RF TEST REPORT

Applicant	HMD Global Oy
FCC ID	2AJOTTA-1223
Product	mobile phone
Brand	Nokia
Model	TA-1223
Report No.	R2001A0040-R1V1
Issue Date	March 16, 2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR 47 Part 22H (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Radiated Power	2.1046 22.913(a)(5)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	2.1051 / 22.917(a)	PASS
4	Peak-to-Average Power Ratio	22.913(d)/ KDB 971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 22.355	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 / 22.917(a)	PASS
7	Radiates Spurious Emission	2.1053 / 22.917 (a)	PASS
Date of Testing: January 16, 2020 ~ February 28, 2020			
Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

Note: This revised report (Report No.: R2001A0040-R1V1) supersedes and replaces the previously issued report (Report No.: R2001A0040-R1). Please discard or destroy the previously issued report and dispose of it accordingly.

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City:	Shanghai
Post code:	201201
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2. General Description of Equipment under Test

2.3. Applicant and Manufacturer Information

Applicant	HMD Global Oy
Applicant address	Bertel Jungin aukio 9,02600 ESPOO. FINLAND
Manufacturer	HMD Global Oy
Manufacturer address	Bertel Jungin aukio 9,02600 ESPOO. FINLAND

2.4. General Information

EUT Description			
Model	TA-1223		
IMEI	IMEI 1:355795100012570 IMEI 2:355795100015342		
Hardware Version	LLDM528		
Software Version	LLDB7749		
Power Supply	Battery/AC adapter		
Antenna Type	Internal Antenna		
Test Mode(s)	GSM 850; WCDMA Band V;LTE Band 5;		
Test Modulation	(GSM)GMSK,8PSK;(WCDMA)BPSK,QPSK; (LTE)QPSK 16QAM 64QAM;		
GPRS Multislot Class	12		
EGPRS Multislot Class	12		
HSDPA UE Category	24		
HSUPA UE Category	6		
LTE Category	4		
Maximum E.R.P.	GSM 850:	27.48dBm	
	WCDMA Band V:	17.58dBm	
	LTE Band 5:	18.06dBm	
Rated Power Supply Voltage	3.8V		
Extreme Voltage	Minimum: 3.6V Maximum: 4.4V		
Extreme Temperature	Lowest: -10°C Highest: +55°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM850	824 ~ 849	869 ~ 894
	WCDMA Band V	824 ~ 849	869 ~ 894
	LTE Band 5	824 ~ 849	869 ~ 894
EUT Accessory			
Adapter 1	Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD. Model: CH-21E		
Adapter 2	Manufacturer: Jiangsu Chenyang Electron Co., Ltd.		

	Model: AD-10WE
Adapter 3	Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD. Model: CH-21U
Adapter 4	Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD. Model: CH-21N
Adapter 5	Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD. Model: CH-21X
Adapter 6	Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD. Model: CH-21A
Adapter 7	Manufacturer: DONGGUAN AOHAI POWER TECHNOLOGY CO., LTD. Model: AD-10WR
Adapter 8	Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD. Model: CH-21B
Battery 1	Manufacturer: Jiade Energy Technology(Zhuhai)Co., Ltd. Model: LC-620U
Battery 2	Manufacturer: Veken Model: LC-620U
Earphone 1	Manufacturer: Huizhou New Leader Industry Co., Ltd. Model: NLD-EM300M-03SF
Earphone 2	Manufacturer: Xiaolin Electronics Model: XL-5178
USB Cable 1	Manufacturer: Xiamen Li Qi Electronics Co., Ltd. Model: LQ03500090
USB Cable 2	Manufacturer: Saibao (Jiangxi) Industrial Co. , Ltd. Model: SLQ-A125A
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant. 2. There is more than one Adapter, Battery, Earphone and USB Cable, each one should be applied throughout the compliance test respectively, and however, only the worst case (Adapter 1, Battery 1) will be recorded in this report.	

Antenna Gain:

Band	Antenna Gain(dBi)		
	Low channel	Middle channel	High channel
GSM 850	-3.61	-3.86	-4.68
WCDMA Band V	-4.01	-3.86	-4.68
LTE Band 5	-3.61	-3.86	-4.68

3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:
FCC CFR 47 Part 22H (2019)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2019)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4. Test Configuration

There is more than one SIM card slot, each one should be applied throughout the compliance test respectively, and however, only the worst case (SIM 1) will be recorded in this report.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (Z axis, horizontal polarization) and the worst case was recorded.

All mode and data rates and positions were investigated. Subsequently, only the worst case emissions are reported.
The following testing in GSM/WCDMA/LTE is set based on the maximum RF Output Power.
Test modes are chosen to be reported as the worst case configuration below:

Test items	Modes/Modulation	
	GSM 850	WCDMA Band V
RF Power Output and Effective Radiated power	GSM GPRS EGPRS	RMC HSDPA/HSUPA
Occupied Bandwidth	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Band Edge Compliance	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Peak-to-Average Power Ratio	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Frequency Stability	GSM GPRS(1Tx slot) EGPRS(1Tx slot)	RMC
Spurious Emissions at Antenna Terminals	GSM	RMC
Radiates Spurious Emission	GSM	RMC

Test modes are chosen as the worst case configuration below for LTE Band 5.

Test items	Bandwidth (MHz)				Modulation			RB			Test Channel		
	1.4	3	5	10	QPSK	16QAM	64QAM	1	50%	100%	L	M	H
RF power output and Effective Radiated power	O	O	O	O	O	O	O	O	O	O	O	O	O
Occupied Bandwidth	O	O	O	O	O	O	O	-	-	O	O	O	O
Band Edge Compliance	O	O	O	O	O	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	O	O	O	O	O	O	O	-	-	O	O	O	O
Frequency Stability	O	O	O	O	O	O	O	O	O	O	O	O	O
Spurious Emissions at Antenna Terminals	O	O	O	O	O	-	-	O	-	-	O	O	O
Radiates Spurious Emission	O	-	O	O	O	-	-	O	-	-	-	O	-
Note	1. The mark “O” means that this configuration is chosen for testing. 2. The mark “-” means that this configuration is not testing.												

5. Test Case Results

5.1. RF Power Output and Effective Radiated Power

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

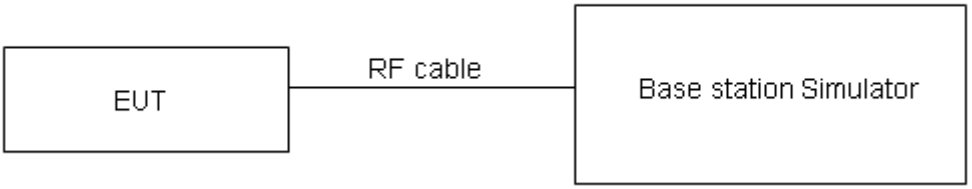
Methods of Measurement

During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

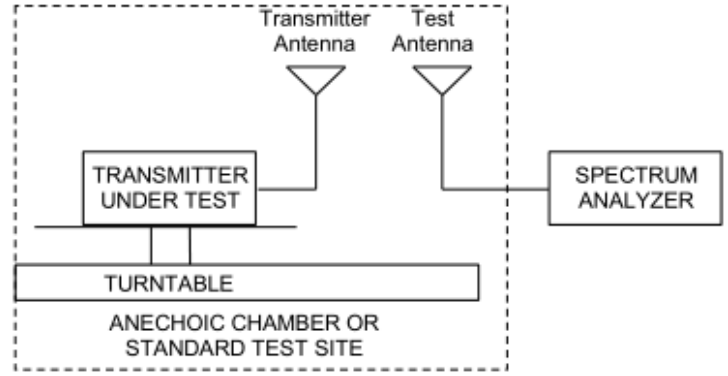
The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).
a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.
b) Key the transmitter, then rotate the EUT 360° azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).
c) Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.
d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading.LOSS = Generator Output Power (dBm) – Analyzer reading (dBm)
e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation:ERP (dBm) = LVL (dBm) + LOSS (dB)
f) The maximum ERP is the maximum value determined in the preceding step.
g) When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g.transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and the point where power is applied to the antenna. ERP can then be calculated as follows:
EIRP (dBm) = Output Power (dBm) - Losses (dB) + Antenna Gain (dBi)
where:dBd refers to gain relative to an ideal dipole.
EIRP (dBm) = ERP (dBm) + 2.15 (dB.)

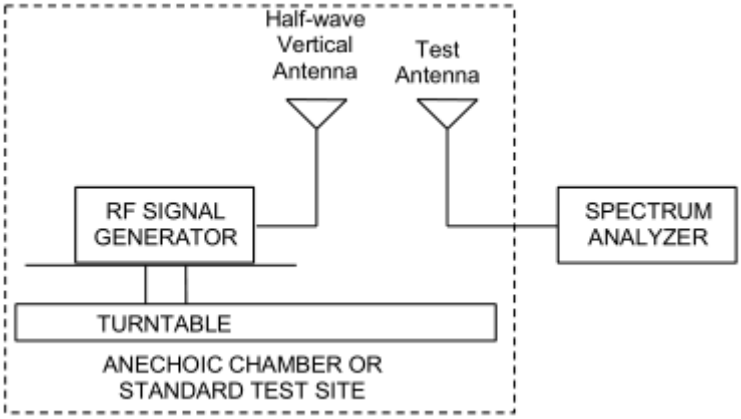
The RB allocation refers to section 5.1, using the maximum output power configuration.

Test Setup



The loss between RF output port of the EUT and the input port of the tester has been taken into consideration.





Limits

No specific RF power output requirements in part 2.1046.

Rule Part 22.913(a)(5) specifies that "Mobile/portable stations are limited to 7 watts ERP".

Limit	≤ 7 W (38.45 dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.4 dB for RF power output, *k* = 2, *U*= 1.19 dB for ERP .

Test Results

GSM 850		Conducted Power (dBm)			ERP (dBm)		
		Channel 128	Channel 190	Channel 251	Channel 128	Channel 190	Channel 251
		824.2 (MHz)	836.6 (MHz)	848.8 (MHz)	824.2 (MHz)	836.6 (MHz)	848.8 (MHz)
GSM	Results	33.24	33.30	33.12	27.48	27.29	26.29
GPRS/EGPRS (GMSK)	1TXslot	33.16	33.20	33.06	27.40	27.19	26.23
	2TXslots	32.00	32.06	31.95	26.24	26.05	25.12
	3TXslots	30.85	31.14	30.78	25.09	25.13	23.95
	4TXslots	28.64	29.06	28.66	22.88	23.05	21.83
EGPRS (8PSK)	1TXslot	27.12	27.28	27.02	21.36	21.27	20.19
	2TXslots	26.86	27.02	26.75	21.10	21.01	19.92
	3TXslots	26.08	25.96	26.21	20.32	19.95	19.38
	4TXslots	23.66	24.10	23.64	17.90	18.09	16.81

WCDMA Band V		Conducted Power (dBm)			ERP (dBm)		
		Channel 4132	Channel 4183	Channel 4233	Channel 4132	Channel 4183	Channel 4233
		826.4 (MHz)	836.6 (MHz)	846.6 (MHz)	826.4 (MHz)	836.6 (MHz)	846.6 (MHz)
RMC	12.2k	23.47	23.59	23.49	17.31	17.58	16.66
ARM	12.2k	23.31	23.42	23.34	17.15	17.41	16.51
HSDPA	Sub - Test 1	22.89	23.01	22.91	16.73	17.00	16.08
	Sub - Test 2	22.88	23.00	22.90	16.72	16.99	16.07
	Sub - Test 3	22.37	22.49	22.39	16.21	16.48	15.56
	Sub - Test 4	22.36	22.48	22.38	16.20	16.47	15.55
HSUPA	Sub - Test 1	22.85	22.97	22.87	16.69	16.96	16.04
	Sub - Test 2	21.84	21.96	21.86	15.68	15.95	15.03
	Sub - Test 3	22.32	22.45	22.35	16.16	16.44	15.52
	Sub - Test 4	21.81	21.94	21.84	15.65	15.93	15.01
	Sub - Test 5	22.80	22.93	22.83	16.64	16.92	16.00

LTE Band 5									
Bandwidth	Modulation	RB allocation	offset	Conducted Power (dBm)			ERP (dBm)		
				Channel/Frequency(MHz)					
				20407/ 824.7	20407/ 824.7	20407/ 824.7	20407/ 824.7	20407/ 824.7	20407/ 824.7
1.4MHz	QPSK	1	0	23.34	23.10	23.20	17.58	17.09	16.37
		1	2	23.29	23.18	23.12	17.53	17.17	16.29
		1	5	23.21	23.16	23.11	17.45	17.15	16.28
		3	0	23.82	23.71	23.53	18.06	17.70	16.70
		3	2	23.70	23.74	23.58	17.94	17.73	16.75
		3	3	23.75	23.67	23.55	17.99	17.66	16.72
		6	0	22.88	22.75	22.60	17.12	16.74	15.77
	16QAM	1	0	23.21	23.15	23.11	17.45	17.14	16.28
		1	2	23.19	23.27	23.15	17.43	17.26	16.32
		1	5	23.27	23.18	23.01	17.51	17.17	16.18
		3	0	22.79	22.78	22.61	17.03	16.77	15.78
		3	2	22.82	22.70	22.68	17.06	16.69	15.85
		3	3	22.73	22.77	22.72	16.97	16.76	15.89
		6	0	21.70	21.81	21.69	15.94	15.80	14.86
	64QAM	1	0	22.87	22.91	22.79	17.11	16.90	15.96
		1	2	22.86	22.92	22.91	17.10	16.91	16.08
		1	5	22.82	22.82	22.96	17.06	16.81	16.13
		3	0	22.72	22.78	22.51	16.96	16.77	15.68
		3	2	22.80	22.74	22.65	17.04	16.73	15.82
		3	3	22.76	22.67	22.54	17.00	16.66	15.71
		6	0	21.74	21.77	21.62	15.98	15.76	14.79
Bandwidth	Modulation	RB allocation	offset	Conducted Power (dBm)			ERP (dBm)		
				Channel/Frequency(MHz)					
				20415/ 825.5	20525/ 836.5	20635/ 847.5	20415/ 825.5	20525/ 836.5	20635/ 847.5
3MHz	QPSK	1	0	23.36	23.14	23.23	17.60	17.13	16.40
		1	7	23.27	23.21	23.16	17.51	17.20	16.33
		1	14	23.24	23.21	23.15	17.48	17.20	16.32
		8	0	22.92	22.83	22.66	17.16	16.82	15.83
		8	4	22.82	22.84	22.70	17.06	16.83	15.87
		8	7	22.85	22.78	22.65	17.09	16.77	15.82
		15	0	22.88	22.79	22.63	17.12	16.78	15.80
	16QAM	1	0	23.24	23.17	23.14	17.48	17.16	16.31
		1	7	23.22	23.27	23.19	17.46	17.26	16.36
		1	14	23.29	23.22	23.04	17.53	17.21	16.21
		8	0	21.90	21.91	21.73	16.14	15.90	14.90
		8	4	21.93	21.83	21.80	16.17	15.82	14.97

		8	7	21.83	21.89	21.85	16.07	15.88	15.02
		15	0	21.73	21.85	21.72	15.97	15.84	14.89
	64QAM	1	0	22.90	22.93	22.82	17.14	16.92	15.99
		1	7	22.89	22.92	22.93	17.13	16.91	16.10
		1	14	22.84	22.81	22.99	17.08	16.80	16.16
		8	0	21.83	21.91	21.63	16.07	15.90	14.80
		8	4	21.91	21.87	21.77	16.15	15.86	14.94
		8	7	21.86	21.79	21.67	16.10	15.78	14.84
		15	0	21.77	21.81	21.65	16.01	15.80	14.82
Bandwidth	Modulation	RB allocation	offset	Conducted Power (dBm)			ERP (dBm)		
				Channel/Frequency(MHz)					
				20425/ 826.5	20525/ 836.5	20625/ 846.5	20425/ 826.5	20525/ 836.5	20625/ 846.5
5MHz	QPSK	1	0	23.33	23.12	23.19	17.57	17.11	16.36
		1	13	23.25	23.17	23.13	17.49	17.16	16.30
		1	24	23.21	23.16	23.11	17.45	17.15	16.28
		12	0	22.89	22.78	22.62	17.13	16.77	15.79
		12	6	22.80	22.80	22.65	17.04	16.79	15.82
		12	13	22.83	22.76	22.61	17.07	16.75	15.78
		25	0	22.88	22.78	22.61	17.12	16.77	15.78
	16QAM	1	0	23.21	23.13	23.11	17.45	17.12	16.28
		1	13	23.19	23.25	23.16	17.43	17.24	16.33
		1	24	23.26	23.20	23.00	17.50	17.19	16.17
		12	0	21.88	21.87	21.70	16.12	15.86	14.87
		12	6	21.90	21.78	21.76	16.14	15.77	14.93
		12	13	21.80	21.84	21.81	16.04	15.83	14.98
		25	0	21.71	21.81	21.67	15.95	15.80	14.84
	64QAM	1	0	22.87	22.93	22.79	17.11	16.92	15.96
		1	13	22.86	22.94	22.90	17.10	16.93	16.07
		1	24	22.85	22.79	22.95	17.09	16.78	16.12
		12	0	21.81	21.87	21.64	16.05	15.86	14.81
		12	6	21.88	21.82	21.73	16.12	15.81	14.90
		12	13	21.83	21.74	21.63	16.07	15.73	14.80
		25	0	21.75	21.77	21.60	15.99	15.76	14.77
Bandwidth	Modulation	RB allocation	offset	Conducted Power (dBm)			ERP (dBm)		
				Channel/Frequency(MHz)					
				20450/ 829	20525/ 836.5	20600/ 844	20450/ 829	20525/ 836.5	20600/ 844
10MHz	QPSK	1	0	23.31	23.05	23.17	17.55	17.04	16.34
		1	25	23.25	23.17	23.12	17.49	17.16	16.29
		1	49	23.18	23.14	23.07	17.42	17.13	16.24
		25	0	22.87	22.74	22.59	17.11	16.73	15.76
		25	13	22.78	22.76	22.62	17.02	16.75	15.79

		25	25	22.79	22.72	22.58	17.03	16.71	15.75
		50	0	22.87	22.71	22.56	17.11	16.70	15.73
	16QAM	1	0	23.04	23.10	23.06	17.28	17.09	16.23
		1	25	23.16	23.24	23.13	17.40	17.23	16.30
		1	49	23.24	23.15	22.98	17.48	17.14	16.15
		25	0	21.85	21.86	21.68	16.09	15.85	14.85
		25	13	21.86	21.75	21.72	16.10	15.74	14.89
		25	25	21.78	21.80	21.78	16.02	15.79	14.95
		50	0	21.69	21.77	21.64	15.93	15.76	14.81
	64QAM	1	0	22.82	22.86	22.74	17.06	16.85	15.91
		1	25	22.83	22.89	22.87	17.07	16.88	16.04
		1	49	22.79	22.74	22.93	17.03	16.73	16.10
		25	0	21.78	21.86	21.58	16.02	15.85	14.75
		25	13	21.84	21.79	21.69	16.08	15.78	14.86
		25	25	21.81	21.70	21.60	16.05	15.69	14.77
		50	0	21.73	21.73	21.57	15.97	15.72	14.74

5.2. Occupied Bandwidth

Ambient condition

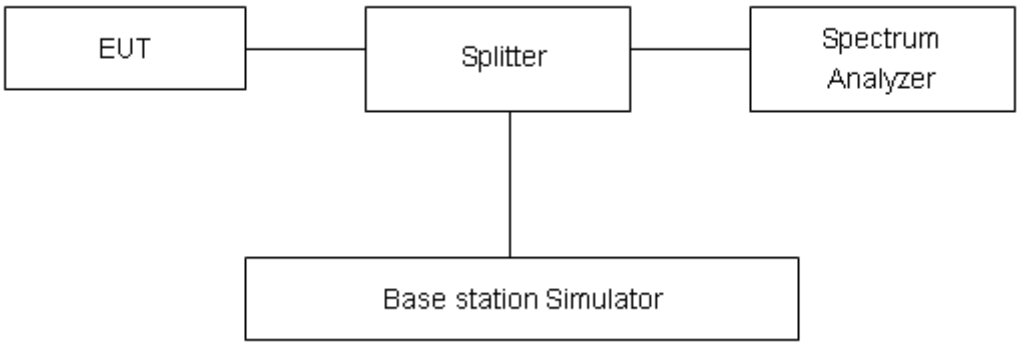
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.
RBW is set to 3kHz, VBW is set to 10kHz for GSM 850,
RBW is set to 51kHz, VBW is set to 160kHz for WCDMA Band V,
RBW is set to 30 kHz, VBW is set to 91kHz for LTE Band 5 (1.4MHz),
RBW is set to 62 kHz, VBW is set to 180kHz for LTE Band 5 (3MHz),
RBW is set to 100 kHz, VBW is set to 300kHz for LTE Band 5 (5MHz),
RBW is set to 200 kHz, VBW is set to 620kHz for LTE Band 5 (10MHz),

99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

No specific occupied bandwidth requirements in part 2.1049.

Measurement Uncertainty

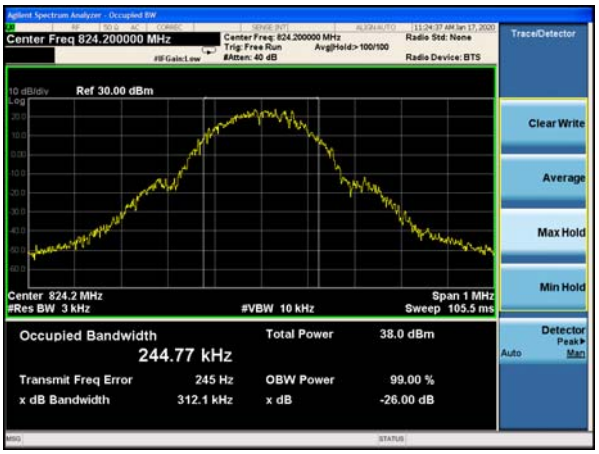
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 624Hz.

