detail 6
1.6. Conducted RF Output Power/ Effective Radiated Power (ERP) 8
1.6.1. Test Setup 8
1.6.2. Test Limits 8
1.6.3. Conducted RF Output Power – LTE Band 5 (824-849MHz) 8
1.6.4. Effective Radiated Power – LTE Band 5 (824-849MHz) 10
1.7. Peak-to-Average Power Ratio 12
1.7.1. Test Setup 12
1.7.2. Test Limit 12
1.7.3. Peak To Average Power Ratio – LTE Band 5 (824-849MHz) 12
1.8. Occupied Bandwidth 15
1.8.1. Test Setup 15
1.8.2. Test Limit 15
1.8.3. Occupied Bandwidth - LTE Band 5 (824-849MHz) 15
1.9. Frequency Stability 20
1.9.1. Test Setup 20
1.9.2. Test Limit 20
1.9.3. Frequency Stability - LTE Band 5 (824-849MHz) 20
1.10. Band Edge Conducted Spurious Emission 23
1.10.1. Test Setup 23
1.10.2. Test Limit 23
1.10.3. Band Edge Conducted Spurious Emission - LTE Band 5 (824-849MHz) 23
1.11. Conducted Spurious Emission 29
1.11.1. Test Setup 29
1.11.2. Test Limit 29
1.11.3. Conducted Spurious Emission - LTE Band 5 (824-849MHz) 29
1.12. Radiated Spurious Emission 36
1.12.1. Test Setup 36
1.12.2. Test Limit 36
1.12.3. Radiated Spurious Emission – LTE Band 5 (824-849MHz) 37

REVISION HISTORY

Revision History	Description	Date	Originator
Rev A.	Initial Report	8-March-2018	Maheshvaran Rajagopal
Rev B.	i. Applicant name and address has been added. ii. The battery model number has been revised. iii. AC adapter accessories devices information has been added. iv. The Test report number of page	30-May-2018	Maheshvaran Rajagopal

	format is corrected. v. RSSs version standard have been added to the cover page. vi. Justification statement of accessory devices is included at section 1.5.		

1.0. Summary of Test Results

FCC Clause	ISED Clause	Test Item	Result	Remark
2.1046	RSS-Gen 6.12 RSS-132 5.4	Conducted RF Output Power	Pass	Meet the requirement of limit
--	RSS-132 5.4	Peak-to-Average Power Ratio	Pass	Meet the requirement of limit
2.1049 22.917	RSS-Gen 6.6	Occupied Bandwidth (26dBc, 99%)	Pass	Meet the requirement of limit
2.1055 22.355	RSS-Gen 6.11 RSS-132 5.3	Frequency Stability	Pass	Meet the requirement of limit
2.1051 22.917	RSS-Gen 6.13 RSS-132 5.5	Band Edge Conducted Spurious Emission	Pass	Meet the requirement of limit
2.1051 22.917	RSS-Gen 6.13 RSS-132 5.5	Conducted Spurious Emissions	Pass	Meet the requirement of limit
22.913(a)(2)	RSS-132 5.4	Effective Radiated Power (ERP)	Pass	Meet the requirement of limit
2.1053 22.917	RSS-132 5.5	Radiated Spurious Emissions	Pass	Meet the requirement of limit

1.1. Measurement Uncertainty

Measurement	Frequency	Expended Uncertainty (k=1.96) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.01
	200MHz ~ 1000MHz	5.01
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.01
	18GHz ~ 25GHz	5.01

1.2. Equipment List

Description	Model	Serial Number	Calibration Date	Calibration Due Date
Broadband ATE 1 (RF Conducted Tests)				
Wideband Radio Communication Tester	CMW500	154550	14-Feb-17	14-Feb-19
Signal Analyzer	FSV40	101431	13-Jul-17	12-Jul-19
Chamber	SH-641	92002651	6-Mar-17	6-Mar-18
Power Supply	6621A	US37370810	5-Jun-17	5-Jun-18
Radiated Spurious Emission (EMC Chamber 1)				
DRG HORN FREQ.	SAS-571	719	18-Jul-17	18-Jul-19
DRG HORN FREQ.	SAS-571	720	2-Mar-17	2-Mar-19
POWER SUPPLY	6032A	2615A01178	6-Jun-17	6-Jun-18
MICROWAVE SIGNAL GENERATOR	SMP04	100127	19-Jul-17	18-Jul-18
EMI TEST RECEIVER	ESIB26	100336	13-Jul-17	12-Jul-18
SIGNAL ANALYZER	FSV40	101103	18-Jul-17	17-Jul-18
5m Semi-anechoic Chamber	S800-HX	J2308	Not Required	Not Required

BILOG ANTENNA	CBL6112B	2950	23-Feb-16	23-Feb-18
BILOG ANTENNA	CBL6112B	2964	3-Feb-17	3-Feb-18
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170143	20-Mar-17	10-Apr-18
DATA LOGGER	SDL500	A.016776	18-Mar-17	18-Mar-18
LOOP ANTENNA	6502	208416	27-Jul-17	27-Jul-18
SYSTEM CONTROLLER	SC104V	050806-1	Not Required	Not Required
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	Not Required	Not Required
ANTENNA POSITIONING TOWER	TLT2	NA	Not Required	Not Required
18 - 40GHz PREAMPLIFIER	BBV9721	9721-007	Not Required	Not Required
PREAMPLIFIER	PAM-0118P	361	Not Required	Not Required
Wideband Radio Communication Tester	CMW500	153174	9-Jan-17	9-Jan-19

1.3. General Information

General Description of EUT

Product	LEX L11 Mission Critical LTE Device		
Brand	Motorola Solutions		
Test Model	LEX L11n		
Power Supply Rating	3.7Vdc (Battery), 5Vdc (Adapter)		
Mode of operation	LTE Band 5		
Modulation Type	QPSK, 16QAM		
Operating Frequency	LTE Band 5	Channel Bandwidth 1.4MHz	824.7MHz~848.3MHz
		Channel Bandwidth 3MHz	825.5MHz~847.5MHz
		Channel Bandwidth 5MHz	826.5MHz~846.5MHz
		Channel Bandwidth 10MHz	829.0MHz~844.0MHz
Max. ERP Power	LTE Band 5 QPSK	Channel Bandwidth 1.4MHz	21.618dBm (0.145W)
		Channel Bandwidth 3MHz	21.764dBm (0.150W)
		Channel Bandwidth 5MHz	21.599dBm (0.145W)
		Channel Bandwidth 10MHz	**21.78dBm (0.151W)**
	LTE Band 5 16QAM	Channel Bandwidth 1.4MHz	20.675dBm (0.117W)
		Channel Bandwidth 3MHz	20.705dBm (0.118W)
		Channel Bandwidth 5MHz	20.701dBm (0.118W)
		Channel Bandwidth 10MHz	**20.765dBm (0.119W)**
Antenna Type	LTE Band 5	Monopole with 0.78dBi gain	
SW Version	L11_D01.00.28		
HW Version	P3a		

Note:

1. The EUT contains following accessory devices and data cable.

Item	Brand	Model or P/N	Specification
Rechargeable Lithium ion battery	Motorola Solutions	PMNN4545A	2500mAH 3.7V LI-ION STD
Rechargeable Lithium ion battery	Motorola Solutions	PMNN4546A	5000mAH 3.7V LI-ION HICAP
Charger Vehicular Adapter VPA	Motorola Solutions	PMLN7779A	18W
Power Supply Adaptor, Power supply Wall cube, AC, DC (USB type A-C)	Motorola Solutions	PS000150A31 - US/JPN plug	7.5W, 100V-240V
Power Supply Adaptor (USB type C-C)	Motorola Solutions	PS000278A01 - US/JPN plug	27W

Detachable Power/Data Cable USB-A to USB-C	Motorola Solutions	CB000756A01	-
Detachable Power/Data Cable USB-C to USB-C	Motorola Solutions	CB000754A01	-

Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	Product	Brand	Model No.	Serial No.	FCC ID
1	Wideband Radio Communication Tester	R&S	CMW500	154550	NA

NO.	Signal Cable Description of The above Support Units
1	NA

Note:

1. All power cords of the above support units are non-shielded.
2. Item 1 acted as a communication partner to transfer data.

EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC 47 CFR Part 2
FCC 47 CFR Part 22
KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI C63.26-2015

NOTE: All test items have been performed and recorded as per the above standards.

1.4. Channel number and frequency info

			Test Channel Number			Test Channel Frequency (MHz)		
Band	Bandwidth supported	Available Channel Number	Low Channel	Mid Channel	High Channel	Low Channel	Mid Channel	High Channel
LTE Band 5	1.4 MHz	20407~ 20643	20407	20525	20643	824.7	836.5	848.3
	3 MHz	20415~ 20635	20415	20525	20635	825.5	836.5	847.5
	5 MHz	20425~20625	20425	20525	20625	826.5	836.5	846.5
	10 MHz	20450~ 20600	20450	20525	20600	829	836.5	844

1.5. Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The Radiated Spurious Emission worst case was found when positioned on Z-Plane for LTE band 5.
Pre-scan also have been conducted with the accessory devices listed in section table 1.3, only the worst case radiated emission results of the combination test configuration is reported in this report.
The following channel(s) was (were) selected for the final test as listed below:

