

FCC TEST REPORT

(PART 90S&90R)

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Address:	4F-2#,Lianjian Science&Industry Park, Huarong Road, Dalang,Longhua District, Shenzhen City, Guangdong Province, P.R.China

Manufacturer or Supplier:	Shenzhen Neoway Technology Co.,Ltd.
Address:	4F-2#,Lianjian Science&Industry Park, Huarong Road, Dalang,Longhua District, Shenzhen City, Guangdong Province, P.R.China
Product:	Cat.M1 Module
Brand Name:	neoway
Model Name:	N27-W3
FCC ID:	PJ7-N27-W3
Date of tests:	Nov. 23, 2019 ~ Jan. 09, 2020

The tests have been carried out according to the requirements of the following standard:

☒ FCC Part 90, Subpart S, Subpart R ☒ ANSI/TIA/EIA-603- D
☒ FCC Part 2 ☒ ANSI/TIA/EIA-603-E ☒ ANSI C63.26-2015

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Alex Chen Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
 Date: Jan. 16, 2020	 Date: Jan. 16, 2020

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Test Report No.: RF191122W002-5

**5 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT
BY THE LAB 89**



Test Report No.: RF191122W002-5

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF191122W002-5	Original release	Jan. 16, 2020

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 90S & Part 90R & Part 2			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
2.1046 90.635(b)	Maximum Peak Output Power	PASS	Compliance
2.1055 90.213	Frequency Stability	PASS	Compliance
2.1049 90.209	Occupied Bandwidth	PASS	Compliance
2.1051 90.691 90.543e	Emission Masks	PASS	Compliance
2.1051 90.691 90.543e	Conducted Spurious Emissions	PASS	Compliance
2.1053 90.691 90.543e	Radiated Spurious Emissions	PASS	Compliance

1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	UNCERTAINTY
Frequency Stability	$\pm 76.97\text{Hz}$
Radiated emissions & Radiated Power (30MHz~1GMHz)	$\pm 4.98\text{dB}$
Radiated emissions & Radiated Power (1GMHz ~6GMHz)	$\pm 4.70\text{dB}$
Radiated emissions (6GMHz ~18GMHz)	$\pm 4.60\text{dB}$
Radiated emissions (18GMHz ~40GMHz)	$\pm 4.12\text{dB}$
Conducted emissions	$\pm 4.01\text{dB}$
Occupied Channel Bandwidth	$\pm 43.58\text{KHz}$
Conducted Output power	$\pm 2.06\text{dB}$
Band Edge Measurements	$\pm 4.70\text{dB}$
Emission Mask Measurements	$\pm 4.48\text{dB}$

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

1.2 TEST SITE AND INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Feb. 26,19	Feb. 25,20
EXA Signal Analyzer	KEYSIGHT	N9010A-526	MY54510322	Feb. 26,19	Feb. 25,20
Bilog Antenna 1	ETS-LINDGREN	3143B	00161964	Feb. 26,19	Feb. 25,20
Bilog Antenna 2	ETS-LINDGREN	3143B	00161965	Feb. 26,19	Feb. 25,20
Horn Antenna 1	ETS-LINDGREN	3117	00168728	Feb. 26,19	Feb. 25,20
Horn Antenna 2	ETS-LINDGREN	3117	00168692	Nov. 24, 19	Nov. 23, 20
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40 -K-SG/QMS-00 361	15433	Nov. 24, 19	Nov. 23, 20
Radio Communication Analyzer	ANRITSU	MT8820C	6201465426	Feb. 26,19	Feb. 25,20
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jun. 24,19	Jun. 23,20
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jun. 24,19	Jun. 23,20
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Jun. 24,19	Jun. 23,20
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn- CT0001143-1216	Feb. 26,19	Feb. 25,20
Test Software	E3	V 9.160323	N/A	N/A	N/A
Test Software	ADT	ADT_Radiated v7.6.15.9.2	N/A	N/A	N/A
10dB Attenuator	JFW/USA	50HF-010-SM A	1505	Jun. 24,19	Jun. 23,20
Power Meter	Anritsu	ML2495A	1506002	Feb. 26,19	Feb. 25,20
Power Sensor	Anritsu	MA2411B	1339352	Feb. 26,19	Feb. 25,20
Humid & Temp Programmable Tester	Juyi	ITH-120-45-CP -AR	IAA1504-001	Jun. 24,19	Jun. 23,20
MXG Analog Microvave Signal Generator	KEYSIGHT	N5183A	MY50143024	Feb. 26,19	Feb. 25,20

- NOTE:** 1. The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in 3m Semi-anechoic Chamber and RF Oven Room.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 525120; The Designation No. is CN1171.

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Cat.M1 Module	
BRAND NAME	neoway	
MODEL NAME	N27-W3	
POWER SUPPLY	$V_{\min}=3.1\text{Vdc}$, $V_{\text{nor}}=3.6\text{Vdc}$, $V_{\max}=4.3\text{Vdc}$	
MODULATION TECHNOLOGY	LTE CAT-M1	QPSK, 16QAM
FREQUENCY RANGE	LTE CAT-M Band 14 Channel Bandwidth: 5MHz	790.5MHz ~ 795.5MHz
	LTE CAT-M Band 14 Channel Bandwidth: 10MHz	793MHz
	LTE CAT-M Band 26 (Channel Bandwidth: 1.4MHz)	814.7MHz ~ 823.3MHz
	LTE CAT-M Band 26 (Channel Bandwidth: 3MHz)	815.5MHz ~ 822.5MHz
	LTE CAT-M Band 26 (Channel Bandwidth: 5MHz)	816.5MHz ~ 821.5MHz
	LTE CAT-M Band 26 (Channel Bandwidth: 10MHz)	819MHz
MAX. ERP POWER	LTE CAT-M Band 14 Channel Bandwidth: 5MHz	136mW
	LTE CAT-M Band 14 Channel Bandwidth: 10MHz	136mW
	LTE CAT-M Band 26 (Channel Bandwidth: 1.4MHz)	145mW
	LTE CAT-M Band 26 (Channel Bandwidth: 3MHz)	145mW
	LTE CAT-M Band 26 (Channel Bandwidth: 5MHz)	145mW
	LTE CAT-M Band 26 (Channel Bandwidth: 10MHz)	146mW



EMISSION DESIGNATOR	LTE CAT-M Band 14 (Channel Bandwidth: 5MHz)	QPSK: 1M08G7D 16QAM: 910KW7D
	LTE CAT-M Band 14 (Channel Bandwidth: 10MHz)	QPSK: 1M08G7D 16QAM: 910KW7D
	LTE CAT-M Band 26 (Channel Bandwidth: 1.4MHz)	QPSK: 1M10G7D 16QAM: 1M10W7D
	LTE CAT-M Band 26 (Channel Bandwidth: 3MHz)	QPSK: 1M27G7D 16QAM: 1M09W7D
	LTE CAT-M Band 26 (Channel Bandwidth: 5MHz)	QPSK: 1M09G7D 16QAM: 911KW7D
	LTE CAT-M Band 26 (Channel Bandwidth: 10MHz)	QPSK: 1M08G7D 16QAM: 904KW7D
ANTENNA TYPE	Monopole Antenna with 1dBi gain for band 14 Monopole Antenna with 1dBi gain for band 26	
HW VERSION	V1.1	
SW VERSION	N27-Q01-STDBZ-01B	
I/O PORTS	Refer to user's manual	
DATA CABLE	N/A	

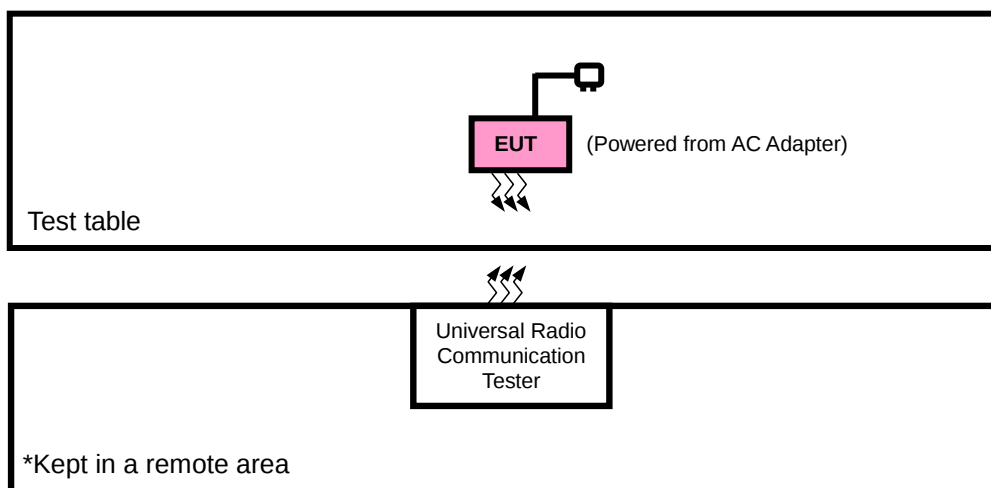
NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitter and one receiver.