Test Result

Mode	Channel	Frequency (MHz)	99% Power Bandwidth (MHz)	-26dBc Bandwidth(MHz)
GSM 850 (GSM)	128	824.2	0.2448	0.312
	190	836.6	0.2467	0.308
	251	848.8	0.2457	0.304
GPRS 850 (GMSK)	128	824.2	0.2490	0.302
	190	836.6	0.2452	0.312
	251	848.8	0.2466	0.314
EGPRS 850 (8-PSK)	128	824.2	0.2461	0.309
	190	836.6	0.2429	0.299
	251	848.8	0.2472	0.312
WCDMA Band V (RMC)	4132	826.4	4.1406	4.682
	4183	836.6	4.1488	4.696
	4233	846.6	4.1335	4.675

LTE Band 5						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% Power Bandwidth(MHz)	-26dBc Bandwidth(MHz)
100%	QPSK	1.4	20407	824.7	1.0888	1.237
			20525	836.5	1.0935	1.239
			20643	848.3	1.0875	1.232
		3	20415	825.5	2.7083	3.019
			20525	836.5	2.7039	2.995
			20635	847.5	2.7112	2.993
		5	20425	826.5	4.5081	4.872
			20525	836.5	4.5032	4.972
			20625	846.5	4.5067	4.963
		10	20450	829	8.9648	9.695
			20525	836.5	8.9734	9.751
			20600	844	8.9996	9.821
	16QAM	1.4	20407	824.7	1.0929	1.234
			20525	836.5	1.0927	1.234
			20643	848.3	1.0897	1.216
		3	20415	825.5	2.7214	2.955
			20525	836.5	2.7076	2.969
			20635	847.5	2.7018	3.016
		5	20425	826.5	4.5013	4.923
			20525	836.5	4.5191	4.956
			20625	846.5	4.5217	4.983
		10	20450	829	8.9709	9.787
			20525	836.5	8.9690	9.707
			20600	844	8.9479	9.660
	64QAM	1.4	20407	824.7	1.0901	1.236
			20525	836.5	1.0911	1.249
			20643	848.3	1.0868	1.226
		3	20415	825.5	2.6917	3.007
			20525	836.5	2.7113	3.015
			20635	847.5	2.7043	2.983
		5	20425	826.5	4.5053	4.906
			20525	836.5	4.5116	4.947
			20625	846.5	4.5080	4.940
		10	20450	829	9.0088	9.751
			20525	836.5	8.9753	9.804
			20600	844	8.9955	9.766