LTE Band 5

Test Item	Available Channel	Tested Channel	Channel Bandwidth	Uplink Modulation	Mode
Conducted RF Output Power/ Effective Radiated Power (ERP)	20407~ 20643	20407, 20525, 20643	1.4 MHz	QPSK, 16QAM	As per table 1.6.2 & 1.6.4
	20415~ 20635	20415, 20525, 20635	3 MHz		
	20425~ 20625	20425, 20525, 20625	5 MHz		
	20450~ 20600	20450, 20525, 20600	10 MHz		
Peak to Average Power Ratio	20407~ 20643	20407, 20525, 20643	1.4 MHz	QPSK, 16QAM	6 RB / 0 RB Offset
	20415~ 20635	20415, 20525, 20635	3 MHz		15 RB / 0 RB Offset
	20425~ 20625	20425, 20525, 20625	5 MHz		25 RB / 0 RB Offset
	20450~ 20600	20450, 20525, 20600	10 MHz		50 RB / 0 RB Offset
Occupied Bandwidth	20407~ 20643	20407, 20525, 20643	1.4 MHz	QPSK, 16QAM	6 RB / 0 RB Offset
	20415~ 20635	20415, 20525, 20635	3 MHz		15 RB / 0 RB Offset
	20425~20625	20425, 20525, 20625	5 MHz		25 RB / 0 RB Offset
	20450~ 20600	20450, 20525, 20600	10 MHz		50 RB / 0 RB Offset
Frequency Stability	20407~ 20643	20407, 20643	1.4 MHz	QPSK	6 RB / 0 RB Offset
	20415~ 20635	20415, 20635	3 MHz		15 RB / 0 RB Offset
	20425~ 20625	20425, 20625	5 MHz		25 RB / 0 RB Offset
	20450~ 20600	20450, 20600	10 MHz		50 RB / 0 RB Offset
Band Edge Conducted Spurious Emission	20407~ 20643	20407, 20643	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 1 RB / 5 RB Offset 6 RB / 0 RB Offset
	20415~ 20635	20415, 20635	3 MHz		1 RB / 0 RB Offset 1 RB / 14 RB Offset 15 RB / 0 RB Offset
	20425~ 20625	20425, 20625	5 MHz		1 RB / 0 RB Offset 1 RB / 24 RB Offset 25 RB / 0 RB Offset
	20450~ 20600	20450, 20600	10 MHz		1 RB / 0 RB Offset 1 RB / 49 RB Offset 50 RB / 0 RB Offset
Conducted Spurious Emission	20407~ 20643	20407, 20525, 20643	1.4 MHz	QPSK	1 RB / 3 RB Offset
	20415~ 20635	20415, 20525, 20635	3 MHz		1 RB / 7 RB Offset
	20425~20625	20425, 20525, 20625	5 MHz		1 RB / 13 RB Offset
	20450~ 20600	20450, 20525, 20600	10 MHz		1 RB / 0 RB Offset
Radiated Spurious Emission	20407~ 20643	20407, 20525, 20643	1.4 MHz	QPSK	1 RB / 3 RB Offset
	20415~ 20635	20415, 20525, 20635	3 MHz		1 RB / 7 RB Offset
	20425~20625	20425, 20525, 20625	5 MHz		1 RB / 13 RB Offset
	20450~ 20600	20450, 20525, 20600	10 MHz		1 RB / 0 RB Offset

NOTE:

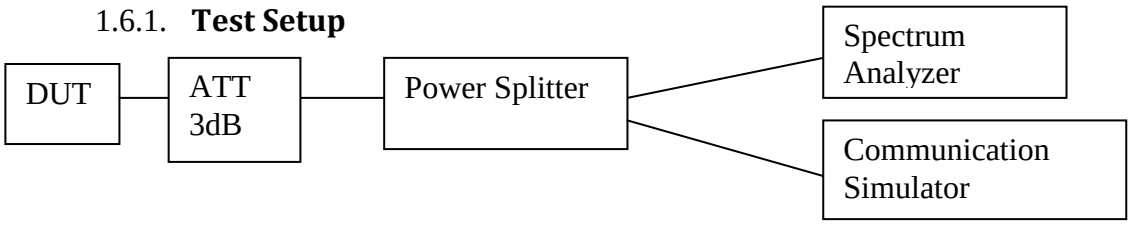
1. The Conducted RF Output Power for QPSK and 16QAM, measured value of QPSK is higher than 16QAM mode. Therefore, only Conducted Spurious Emission and Radiated Emission had been tested under QPSK modes.
2. Band Edge was performed with 1 and full Resource Block at the lowest and highest operating frequency band.
3. The Effective Radiated Power (ERP) was calculated from Conducted RF Output Power results in QPSK and 16QAM modulation.
4. Peak to Average and Occupied Bandwidth were performed with full Resource Block which is the worst case.
5. Frequency stability was performed with full Resource Block in QPSK modulation.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Conducted RF Output Power/ Effective Radiated Power	**25°C, 50% RH**	**3.7V DC**	**Maheshvaran**
Peak-to-Average Power Ratio	**25°C, 50% RH**	**3.7V DC**	**Maheshvaran**
Occupied Bandwidth	**25°C, 50% RH**	**3.7V DC**	**Maheshvaran**
Frequency Stability	**25°C, 50% RH**	**3.7V DC**	**Maheshvaran**
Band Edge Conducted Spurious Emission	**25°C, 50% RH**	**3.7V DC**	**Maheshvaran**
Conducted Spurious Emission	**25°C, 50% RH**	**3.7V DC**	**Maheshvaran**
Radiated Spurious Emission	**25°C, 63.7% RH**	**3.7V DC**	**Nazrin/Qawiman**

1.6. Conducted RF Output Power/ Effective Radiated Power (ERP)

1.6.1. Test Setup



1. The DUT transmitter output port was connected to communication simulator with above setup.
2. Path loss for the measurement included.
3. Set DUT to transmit maximum power through communication simulator
4. All the measurement was done at low, mid, high channel for each band and different modulation.
5. Record the average power into the test report.

1.6.2. Test Limits

FCC: The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.
ISED: The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts.

1.6.3. Conducted RF Output Power – LTE Band 5 (824-849MHz)

Conducted Output Power (dBm)								
LTE Band/BW	RB Size	RB Offset	QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20407	20525	20643	20407	20525	20643
			824.7MHz	836.5MHz	848.3 MHz	824.7 MHz	836.5MHz	848.3 MHz
Band 5 / 1.4 MHz	**1**	**0**	22.931	22.772	22.126	21.997	21.709	21.27
	1	**3**	**22.988**	22.723	22.208	**22.045**	21.664	21.364
	1	**5**	22.912	22.666	22.145	21.981	21.626	21.303
	3	**0**	22.96	22.734	22.127	21.891	21.909	21.285
	3	**2**	22.986	22.695	22.208	21.938	21.85	21.328
	3	**3**	22.92	22.64	22.166	21.892	21.801	21.296
	6	**0**	21.976	21.634	21.158	20.926	20.668	20.208

Conducted Output Power (dBm)								
LTE Band/BW	RB Size	RB Offset	QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20415	20525	20635	20415	20525	20635
			825.5MHz	836.5MHz	847.5MHz	825.5 MHz	836.5MHz	847.5 MHz
Band 5 / 3MHz	**1**	**0**	23.036	22.727	22.317	21.998	**22.075**	21.362
	1	**7**	**23.134**	22.711	22.292	22.056	22.045	21.337
	1	**14**	22.972	22.602	22.182	21.916	21.915	21.211
	8	**0**	22.021	21.83	21.215	21.021	20.975	20.174
	8	**4**	22.012	21.708	21.24	21.032	20.882	20.2
	8	**7**	21.958	21.682	21.223	20.987	20.847	20.181
	15	**0**	21.978	21.706	21.214	20.998	20.753	20.204

Conducted Output Power (dBm)								
LTE Band/BW	RB Size	RB Offset	QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20425	20525	20625	20425	20525	20625
			826.5MHz	836.5MHz	846.5MHz	826.5 MHz	836.5MHz	846.5 MHz
Band 5 / 5MHz	**1**	**0**	22.956	22.848	22.263	**22.071**	22.07	21.211
	1	**13**	**22.969**	22.741	22.317	22.059	21.978	21.273
	1	**25**	22.825	22.642	22.136	21.941	21.87	21.089
	12	**0**	21.972	21.828	21.308	20.911	20.801	20.286
	12	**6**	21.967	21.82	21.324	20.913	20.788	20.311
	12	**13**	21.935	21.65	21.194	20.832	20.632	20.204
	25	**0**	21.963	21.731	21.324	20.934	20.673	20.29

Conducted Output Power (dBm)								
LTE Band/BW	RB Size	RB Offset	QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20450	20525	20600	20450	20525	20600
			829 MHz	836.5MHz	844 MHz	829 MHz	836.5MHz	844 MHz
Band 5 / 10MHz	**1**	**0**	**23.150**	22.767	22.531	22.051	**22.135**	21.595
	1	**25**	22.997	22.586	22.376	21.911	21.935	21.427
	1	**49**	22.786	22.415	22.134	21.687	21.749	21.216
	25	**0**	22.031	21.848	21.46	21.078	20.888	20.524
	25	**13**	22.014	21.704	21.447	21.049	20.776	20.524
	25	**25**	21.783	21.679	21.308	20.879	20.708	20.369
	50	**0**	21.953	21.701	21.326	21.012	20.739	20.331

1.6.4. Effective Radiated Power – LTE Band 5 (824-849MHz)

ERP (dBm)								
			QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20407	20525	20643	20407	20525	20643
LTE Band/BW	RB Size	RB Offset	824.7MHz	836.5MHz	848.3 MHz	824.7 MHz	836.5MHz	848.3 MHz
Band 5 / 1.4 MHz	**1**	**0**	21.561	21.402	20.756	20.627	20.339	19.9
	1	**3**	**21.618**	21.353	20.838	**20.675**	20.294	19.994
	1	**5**	21.542	21.296	20.775	20.611	20.256	19.933
	3	**0**	21.59	21.364	20.757	20.521	20.539	19.915
	3	**2**	21.616	21.325	20.838	20.568	20.48	19.958
	3	**3**	21.55	21.27	20.796	20.522	20.431	19.926
	6	**0**	20.606	20.264	19.788	19.556	19.298	18.838

ERP (dBm)								
			QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20415	20525	20635	20415	20525	20635
LTE Band/BW	RB Size	RB Offset	825.5MHz	836.5MHz	847.5MHz	825.5 MHz	836.5MHz	847.5 MHz
Band 5 / 3MHz	**1**	**0**	21.666	21.357	20.947	20.628	**20.705**	19.992
	1	**7**	**21.764**	21.341	20.922	20.686	20.675	19.967
	1	**14**	21.602	21.232	20.812	20.546	20.545	19.841
	8	**0**	20.651	20.46	19.845	19.651	19.605	18.804
	8	**4**	20.642	20.338	19.87	19.662	19.512	18.83
	8	**7**	20.588	20.312	19.853	19.617	19.477	18.811
	15	**0**	20.608	20.336	19.844	19.628	19.383	18.834

ERP (dBm)								
			QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20425	20525	20625	20425	20525	20625
LTE Band/BW	RB Size	RB Offset	826.5MHz	836.5MHz	846.5MHz	826.5 MHz	836.5MHz	846.5 MHz
Band 5 / 5MHz	**1**	**0**	21.586	21.478	20.893	**20.701**	20.7	19.841
	1	**13**	**21.599**	21.371	20.947	20.689	20.608	19.903
	1	**25**	21.455	21.272	20.766	20.571	20.5	19.719
	12	**0**	20.602	20.458	19.938	19.541	19.431	18.916
	12	**6**	20.597	20.45	19.954	19.543	19.418	18.941
	12	**13**	20.565	20.28	19.824	19.462	19.262	18.834