MODULATION MODE	TX FUNCTION
LTE CAT-M1	1TX/1RX

2.2 CONFIGURATION OF SYSTEM UNDER TEST

FOR RADIATION EMISSION TEST



2.3 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	Adapter	JINGSAI	CLS-050200	N/A	N/A
2	DC source	LONG WEI	PS-6403D	010934269	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	Unshielded, Detachable 1.8m
2	DC Line: Unshielded, Detachable 1.0m

2.4 DESCRIPTION OF TEST MODES

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 worst case in ERP/EIRP and radiated emission was found when positioned on X-plane for LTE. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	DESCRIPTION
-	EUT + Adapter with LTE link

LTE CAT-M BAND 14 MODE

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
EIRP	23305 to 23355	23305, 23330, 23355	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset
	23330	23330	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset
FREQUENCY STABILITY	23305 to 23355	23305, 23355	5MHz	QPSK	2 RB / 0 RB Offset
	23330	23330	10MHz	QPSK	2 RB / 0 RB Offset
OCCUPIED BANDWIDTH	23305 to 23355	23305, 23330, 23355	5MHz	QPSK, 16QAM	6 RB / 0 RB Offset 5 RB / 0 RB Offset
	23330	23330	10MHz	QPSK, 16QAM	6 RB / 0 RB Offset 5 RB / 0 RB Offset
PEAK TO AVERAGE RATIO	23305 to 23355	23305, 23330, 23355	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset
	23330	23330	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset
BAND EDGE	23305 to 23355	23305	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset 6 RB / 0 RB Offset
		23355	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset 5 RB / 0 RB Offset
	23330	23330	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset 6 RB / 0 RB Offset
		23330	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset 5 RB / 0 RB Offset
	23305 to 23355	23305, 23330, 23355	5MHz	QPSK	2 RB / 0 RB Offset
		23330	10MHz	QPSK	2 RB / 0 RB Offset
CONDCUDED EMISSION	23305 to 23355	23305, 23330, 23355	5MHz	QPSK	2 RB / 0 RB Offset
	23330	23330	10MHz	QPSK	2 RB / 0 RB Offset
RADIATED EMISSION	23305 to 23355	23305, 23330, 23355	5MHz	QPSK	2 RB / 0 RB Offset
	23330	23330	10MHz	QPSK	2 RB / 0 RB Offset

Note: This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.

LTE CAT-M BAND 26

EUT CONFIGURE MODE	TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
B	ERP	26697 to 26783	26697, 26740, 26783	1.4MHz	QPSK, 16QAM	2 RB / 0 RB Offset
		26705 to 26775	26705, 26740, 26775	3MHz	QPSK, 16QAM	2 RB / 0 RB Offset
		26715 to 26765	26715, 26740, 26765	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset
		26740	26740	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset
B	FREQUENCY STABILITY	26697 to 26783	26697, 26783	1.4MHz	QPSK	2 RB / 0 RB Offset
		26705 to 26775	26705, 26775	3MHz	QPSK	2 RB / 0 RB Offset
		26715 to 26765	26715, 26765	5MHz	QPSK	2 RB / 0 RB Offset
		26740	26740	10MHz	QPSK	2 RB / 0 RB Offset
B	OCCUPIED BANDWIDTH	26697 to 26783	26697, 26740, 26783	1.4MHz	QPSK, 16QAM	6 RB / 0 RB Offset 5 RB / 0 RB Offset
		26705 to 26775	26705, 26740, 26775	3MHz	QPSK, 16QAM	6 RB / 0 RB Offset 5 RB / 0 RB Offset
		26715 to 26765	26715, 26740, 26765	5MHz	QPSK, 16QAM	6 RB / 0 RB Offset 5 RB / 0 RB Offset
		26740	26740	10MHz	QPSK, 16QAM	6 RB / 0 RB Offset 5 RB / 0 RB Offset
B	PEAK TO AVERAGE RATIO	26697 to 26783	26697, 26740, 26783	1.4MHz	QPSK, 16QAM	2 RB / 0 RB Offset
		26705 to 26775	26705, 26740, 26775	3MHz	QPSK, 16QAM	2 RB / 0 RB Offset
		26715 to 26765	26715, 26740, 26765	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset
		26740	26740	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset
B	BAND EDGE	26697 to 26783	26697	1.4MHz	QPSK, 16QAM	2 RB / 0 RB Offset 6 RB / 0 RB Offset
			26783	1.4MHz	QPSK, 16QAM	2 RB / 0 RB Offset 5 RB / 0 RB Offset
		26705 to 26775	26705	3MHz	QPSK, 16QAM	2 RB / 0 RB Offset 6 RB / 0 RB Offset
			26775	3MHz	QPSK, 16QAM	2 RB / 0 RB Offset 5 RB / 0 RB Offset
		26715 to 26765	26715	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset 6 RB / 0 RB Offset
			26765	5MHz	QPSK, 16QAM	2 RB / 0 RB Offset 5 RB / 0 RB Offset
		26740	26740	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset 6 RB / 0 RB Offset
			26740	10MHz	QPSK, 16QAM	2 RB / 0 RB Offset 5 RB / 0 RB Offset
		26697 to 26783	26697, 26740, 26783	1.4MHz	QPSK	2 RB / 0 RB Offset
			26705, 26740, 26775	3MHz	QPSK	2 RB / 0 RB Offset
		26715 to 26765	26715, 26740, 26765	5MHz	QPSK	2 RB / 0 RB Offset
		26740	26740	10MHz	QPSK	2 RB / 0 RB Offset
A	RADIATED EMISSION	26697 to 26783	26697, 26740, 26783	1.4MHz	QPSK	2 RB / 0 RB Offset
		26705 to 26775	26740	3MHz	QPSK	2 RB / 0 RB Offset
		26715 to 26765	26740	5MHz	QPSK	2 RB / 0 RB Offset
		26740	26740	10MHz	QPSK	2 RB / 0 RB Offset

Note: This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.

TEST CONDITION:

TEST ITEM	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
EIRP(ERP)	23deg. C, 70%RH	5Vdc from adapter	Tony Xiong
FREQUENCY STABILITY	23deg. C, 70%RH	DC 3.1V/3.6V/4.3V	Kevin Zhang
OCCUPIED BANDWIDTH	23deg. C, 70%RH	5Vdc from adapter	Kevin Zhang
PEAK TO AVERAGE RATIO	23deg. C, 70%RH	5Vdc from adapter	Kevin Zhang
BAND EDGE	23deg. C, 70%RH	5Vdc from adapter	Kevin Zhang
CONDCUDED EMISSION	23deg. C, 70%RH	5Vdc from adapter	Kevin Zhang
RADIATED EMISSION	23deg. C, 70%RH	5Vdc from adapter	Tony Xiong



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2.5 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 90

KDB 971168 D01 Power Meas License Digital Systems v03r01

ANSI/TIA/EIA-603-D

ANSI/TIA/EIA-603-E

ANSI C63.26-2015

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

3 TEST TYPES AND RESULTS

3.1 OUTPUT POWER MEASUREMENT

3.1.1 LIMITS OF OUTPUT POWER MEASUREMENT

Per FCC Part 90.635(a)(b)

Mobile stations are limited to 100 watts e.r.p. Portable stations are limited to 3 watts e.r.p.