GSM 850 CH-Low



GSM 850 GPRS CH-Low

GSM 850 CH-Middle

GSM 850 GPRS CH-Middle

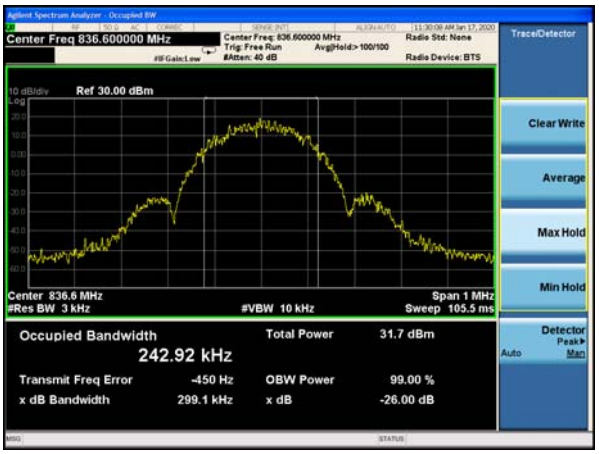
GSM 850 CH-High

GSM 850 GPRS CH-High

GSM 850 EGPRS CH-Low

WCDMA Band V CH-Low

GSM 850 EGPRS CH-Middle

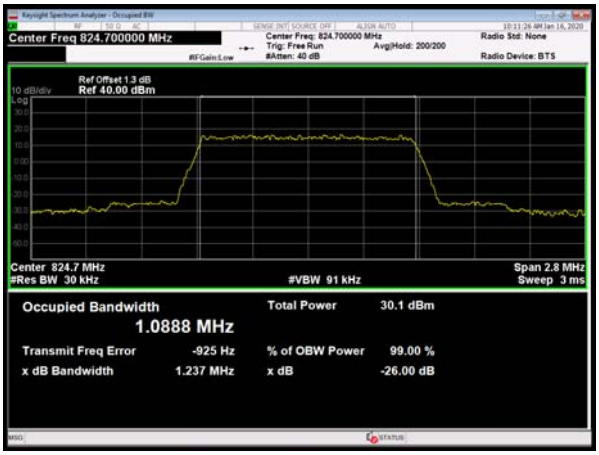


WCDMA Band V CH-Middle

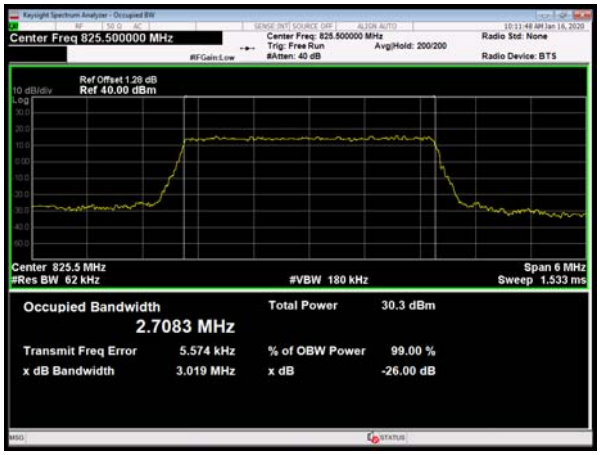
GSM 850 EGPRS CH-High

WCDMA Band V CH-High

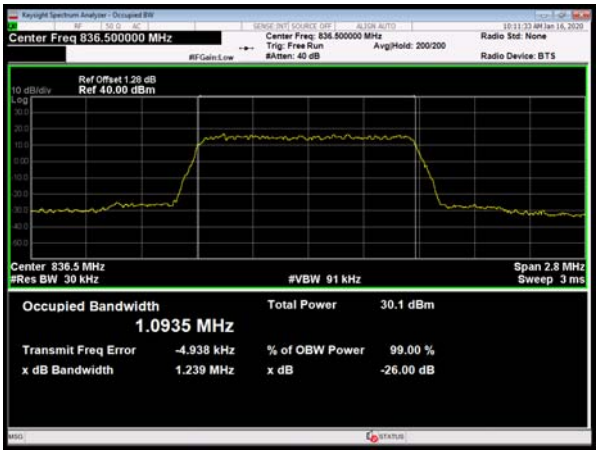
LTE Band 5 QPSK 1.4MHz CH-Low



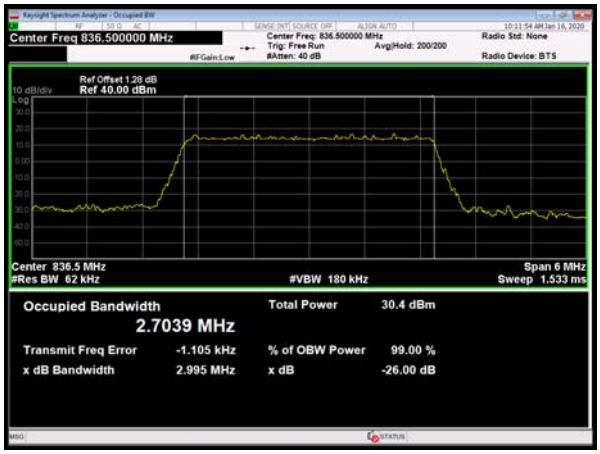
LTE Band 5 QPSK 3MHz CH-Low



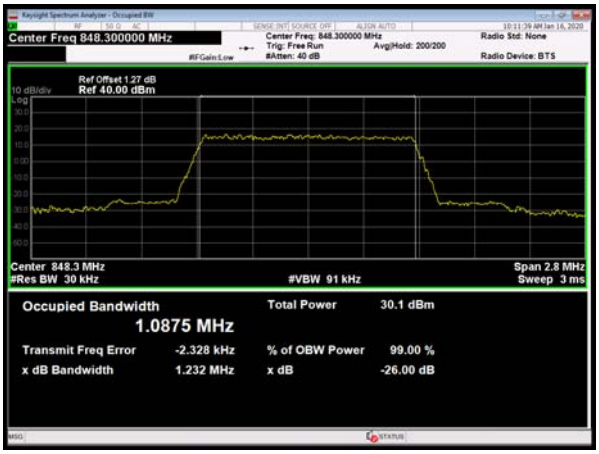
LTE Band 5 QPSK 1.4MHz CH-Middle



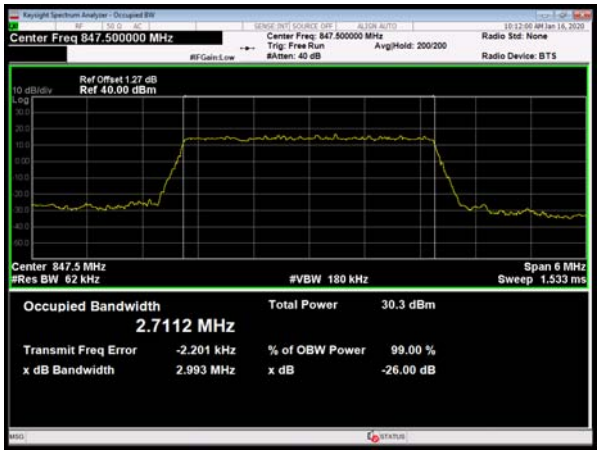
LTE Band 5 QPSK 3MHz CH-Middle



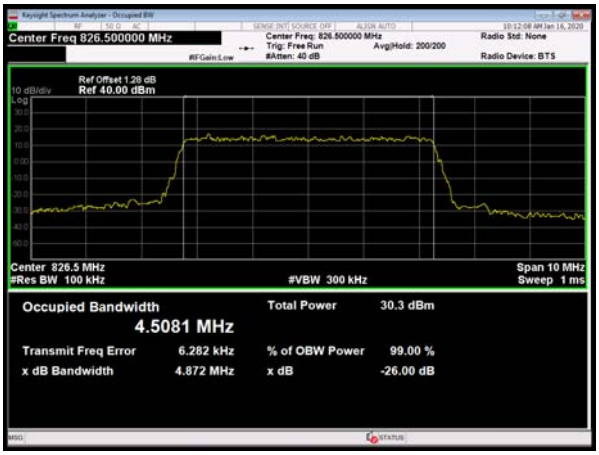
LTE Band 5 QPSK 1.4MHz CH-High



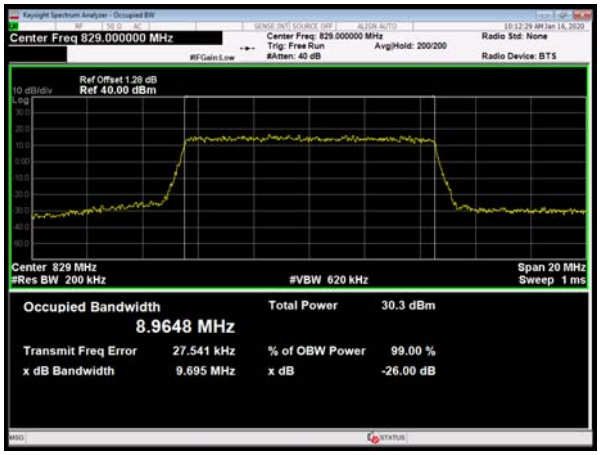
LTE Band 5 QPSK 3MHz CH-High



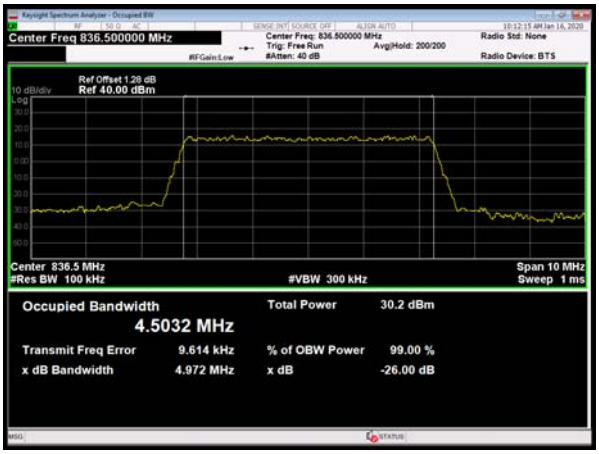
LTE Band 5 QPSK 5MHz CH-Low



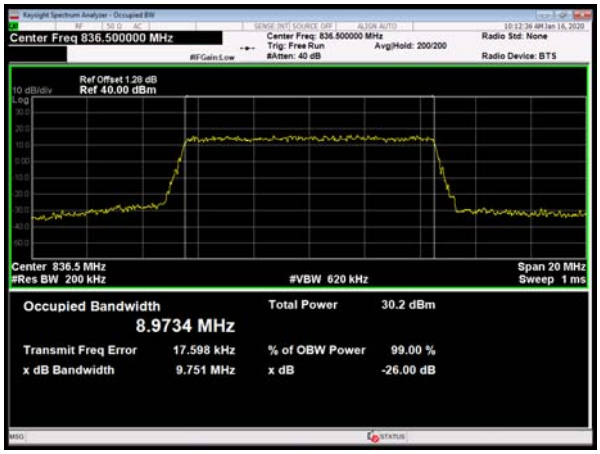
LTE Band 5 QPSK 10MHz CH-Low



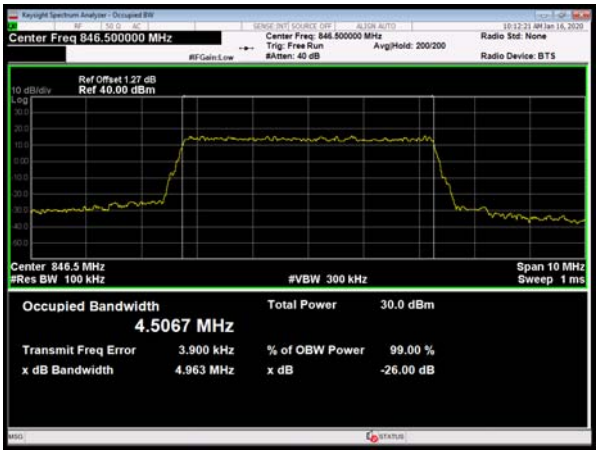
LTE Band 5 QPSK 5MHz CH-Middle



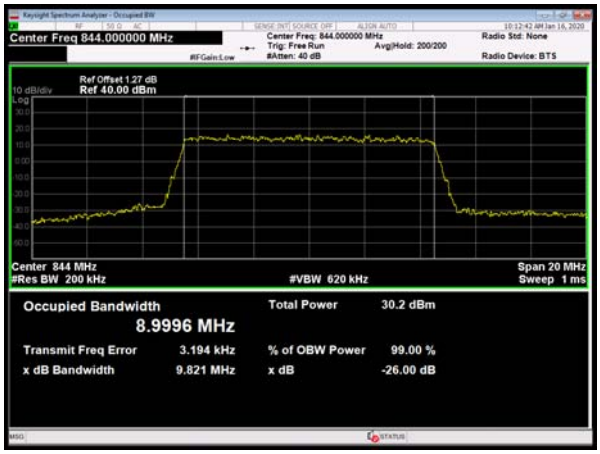
LTE Band 5 QPSK 10MHz CH-Middle



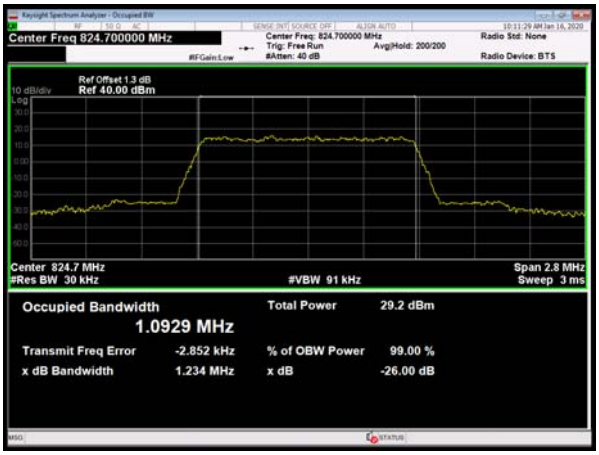
LTE Band 5 QPSK 5MHz CH-High



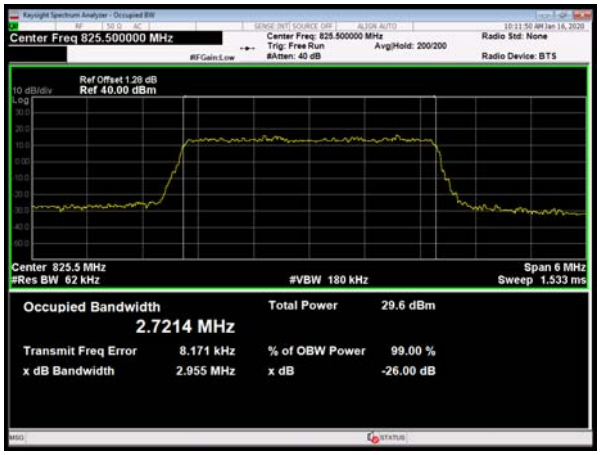
LTE Band 5 QPSK 10MHz CH-High



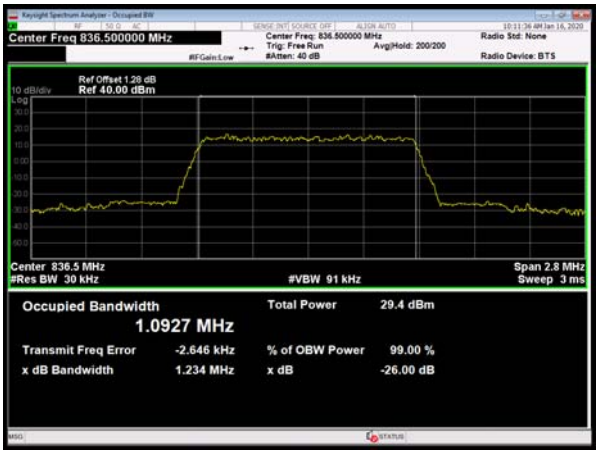
LTE Band 5 16QAM 1.4MHz CH-Low



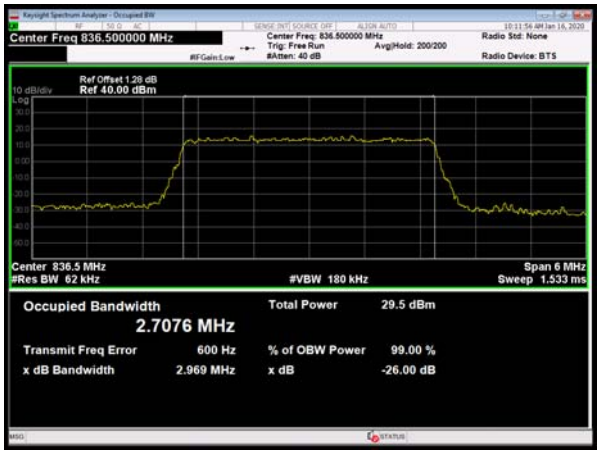
LTE Band 5 16QAM 3MHz CH-Low



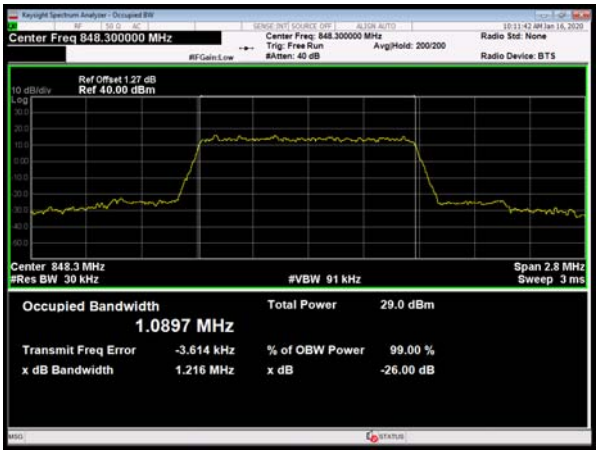
LTE Band 5 16QAM 1.4MHz CH-Middle



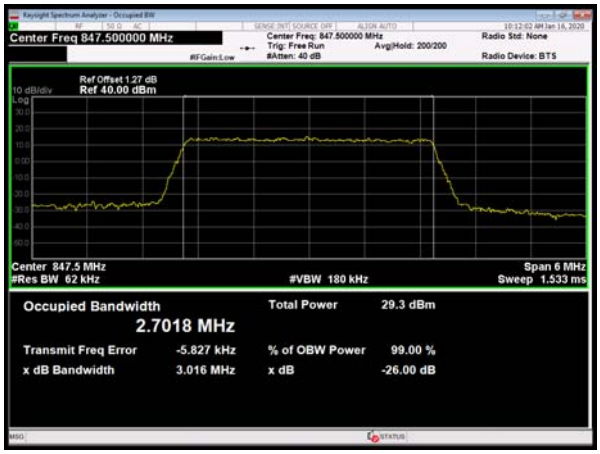
LTE Band 5 16QAM 3MHz CH-Middle



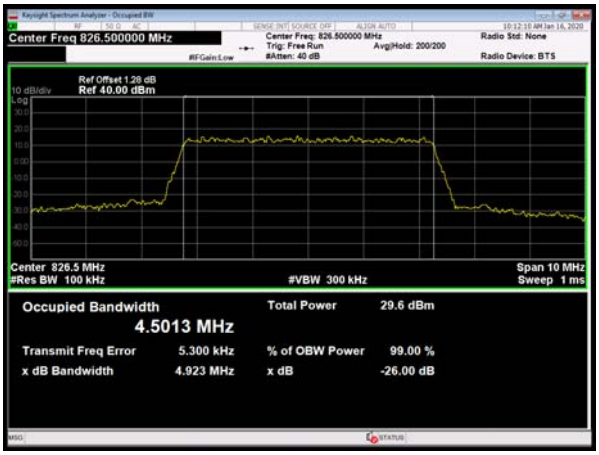
LTE Band 5 16QAM 1.4MHz CH-High



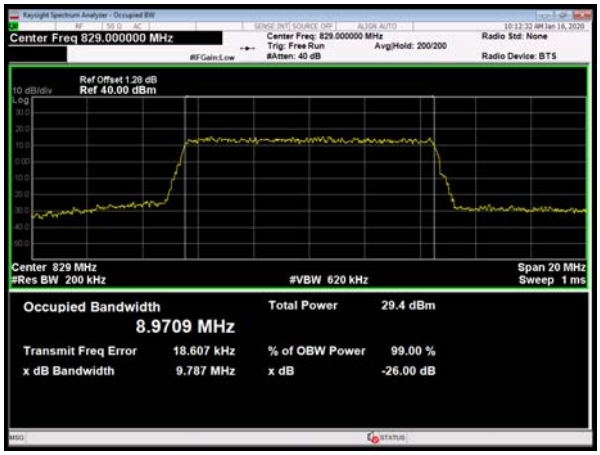
LTE Band 5 16QAM 3MHz CH-High



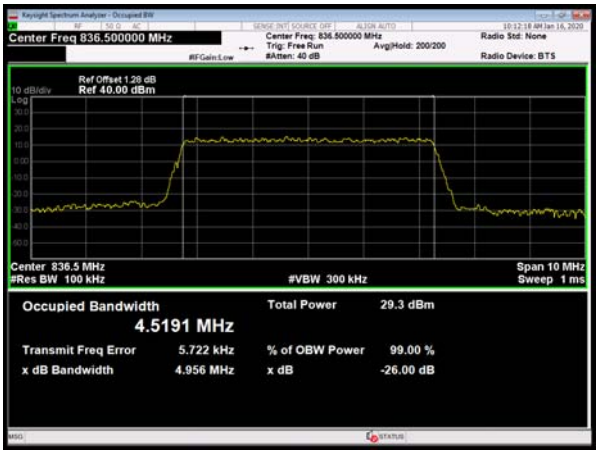
LTE Band 5 16QAM 5MHz CH-Low



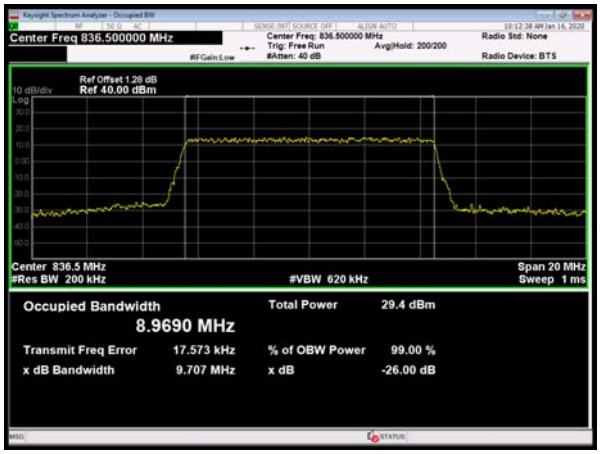
LTE Band 5 16QAM 10MHz CH-Low



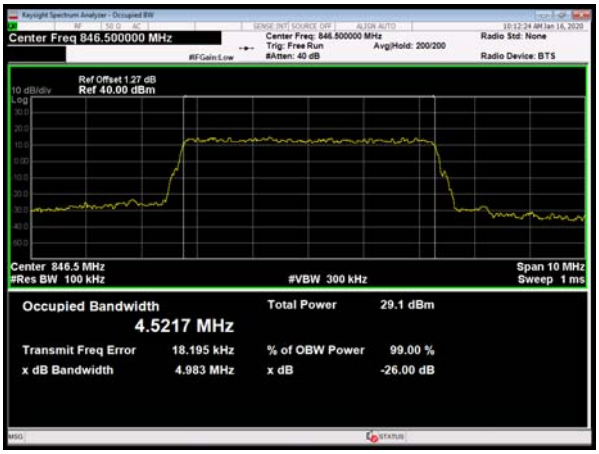
LTE Band 5 16QAM 5MHz CH-Middle



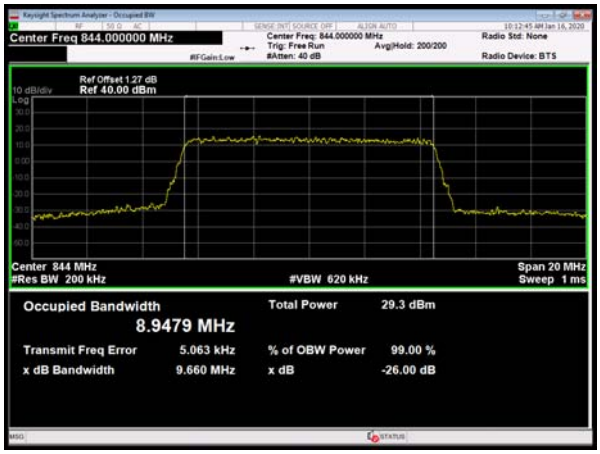
LTE Band 5 16QAM 10MHz CH-Middle



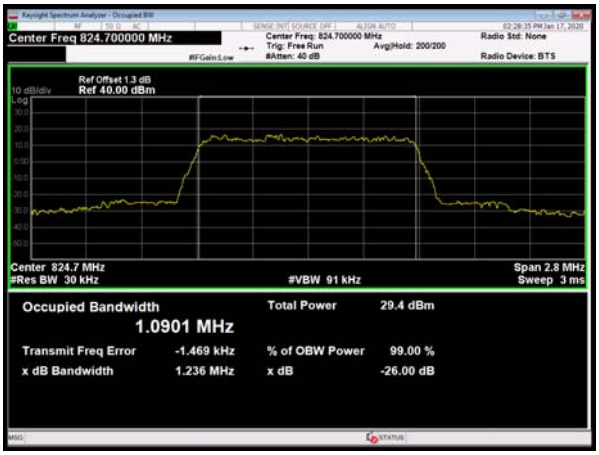
LTE Band 5 16QAM 5MHz CH-High



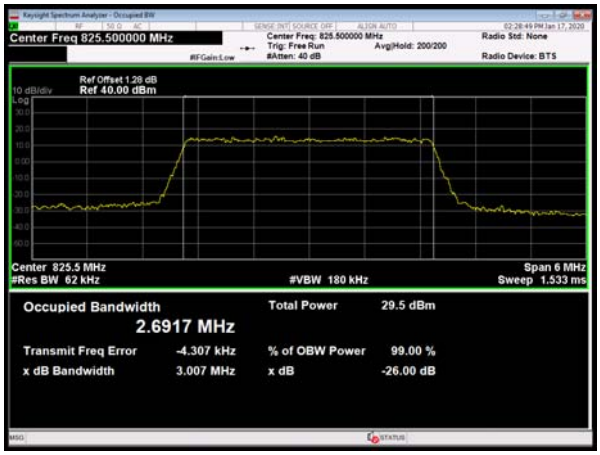
LTE Band 5 16QAM 10MHz CH-High



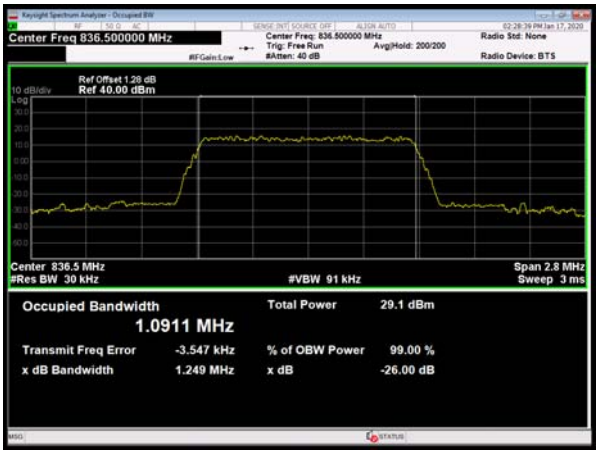
LTE Band 5 64QAM 1.4MHz CH-Low



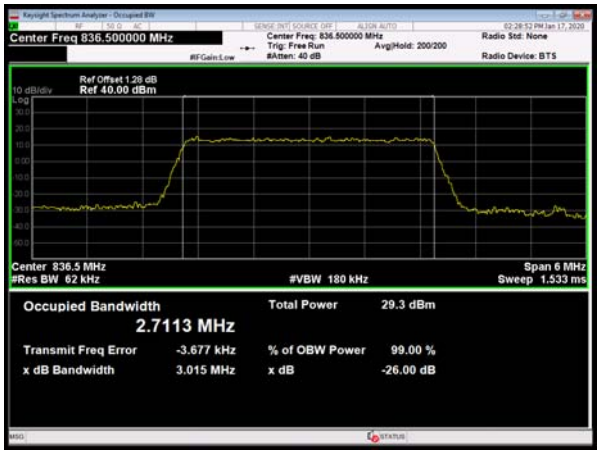
LTE Band 5 64QAM 3MHz CH-Low



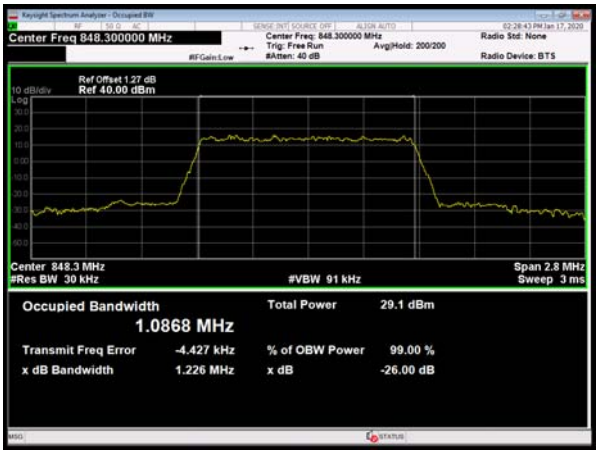
LTE Band 5 64QAM 1.4MHz CH-Middle



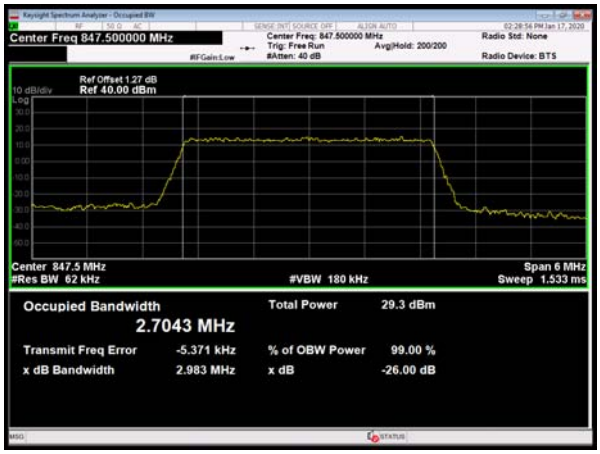
LTE Band 5 64QAM 3MHz CH-Middle



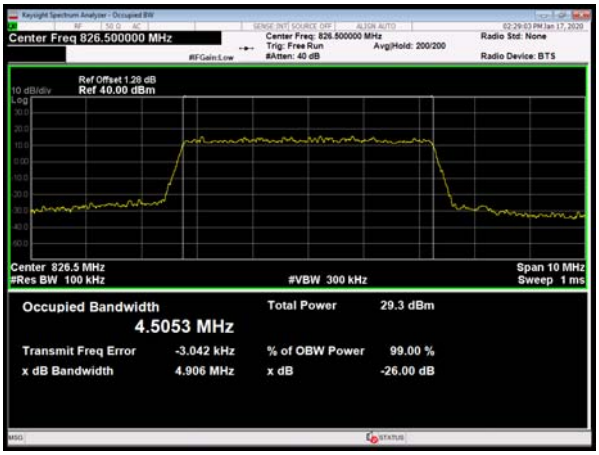
LTE Band 5 64QAM 1.4MHz CH-High



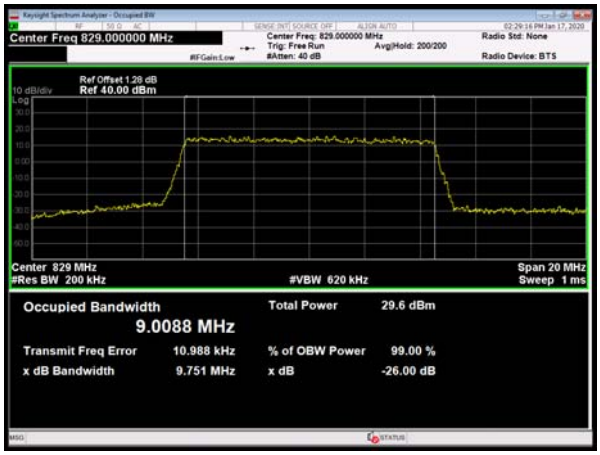
LTE Band 5 64QAM 3MHz CH-High



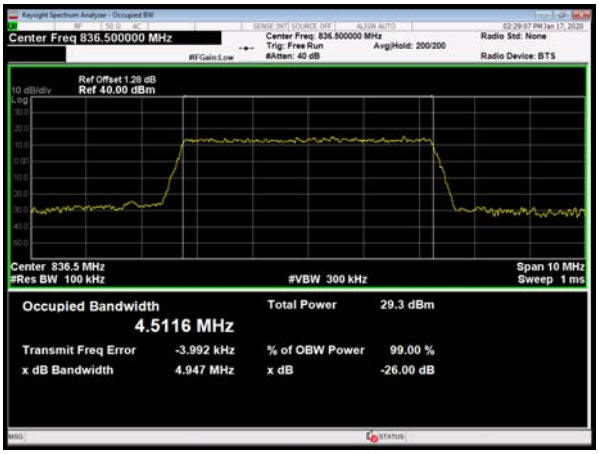
LTE Band 5 64QAM 5MHz CH-Low



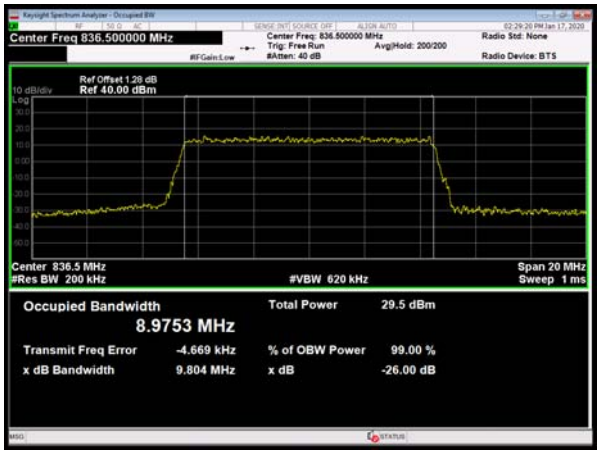
LTE Band 5 64QAM 10MHz CH-Low



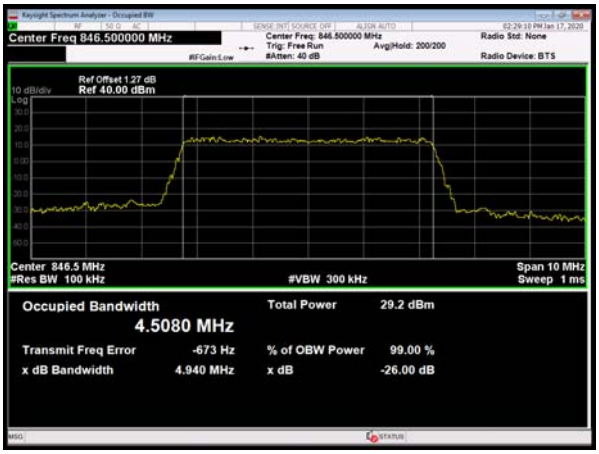
LTE Band 5 64QAM 5MHz CH-Middle



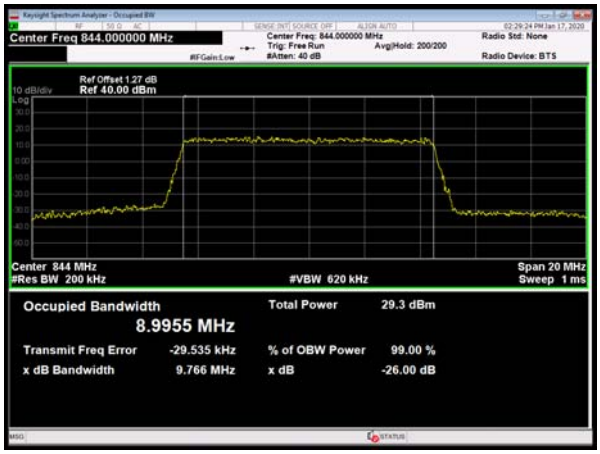
LTE Band 5 64QAM 10MHz CH-Middle



LTE Band 5 64QAM 5MHz CH-High



LTE Band 5 64QAM 10MHz CH-High



5.3. Band Edge Compliance

Ambient condition

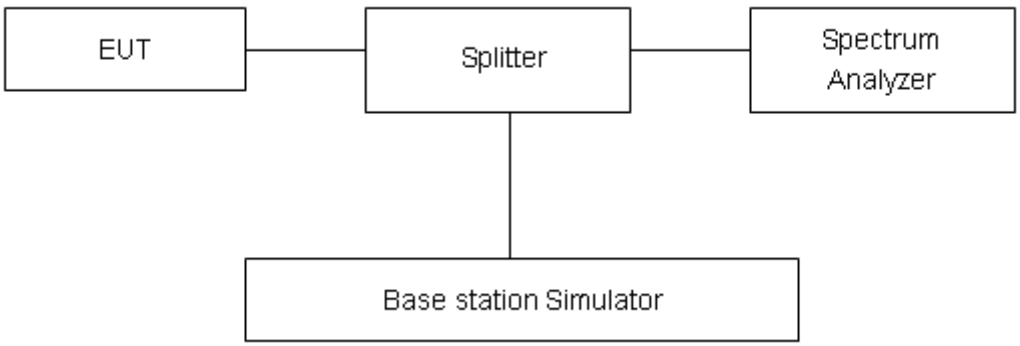
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured. The average detector is used.
RBW is set to 3kHz,VBW is set to 10kHz for GSM 850,
RBW is set to 51kHz,VBW is set to 160kHz for WCDMA Band V,
RBW is set to 15kHz, VBW is set to 43kHz for LTE Band 5 (1.4MHz),
RBW is set to 30kHz,VBW is set to 91kHz for LTE Band 5 (3MHz),
RBW is set to 51kHz,VBW is set to 150kHz for LTE Band 5 (5MHz),
RBW is set to 100kHz,VBW is set to 300kHz for LTE Band 5 (10MHz),

Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

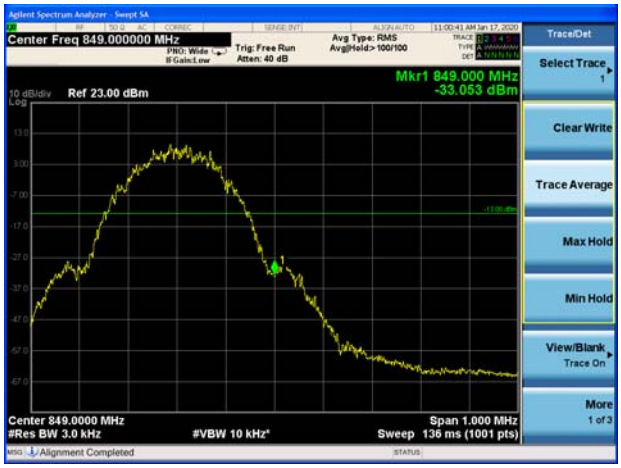
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U=0.684dB.

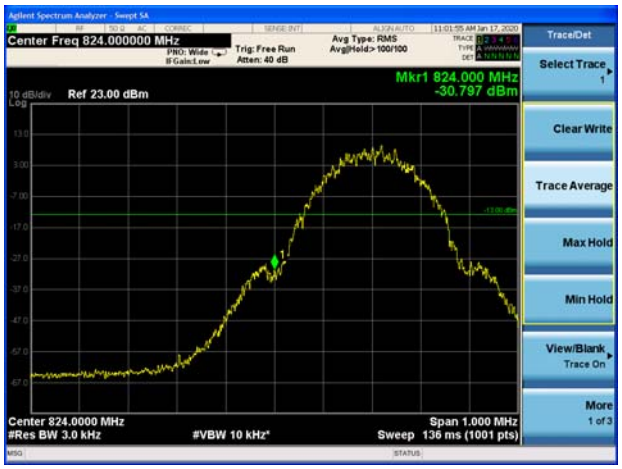
Test Result:

GSM 850 CH-Low

GSM 850 CH-High

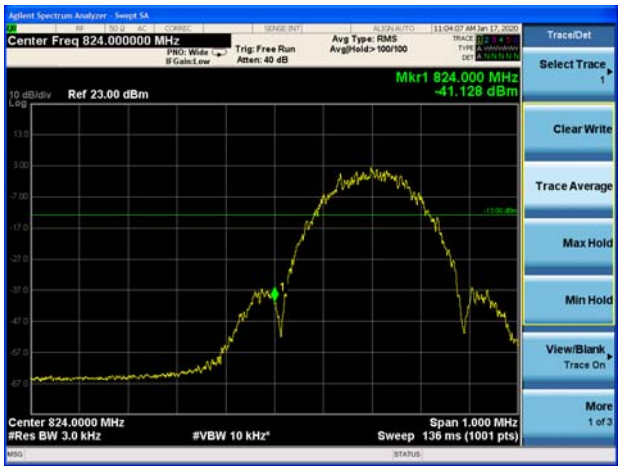


GSM 850 GPRS CH-Low



GSM 850 GPRS CH-High

GSM 850 EGPRS CH-Low



GSM 850 EGPRS CH-High

WCDMA Band V CH-Low

WCDMA Band V CH-High

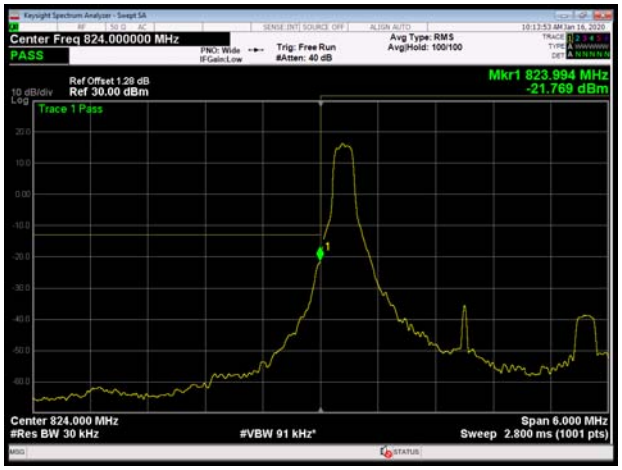
LTE Band 5 QPSK 1.4MHz CH-Low 1RB

LTE Band 5 QPSK 1.4MHz CH-High 1RB

LTE Band 5 QPSK 1.4MHz CH-Low 100%RB

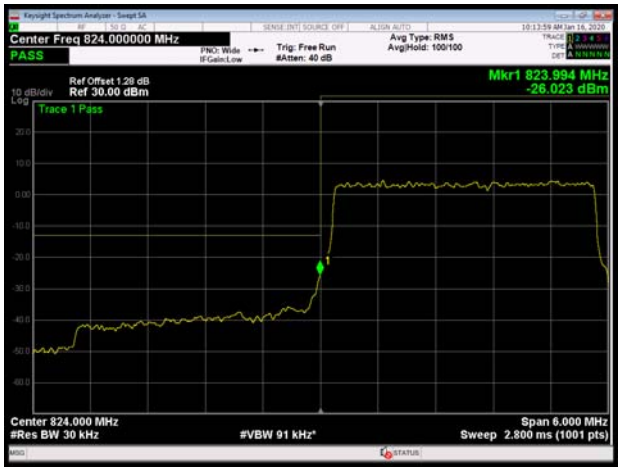
LTE Band 5 QPSK 1.4MHz CH-High 100%RB

LTE Band 5 QPSK 3MHz CH-Low 1RB



LTE Band 5 QPSK 3MHz CH-High 1RB

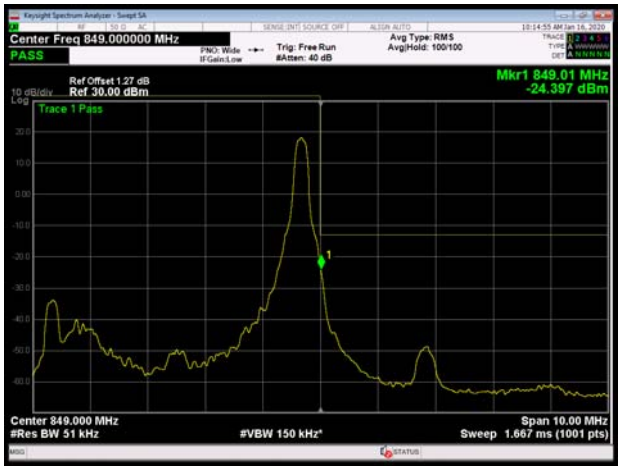
LTE Band 5 QPSK 3MHz CH-Low 100%RB



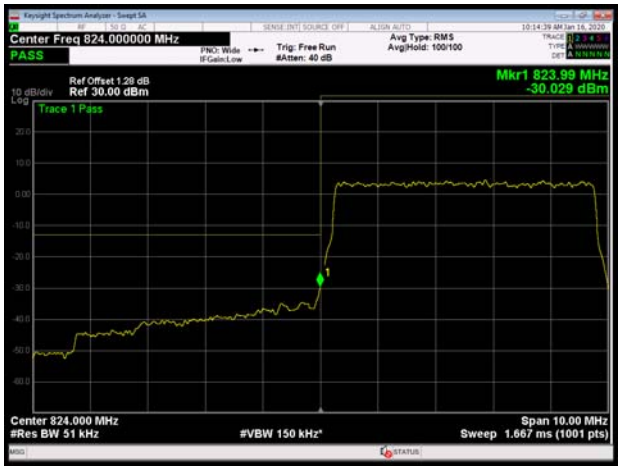
LTE Band 5 QPSK 3MHz CH-High 100%RB

LTE Band 5 QPSK 5MHz CH-Low 1RB

LTE Band 5 QPSK 5MHz CH-High 1RB

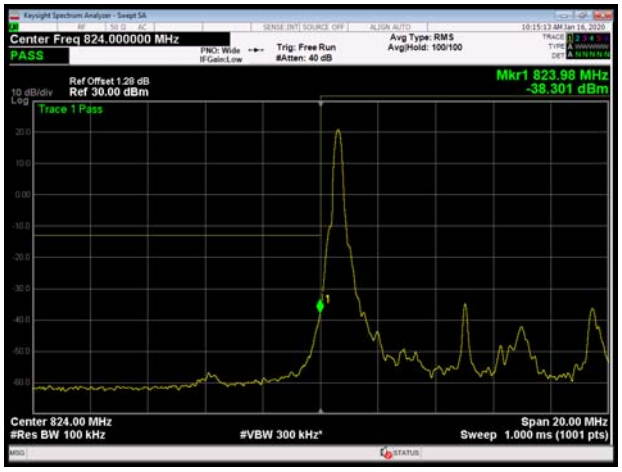


LTE Band 5 QPSK 5MHz CH-Low 100%RB

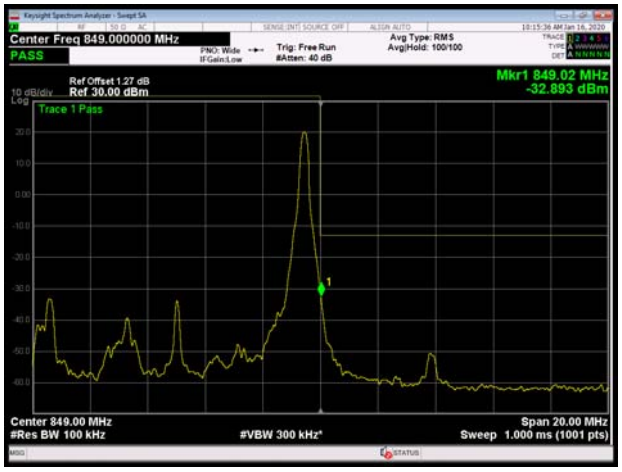


LTE Band 5 QPSK 5MHz CH-High 100%RB

LTE Band 5 QPSK 10MHz CH-Low 1RB



LTE Band 5 QPSK 10MHz CH-High 1RB



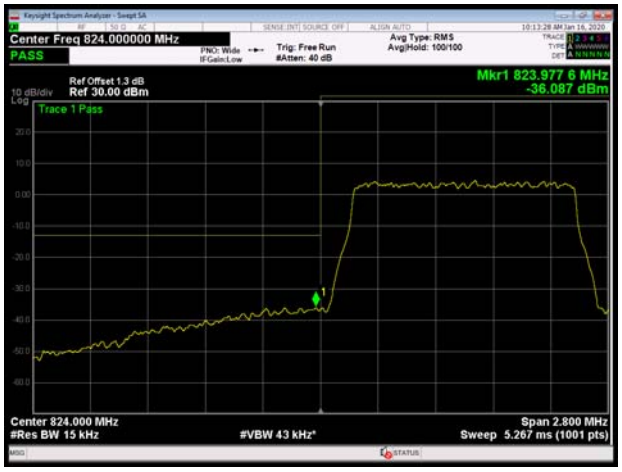
LTE Band 5 QPSK 10MHz CH-Low 100%RB

LTE Band 5 QPSK 10MHz CH-High 100%RB

LTE Band 5 16QAM 1.4MHz CH-Low 1RB

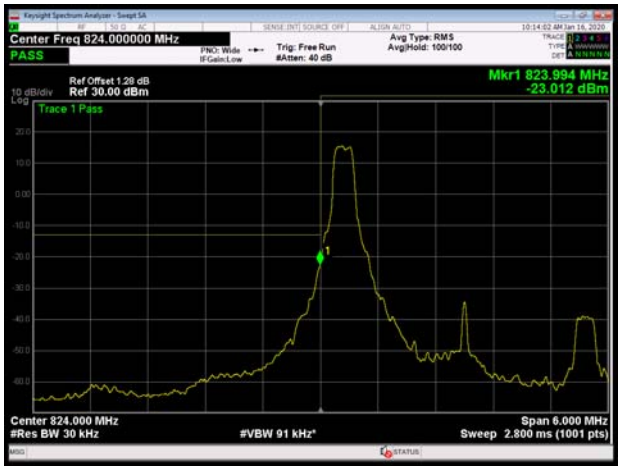
LTE Band 5 16QAM 1.4MHz CH-High 1RB

LTE Band 5 16QAM 1.4MHz CH-Low 100%RB

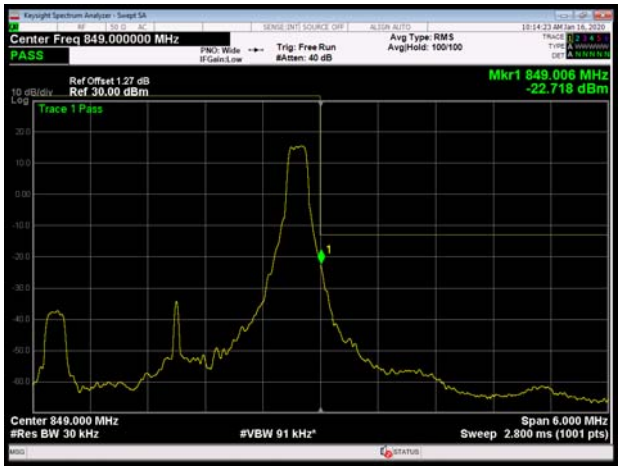


LTE Band 5 16QAM 1.4MHz CH-High 100%RB

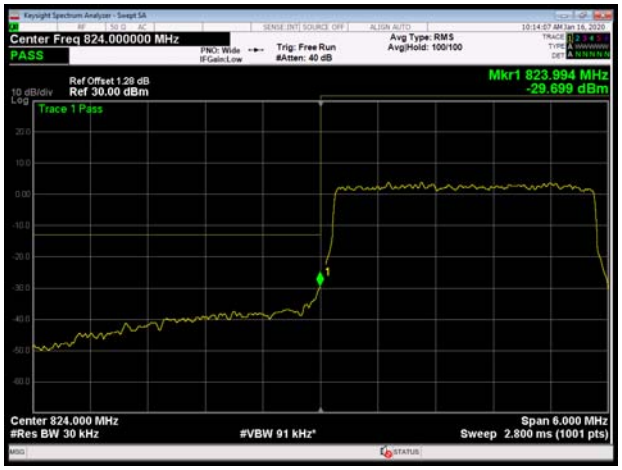
LTE Band 5 16QAM 3MHz CH-Low 1RB



LTE Band 5 16QAM 3MHz CH-High 1RB

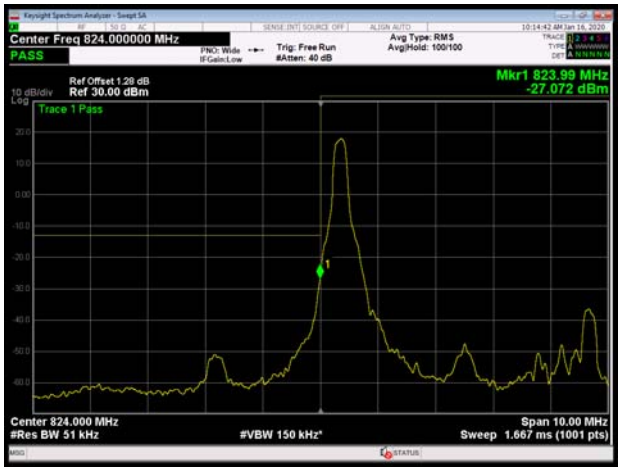


LTE Band 5 16QAM 3MHz CH-Low 100%RB



LTE Band 5 16QAM 3MHz CH-High 100%RB

LTE Band 5 16QAM 5MHz CH-Low 1RB

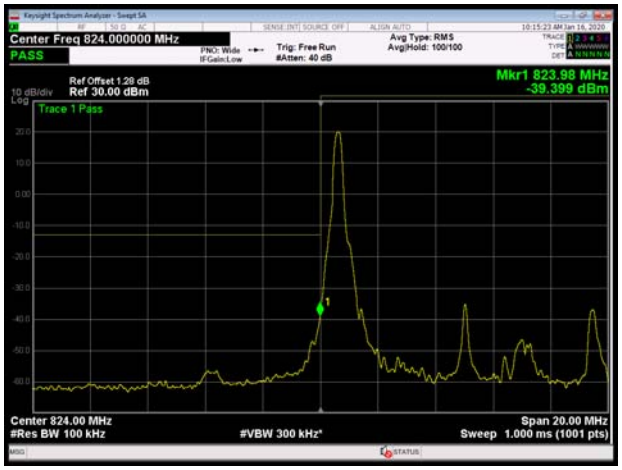


LTE Band 5 16QAM 5MHz CH-High 1RB

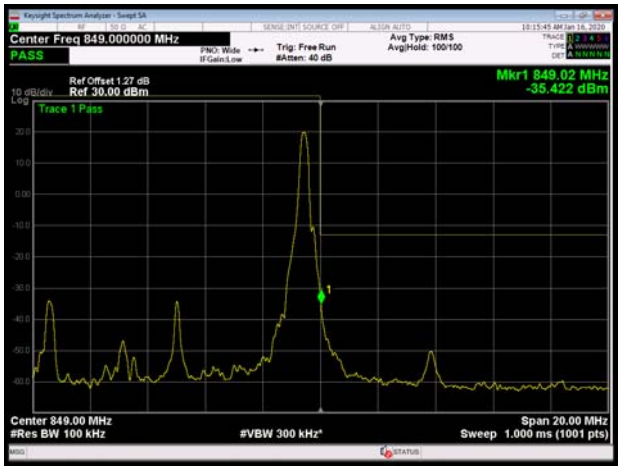
LTE Band 5 16QAM 5MHz CH-Low 100%RB

LTE Band 5 16QAM 5MHz CH-High 100%RB

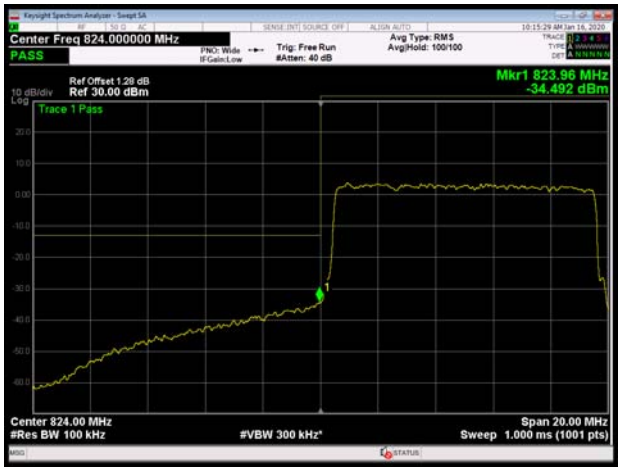
LTE Band 5 16QAM 10MHz CH-Low 1RB



LTE Band 5 16QAM 10MHz CH-High 1RB



LTE Band 5 16QAM 10MHz CH-Low 100%RB



LTE Band 5 16QAM 10MHz CH-High 100%RB

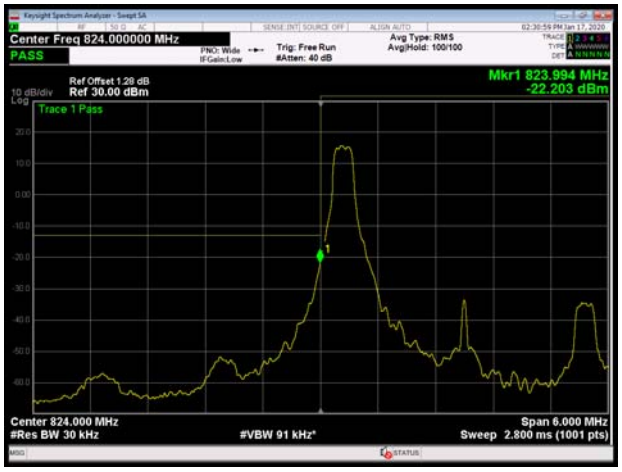
LTE Band 5 64QAM 1.4MHz CH-Low 1RB

LTE Band 5 64QAM 1.4MHz CH-High 1RB

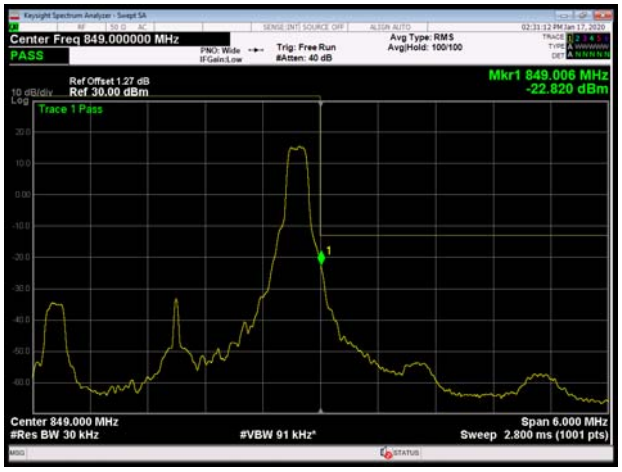
LTE Band 5 64QAM 1.4MHz CH-Low 100%RB

LTE Band 5 64QAM 1.4MHz CH-High 100%RB

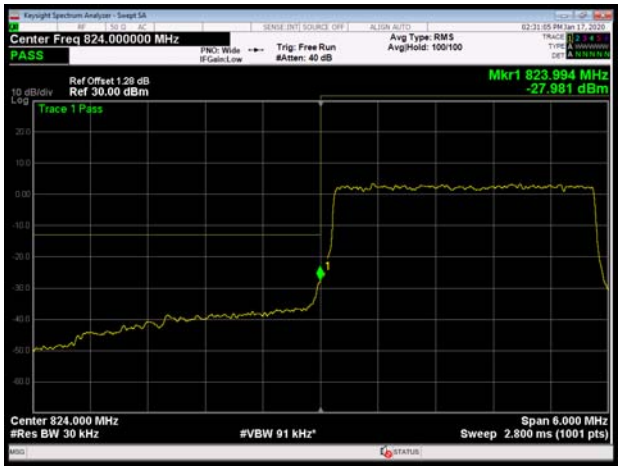
LTE Band 5 64QAM 3MHz CH-Low 1RB



LTE Band 5 64QAM 3MHz CH-High 1RB

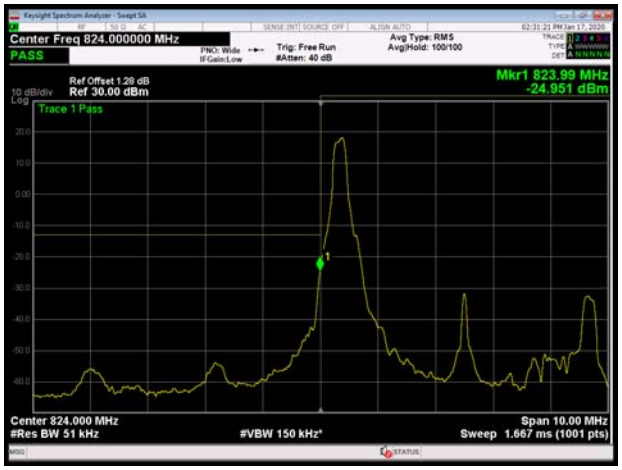


LTE Band 5 64QAM 3MHz CH-Low 100%RB

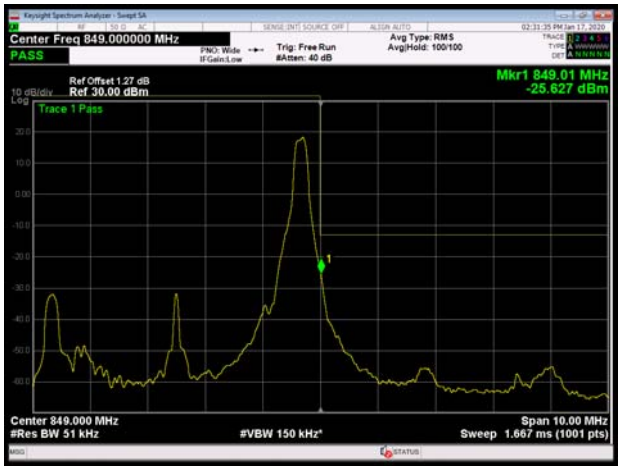


LTE Band 5 64QAM 3MHz CH-High 100%RB

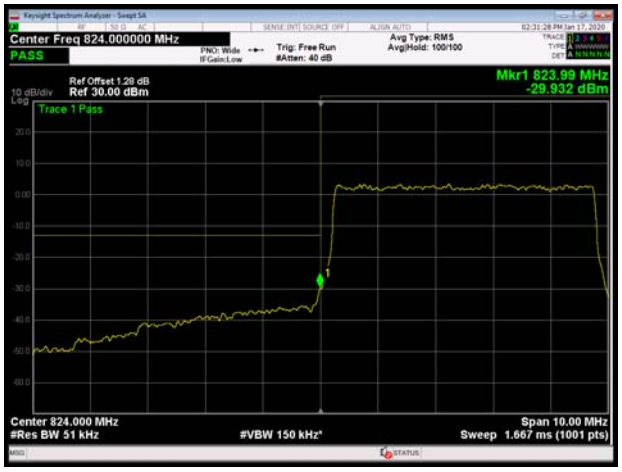
LTE Band 5 64QAM 5MHz CH-Low 1RB



LTE Band 5 64QAM 5MHz CH-High 1RB

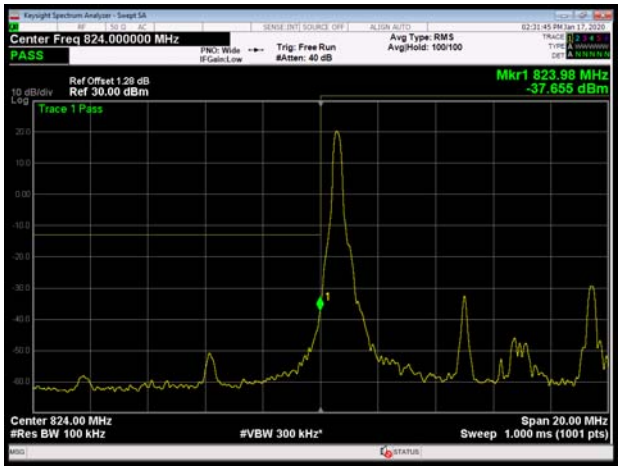


LTE Band 5 64QAM 5MHz CH-Low 100%RB

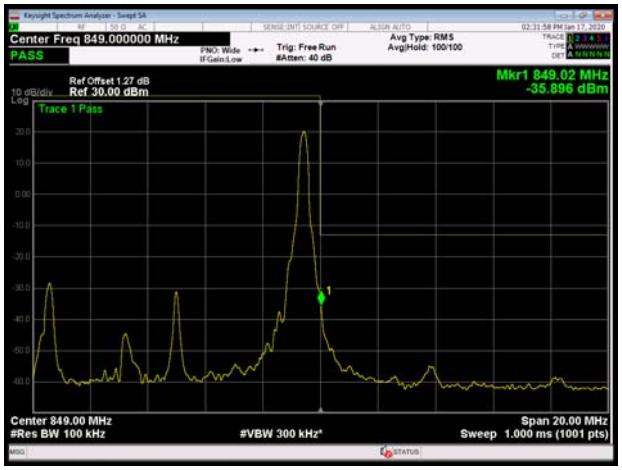


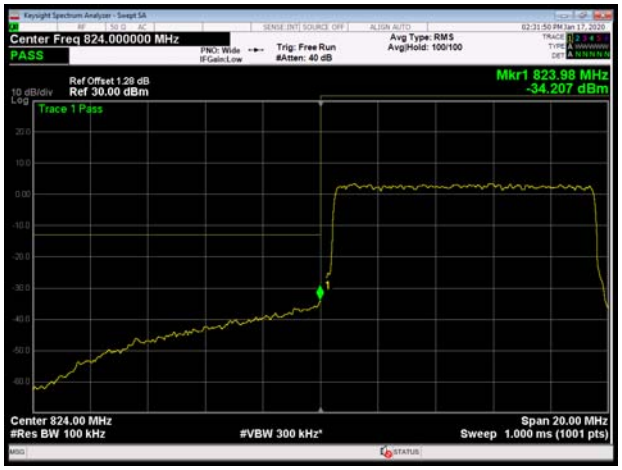
LTE Band 5 64QAM 5MHz CH-High 100%RB

LTE Band 5 64QAM 10MHz CH-Low 1RB



LTE Band 5 64QAM 10MHz CH-High 1RB



LTE Band 5 64QAM 10MHz CH-Low 100%RB	LTE Band 5 64QAM 10MHz CH-High 100%RB
	

5.4. Peak-to-Average Power Ratio (PAPR)

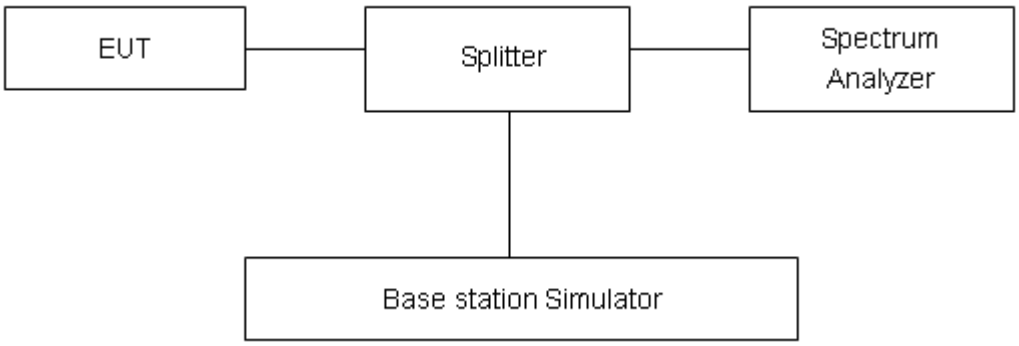
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as P_{Pk}. And measure the total average power and record as P_{Avg}. Both the peak and average power levels must be expressed in the same logarithmic units (*e.g.*, dBm). Determine the PAPR from:
PAPR (dB) = P_{Pk} (dBm) - P_{Avg} (dBm).