	25	**0**	20.593	20.361	19.954	19.564	19.303	18.92

ERP (dBm)								
			QPSK Modulation			16QAM Modulation		
			Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20450	20525	20600	20450	20525	20600
LTE Band/BW	RB Size	RB Offset	829 MHz	836.5MHz	844 MHz	829 MHz	836.5MHz	844 MHz
Band 5 / 10MHz	**1**	**0**	**21.78**	21.397	21.161	20.681	**20.765**	20.225
	1	**25**	21.627	21.216	21.006	20.541	20.565	20.057
	1	**49**	21.416	21.045	20.764	20.317	20.379	19.846
	25	**0**	20.661	20.478	20.09	19.708	19.518	19.154
	25	**13**	20.644	20.334	20.077	19.679	19.406	19.154
	25	**25**	20.413	20.309	19.938	19.509	19.338	18.999
	50	**0**	20.583	20.331	19.956	19.642	19.369	18.961

The maximum ERP/EIRP from the measured RF output power is given in Equation as follows:

$$\mathbf{EIRP} = \mathbf{P_{Meas}} + \mathbf{G_T}$$

$$\mathbf{ERP} = \mathbf{EIRP} - \mathbf{2.15}$$

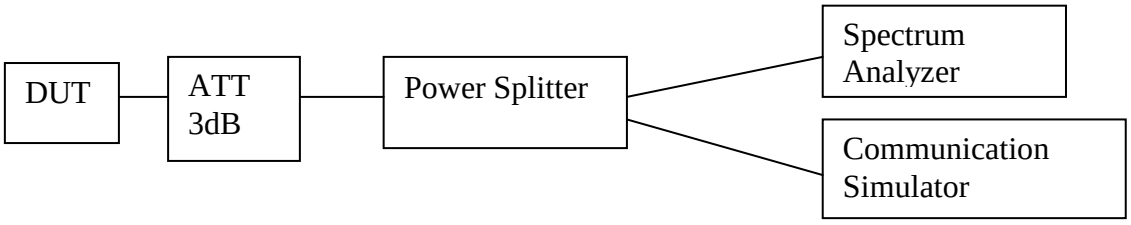
Where, ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (Expressed in the same units as PMeas, e.g., dBm)

$\mathbf{P_{Meas}}$ measured transmitter output power, in dBm

$\mathbf{G_T}$ gain of the transmitting antenna, in dBi (EIRP)

1.7. Peak-to-Average Power Ratio

1.7.1. Test Setup



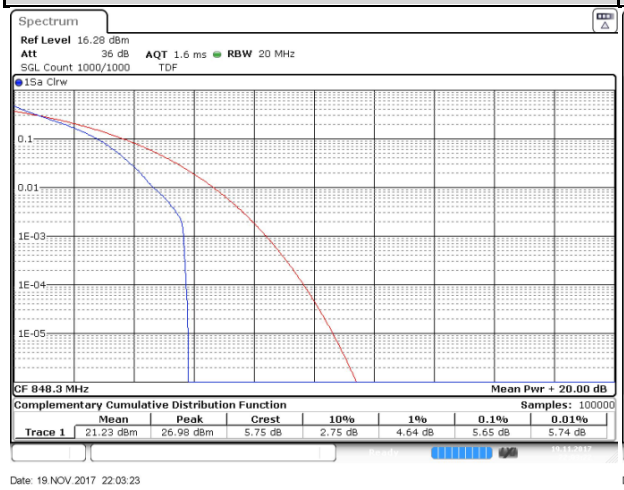
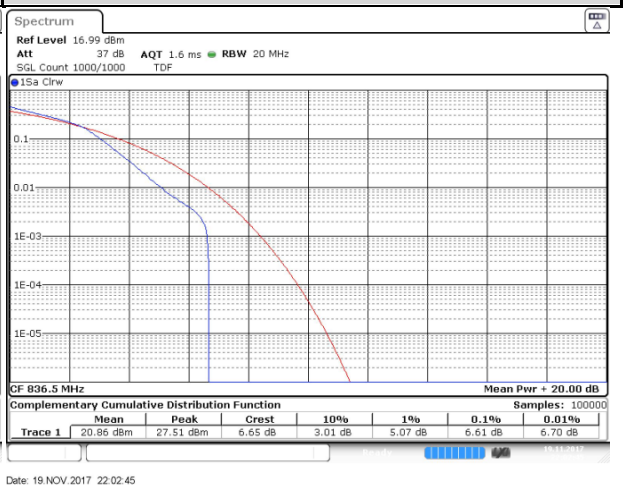
1. The DUT transmitter output port was connected to communication simulator with above setup.
2. Path loss for the measurement included.
3. Set DUT to transmit maximum power through communication simulator
4. Set the CCDF (Complementary Cumulative Distribution Function) option in the spectrum analyzer.
5. Spectrum Analyzer setting, RBW = 20MHz.
6. Recorded the maximum PAR level associated with a probability of 0.1% as Peak to Average Ratio.
7. All the measurement was done at low, mid, high channel for each band and different modulation.

1.7.2. Test Limit

The peak-to-average radio (PAR) of the transmission may not exceed 13 dB.

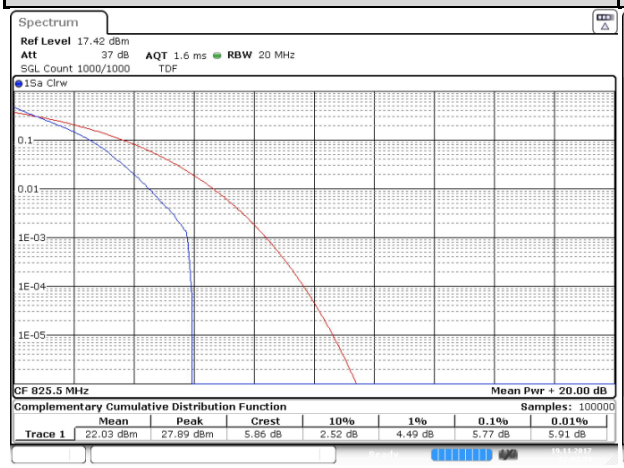
1.7.3. Peak To Average Power Ratio – LTE Band 5 (824-849MHz)

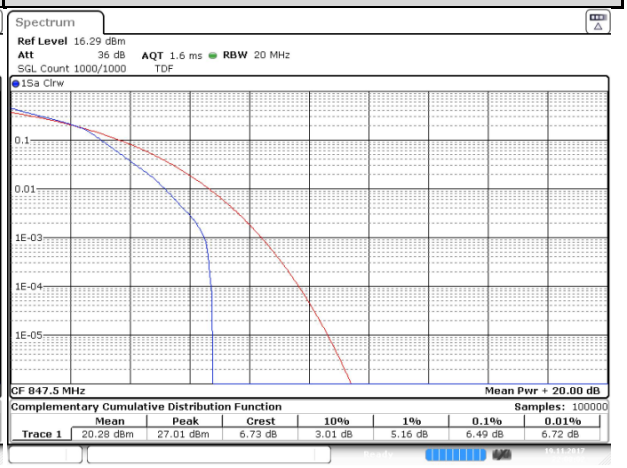
LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	Peak To Average (dB)	
			QPSK Modulation	16QAM Modulation
Band 5/1.4MHz/6/0	Low CH 20407	824.7 MHz	5.42	6.435
	Mid CH 20525	836.5 MHz	5.536	**6.609**
	High CH 20643	848.3 MHz	**5.652**	6.522

Spectrum Plot of Worst Value	
QPSK	16QAM
	

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	Peak To Average (dB)	
			QPSK Modulation	16QAM Modulation
Band 5/3MHz/15/0	Low CH 20415	825.5 MHz	**5.768**	6.348
	Mid CH 20525	836.5 MHz	5.565	6.464
	High CH 20635	847.5 MHz	5.478	**6.493**

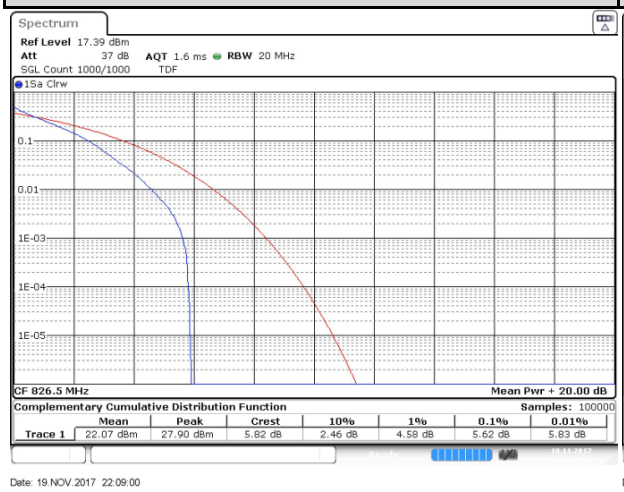
Spectrum Plot of Worst Value	
QPSK	16QAM

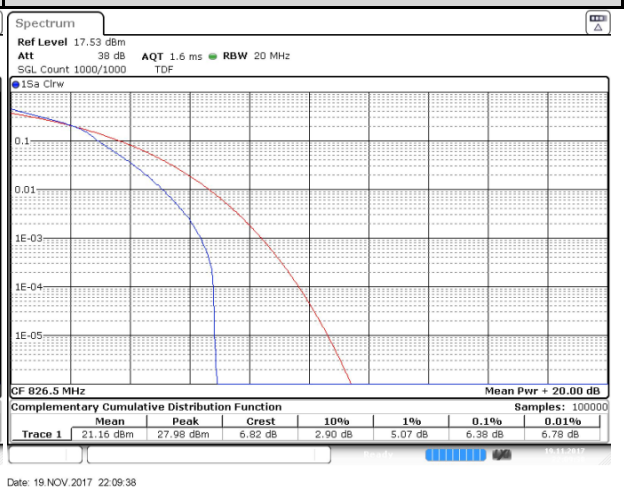




LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	Peak To Average (dB)	
			QPSK Modulation	16QAM Modulation
Band 5/5MHz/25/0	Low CH 20425	826.5 MHz	**5.623**	**6.377**
	Mid CH 20525	836.5 MHz	5.565	6.348
	High CH 20625	846.5 MHz	5.391	6.319