3.1.2 TEST PROCEDURES

EIRP / ERP MEASUREMENT:

Per KDB 971168 D01 Power Meas License Digital Systems v03r01 or subclause 5.2.5.5 of ANSI C63.26-2015, the relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_T - L_C$$

Where:

ERP or EIRP = effective radiated power or equivalent isotropically radiated power, respectively

(expressed in the same units as P_{Meas} , typically dBW or dBm);

P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;

G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

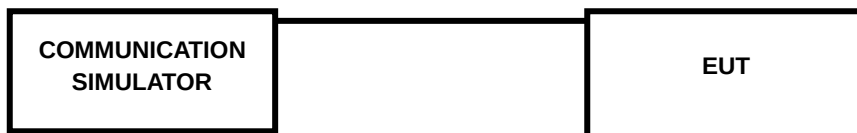
L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

CONDUCTED POWER MEASUREMENT:

- The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.
- Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

3.1.3 TEST SETUP

CONDUCTED POWER MEASUREMENT:



3.1.4 TEST RESULTS

AVERAGE CONDUCTED OUTPUT POWER (dBm)

LTE CAT-M BAND 14

Band/BW	Modulation	RB Size	RB Offset	Low CH 23305	Mid CH 23330	High CH 23355
				Frequency 790.5 MHz	Frequency 793 MHz	Frequency 795.5 MHz
14/ 5	QPSK	2	0	22.22	22.21	22.21
		2	4	22.28	22.24	22.25
		5	0	22.27	22.30	22.29
		5	1	22.31	22.32	22.33
		6	0	21.98	21.97	21.97
	16QAM	2	0	22.35	22.35	22.37
		2	4	22.45	22.47	22.48
		5	0	22.26	22.22	22.22
		5	1	22.24	22.22	22.25

Band/BW	Modulation	RB Size	RB Offset	CH	Mid CH 23330	CH
				MHz	Frequency 793 MHz	MHz
14/ 10	QPSK	2	0	-	22.27	-
		2	4	-	22.31	-
		5	0	-	22.35	-
		5	1	-	22.36	-
		6	0	-	22.01	-
	16QAM	2	0	-	22.43	-
		2	4	-	22.50	-
		5	0	-	22.27	-
		5	1	-	22.29	-

LTE CAT-M BAND 26

Band/BW	Modulation	RB Size	RB Offset	Low CH 26697	Mid CH 26740	High CH 26783
				Frequency 814.7 MHz	Frequency 819 MHz	Frequency 823.3 MHz
26/ 1.4	QPSK	2	0	22.67	22.66	22.68
		2	4	22.76	22.72	22.70
		5	0	22.56	22.59	22.56
		5	1	22.62	22.66	22.56
		6	0	22.41	22.40	22.40
	16QAM	2	0	22.52	22.55	22.50
		2	4	22.59	22.57	22.57
		5	0	22.71	22.69	22.69
		5	1	22.50	22.55	22.49

Band/BW	Modulation	RB Size	RB Offset	Low CH CH26705	Mid CH CH26740	High CH CH26775
				Frequency 815.5MHz	Frequency 819.0MHz	Frequency 822.5MHz
26/ 3	QPSK	2	0	22.67	22.68	22.66
		2	4	22.76	22.72	22.72
		5	0	22.57	22.59	22.53
		5	1	22.63	22.63	22.58
		6	0	22.38	22.39	22.40
	16QAM	2	0	22.51	22.53	22.50
		2	4	22.53	22.59	22.58
		5	0	22.68	22.71	22.72
		5	1	22.50	22.49	22.44

Band/BW	Modulation	RB Size	RB Offset	Low CH CH26715	Mid CH CH26740	High CH CH26765
				Frequency 816.5MHz	Frequency 819.0MHz	Frequency 821.5MHz
26/ 5	QPSK	2	0	22.68	22.66	22.65
		2	4	22.69	22.75	22.69
		5	0	22.55	22.56	22.60
		5	1	22.64	22.66	22.60
		6	0	22.39	22.44	22.41
	16QAM	2	0	22.51	22.56	22.44
		2	4	22.60	22.58	22.63
		5	0	22.70	22.67	22.65
		5	1	22.49	22.50	22.49



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Band/BW	Modulation	RB Size	RB Offset	CH	Mid CH CH26740	CH
				MHz	Frequency 819.0MHz	MHz
26/ 10	QPSK	2	0	-	22.73	-
		2	4	-	22.78	-
		5	0	-	22.64	-
		5	1	-	22.68	-
		6	0	-	22.45	-
	16QAM	2	0	-	22.58	-
		2	4	-	22.65	-
		5	0	-	22.75	-
		5	1	-	22.57	-

ERP

LTE CAT-M BAND 14

CHANNEL BANDWIDTH: 5MHz QPSK

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	EIRP (dBm)	EIRP (mW)	Limit (W)
23305	790.5	22.31	1.00	21.16	130.62	3
23330	793.0	22.32	1.00	21.17	130.92	3
23355	795.5	22.33	1.00	21.18	131.22	3

CHANNEL BANDWIDTH: 5MHz 16QAM

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	EIRP (dBm)	EIRP (mW)	Limit (W)
23305	790.5	22.45	1.00	21.30	134.90	3
23330	793.0	22.47	1.00	21.32	135.52	3
23355	795.5	22.48	1.00	21.33	135.83	3

CHANNEL BANDWIDTH: 10MHz QPSK

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	EIRP (dBm)	EIRP (mW)	Limit (W)
23330	793.0	22.36	1.00	21.21	132.13	3

CHANNEL BANDWIDTH: 10MHz 16QAM

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	EIRP (dBm)	EIRP (mW)	Limit (W)
23330	793.0	22.50	1.00	21.35	136.46	3

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CHANNEL BANDWIDTH: 1.4MHz QPSK

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _C (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26797	814.7	22.76	1.00	21.61	144.88	7
26840	819.0	22.72	1.00	21.57	143.55	7
26883	823.3	22.70	1.00	21.55	142.89	7

CHANNEL BANDWIDTH: 1.4MHz 16QAM

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _C (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26797	814.7	22.71	1.00	21.56	143.22	7
26840	819.0	22.69	1.00	21.54	142.56	7
26883	823.3	22.69	1.00	21.54	142.56	7

CHANNEL BANDWIDTH: 3MHz QPSK

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _C (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26805	815.5	22.76	1.00	21.61	144.88	7
26840	819.0	22.72	1.00	21.57	143.55	7
26875	822.5	22.72	1.00	21.57	143.55	7

CHANNEL BANDWIDTH: 3MHz 16QAM

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _C (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26805	815.5	22.68	1.00	21.53	142.23	7
26840	819.0	22.71	1.00	21.56	143.22	7
26875	822.5	22.72	1.00	21.57	143.55	7

CHANNEL BANDWIDTH: 5MHz QPSK

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26815	816.5	22.69	1.00	21.54	142.56	7
26840	819.0	22.75	1.00	21.60	144.54	7
26865	821.5	22.69	1.00	21.54	142.56	7

CHANNEL BANDWIDTH: 5MHz 16QAM

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26815	816.5	22.70	1.00	21.55	142.89	7
26840	819.0	22.69	1.00	21.54	142.56	7
26865	821.5	22.65	1.00	21.50	141.25	7

CHANNEL BANDWIDTH: 10MHz QPSK

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26840	819.0	22.78	1.00	21.63	145.55	7

CHANNEL BANDWIDTH: 10MHz 16QAM

Channel	Frequency (MHz)	Conducted Power (dBm)	G _T -L _c (dB)	ERP (dBm)	ERP (mW)	Limit (W)
26840	819.0	22.75	1.00	21.60	144.54	7

REMARKS: 1. ERP Output Power (dBm) = SPA LVL (dBm) + Correction Factor (dB) -2.15(dB).
2. Correction factor (dB) = Free Space Loss + Antenna Factor + Cable Loss