Test Setup



Limits

According to the Sec. 22.913(d), The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.4 dB.

Test Results

Mode	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
GSM 850 (GSM)	128	824.2	34.92	33.24	1.68	≤13	PASS
	190	836.6	35.09	33.30	1.79	≤13	PASS
	251	848.8	34.96	33.12	1.84	≤13	PASS
GPRS 850 (GMSK)	128	824.2	35.02	33.16	1.86	≤13	PASS
	190	836.6	34.93	33.20	1.73	≤13	PASS
	251	848.8	35.00	33.06	1.94	≤13	PASS
EGPRS 850 (8-PSK)	128	824.2	29.46	27.12	2.34	≤13	PASS
	190	836.6	29.69	27.28	2.41	≤13	PASS
	251	848.8	29.30	27.02	2.28	≤13	PASS
WCDMA Band V (RMC)	4132	826.4	26.00	22.92	3.08	≤13	PASS
	4183	836.6	26.09	23.04	3.05	≤13	PASS
	4233	846.6	26.07	23.00	3.07	≤13	PASS

LTE Band 5								
RB	Modulation	Bandwidth (MHz)	Channel	Peak	Avg	PAPR	Limit (dB)	Conclusion
100%	QPSK	1.4M	20407	27.35	22.50	4.85	≤13	PASS
			20525	27.27	22.46	4.81	≤13	PASS
			20643	27.21	22.34	4.87	≤13	PASS
		3M	20415	27.26	22.55	4.71	≤13	PASS
			20525	27.21	22.57	4.64	≤13	PASS
			20635	27.14	22.42	4.72	≤13	PASS
		5M	20425	27.46	22.56	4.90	≤13	PASS
			20525	27.36	22.56	4.80	≤13	PASS
			20625	27.30	22.44	4.86	≤13	PASS
		10M	20450	27.43	22.64	4.79	≤13	PASS
			20525	27.31	22.54	4.77	≤13	PASS
			20600	27.13	22.41	4.72	≤13	PASS
	16QAM	1.4M	20407	27.60	21.52	6.08	≤13	PASS
			20525	27.48	21.51	5.97	≤13	PASS
			20643	27.57	21.43	6.14	≤13	PASS
		3M	20415	27.64	21.65	5.99	≤13	PASS
			20525	27.61	21.65	5.96	≤13	PASS

			20635	27.54	21.54	6.00	≤13	PASS
		5M	20425	27.68	21.63	6.05	≤13	PASS
			20525	27.61	21.64	5.97	≤13	PASS
			20625	27.53	21.53	6.00	≤13	PASS
		10M	20450	27.69	21.69	6.00	≤13	PASS
			20525	27.59	21.67	5.92	≤13	PASS
			20600	27.39	21.47	5.92	≤13	PASS
	64QAM	1.4M	20407	27.58	21.52	6.06	≤13	PASS
			20525	27.48	21.52	5.96	≤13	PASS
			20643	27.57	21.53	6.04	≤13	PASS
		3M	20415	27.69	21.64	6.05	≤13	PASS
			20525	27.54	21.60	5.94	≤13	PASS
			20635	27.58	21.63	5.95	≤13	PASS
		5M	20425	27.69	21.63	6.06	≤13	PASS
			20525	27.60	21.63	5.97	≤13	PASS
			20625	27.50	21.52	5.98	≤13	PASS
		10M	20450	27.70	21.69	6.01	≤13	PASS
			20525	27.59	21.67	5.92	≤13	PASS
			20600	27.42	21.52	5.90	≤13	PASS

5.5. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to +55°C in 10°C step size,

(1) With all power removed, the temperature was decreased to 0°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

(3) Repeat the above measurements at 10°C increments from -30°C to +55°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements. Frequency Stability (Voltage Variation)

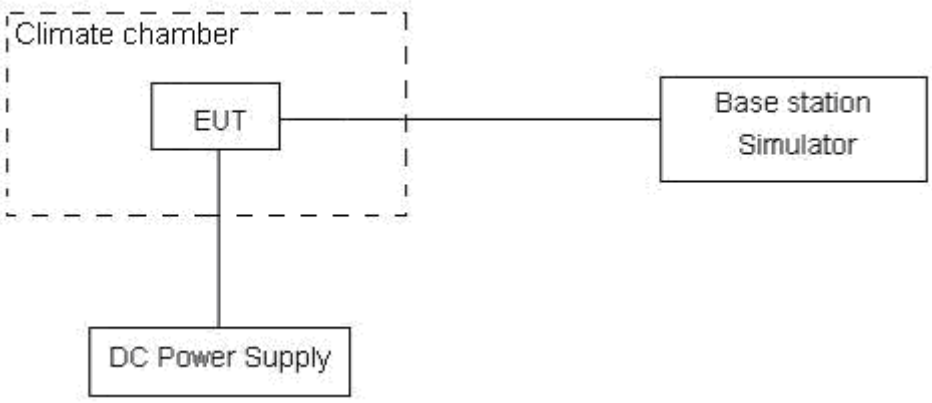
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 3.6 V and 4.4 V, with a nominal voltage of 3.8V.

Test setup



Limits

According to the Sec. 22.355, the frequency stability of the carrier shall be accurate to within 2.5 ppm of the received frequency for mobile stations.

Limits	≤ 2.5 ppm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75％ confidence level for the normal distribution is with the coverage factor k = 3, U= 0.01ppm.

Test Result

GSM850						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Temperature	Voltage	GMSK	8PSK	GMSK	8PSK	
Normal(25℃)	Normal	14.48	5.25	0.00770	0.00279	PASS
Extreme(55℃)		7.83	3.18	0.00417	0.00169	PASS
Extreme(50℃)		3.10	2.17	0.00165	0.00115	PASS
Extreme(40℃)		10.12	11.26	0.00538	0.00599	PASS
Extreme(30℃)		16.38	11.72	0.00871	0.00623	PASS
Extreme(20℃)		13.39	2.33	0.00712	0.00124	PASS
Extreme(10℃)		10.62	2.61	0.00565	0.00139	PASS
Extreme(0℃)		15.48	2.02	0.00823	0.00108	PASS
Extreme(-10℃)		11.90	7.24	0.00633	0.00385	PASS
Extreme(-20℃)		12.00	11.34	0.00638	0.00603	PASS
Extreme(-30℃)		16.06	17.29	0.00854	0.00920	PASS
25℃	LV	1.08	1.24	0.00057	0.00066	PASS
	HV	7.93	6.86	0.00422	0.00365	PASS

WCDMA Band V						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability(ppm)	Frequency Stability(ppm)	Verdict
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal(25℃)	Normal	11.64	4.60	0.00619	0.00245	PASS
Extreme(55℃)		3.37	7.15	0.00179	0.00380	PASS
Extreme(50℃)		5.99	9.65	0.00319	0.00513	PASS
Extreme(40℃)		3.88	9.98	0.00207	0.00531	PASS
Extreme(30℃)		8.69	8.78	0.00462	0.00467	PASS
Extreme(20℃)		3.99	17.33	0.00212	0.00922	PASS
Extreme(10℃)		7.96	7.04	0.00423	0.00375	PASS
Extreme(0℃)		16.43	2.51	0.00874	0.00134	PASS
Extreme(-10℃)		5.58	9.92	0.00297	0.00528	PASS
Extreme(-20℃)		10.31	2.39	0.00548	0.00127	PASS
Extreme(-30℃)		11.50	16.29	0.00612	0.00866	PASS
25℃	LV	3.75	4.61	0.00200	0.00245	PASS
	HV	1.21	6.43	0.00065	0.00342	PASS

LTE Band 5								
Condition		Freq. Error (Hz)	Freq. Error (Hz)	Freq. Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	1.4MHz							
Temperature	Voltage	64QAM	16QAM	QPSK	64QAM	16QAM	QPSK	
Normal(25℃)	Normal	14.71	3.16	10.76	0.00783	0.00168	0.00572	Pass
Extreme(55℃)		13.61	11.60	9.31	0.00724	0.00617	0.00495	Pass
Extreme(50℃)		7.55	14.10	17.99	0.00402	0.00750	0.00957	Pass
Extreme(40℃)		5.90	1.29	14.97	0.00314	0.00069	0.00796	Pass
Extreme(30℃)		6.47	6.31	16.92	0.00344	0.00336	0.00900	Pass
Extreme(20℃)		10.67	12.90	14.65	0.00567	0.00686	0.00779	Pass
Extreme(10℃)		15.04	10.85	1.38	0.00800	0.00577	0.00073	Pass
Extreme(0℃)		17.81	11.42	14.89	0.00948	0.00608	0.00792	Pass
Extreme(-10℃)		11.11	6.06	8.92	0.00591	0.00322	0.00475	Pass
Extreme(-20℃)		12.20	2.48	9.84	0.00649	0.00132	0.00523	Pass
Extreme(-30℃)		15.47	14.22	9.11	0.00823	0.00756	0.00485	Pass
25℃	LV	13.14	2.47	1.45	0.00699	0.00131	0.00077	Pass
	HV	5.34	1.16	15.12	0.00284	0.00061	0.00804	Pass
Condition		Freq. Error (Hz)	Freq. Error (Hz)	Freq. Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	3MHz							
Temperature	Voltage	64QAM	16QAM	QPSK	64QAM	16QAM	QPSK	
Normal(25℃)	Normal	11.87	2.30	1.50	0.00632	0.00122	0.00080	PASS
Extreme(55℃)		17.88	16.85	15.36	0.00951	0.00896	0.00817	PASS
Extreme(50℃)		5.90	17.50	17.00	0.00314	0.00931	0.00904	PASS
Extreme(40℃)		11.32	13.53	15.54	0.00602	0.00720	0.00827	PASS
Extreme(30℃)		5.92	11.95	5.07	0.00315	0.00635	0.00270	PASS
Extreme(20℃)		13.59	17.11	9.20	0.00723	0.00910	0.00489	PASS
Extreme(10℃)		13.70	9.34	10.46	0.00729	0.00497	0.00556	PASS
Extreme(0℃)		14.91	8.57	5.08	0.00793	0.00456	0.00270	PASS
Extreme(-10℃)		4.67	6.04	14.45	0.00249	0.00321	0.00769	PASS
Extreme(-20℃)		17.54	10.70	7.08	0.00933	0.00569	0.00377	PASS
Extreme(-30℃)		2.51	1.26	15.50	0.00133	0.00067	0.00824	PASS
25℃	LV	17.12	15.74	1.62	0.00911	0.00837	0.00086	PASS
	HV	9.43	13.38	2.74	0.00502	0.00711	0.00146	PASS
Condition		Freq. Error (Hz)	Freq. Error (Hz)	Freq. Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	5MHz							
Temperature	Voltage	64QAM	16QAM	QPSK	64QAM	16QAM	QPSK	

Normal(25℃)	Normal	4.50	6.32	9.15	0.00240	0.00336	0.00486	PASS
Extreme(55℃)		6.28	5.01	7.80	0.00334	0.00267	0.00415	PASS
Extreme(50℃)		1.22	9.86	8.60	0.00065	0.00524	0.00458	PASS
Extreme(40℃)		2.13	14.16	3.76	0.00113	0.00753	0.00200	PASS
Extreme(30℃)		16.75	6.55	1.26	0.00891	0.00348	0.00067	PASS
Extreme(20℃)		2.79	9.86	13.54	0.00149	0.00525	0.00720	PASS
Extreme(10℃)		6.92	13.01	7.10	0.00368	0.00692	0.00378	PASS
Extreme(0℃)		13.74	7.35	16.40	0.00731	0.00391	0.00872	PASS
Extreme(-10℃)		3.57	12.53	6.06	0.00190	0.00666	0.00322	PASS
Extreme(-20℃)		3.31	3.80	14.73	0.00176	0.00202	0.00784	PASS
Extreme(-30℃)		7.71	1.69	4.36	0.00410	0.00090	0.00232	PASS
25℃	LV	10.08	13.49	4.42	0.00536	0.00717	0.00235	PASS
	HV	6.50	1.97	9.39	0.00346	0.00105	0.00500	PASS
Condition		Freq. Error (Hz)	Freq. Error (Hz)	Freq. Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	10MHz							
Temperature	Voltage	64QAM	16QAM	QPSK	64QAM	16QAM	QPSK	
Normal(25℃)	Normal	1.66	10.89	3.94	0.00088	0.00579	0.00210	PASS
Extreme(55℃)		4.43	8.94	5.63	0.00236	0.00475	0.00299	PASS
Extreme(50℃)		10.55	6.07	5.62	0.00561	0.00323	0.00299	PASS
Extreme(40℃)		12.53	16.42	14.61	0.00666	0.00873	0.00777	PASS
Extreme(30℃)		3.00	15.45	9.74	0.00159	0.00822	0.00518	PASS
Extreme(20℃)		11.58	10.61	13.06	0.00616	0.00564	0.00695	PASS
Extreme(10℃)		17.53	13.57	9.62	0.00933	0.00722	0.00512	PASS
Extreme(0℃)		10.79	4.73	15.57	0.00574	0.00252	0.00828	PASS
Extreme(-10℃)		1.34	14.58	8.47	0.00071	0.00775	0.00450	PASS
Extreme(-20℃)		4.77	15.89	9.53	0.00254	0.00845	0.00507	PASS
Extreme(-30℃)		7.36	6.28	1.06	0.00391	0.00334	0.00056	PASS
25℃	LV	9.99	1.30	6.48	0.00531	0.00069	0.00344	PASS
	HV	1.76	15.64	10.89	0.00094	0.00832	0.00579	PASS

5.6. Spurious Emissions at Antenna Terminals

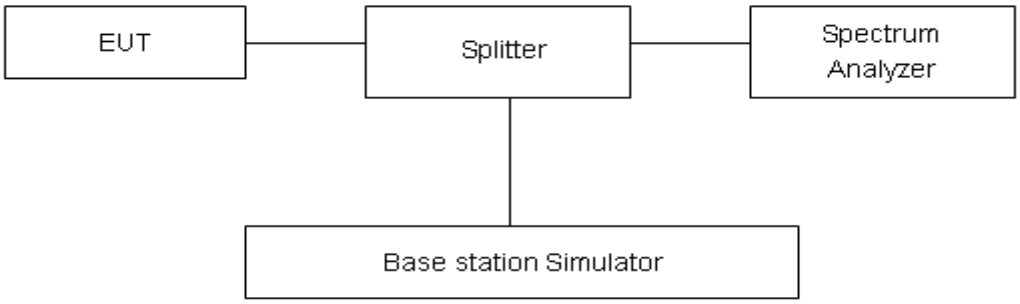
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 9kHz to the 10th harmonic of the carrier.
The peak detector is used. RBW are set to 100 kHz and VBW are set to 300 kHz for below 1G, RBW are set to 1MHz and VBW are set to 3MHz for above 1G, Sweep is set to ATUO.
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

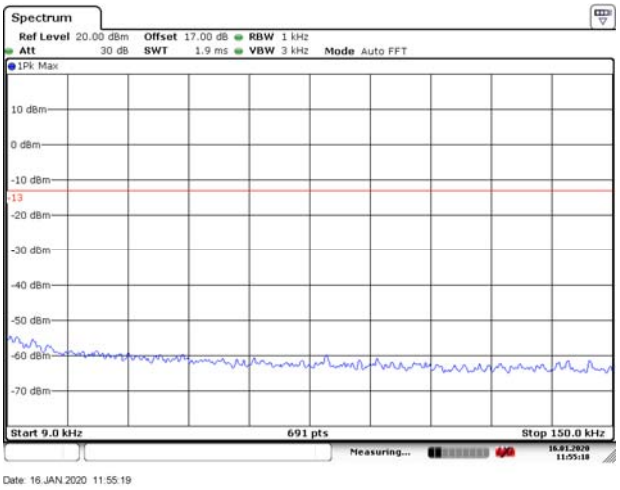
Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-18GHz	1.407 dB

Test Result

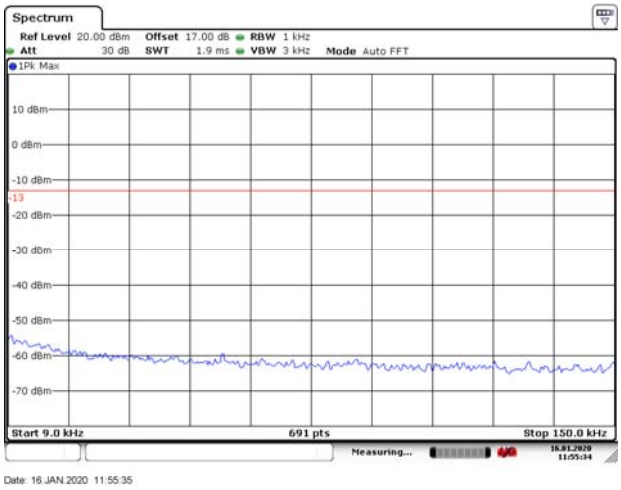
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

The signal beyond the limit is carrier.