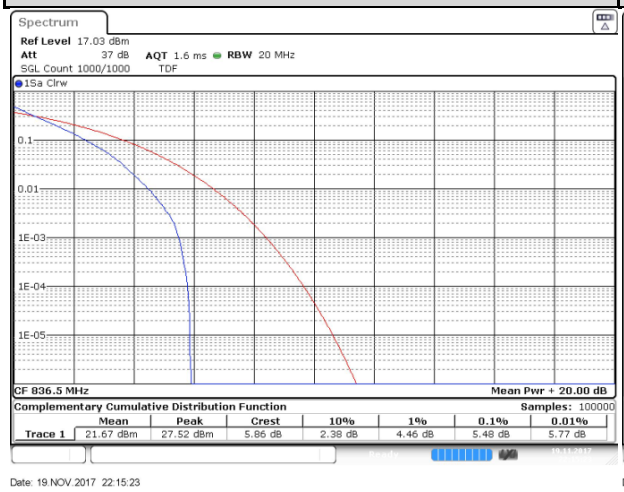
Spectrum Plot of Worst Value	
QPSK	16QAM

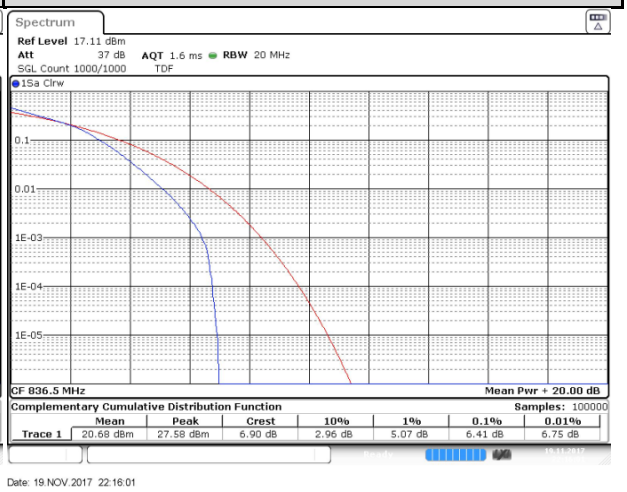




LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	Peak To Average (dB)	
			QPSK Modulation	16QAM Modulation
Band 5/10MHz/50/0	Low CH 20450	829MHz	5.362	6.29
	Mid CH 20525	836.5 MHz	**5.478**	**6.406**
	High CH 20600	844MHz	5.42	6.29

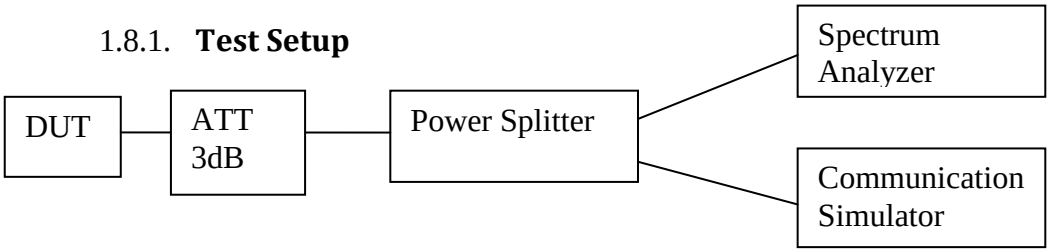
Spectrum Plot of Worst Value	
QPSK	16QAM





1.8. Occupied Bandwidth

1.8.1. **Test Setup**



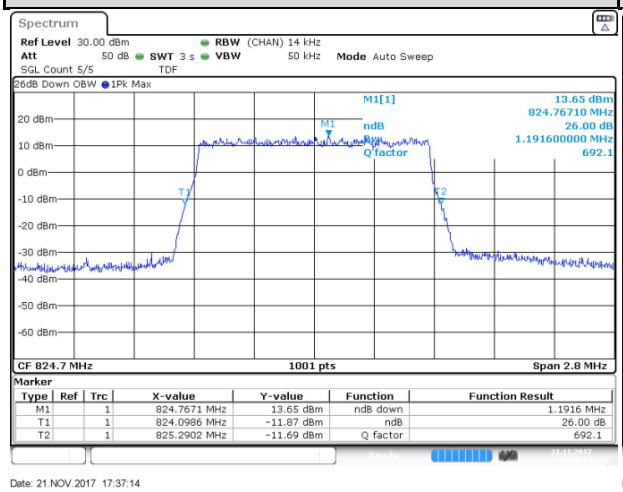
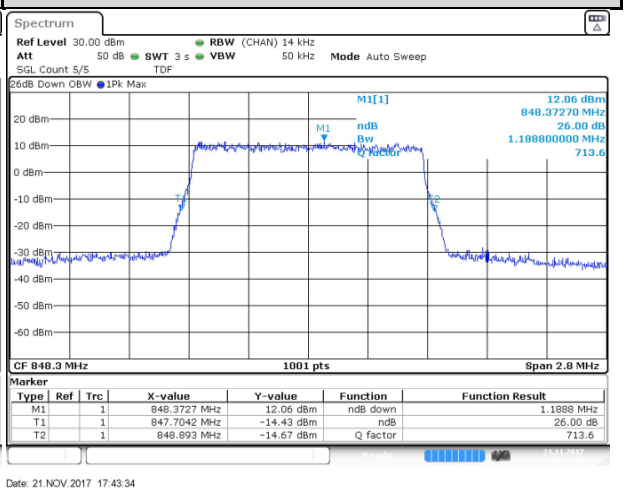
1) The DUT transmitter output port was connected to communication simulator with above setup.
2) Path loss for the measurement included.
3) For LTE measurement, set DUT to transmit maximum power & full RB size through communication simulator.
4) For LTE measurement, set DUT to transmit maximum power through communication simulator.
5) Spectrum Analyzer setting, RBW is 1% of OBW and VBW is 3 times of RBW.
6) Measure & record -26dBc and 99% occupied bandwidth (BW).
7) All the measurement was done at low, mid, high channel for each band and different modulation.

1.8.2. **Test Limit**

The emission 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 at least 26 dB below the transmitter power.

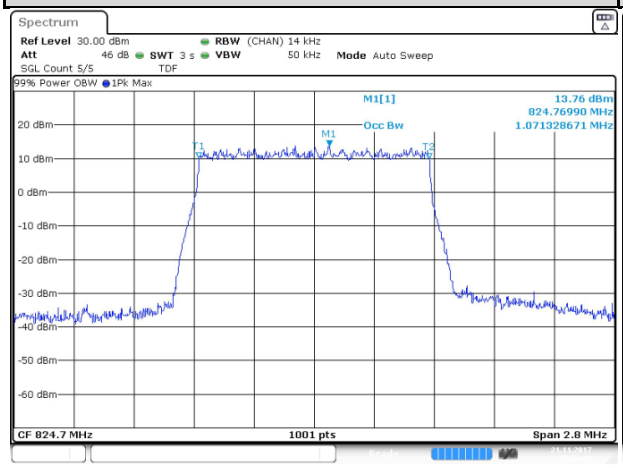
1.8.3. **Occupied Bandwidth - LTE Band 5 (824-849MHz)**

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	-26 dBc Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/1.4MHz/6/0	Low CH 20407	824.7 MHz	**1.192**	1.175
	Mid CH 20525	836.5 MHz	1.183	1.18
	High CH 20643	848.3 MHz	1.186	**1.189**

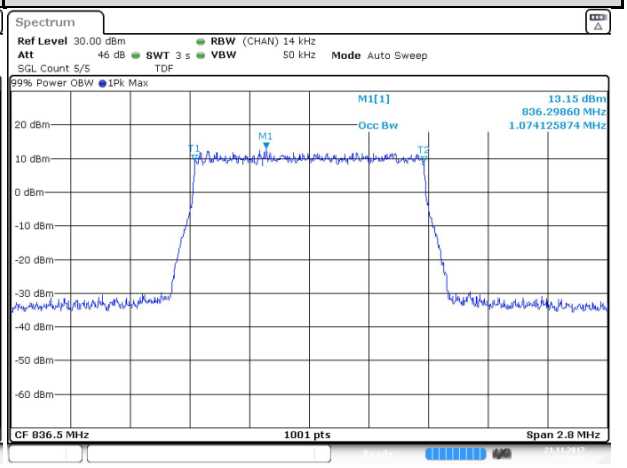
Spectrum Plot of Worst Value	
-26 dBc Bandwidth	
QPSK	16QAM
	

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	99% Occupied Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/1.4MHz/6/0	Low CH 20407	824.7 MHz	**1.071**	1.071
	Mid CH 20525	836.5 MHz	1.071	**1.074**
	High CH 20643	848.3 MHz	1.071	1.071

Spectrum Plot of Worst Value	
99% Occupied Bandwidth	
QPSK	16QAM



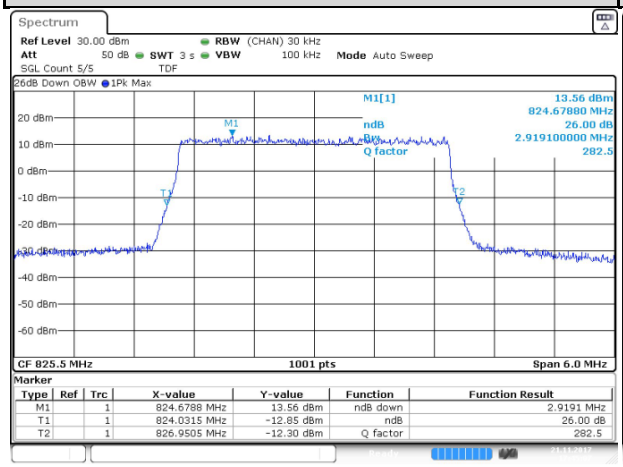
Date: 21.NOV.2017 17:36:50



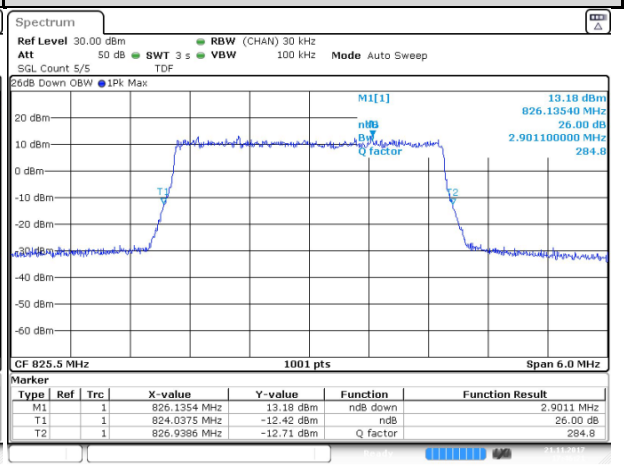
Date: 21.NOV.2017 17:40:38

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	-26 dBc Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/3MHz/15/0	Low CH 20415	825.5 MHz	**2.919**	**2.901**
	Mid CH 20525	836.5 MHz	2.883	2.901
	High CH 20635	847.5 MHz	2.871	2.865