3.2 FREQUENCY STABILITY MEASUREMENT

3.2.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

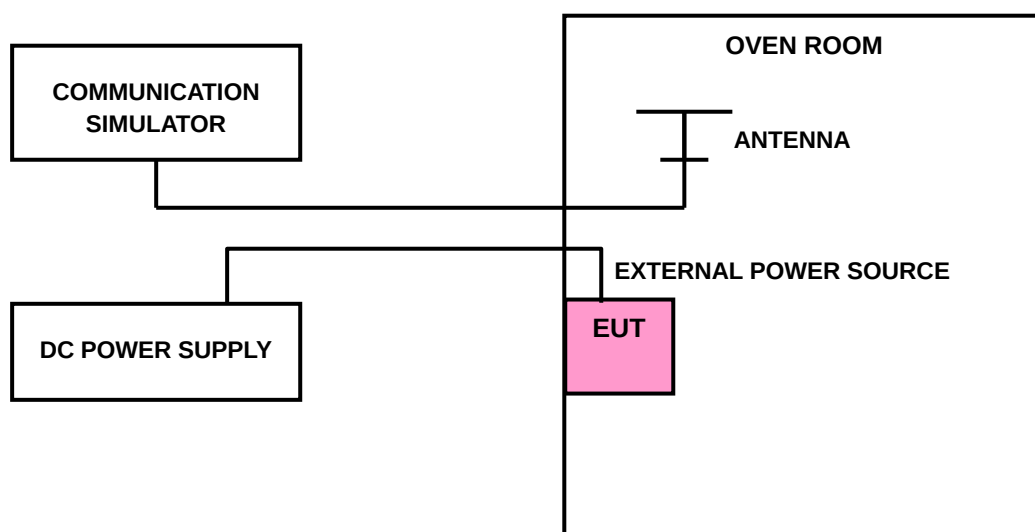
The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked

3.2.2 TEST PROCEDURE

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

NOTE: The frequency error was recorded frequency error from the communication simulator.

3.2.3 TEST SETUP



3.2.4 TEST RESULTS

LTE CAT-M BAND 14

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0021	0.0024	2.5
V _{min}	-0.0023	-0.0030	2.5
V _{max}	0.0021	0.0021	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} to V_{max} .

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0113	-0.0112	2.5
-20	-0.0099	-0.0110	2.5
-10	-0.0086	-0.0079	2.5
0	-0.0075	-0.0076	2.5
10	-0.0053	-0.0048	2.5
20	-0.0041	-0.0041	2.5
30	-0.0027	-0.0035	2.5
40	-0.0021	-0.0020	2.5
50	-0.0004	-0.0003	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	10MHz	LIMIT (ppm)
	FREQUENCY ERROR (ppm)	
	Mid Channel	
V_{nor}	0.0024	2.5
V_{min}	-0.0031	2.5
V_{max}	0.0026	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} to V_{max} .

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	10MHz	LIMIT (ppm)
	FREQUENCY ERROR (ppm)	
	Mid Channel	
-30	-0.0112	2.5
-20	-0.0111	2.5
-10	-0.0081	2.5
0	-0.0076	2.5
10	-0.0050	2.5
20	-0.0042	2.5
30	-0.0038	2.5
40	-0.0017	2.5
50	-0.0003	2.5

LTE CAT-M BAND 26

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	1.4MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0026	0.0025	2.5
V _{min}	-0.0031	-0.0031	2.5
V _{max}	0.0026	0.0025	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} to V_{max} .

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	1.4MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0119	-0.0123	2.5
-20	-0.0102	-0.0112	2.5
-10	-0.0084	-0.0081	2.5
0	-0.0079	-0.0076	2.5
10	-0.0054	-0.0051	2.5
20	-0.0042	-0.0040	2.5
30	-0.0033	-0.0043	2.5
40	-0.0019	-0.0022	2.5
50	-0.0006	-0.0003	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	3MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0026	0.0026	2.5
V _{min}	-0.0031	-0.0031	2.5
V _{max}	0.0026	0.0025	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} to V_{max} .

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	3MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0123	-0.0117	2.5
-20	-0.0113	-0.0102	2.5
-10	-0.0083	-0.0083	2.5
0	-0.0074	-0.0076	2.5
10	-0.0054	-0.0052	2.5
20	-0.0041	-0.0040	2.5
30	-0.0027	-0.0028	2.5
40	-0.0021	-0.0018	2.5
50	-0.0005	-0.0002	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
V _{nor}	0.0025	0.0026	2.5
V _{min}	-0.0031	-0.0031	2.5
V _{max}	0.0024	0.0024	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} to V_{max} .

FREQUENCY ERROR vs. TEMPERATURE.

TEMP. (°C)	5MHz		LIMIT (ppm)
	FREQUENCY ERROR (ppm)		
	Low Channel	High Channel	
-30	-0.0123	-0.0124	2.5
-20	-0.0106	-0.0114	2.5
-10	-0.0084	-0.0086	2.5
0	-0.0076	-0.0077	2.5
10	-0.0052	-0.0050	2.5
20	-0.0039	-0.0043	2.5
30	-0.0042	-0.0038	2.5
40	-0.0016	-0.0018	2.5
50	-0.0004	-0.0005	2.5

FREQUENCY ERROR VS. VOLTAGE

VOLTAGE (Volts)	10MHz	LIMIT (ppm)
	FREQUENCY ERROR (ppm)	
	Mid Channel	
V_{nor}	0.0024	2.5
V_{min}	-0.0031	2.5
V_{max}	0.0026	2.5

NOTE: The applicant defined the normal working voltage of the battery is from V_{min} to V_{max} .

FREQUENCY ERROR vs. TEMPERATURE.

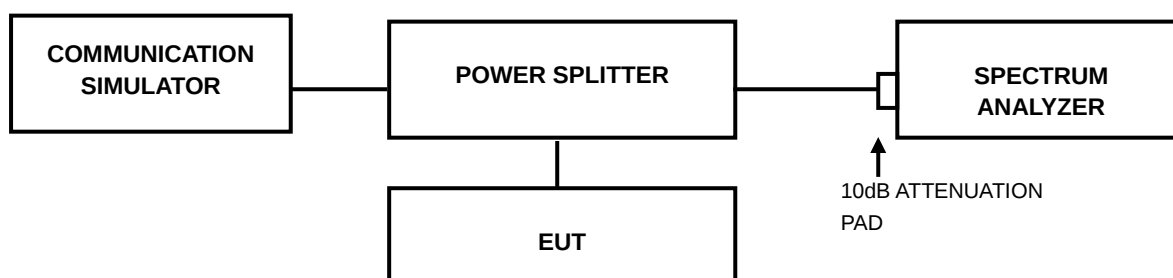
TEMP. (°C)	10MHz	LIMIT (ppm)
	FREQUENCY ERROR (ppm)	
	Mid Channel	
-30	-0.0120	2.5
-20	-0.0103	2.5
-10	-0.0082	2.5
0	-0.0075	2.5
10	-0.0052	2.5
20	-0.0038	2.5
30	-0.0025	2.5
40	-0.0022	2.5
50	-0.0005	2.5