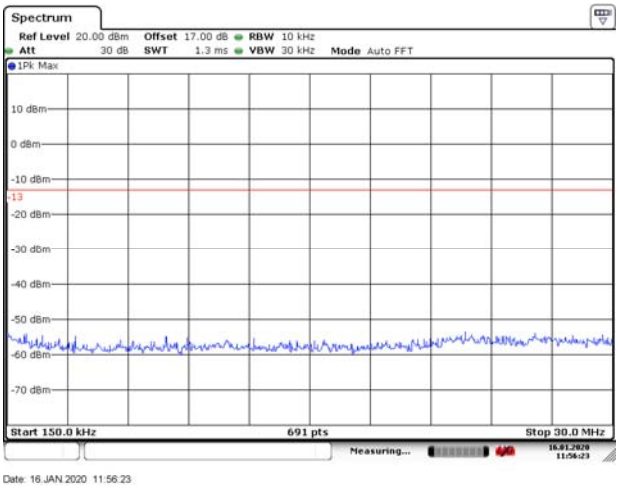
GSM 850 CH-Low 9kHz ~ 150kHz



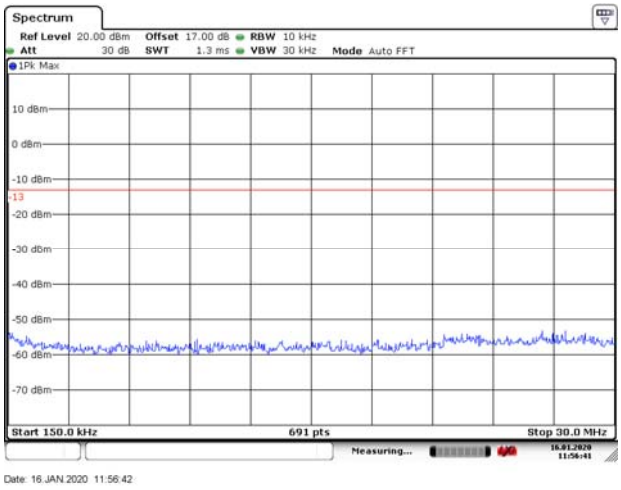
GSM 850 CH- Middle 9kHz ~ 150kHz



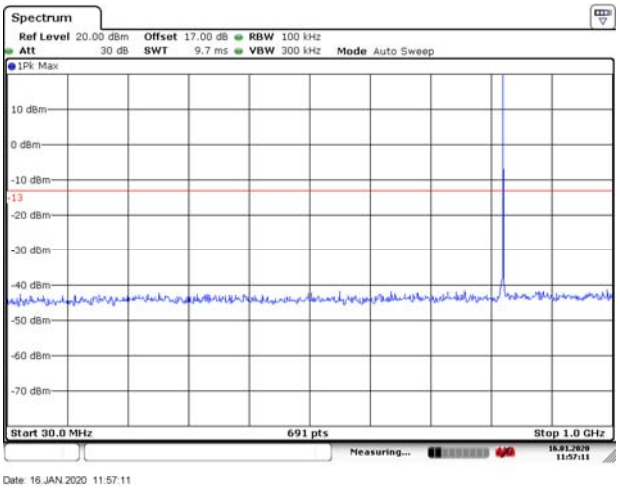
GSM 850 CH-Low 150kHz ~ 30MHz



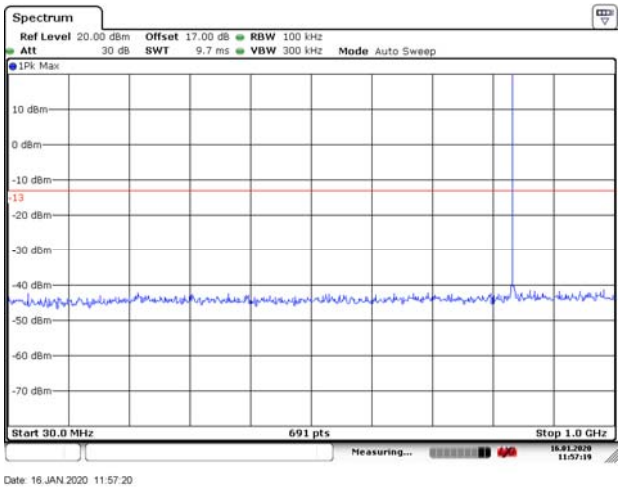
GSM 850 CH- Middle 150kHz ~ 30MHz



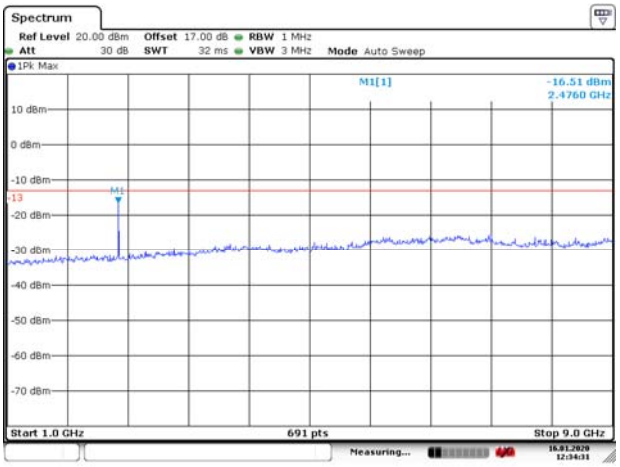
GSM 850 CH-Low 30MHz ~ 1GHz



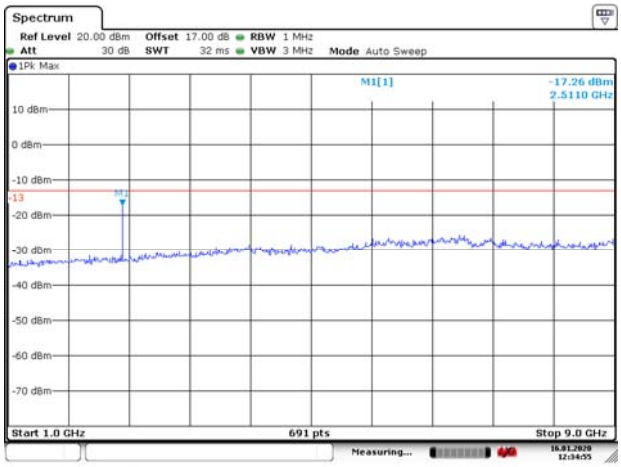
GSM 850 CH- Middle 30MHz ~ 1GHz



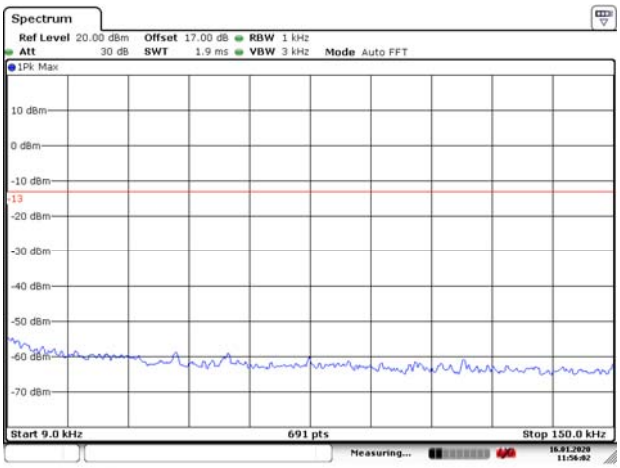
GSM 850 CH-Low 1GHz ~ 9GHz



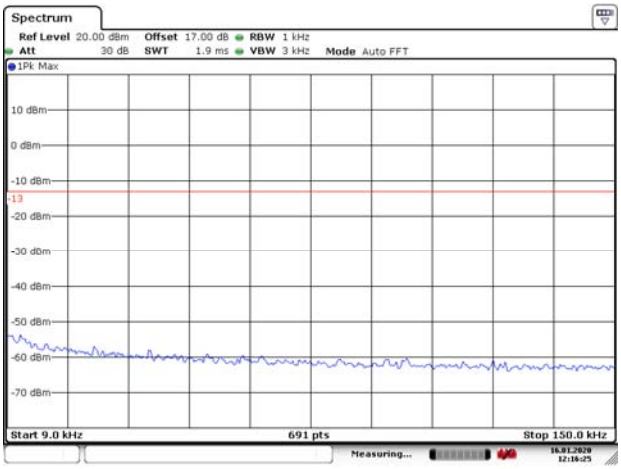
GSM 850 CH- Middle 1GHz ~ 9GHz



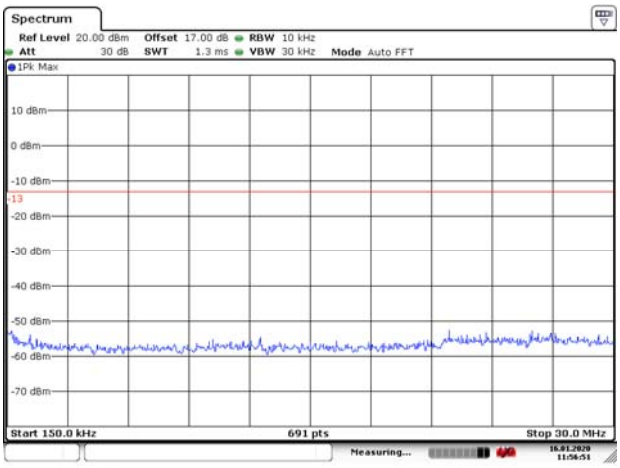
GSM 850 CH-High 9kHz ~ 150kHz



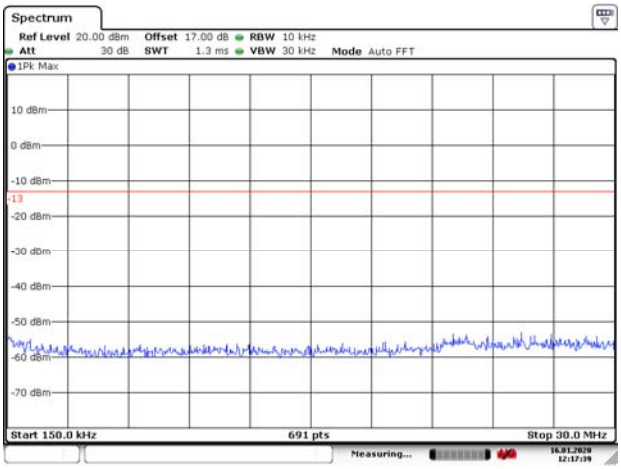
GPRS 850 CH-Low 9kHz ~ 150kHz



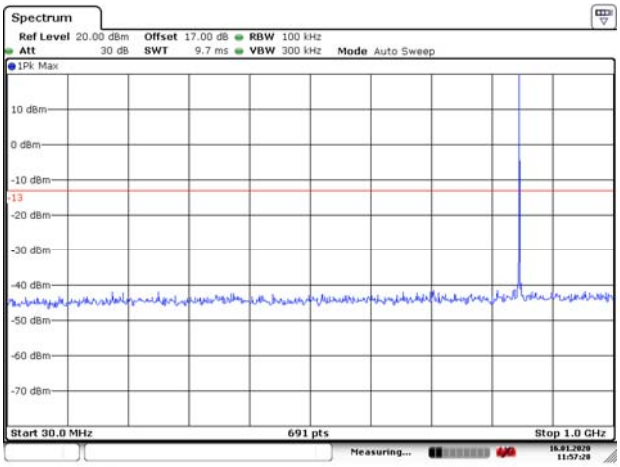
GSM 850 CH-High 150kHz ~ 30MHz



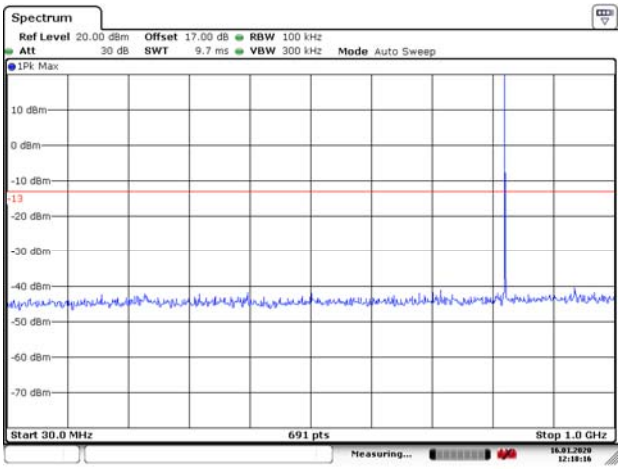
GPRS 850 CH-Low 150kHz ~ 30MHz



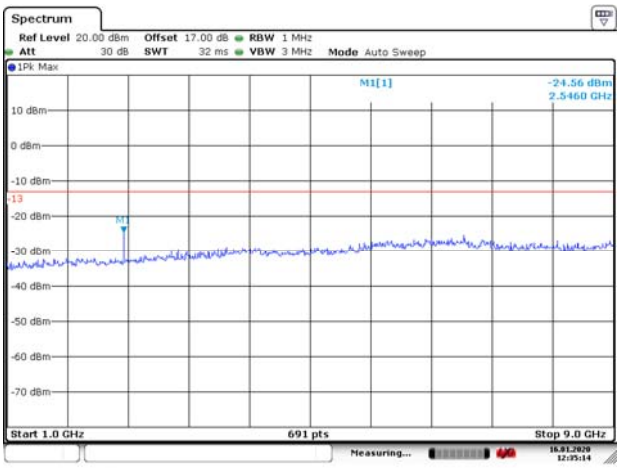
GSM 850 CH-High 30MHz ~ 1GHz



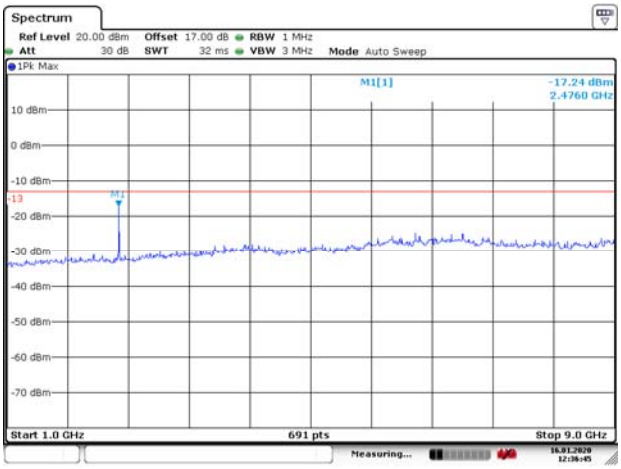
GPRS 850 CH-Low 30MHz ~ 1GHz



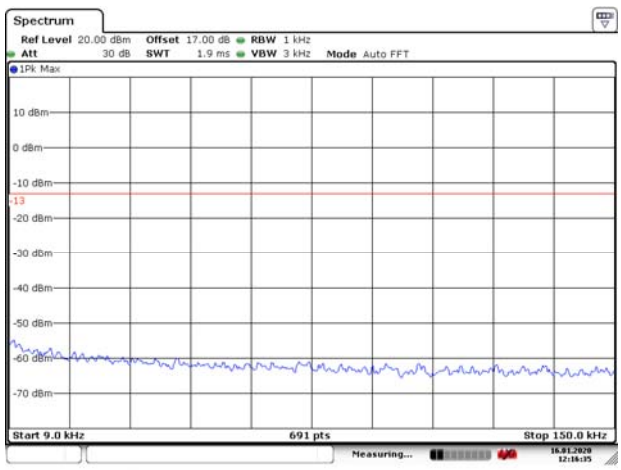
GSM 850 CH-High 1GHz ~ 9GHz



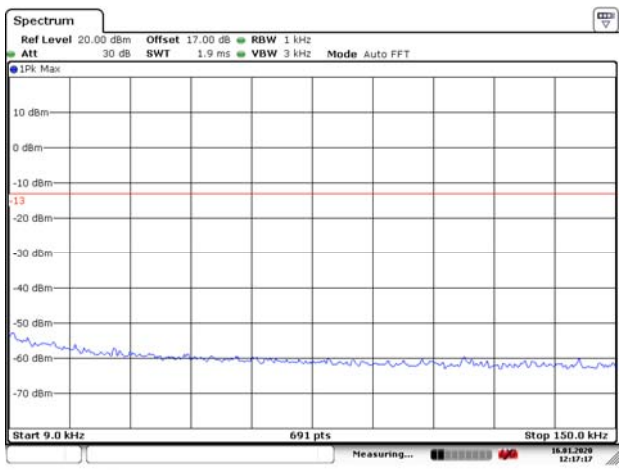
GPRS 850 CH-Low 1GHz ~ 9GHz



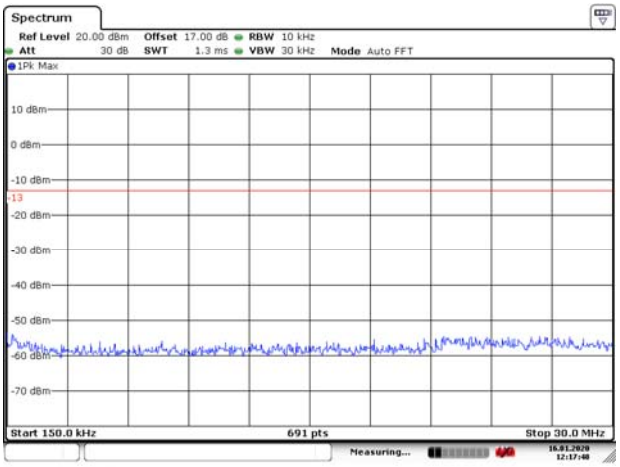
GPRS 850 CH- Middle 9kHz ~ 150kHz



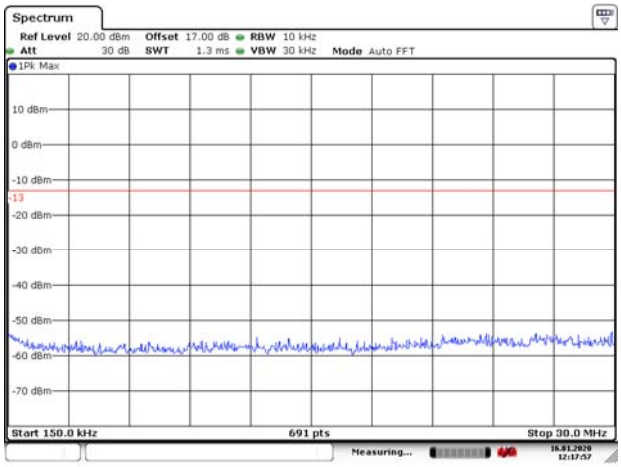
GPRS 850 CH-High 9kHz ~ 150kHz



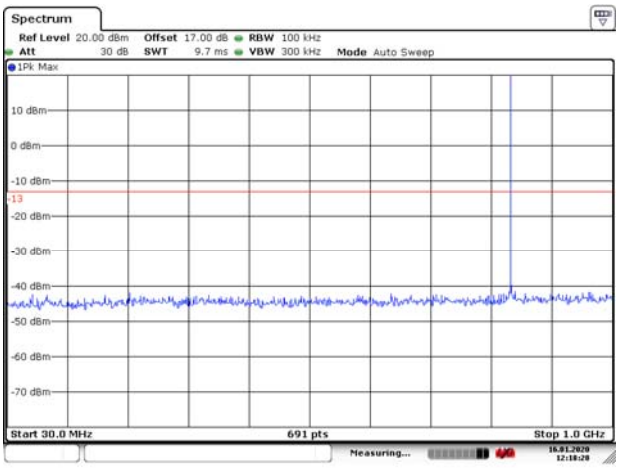
GPRS 850 CH- Middle 150kHz ~ 30MHz



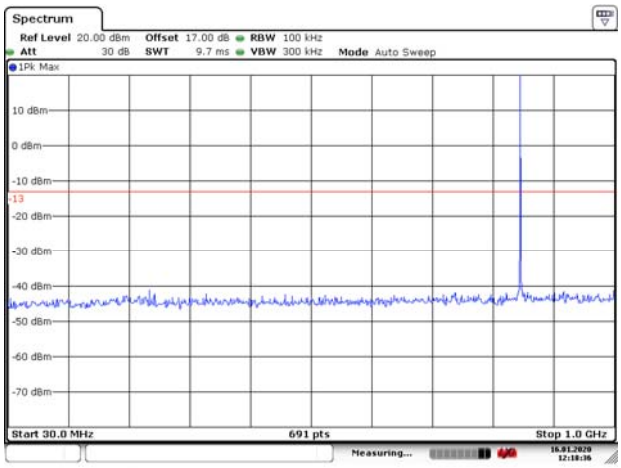
GPRS 850 CH-High 150kHz ~ 30MHz



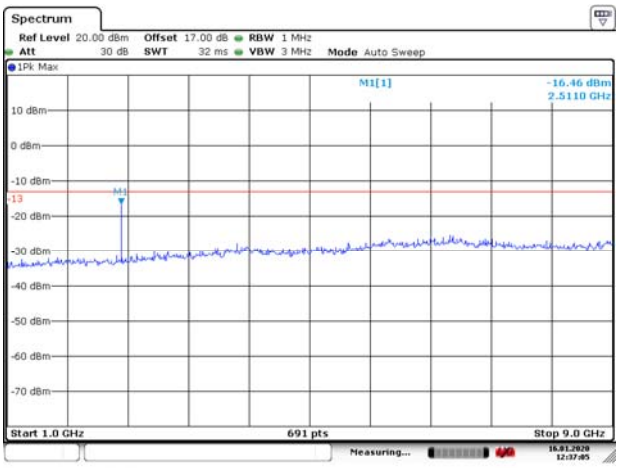
GPRS 850 CH- Middle 30MHz ~ 1GHz



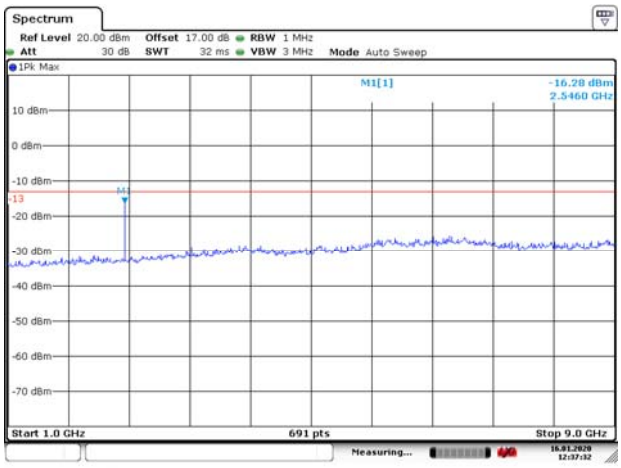
GPRS 850 CH-High 30MHz ~ 1GHz



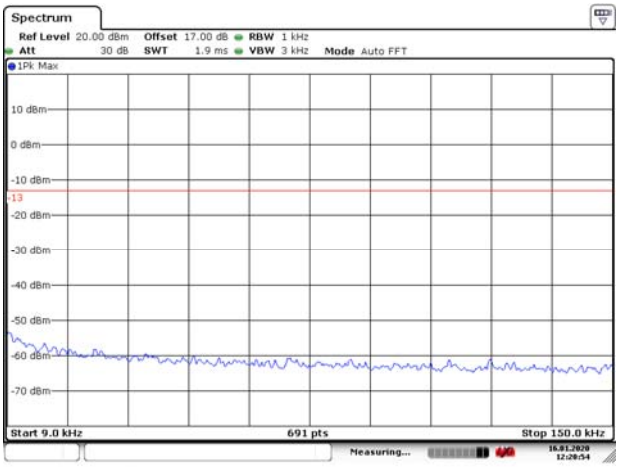
GPRS 850 CH- Middle 1GHz ~ 9GHz



GPRS 850 CH-High 1GHz ~ 9GHz

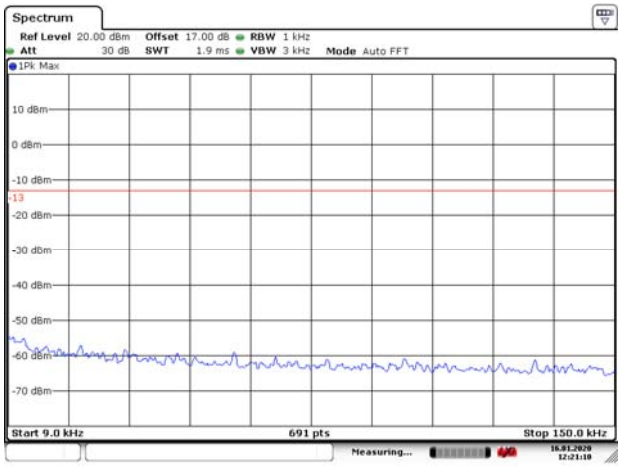


EGPRS 850 CH-Low 9kHz ~ 150kHz



Date: 16.JAN.2020 12:20:55

EGPRS 850 CH- Middle 9kHz ~ 150kHz



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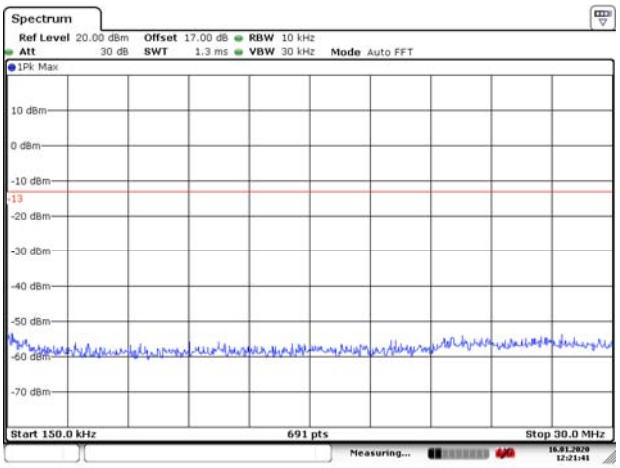
EGPRS 850 CH-Low 150kHz ~ 30MHz