Spectrum Plot of Worst Value	
-26 dBc Bandwidth	
QPSK	16QAM



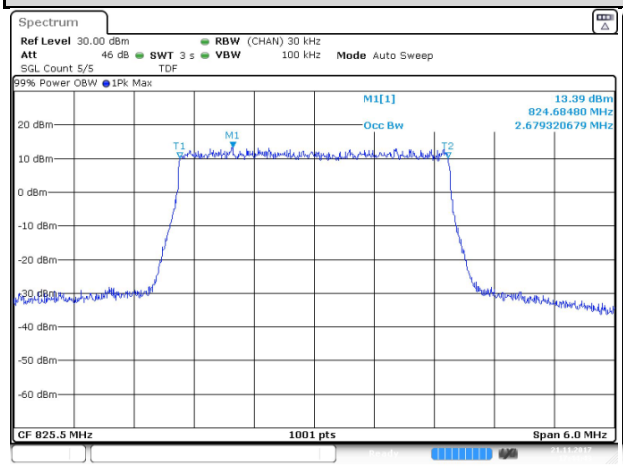
Date: 21.NOV.2017 17:45:08



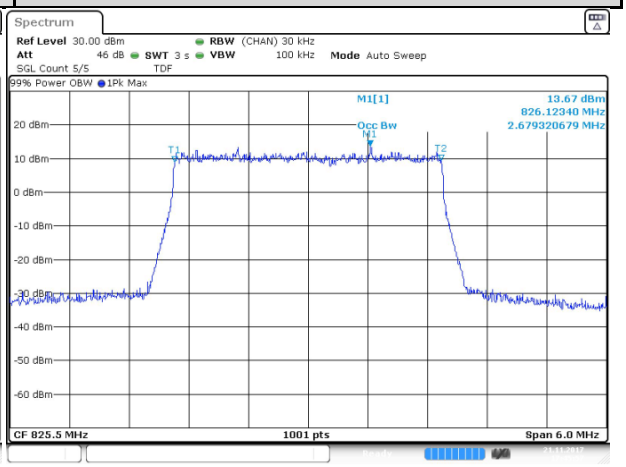
Date: 21.NOV.2017 17:46:21

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	99% Occupied Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/3MHz/15/0	Low CH 20415	825.5 MHz	**2.679**	**2.679**
	Mid CH 20525	836.5 MHz	2.679	2.673
	High CH 20635	847.5 MHz	2.679	2.679

Spectrum Plot of Worst Value	
99% Occupied Bandwidth	
QPSK	16QAM



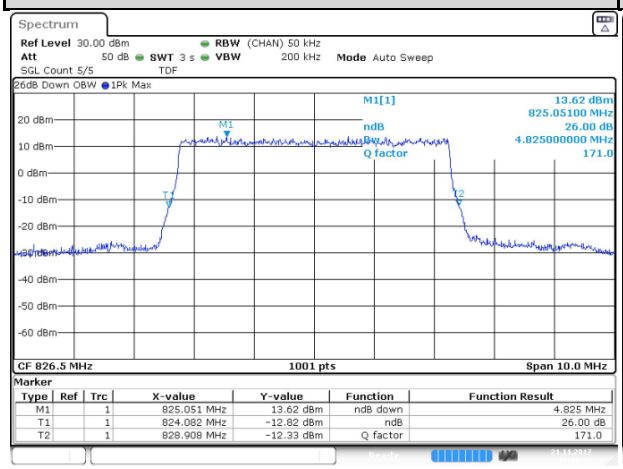
Date: 21.NOV.2017 17:44:43



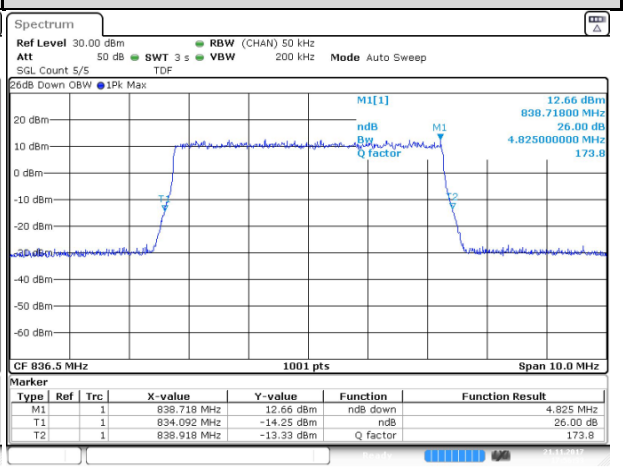
Date: 21.NOV.2017 17:45:57

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	-26 dBc Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/5MHz/25/0	Low CH 20425	826.5 MHz	**4.825**	4.805
	Mid CH 20525	836.5 MHz	4.815	**4.825**
	High CH 20625	846.5 MHz	4.805	4.815

Spectrum Plot of Worst Value	
-26 dBc Bandwidth	
QPSK	16QAM



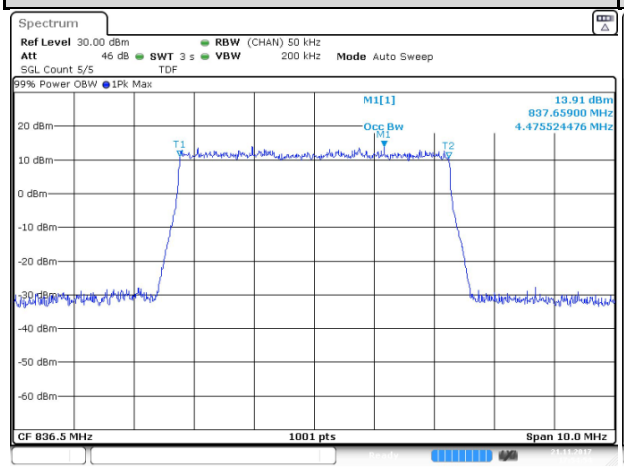
Date: 21.NOV.2017 17:52:51



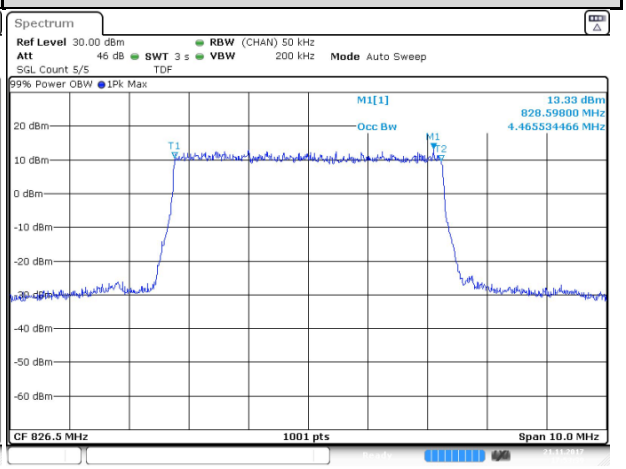
Date: 21.NOV.2017 17:56:33

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	99% Occupied Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/5MHz/25/0	Low CH 20425	826.5 MHz	4.456	**4.466**
	Mid CH 20525	836.5 MHz	**4.476**	4.466
	High CH 20625	846.5 MHz	4.466	4.466

Spectrum Plot of Worst Value	
99% Occupied Bandwidth	
QPSK	16QAM



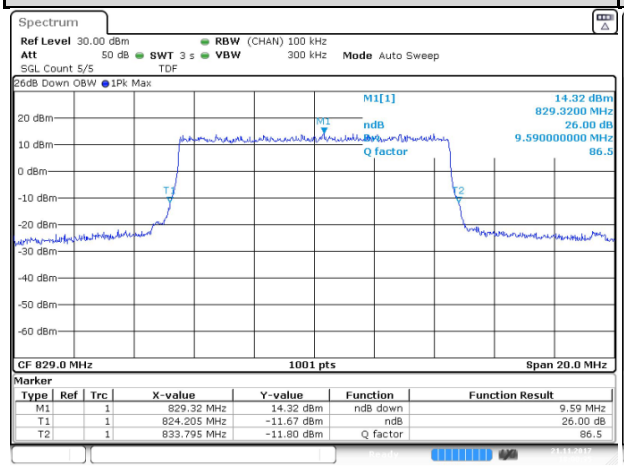
Date: 21.NOV.2017 17:54:54



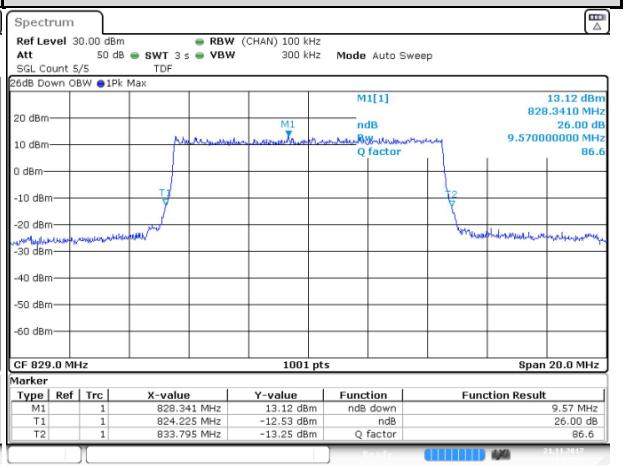
Date: 21.NOV.2017 17:53:40

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	-26 dBc Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/10MHz/50/0	Low CH 20450	829MHz	**9.59**	**9.57**
	Mid CH 20525	836.5 MHz	9.57	9.53
	High CH 20600	844MHz	9.53	9.53