3.3 OCCUPIED BANDWIDTH MEASUREMENT

3.3.1 LIMITS OF OCCUPIED BANDWIDTH MEASUREMENT

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

3.3.2 TEST SETUP



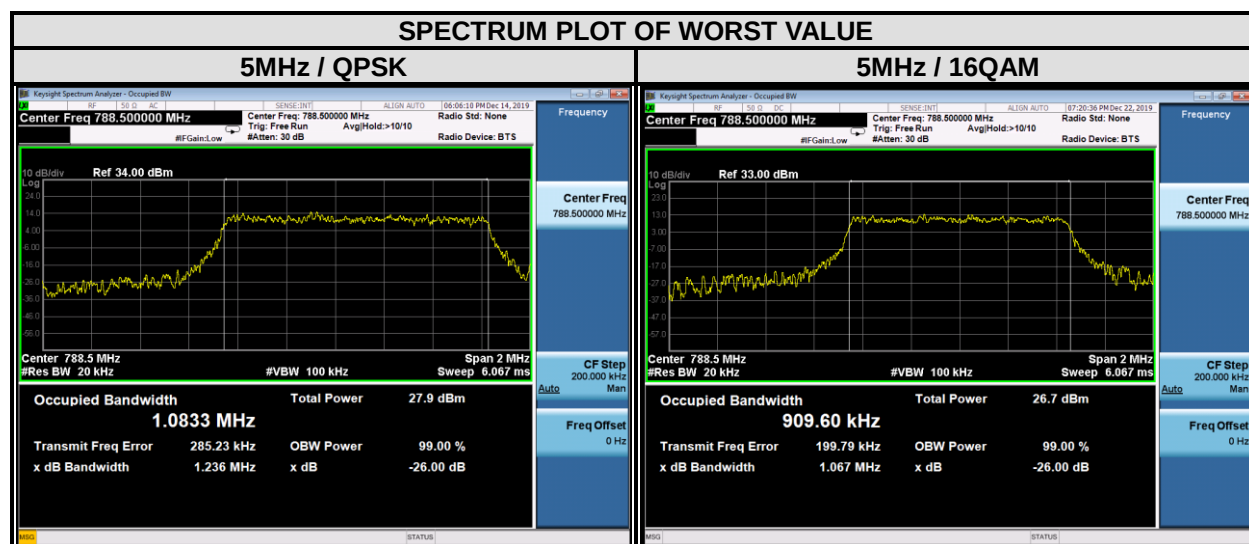
3.3.3 TEST PROCEDURES

- The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

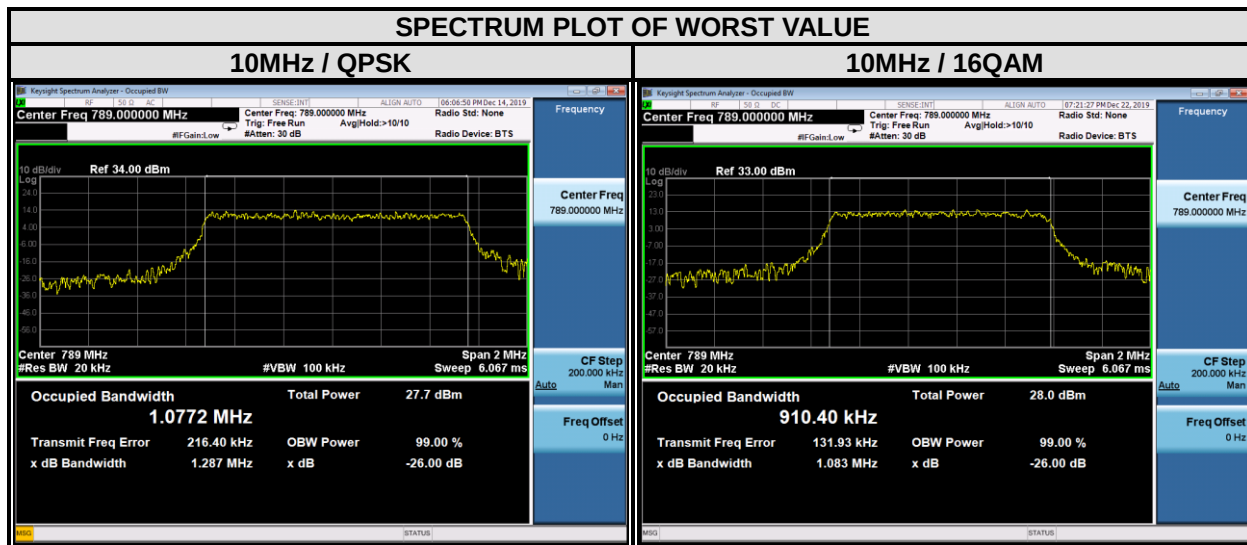
3.3.4 TEST RESULTS

LTE CAT-M BAND 14

CHANNEL BANDWIDTH: 5MHz					
CHANNEL	Frequency (MHz)	99% OCCUPIED Bandwidth (MHz)		26dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
23305	790.5	1.08	0.910	1.24	1.07
23330	793	1.08	0.904	1.27	1.09
23355	795.5	1.08	0.909	1.25	1.11

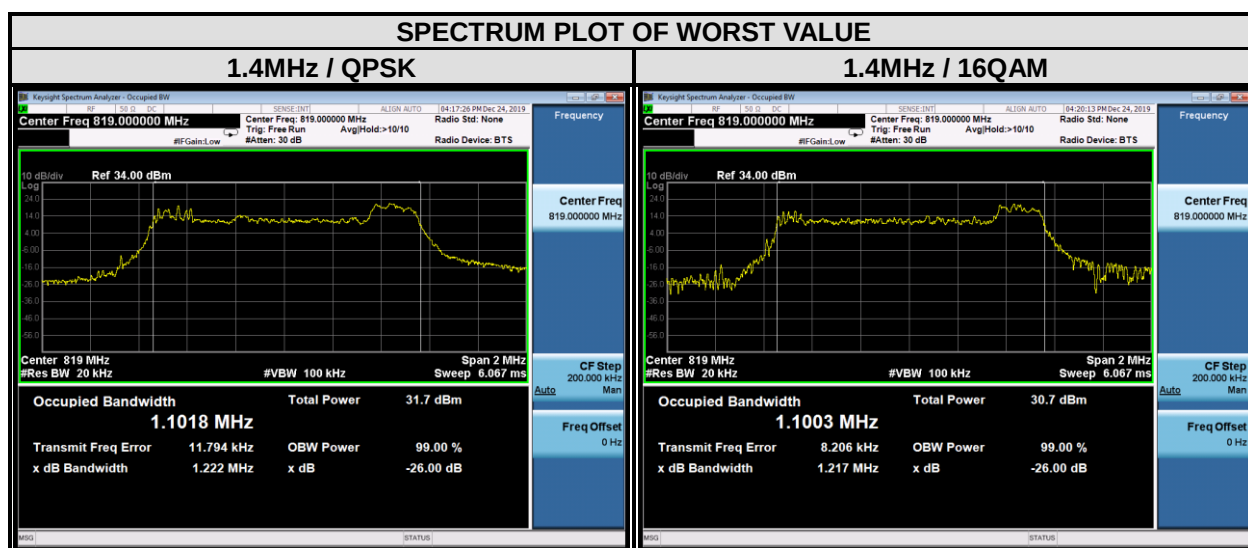


CHANNEL BANDWIDTH: 10MHz					
CHANNEL	Frequency (MHz)	99% OCCUPIED Bandwidth (MHz)		26dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
-	-	-	-	-	-
23330	793	1.08	0.910	1.29	1.08
-	-	-	-	-	-