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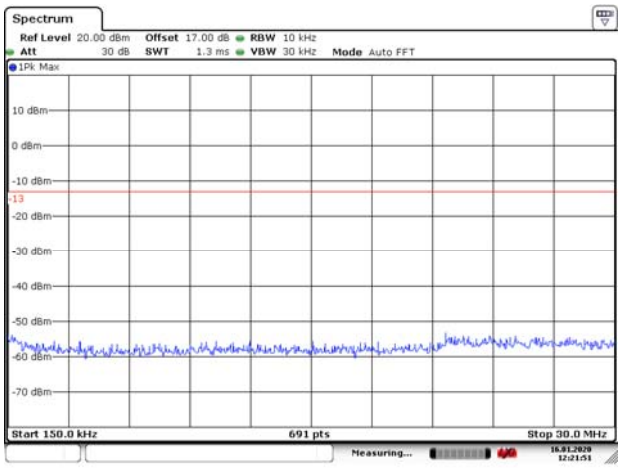
EGPRS 850 CH- Middle 150kHz ~ 30MHz



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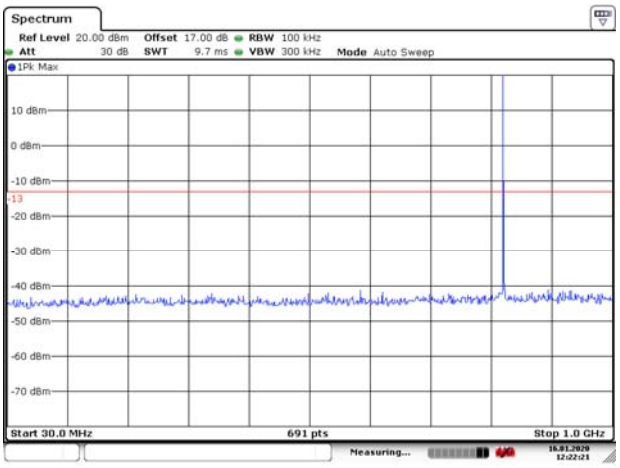
EGPRS 850 CH-Low 30MHz ~ 1GHz



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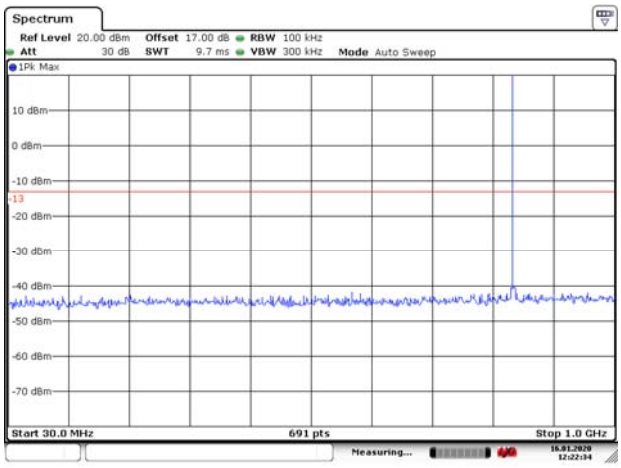
EGPRS 850 CH- Middle 30MHz ~ 1GHz



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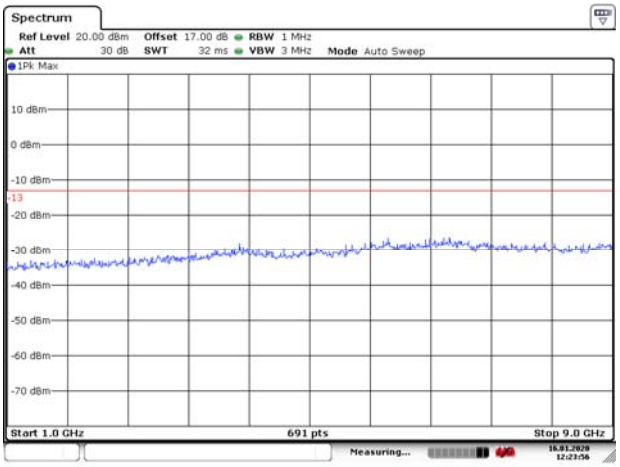
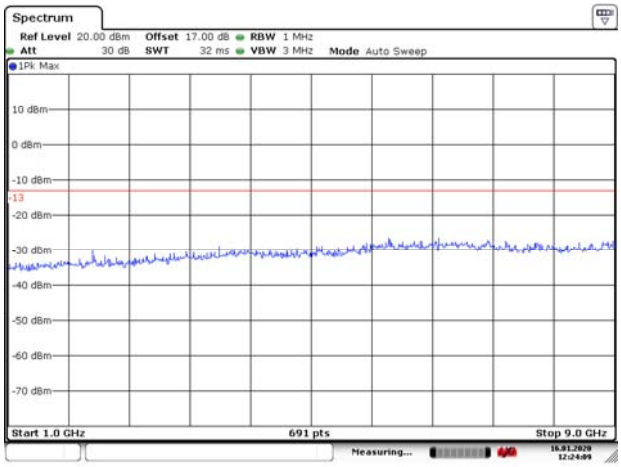
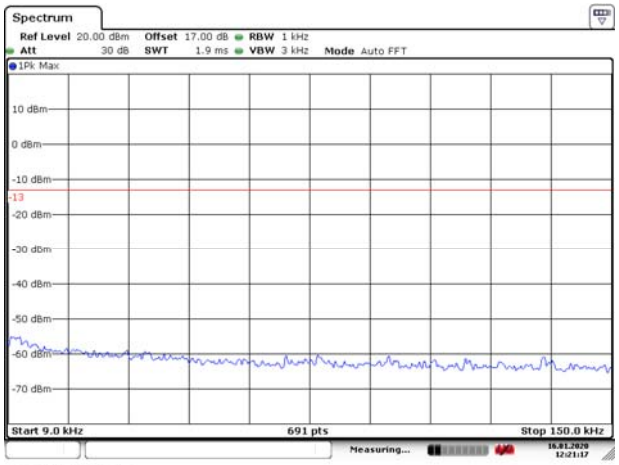
EGPRS 850 CH-Low 1GHz ~ 9GHz