Spectrum Plot of Worst Value	
-26 dBc Bandwidth	
QPSK	16QAM



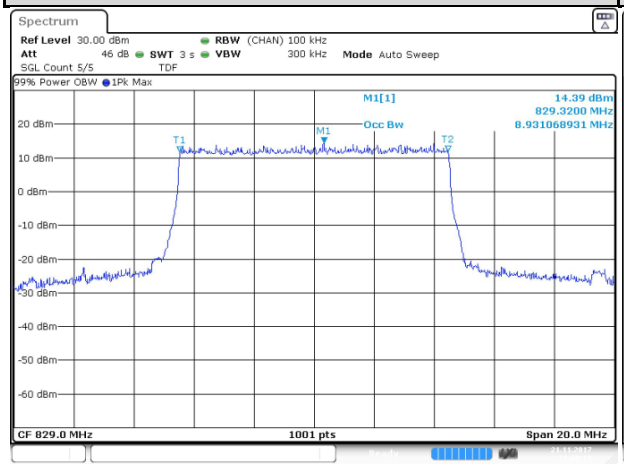
Date: 21.NOV.2017 18:00:36



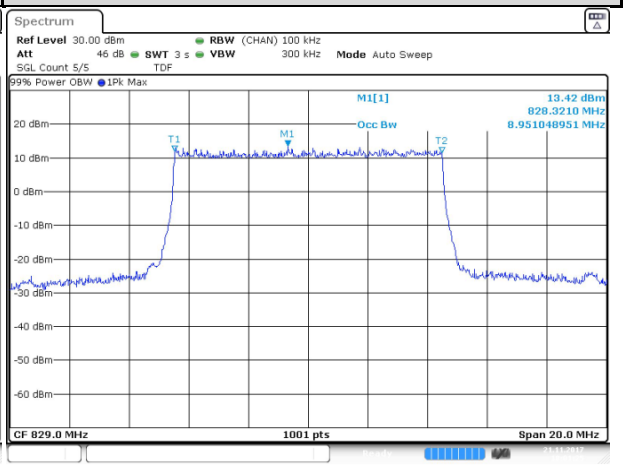
Date: 21.NOV.2017 18:01:50

LTE Band/BW/RB Size/RB Offset	Channel Number	Tx Frequency	99% Occupied Bandwidth (MHz)	
			QPSK Modulation	16QAM Modulation
Band 5/10MHz/50/0	Low CH 20450	829MHz	**8.931**	**8.951**
	Mid CH 20525	836.5 MHz	8.931	8.911
	High CH 20600	844MHz	8.911	8.911

Spectrum Plot of Worst Value	
99% Occupied Bandwidth	
QPSK	16QAM



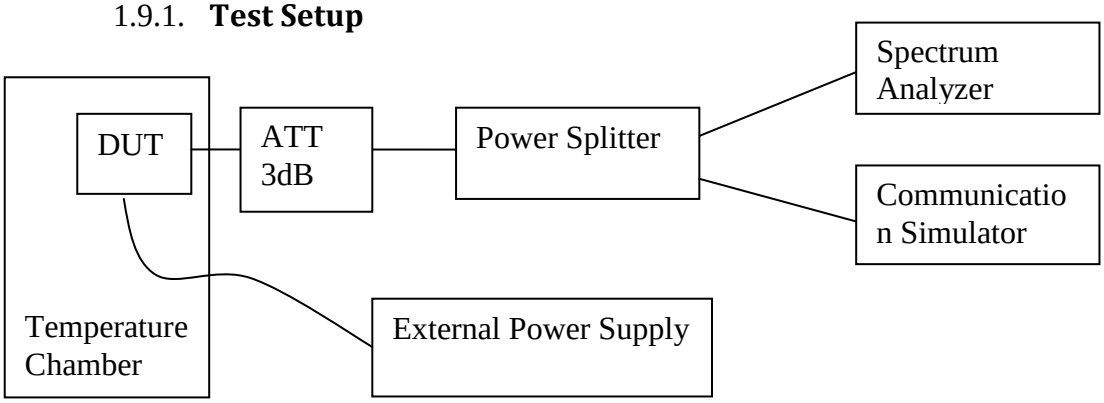
Date: 21.NOV.2017 18:00:11



Date: 21.NOV.2017 18:01:25

1.9. Frequency Stability

1.9.1. **Test Setup**



1) The DUT is placed in the temperature chamber and DUT is power up by external power supply to control the DC input voltage.
2) The temperature chamber could control the temperature and humidity and external power supply could control the test voltage range from minimum to maximum operating voltage.
3) Measured frequency error from the communication simulator by vary below step :
   i. Vary temperature of the temperature chamber from -30 ~ 50 deg C (10 deg C / Step) and set external supply voltage constant at nominal voltage.
   ii. Vary external supply voltage from minimum to maximum operation voltage support by DUT and set temperature chamber constant at room temp.
4) All the measurement was done at mid channel for each band.

1.9.2. **Test Limit**

The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

1.9.3. **Frequency Stability - LTE Band 5 (824-849MHz)**

Band	Temp (Deg C)	Frequency Error VS Temperature			
		Channel Bandwidth: 1.4 MHz			
		Low Channel		High Channel	
		824.7MHz		848.3MHz	
		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
LTE Band 5	**50**	824.699992	-0.009193	848.299981	-0.021973
	40	824.700021	0.025602	848.300021	0.025177
	30	824.699986	-0.016565	848.29999	-0.012074
	20	824.699992	-0.009679	848.300011	0.012378
	10	824.700008	0.009401	848.300008	0.009865
	0	824.700018	0.021249	848.299991	-0.010759
	-10	824.699992	-0.009488	848.299987	-0.014907
	-20	824.700009	0.010373	848.299992	-0.009865
	-30	824.699992	-0.009193	848.299985	-0.017268

Band	Voltage (V)	Frequency Error VS Voltage			
		Channel Bandwidth: 1.4 MHz			
		Low Channel		High Channel	
		824.7MHz		848.3MHz	
		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
LTE Band 5	**4.35**	824.70001	0.011865	848.299987	-0.01575
	3.7	824.70001	0.012454	848.300013	0.015295
	3.2	824.699993	-0.008135	848.299989	-0.012951

Band	Temp (Deg C)	Frequency Error VS Temperature			
		Channel Bandwidth: 3 MHz			
		Low Channel		High Channel	
		825.5MHz		847.5MHz	
		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
LTE Band 5	**50**	825.50001	0.01246	847.499993	-0.008541
	40	825.50001	0.011714	847.500008	0.009182
	30	825.500009	0.011125	847.500008	0.009959
	20	825.50001	0.011558	847.500007	0.008693
	10	825.500011	0.012893	847.499991	-0.010887
	0	825.500011	0.012997	847.500008	0.00952
	-10	825.500007	0.008197	847.500007	0.00876
	-20	825.500012	0.014348	847.500009	0.010668
	-30	825.500012	0.015094	847.500009	0.011157

Band	Voltage (V)	Frequency Error VS Voltage			
		Channel Bandwidth: 3 MHz			
		Low Channel		High Channel	
		825.5MHz		847.5MHz	
		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
LTE Band 5	**4.35**	825.500008	0.009652	847.499993	-0.008406
	3.7	825.500014	0.017052	847.500008	0.009908
	3.2	825.500013	0.01525	847.500007	0.008254

Band	Temp (Deg C)	Frequency Error VS Temperature			
		Channel Bandwidth: 5 MHz			
		Low Channel		High Channel	
		826.5MHz		846.5MHz	
		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
LTE Band 5	**50**	826.499994	-0.007304	846.500009	0.010139
	40	826.499993	-0.008221	846.500012	0.014077
	30	826.500007	0.008983	846.50001	0.01188
	20	826.500008	0.009519	846.500011	0.013148
	10	826.500007	0.009	846.500011	0.012894
	0	826.500009	0.010454	846.500011	0.012624

	-10	826.499996	-0.004275	846.500008	0.009109
	-20	826.500009	0.010298	846.500009	0.010748
	-30	826.499993	-0.009	846.500012	0.014719

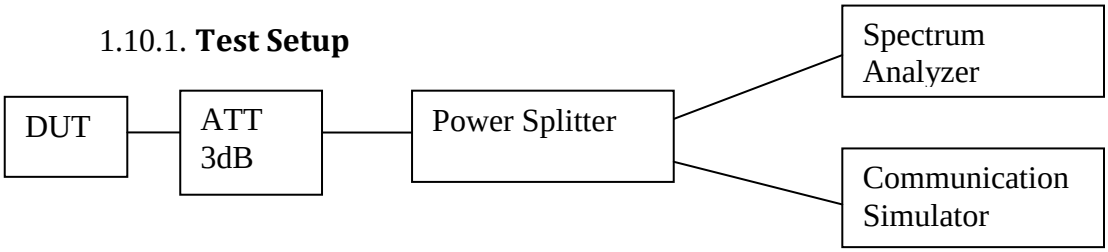
Band	Voltage (V)	Frequency Error VS Voltage			
		Channel Bandwidth: 5 MHz			
		Low Channel		High Channel	
		826.5MHz		846.5MHz	
LTE Band 5		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
	4.35	826.500009	0.010887	846.50001	0.011677
	3.7	826.500007	0.00881	846.500009	0.010359
	3.2	826.500007	0.008308	846.500011	0.012657

Band	Temp (Deg C)	Frequency Error VS Temperature			
		Channel Bandwidth: 10 MHz			
		Low Channel		High Channel	
		829MHz		844MHz	
LTE Band 5		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
	50	828.99999	-0.0122	843.999991	-0.011237
	40	828.99999	-0.012614	843.99999	-0.011949
	30	828.999989	-0.012752	843.99999	-0.011458
	20	828.999992	-0.009991	843.999991	-0.010254
	10	828.999992	-0.010112	843.99999	-0.01139
	0	828.999991	-0.011441	843.999991	-0.010915
	-10	828.999992	-0.009922	844.000005	0.006407
	-20	828.99999	-0.012511	843.99999	-0.012373
	-30	828.99999	-0.011596	843.999991	-0.010339

Band	Voltage (V)	Frequency Error VS Voltage			
		Channel Bandwidth: 10 MHz			
		Low Channel		High Channel	
		829MHz		844MHz	
LTE Band 5		Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
	4.35	828.999992	-0.009715	843.999991	-0.010339
	3.7	828.999991	-0.010509	843.999991	-0.011119
	3.2	828.999992	-0.009197	843.99999	-0.011915

1.10. Band Edge Conducted Spurious Emission

1.10.1. **Test Setup**



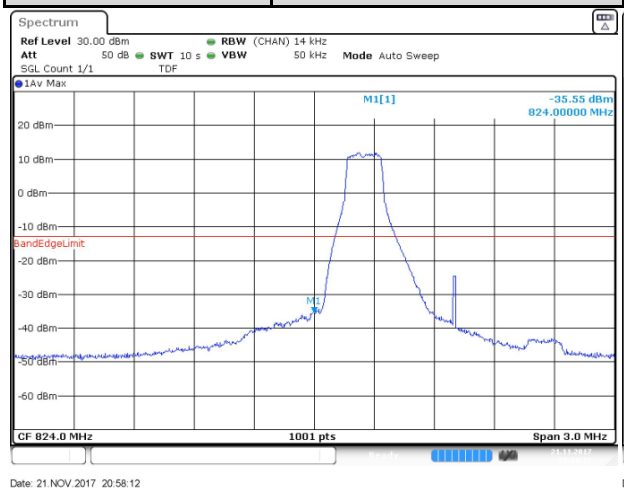
1) The DUT transmitter output port was connected to communication simulator with above setup.
2) Path loss for the measurement included.
3) Set DUT to transmit maximum power through communication simulator.
4) The band edges of lowest and highest channels with the highest RF powers were measured.
5) The center frequency of spectrum is the band edge frequency, span is 3MHz, RBW is 1~3% of EBW and VBW is 3 times of RBW.
6) Record the maximum trace plot into the test report.