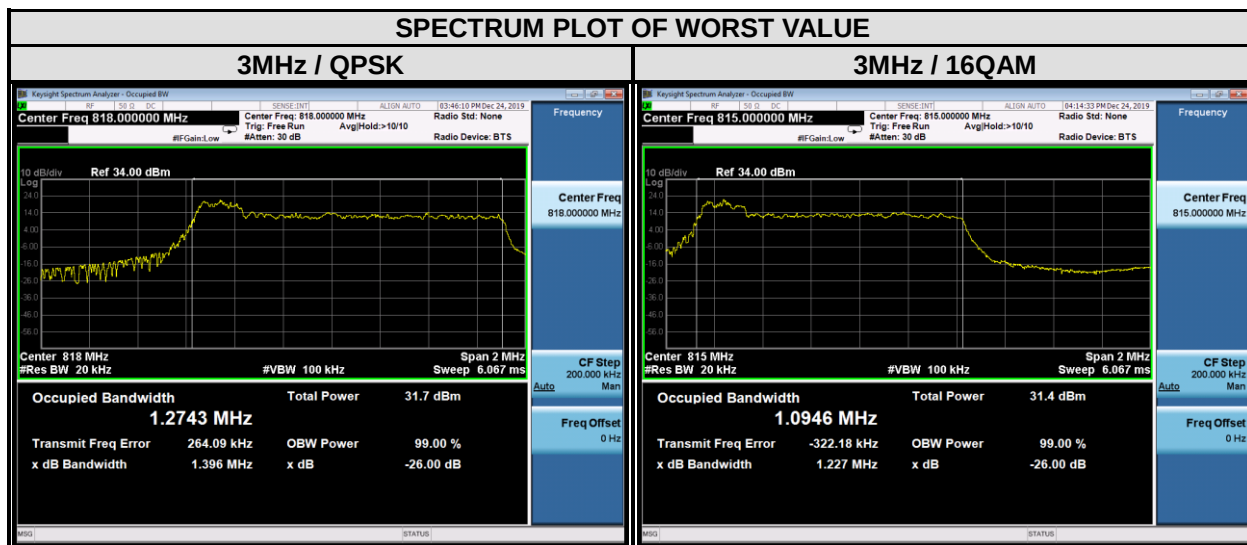


LTE CAT-M BAND 26

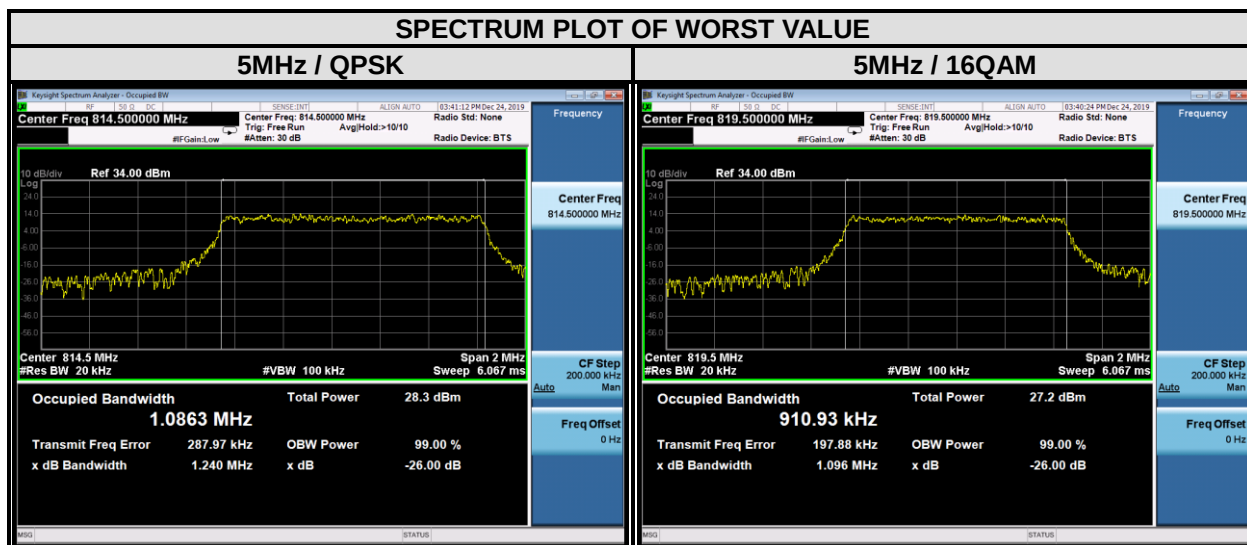
CHANNEL BANDWIDTH: 1.4MHz					
CHANNEL	Frequency (MHz)	99% OCCUPIED Bandwidth (MHz)		26dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
26697	814.7	1.09	1.09	1.21	1.21
26740	819	1.10	1.10	1.22	1.22
26783	823.3	1.09	1.09	1.23	1.21



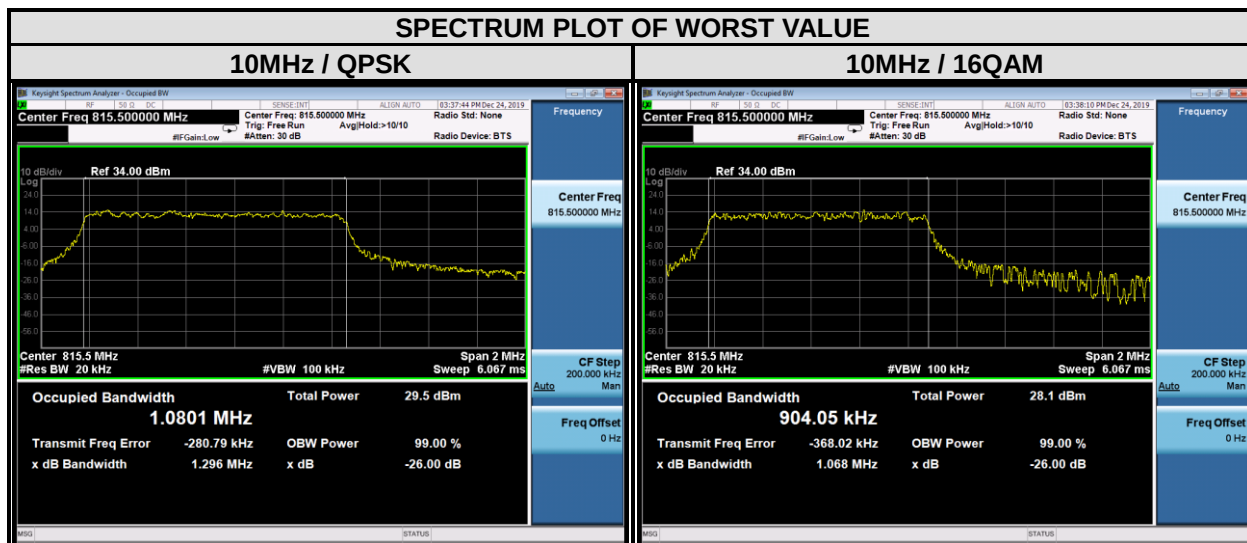
CHANNEL BANDWIDTH: 3MHz					
CHANNEL	Frequency (MHz)	99% OCCUPIED Bandwidth (MHz)		26dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
26705	815.5	1.24	1.09	1.40	1.23
26740	819	1.27	1.09	1.40	1.22
26775	822.5	1.26	1.09	1.41	1.22



CHANNEL BANDWIDTH: 5MHz					
CHANNEL	Frequency (MHz)	99% OCCUPIED Bandwidth (MHz)		26dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
26715	816.5	1.09	0.910	1.24	1.16
26740	819	1.08	0.907	1.25	1.07
26765	821.5	1.08	0.911	1.26	1.10



CHANNEL BANDWIDTH: 10MHz					
CHANNEL	Frequency (MHz)	99% OCCUPIED Bandwidth (MHz)		26dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
-	-	-	-	-	-
26740	819	1.08	0.904	1.30	1.07
-	-	-	-	-	-