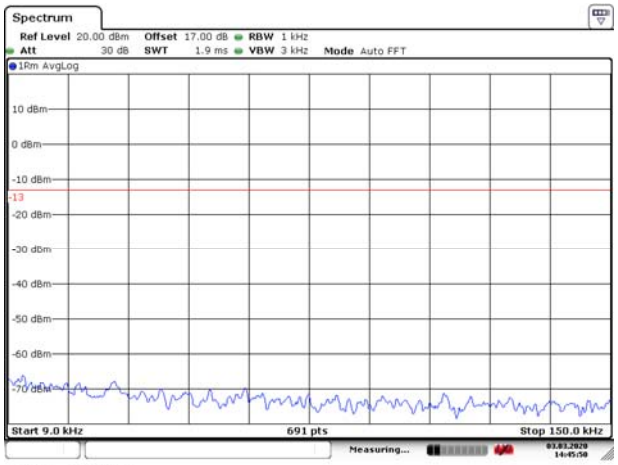
EGPRS 850 CH- Middle 1GHz ~ 9GHz



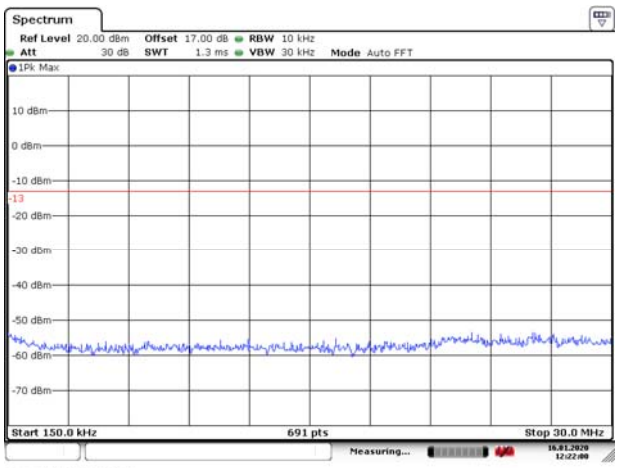
EGPRS 850 CH-High 9kHz ~ 150kHz



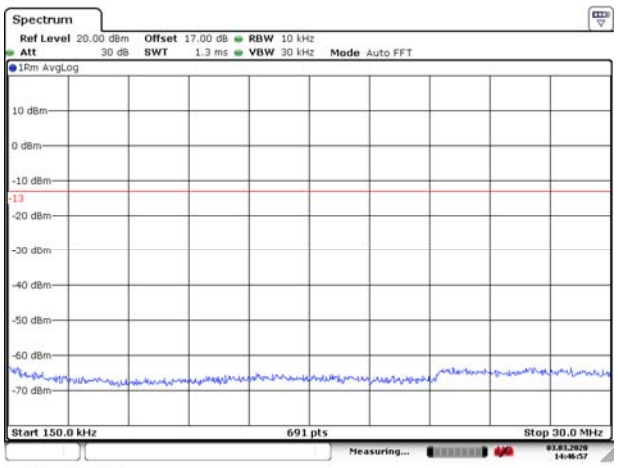
WCDMA BAND V CH-Low 9kHz ~ 150kHz



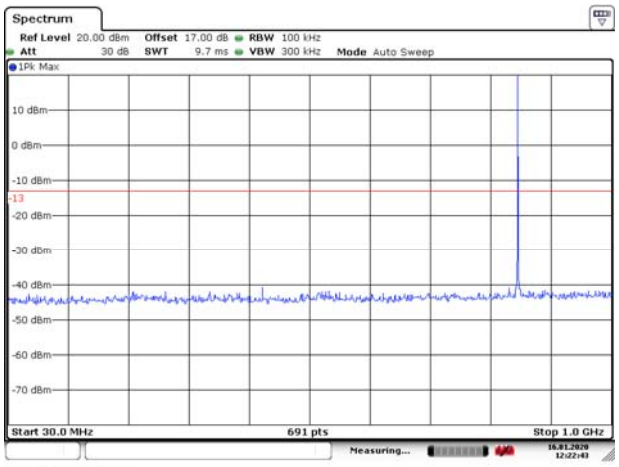
EGPRS 850 CH-High 150kHz ~ 30MHz



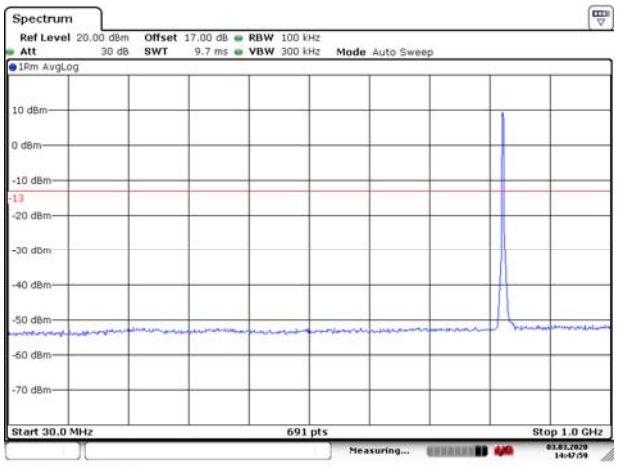
WCDMA BAND V CH-Low 150kHz ~ 30MHz



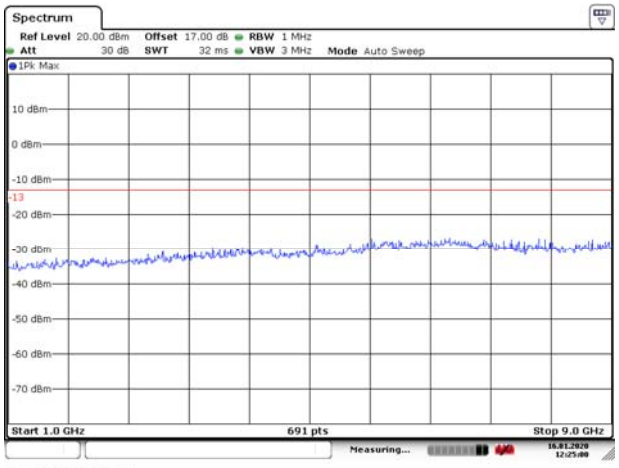
EGPRS 850 CH-High 30MHz ~ 1GHz



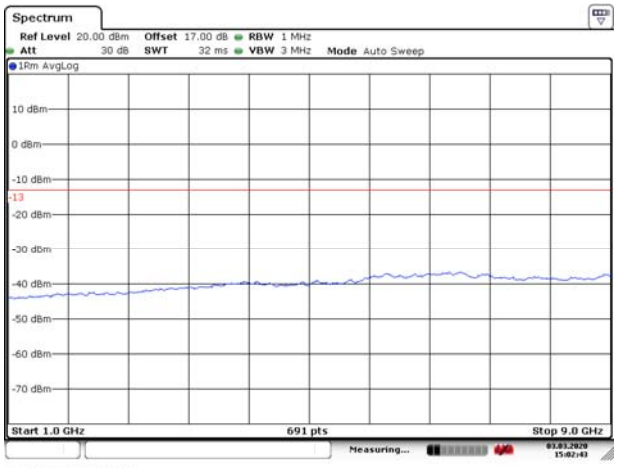
WCDMA BAND V CH-Low 30MHz ~ 1GHz



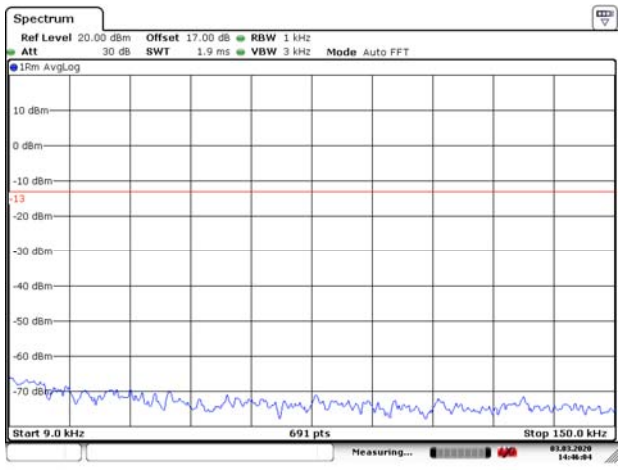
EGPRS 850 CH-High 1GHz ~ 9GHz



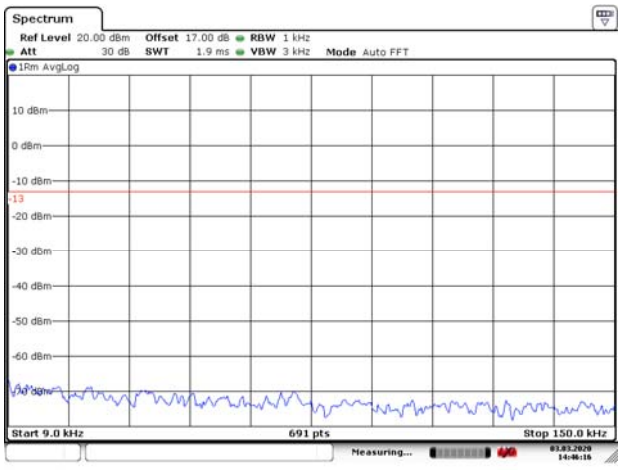
WCDMA BAND V CH-Low 1GHz ~ 9GHz



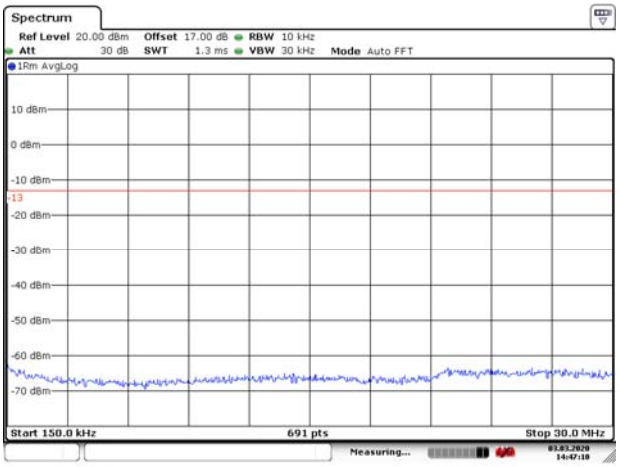
WCDMA BAND V CH- Middle 9kHz ~ 150kHz



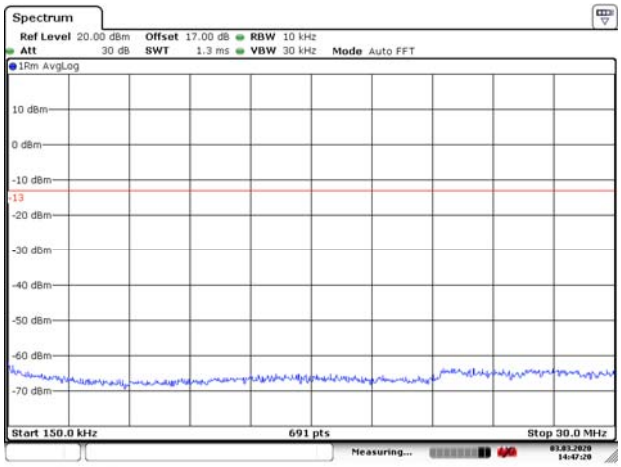
WCDMA BAND V CH-High 9kHz ~ 150kHz



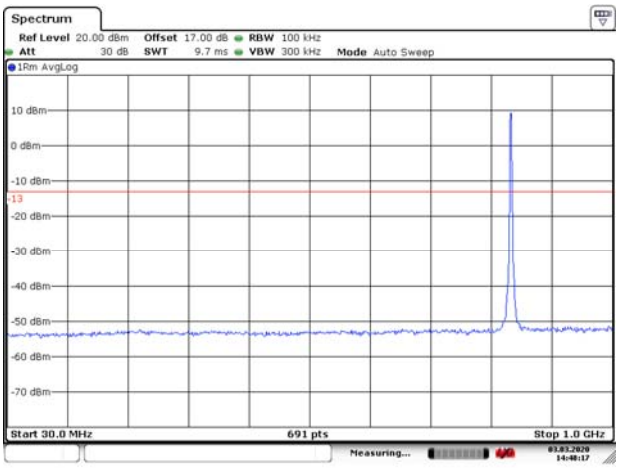
WCDMA BAND V CH- Middle 150kHz ~ 30MHz



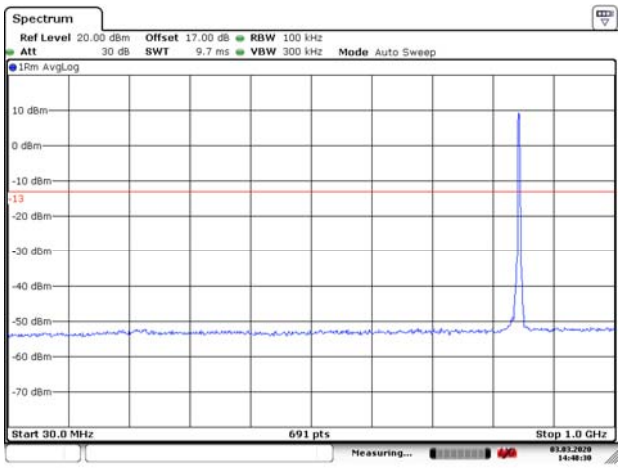
WCDMA BAND V CH-High 150kHz ~ 30MHz



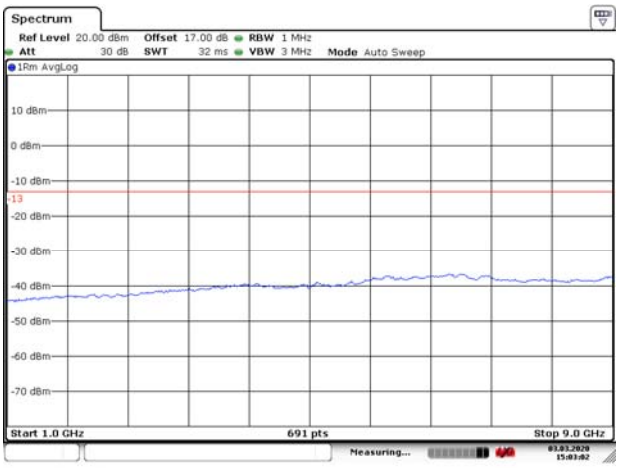
WCDMA BAND V CH- Middle 30MHz ~ 1GHz



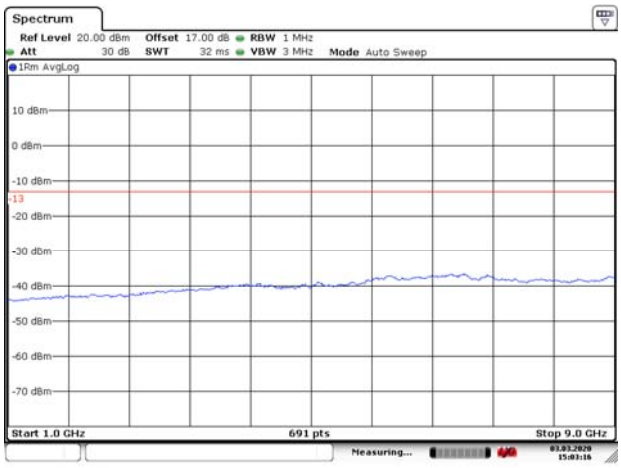
WCDMA BAND V CH-High 30MHz ~ 1GHz



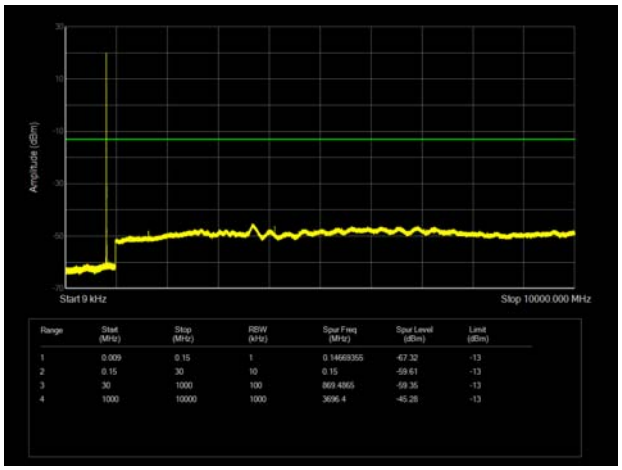
WCDMA BAND V CH- Middle 1GHz ~ 9GHz



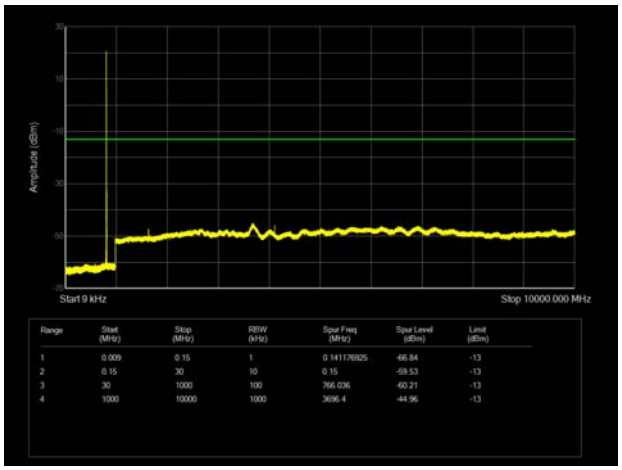
WCDMA BAND V CH-High 1GHz ~ 9GHz



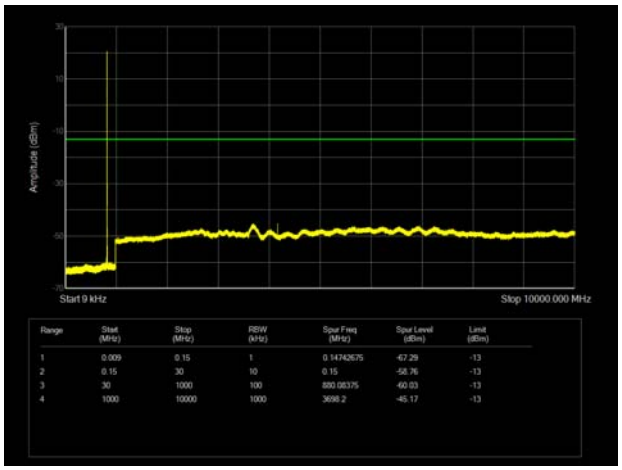
LTE Band 5 1.4MHz CH-Low 9kHz~10GHz



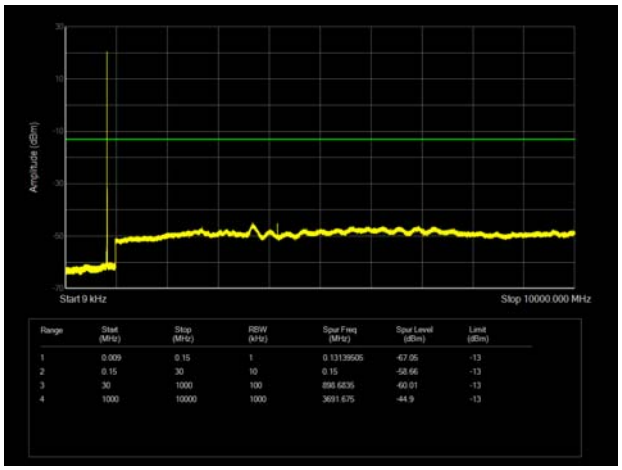
LTE Band 5 3MHz CH-Low 9kHz~10GHz



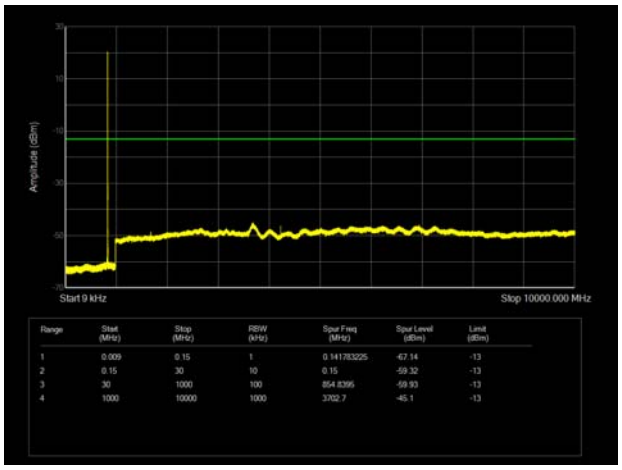
LTE Band 5 1.4MHz CH-Middle 9kHz~10GHz



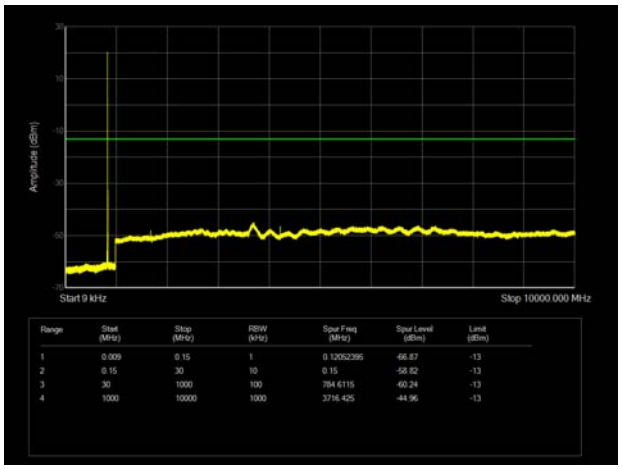
LTE Band 5 3MHz CH-Middle 9kHz~10GHz



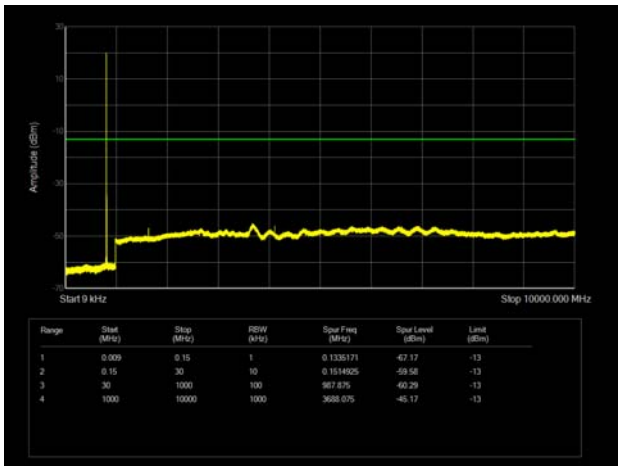
LTE Band 5 1.4MHz CH-High 9kHz~10GHz



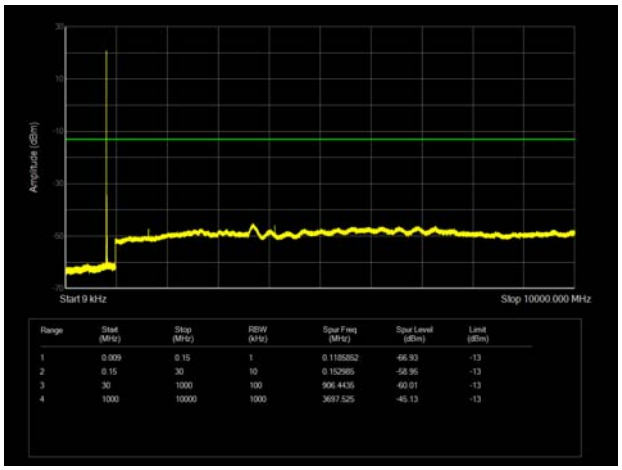
LTE Band 5 3MHz CH-High 9kHz~10GHz



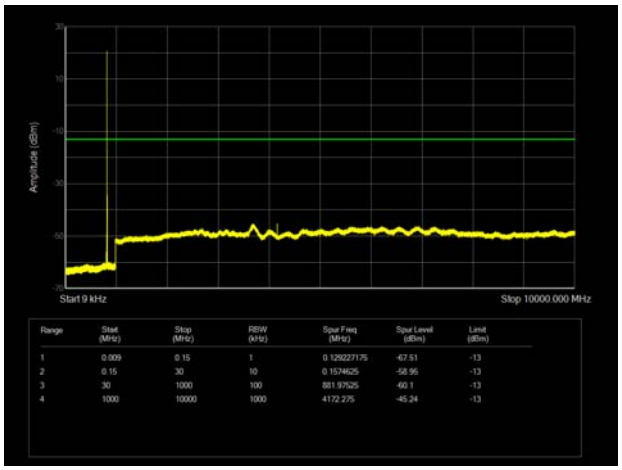
LTE Band 5 5MHz CH-Low 9kHz~10GHz



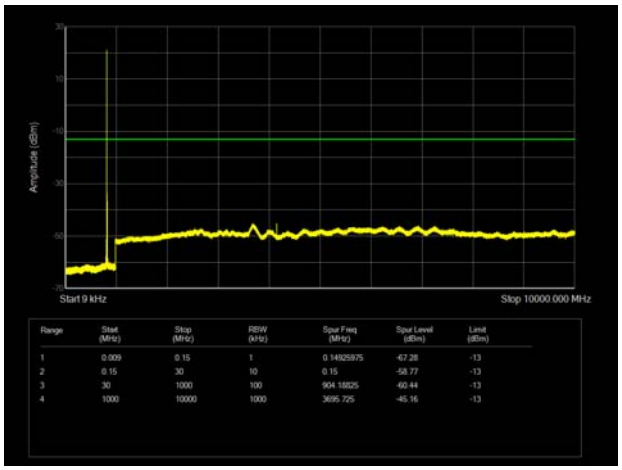
LTE Band 5 10MHz CH-Low 9kHz~10GHz



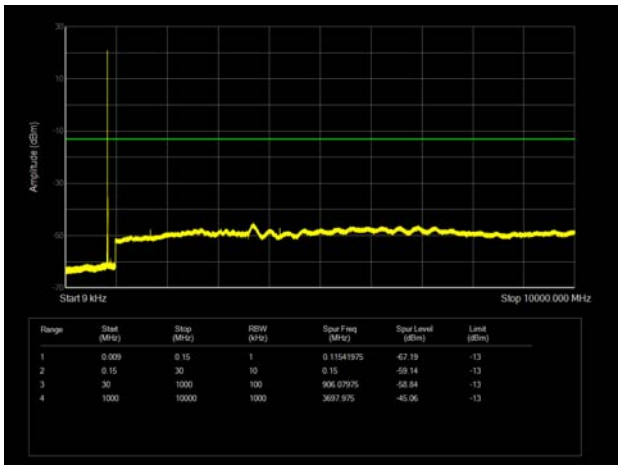
LTE Band 5 5MHz CH-Middle 9kHz~10GHz



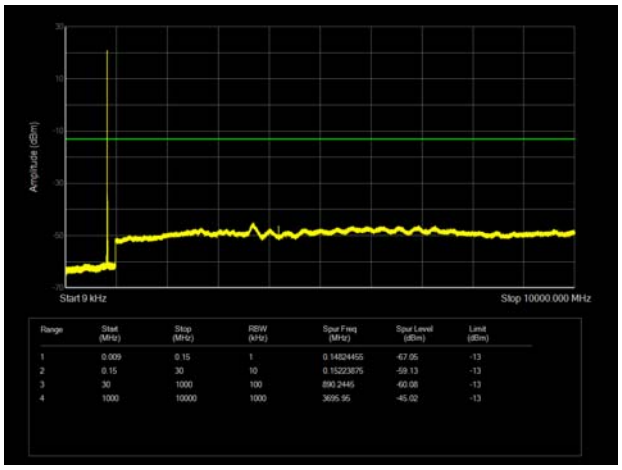
LTE Band 5 10MHz CH-Middle 9kHz~10GHz



LTE Band 5 5MHz CH-High 9kHz~10GHz



LTE Band 5 10MHz CH-High 9kHz~10GHz



5.7. Radiates Spurious Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

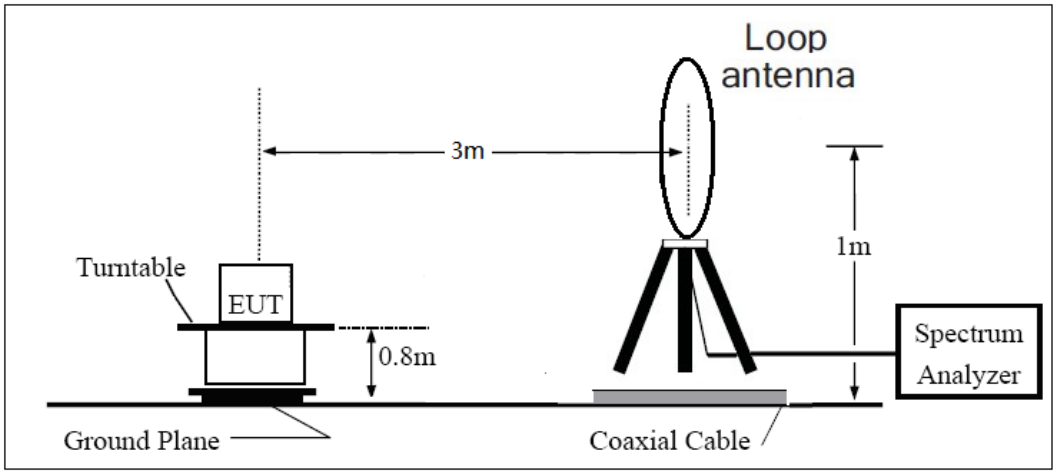
1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).
2. Below 1GHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
3. A loop antenna, A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=200Hz,VBW=600Hz for 9kHz150kHz , RBW=10kHz, VBW=30kHz 150kHz-30MHz , RBW=100kHz,VBW=300kHz for 30MHz to 1GHz and RBW=1MHz, VBW=3MHz for above 1GHz, And the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
7. The measurement results are obtained as described below:
Power(EIRP)=PMea- PAg - Pcl + Ga
The measurement results are amend as described below:
Power(EIRP)=PMea- Pcl + Ga
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi)

and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

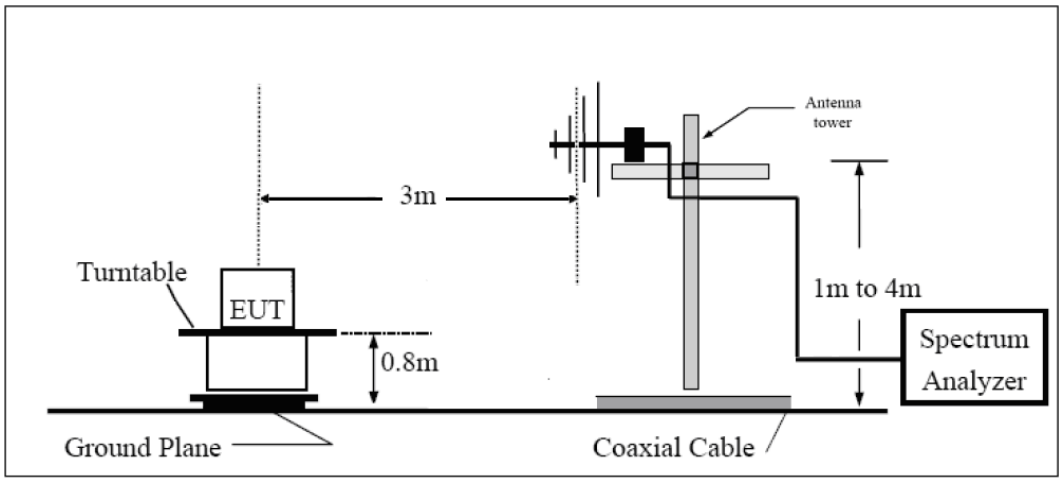
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

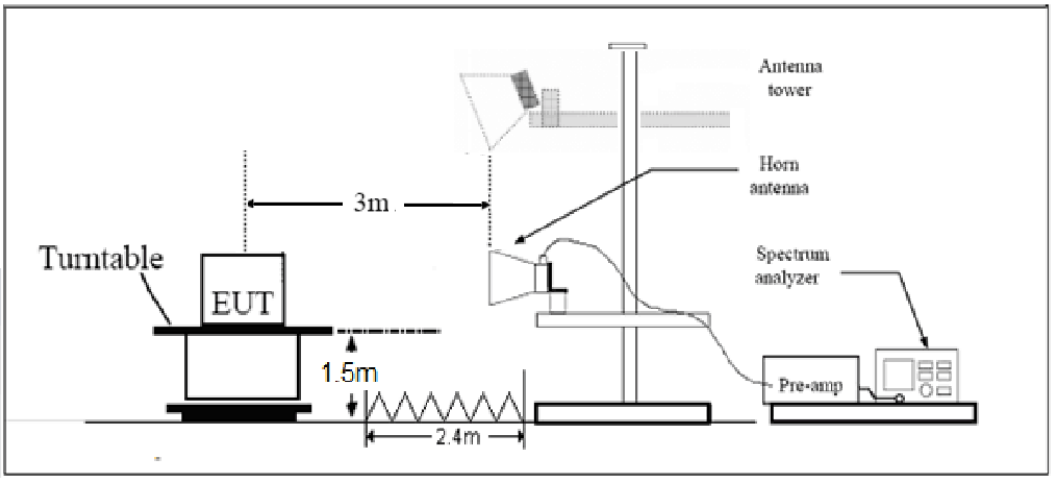
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95％ confidence level for the normal distribution is with the coverage factor k = 1.96, U= 3.55 dB.

Test Result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

GSM 850 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.2	-55.03	2.00	10.75	Horizontal	-48.43	-13.00	35.43	225
3	2509.8	-46.02	2.51	11.05	Horizontal	-39.63	-13.00	26.63	135
4	3346.4	-59.44	4.20	11.15	Horizontal	-54.64	-13.00	41.64	270
5	4183.0	-56.55	5.20	11.15	Horizontal	-52.75	-13.00	39.75	45
6	5019.6	-55.00	5.50	11.95	Horizontal	-50.70	-13.00	37.70	180
7	5856.2	-57.74	5.70	13.55	Horizontal	-52.04	-13.00	39.04	315
8	6692.8	-58.97	6.30	13.75	Horizontal	-53.67	-13.00	40.67	225
9	7529.4	-55.12	6.80	13.85	Horizontal	-50.22	-13.00	37.22	90
10	8366.0	-55.55	6.90	14.25	Horizontal	-50.35	-13.00	37.35	180
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

WCDMA Band V CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.2	-66.83	2.00	10.75	Horizontal	-60.23	-13.00	47.23	90
3	2509.8	-60.55	2.51	11.05	Horizontal	-54.16	-13.00	41.16	270
4	3346.4	-60.40	4.20	11.15	Horizontal	-55.60	-13.00	42.60	45
5	4183.0	-51.66	5.20	11.15	Horizontal	-47.86	-13.00	34.86	180
6	5019.6	-55.39	5.50	11.95	Horizontal	-51.09	-13.00	38.09	270
7	5856.2	-57.34	5.70	13.55	Horizontal	-51.64	-13.00	38.64	0
8	6692.8	-58.12	6.30	13.75	Horizontal	-52.82	-13.00	39.82	135
9	7529.4	-55.05	6.80	13.85	Horizontal	-50.15	-13.00	37.15	90
10	8366.0	-57.40	6.90	14.25	Horizontal	-52.20	-13.00	39.20	225
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

LTE Band 5 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.0	-65.53	2.00	10.75	Horizontal	-58.93	-13.00	45.93	45
3	2509.5	-61.57	2.51	11.05	Horizontal	-55.18	-13.00	42.18	135
4	3346.0	-57.85	4.20	11.15	Horizontal	-53.05	-13.00	40.05	270
5	4182.5	-52.77	5.20	11.15	Horizontal	-48.97	-13.00	35.97	45
6	5019.0	-55.65	5.50	11.95	Horizontal	-51.35	-13.00	38.35	90
7	5855.5	-57.13	5.70	13.55	Horizontal	-51.43	-13.00	38.43	315
8	6692.0	-58.08	6.30	13.75	Horizontal	-52.78	-13.00	39.78	90
9	7528.5	-54.51	6.80	13.85	Horizontal	-49.61	-13.00	36.61	315
10	8365.0	-54.15	6.90	14.25	Horizontal	-48.95	-13.00	35.95	0
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

LTE Band 5 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.0	-65.25	2.00	10.75	Horizontal	-58.65	-13.00	45.65	225
3	2509.5	-59.75	2.51	11.05	Horizontal	-53.36	-13.00	40.36	0
4	3466.2	-58.86	4.20	11.15	Horizontal	-54.06	-13.00	41.06	90
5	4215.9	-52.41	5.20	11.15	Horizontal	-48.61	-13.00	35.61	315
6	5165.6	-56.15	5.50	11.95	Horizontal	-51.85	-13.00	38.85	45
7	5815.3	-56.98	5.70	13.55	Horizontal	-51.28	-13.00	38.28	135
8	6765.0	-59.25	6.30	13.75	Horizontal	-53.95	-13.00	40.95	0
9	7614.7	-54.93	6.80	13.85	Horizontal	-50.03	-13.00	37.03	45
10	8464.4	-51.69	6.90	14.25	Horizontal	-46.49	-13.00	33.49	135
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

LTE Band 5 10MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.0	-66.00	2.00	10.75	Horizontal	-59.40	-13.00	46.40	45
3	2509.5	-59.04	2.51	11.05	Horizontal	-52.65	-13.00	39.65	180
4	3346.0	-59.00	4.20	11.15	Horizontal	-54.20	-13.00	41.20	90
5	4182.5	-52.88	5.20	11.15	Horizontal	-49.08	-13.00	36.08	315
6	5019.0	-56.57	5.50	11.95	Horizontal	-52.27	-13.00	39.27	45
7	5855.5	-57.21	5.70	13.55	Horizontal	-51.51	-13.00	38.51	0
8	6692.0	-58.01	6.30	13.75	Horizontal	-52.71	-13.00	39.71	135
9	7528.5	-54.06	6.80	13.85	Horizontal	-49.16	-13.00	36.16	315
10	8365.0	-54.35	6.90	14.25	Horizontal	-49.15	-13.00	36.15	90

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.
2.The worst emission was found in the antenna is Horizontal position.

6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	113824	2019-05-19	2020-05-18
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Key sight	N9010A	MY50210259	2019-05-19	2020-05-18
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2019-05-19	2020-05-18
Signal Analyzer	R&S	FSV40	101298	2019-05-19	2020-05-18
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2020-09-25
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2020-11-17
Horn Antenna	R&S	HF907	100126	2018-07-07	2020-07-06
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2020-06-19
Signal generator	R&S	SMB 100A	102594	2019-05-19	2020-05-18
Climatic Chamber	ESPEC	SU-242	93000506	2017-12-17	2020-12-16
Preampflier	R&S	SCU18	102327	2019-05-19	2020-05-18
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2019-05-20	2020-05-21
RF Cable	Agilent	SMA 15cm	0001	2019-12-13	2020-6-12
Software	R&S	EMC32	9.26.0	/	/

********END OF REPORT ********