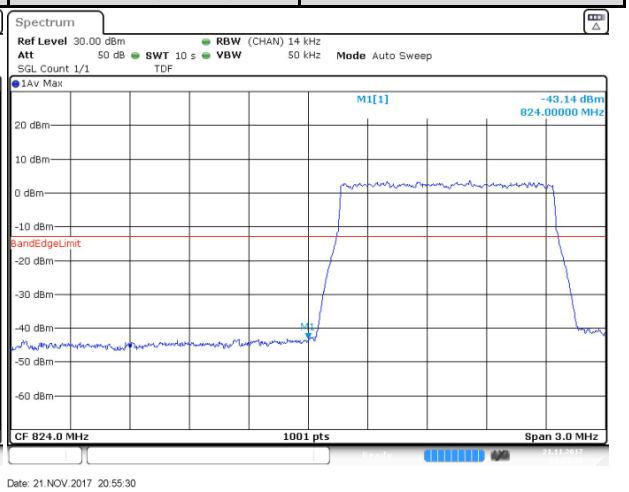
1.10.2. **Test Limit**

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed

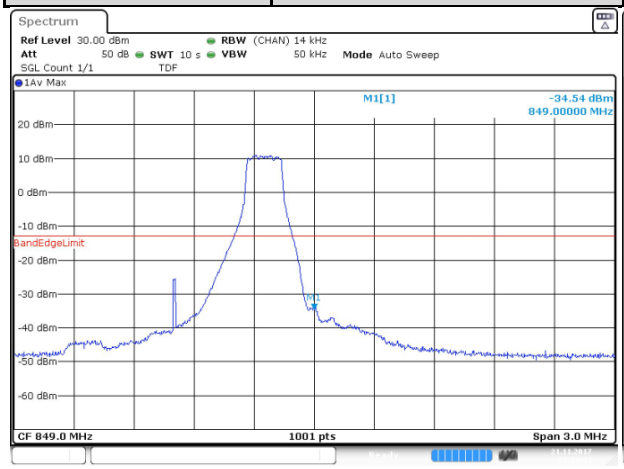
1.10.3. **Band Edge Conducted Spurious Emission - LTE Band 5 (824-849MHz)**

Band 5, 1.4MHz QPSK , Low Channel 20407			
RB = 1	Offset = 0	RB = X (100%)	Offset = 0

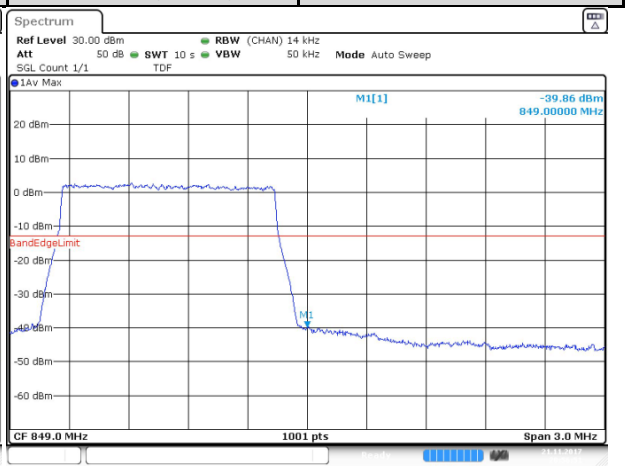




Band 5, 1.4MHz QPSK , High Channel 20643			
RB = 1	Offset =X-1	RB = X (100%)	Offset = 0

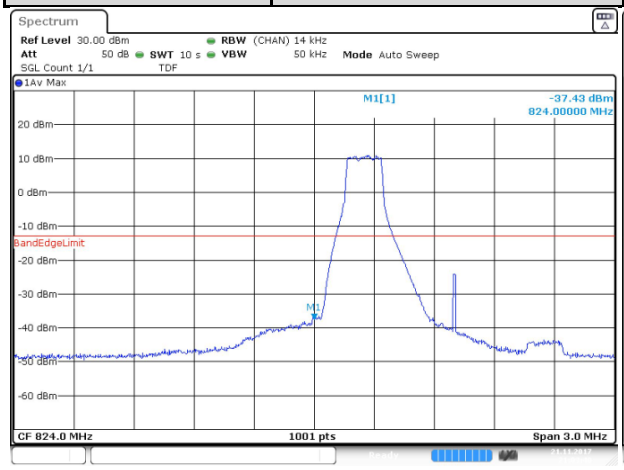


Date: 21.NOV.2017 20:59:34

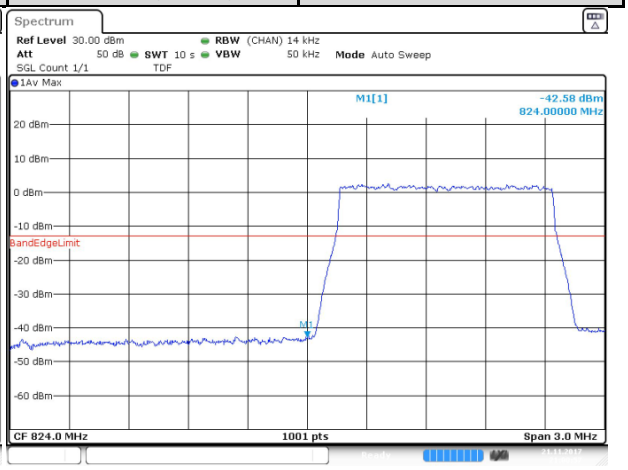


Date: 21.NOV.2017 20:56:52

Band 5, 1.4MHz 16-QAM , Low Channel 20407			
RB = 1	Offset = 0	RB = X (100%)	Offset = 0

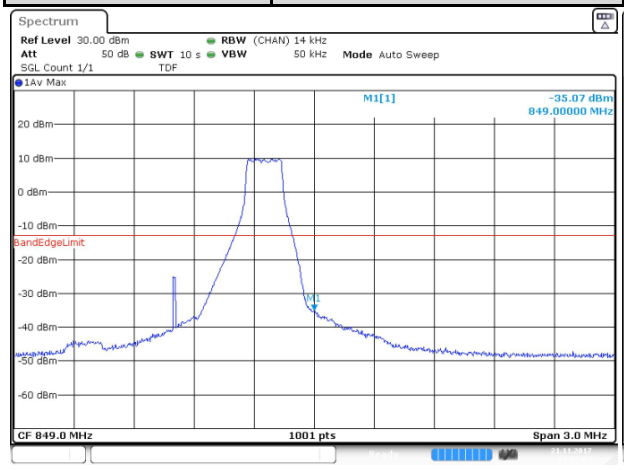


Date: 21.NOV.2017 21:03:40

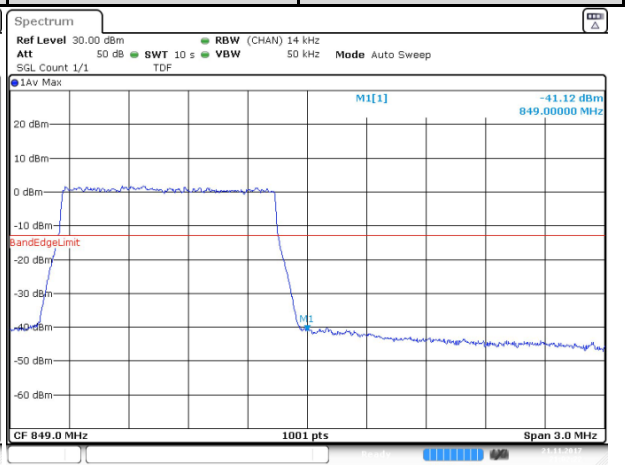


Date: 21.NOV.2017 21:00:58

Band 5, 1.4MHz 16-QAM, High Channel 20643			
RB = 1	Offset =X-1	RB = X (100%)	Offset = 0