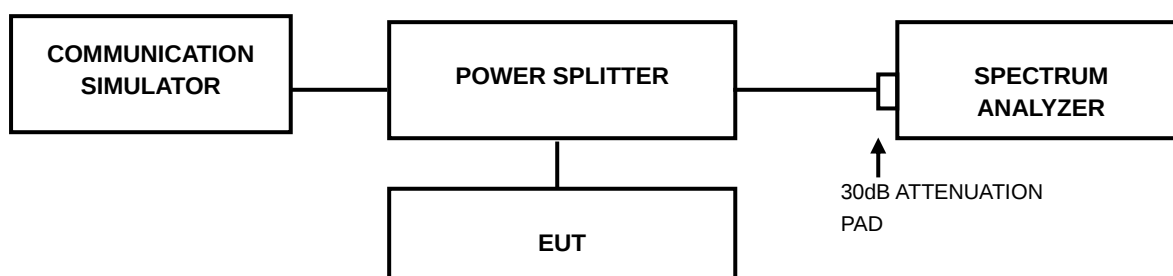


3.4 PEAK TO AVERAGE RATIO

3.4.1 LIMITS OF PEAK TO AVERAGE RATIO MEASUREMENT

In addition, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

3.4.2 TEST SETUP



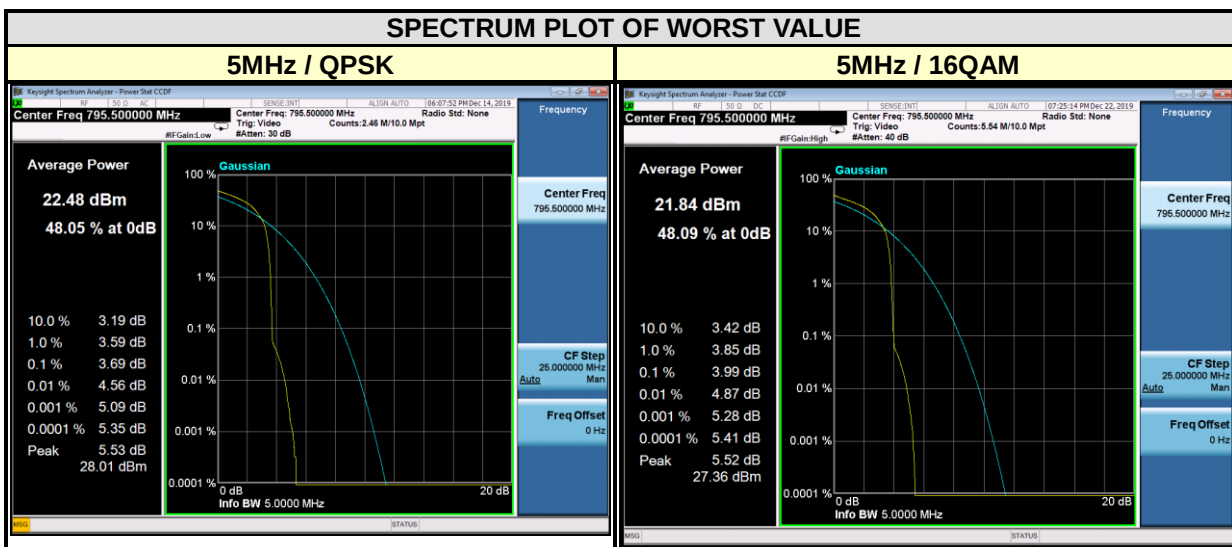
3.4.3 TEST PROCEDURES

1. Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1%.

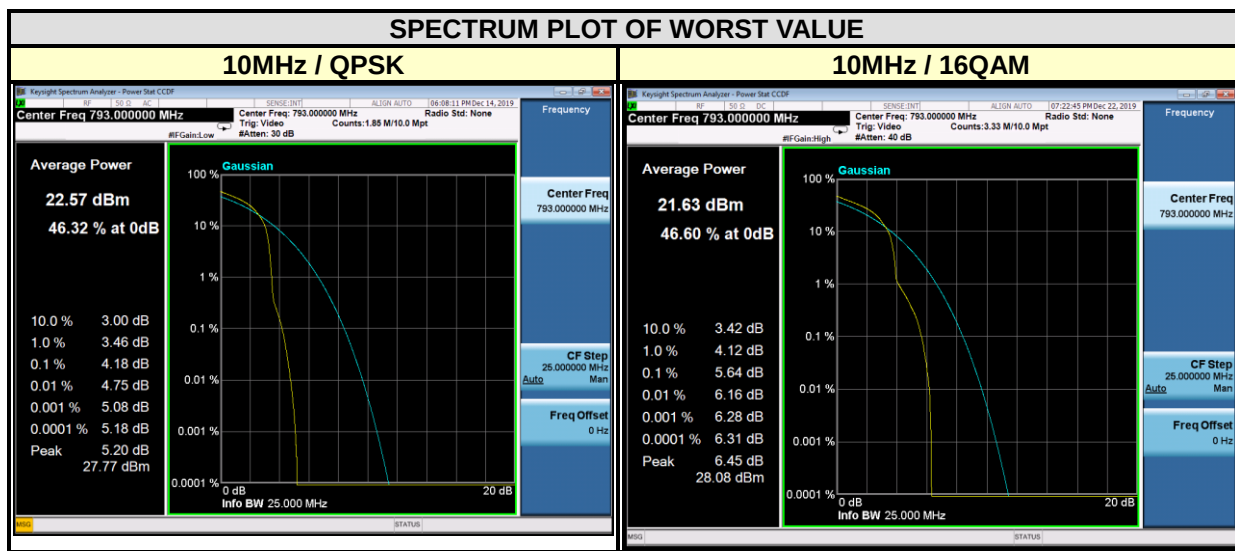
3.4.4 TEST RESULTS

LTE CAT-M BAND 14

CHANNEL BANDWIDTH: 5MHz			
CHANNEL	FREQUENCY (MHz)	PEAK TO AVERAGE RATIO (dB)	
		QPSK	16QAM
23305	790.5	3.46	3.82
23330	793	3.37	3.71
23355	795.5	3.69	3.99

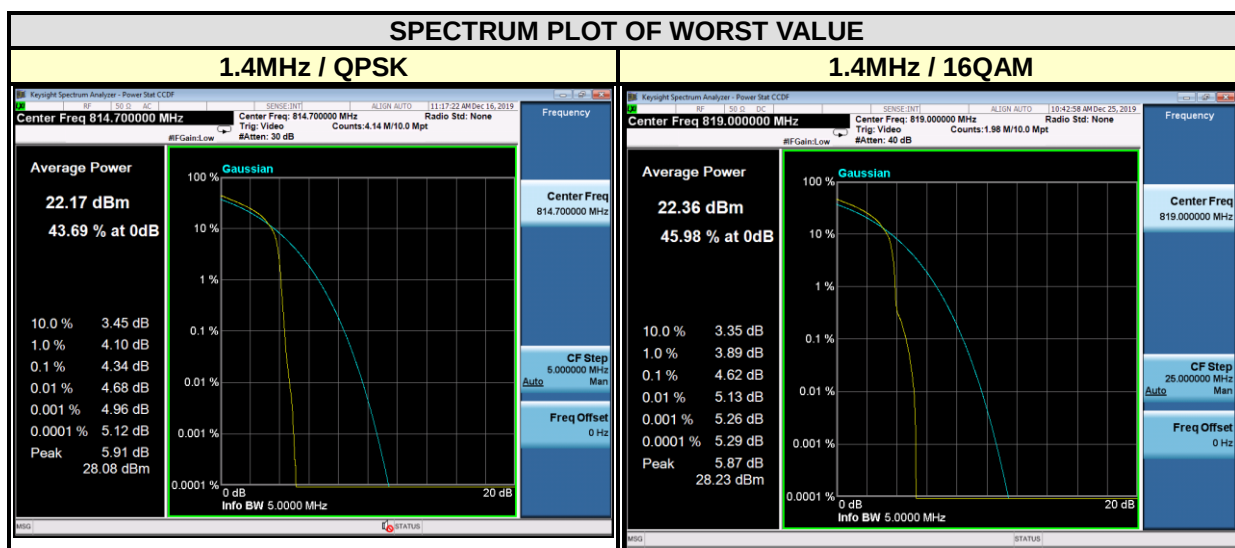


CHANNEL BANDWIDTH: 10MHz			
CHANNEL	FREQUENCY (MHz)	PEAK TO AVERAGE RATIO (dB)	
		QPSK	16QAM
-	-	-	-
23330	793	4.18	5.64
-	-	-	-