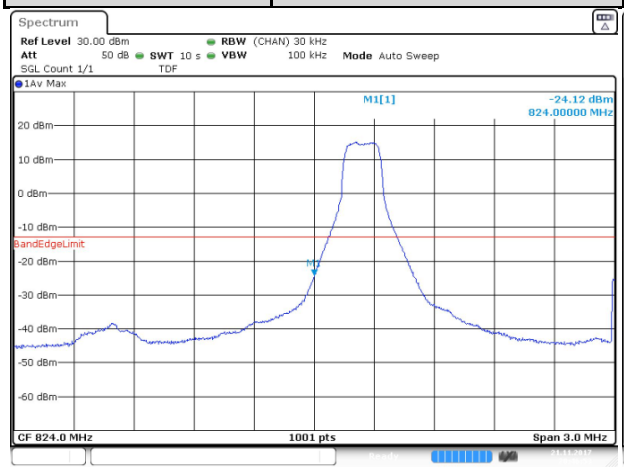


Date: 21.NOV.2017 21:05:04

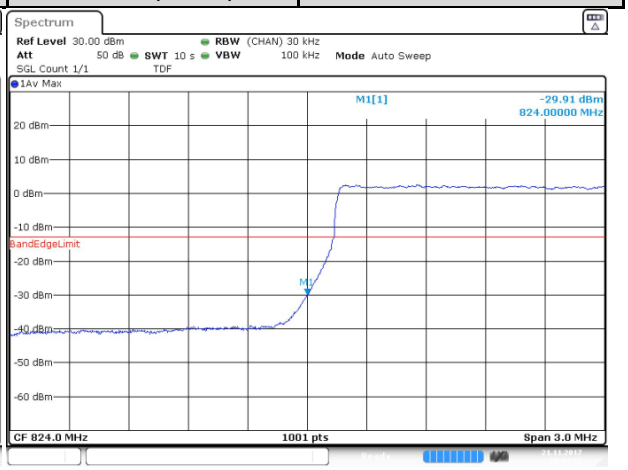


Date: 21.NOV.2017 21:02:22

Band 5, 3MHz QPSK, Low CH 20415			
RB = 1	Offset = 0	RB = X (100%)	Offset = 0

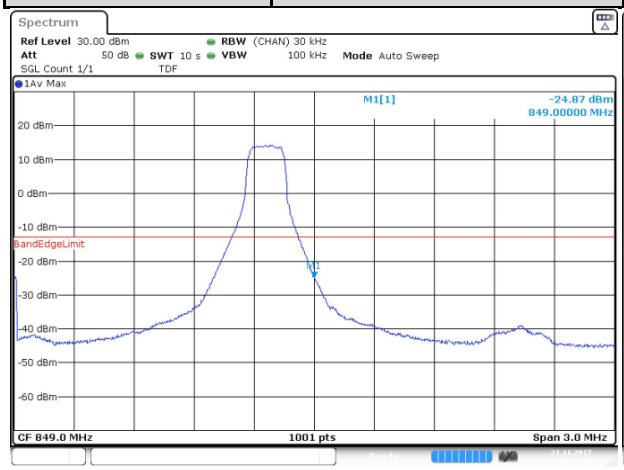


Date: 21.NOV.2017 20:46:54

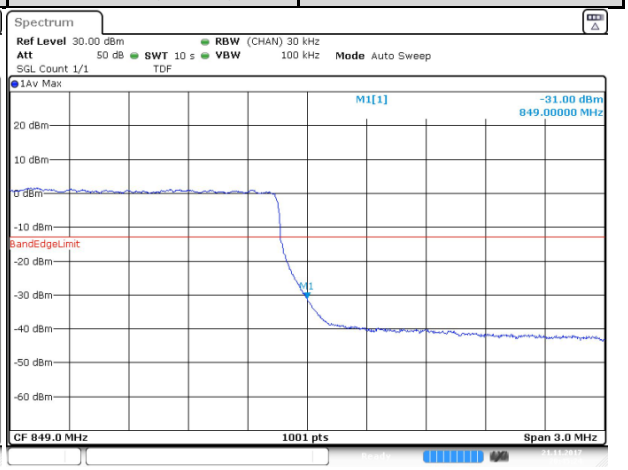


Date: 21.NOV.2017 20:44:03

Band 5, 3MHz QPSK, High CH 20635			
RB = 1	Offset =X-1	RB = X (100%)	Offset = 0

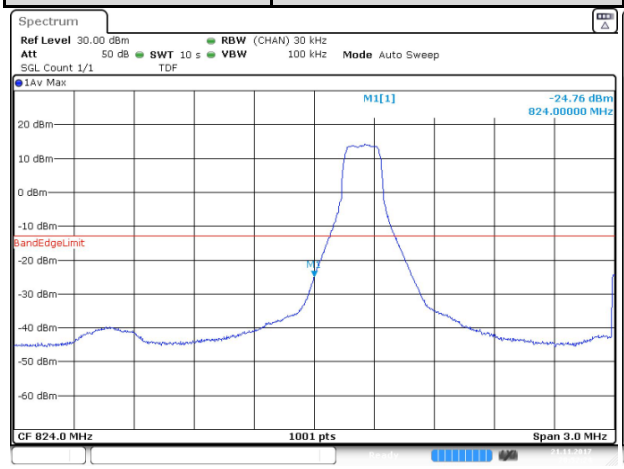


Date: 21.NOV.2017 20:48:15

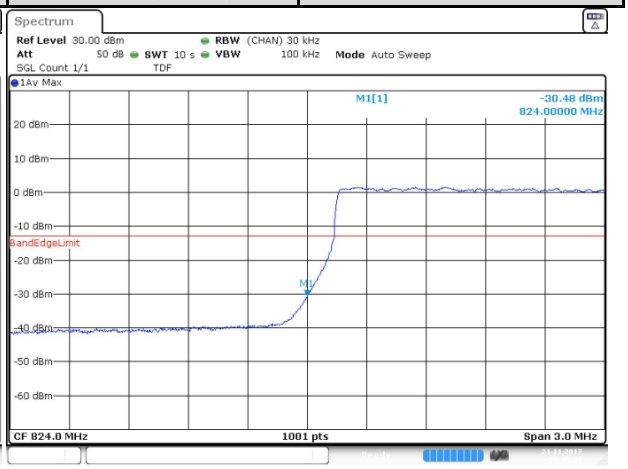


Date: 21.NOV.2017 20:45:25

Band 5, 3MHz 16-QAM, Low CH 20415			
RB = 1	Offset = 0	RB = X (100%)	Offset = 0

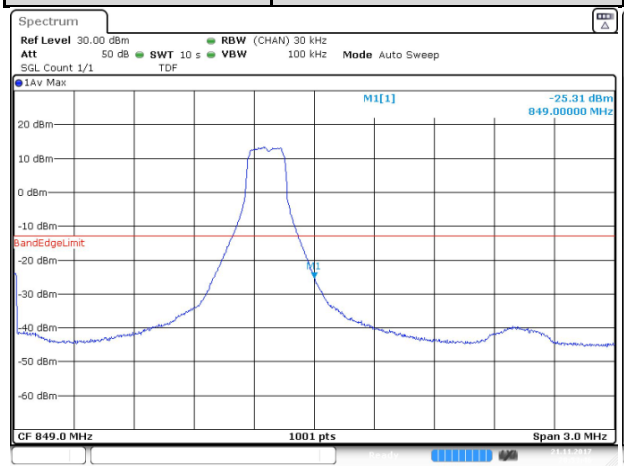


Date: 21.NOV.2017 20:52:25

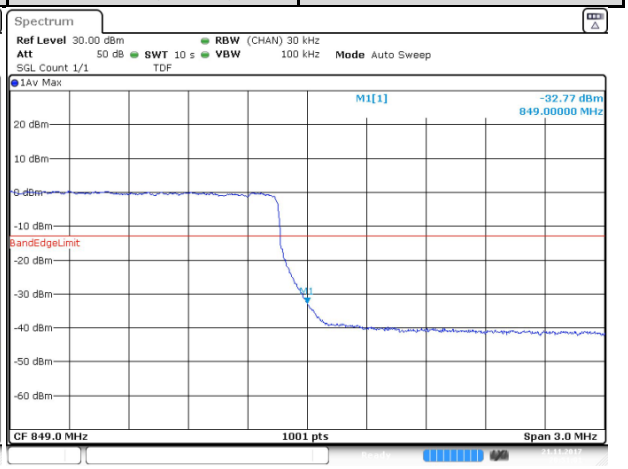


Date: 21.NOV.2017 20:49:40

Band 5, 3MHz 16-QAM, High CH 20635			
RB = 1	Offset =X-1	RB = X (100%)	Offset = 0

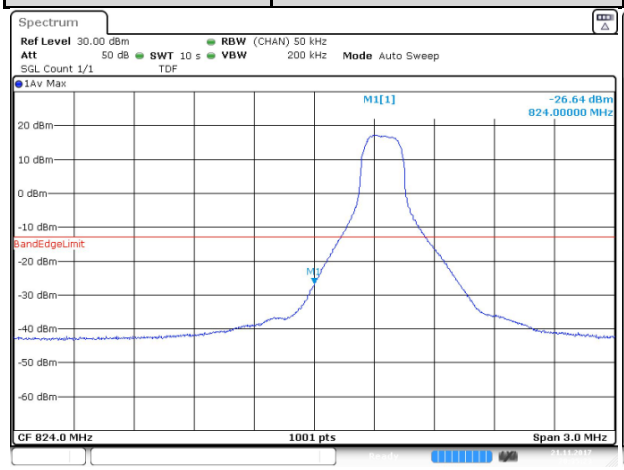


Date: 21.NOV.2017 20:53:47

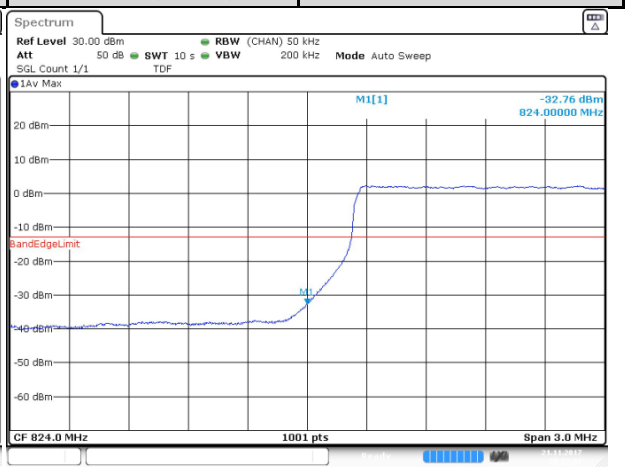


Date: 21.NOV.2017 20:51:02

Band 5, 5MHz QPSK, Low CH 20425			
RB = 1	Offset = 0	RB = X (100%)	Offset = 0

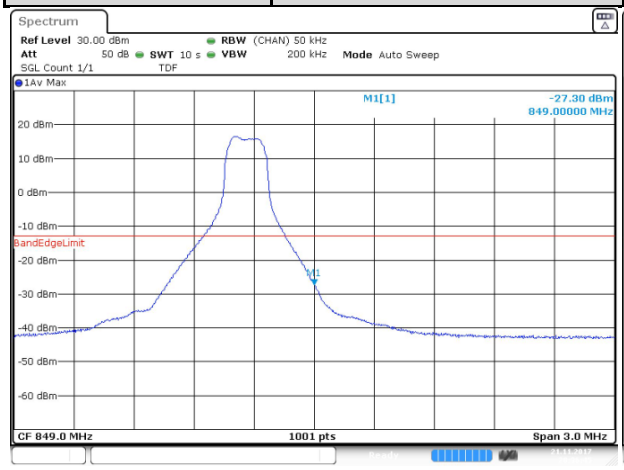


Date: 21.NOV.2017 20:35:24

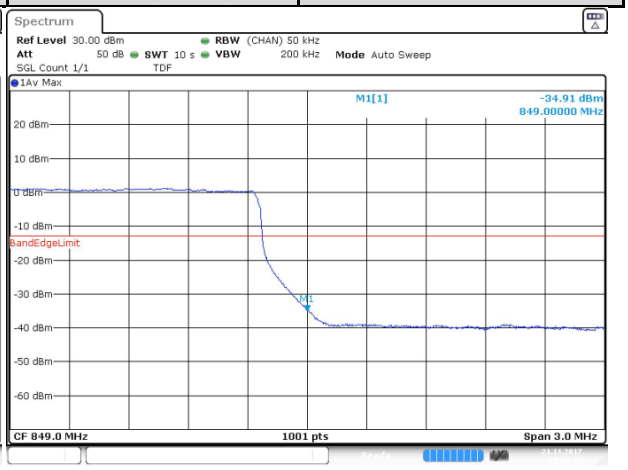


Date: 21.NOV.2017 20:32:37

Band 5, 5MHz QPSK, High CH 20625			
RB = 1	Offset =X-1	RB = X (100%)	Offset = 0



Date: 21.NOV.2017 20:36:45



Date: 21.NOV.2017 20:34:01