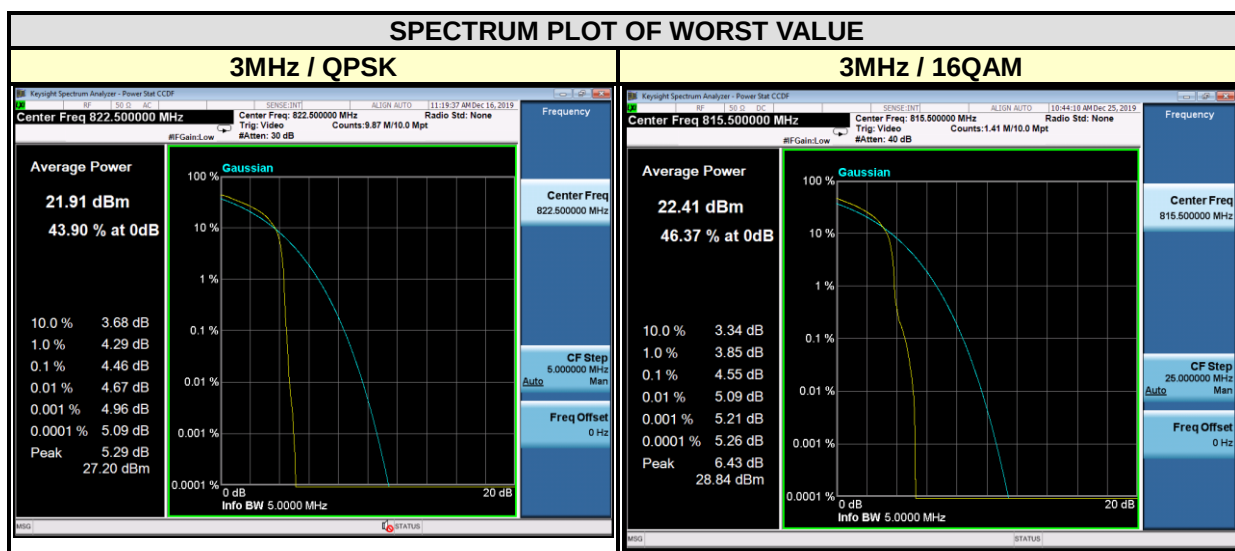


LTE CAT-M BAND 26

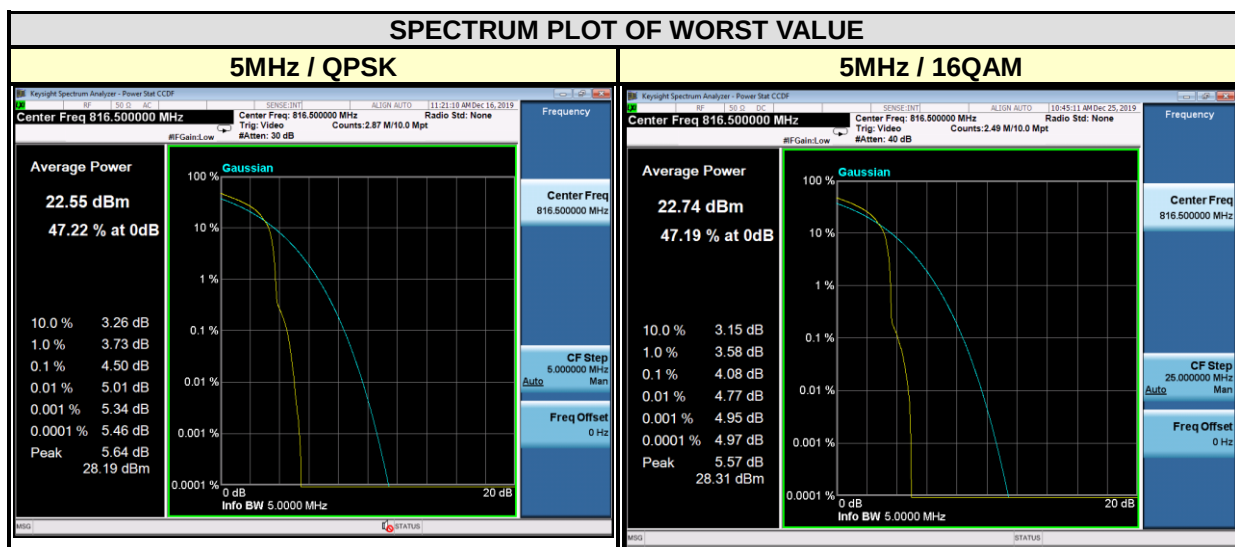
CHANNEL BANDWIDTH: 1.4MHz			
CHANNEL	FREQUENCY (MHz)	PEAK TO AVERAGE RATIO (dB)	
		QPSK	16QAM
26697	814.7	4.34	4.56
26740	819	4.27	4.62
26783	823.3	4.25	4.60



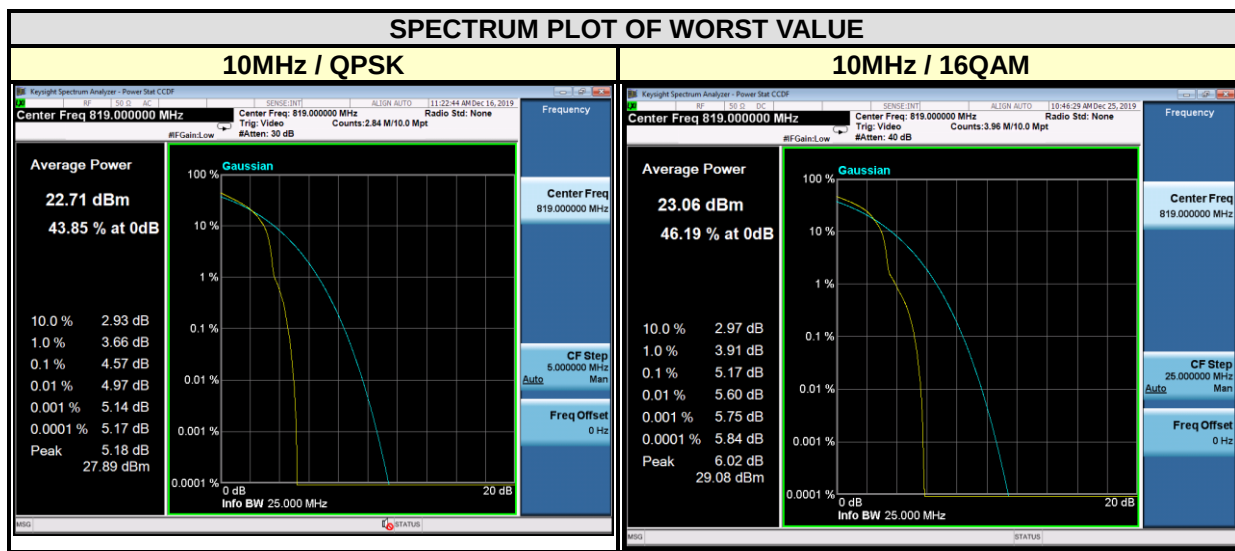
CHANNEL BANDWIDTH: 3MHz			
CHANNEL	FREQUENCY (MHz)	PEAK TO AVERAGE RATIO (dB)	
		QPSK	16QAM
26705	815.5	4.15	4.55
26740	819	3.33	4.29
26775	822.5	4.46	4.32



CHANNEL BANDWIDTH: 5MHz			
CHANNEL	FREQUENCY (MHz)	PEAK TO AVERAGE RATIO (dB)	
		QPSK	16QAM
26715	816.5	4.50	4.08
26740	819	4.49	3.80
26765	821.5	4.49	4.05



CHANNEL BANDWIDTH: 10MHz			
CHANNEL	FREQUENCY (MHz)	PEAK TO AVERAGE RATIO (dB)	
		QPSK	16QAM
-	-	-	-
26740	819	4.57	5.17
-	-	-	-



3.5 EMISSION MASK MEASUREMENT

3.5.1 LIMITS OF EMISSION MASK MEASUREMENT

According to FCC part 90.691 shall be tested the emission mask. For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

FCC part 90.543e as below:

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

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

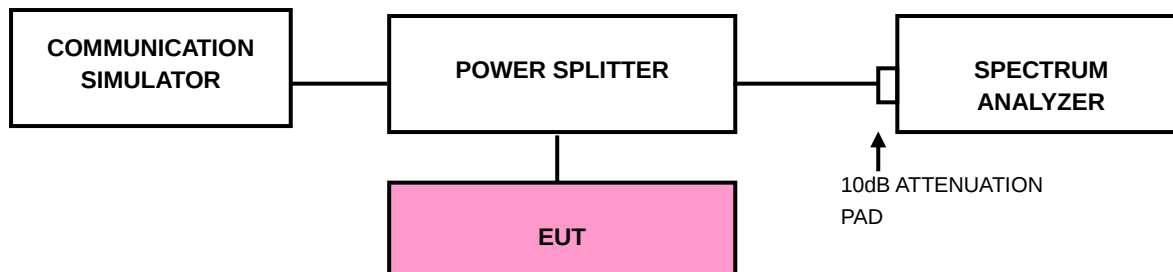
(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

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

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

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

3.5.2 TEST SETUP



3.5.3 TEST PROCEDURES

- The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 2 channels (low and high operational frequency range.).
- The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- The center frequency of spectrum is the band edge frequency and span is 1~5 MHz. RBW of the spectrum is 50kHz and VBW of the spectrum is 200kHz. (LTE bandwidth 5MHz)
- The center frequency of spectrum is the band edge frequency and span is 1~5 MHz. RBW of the spectrum is 100kHz and VBW of the spectrum is 300kHz. (LTE bandwidth 10MHz)
- Record the max trace plot into the test report.

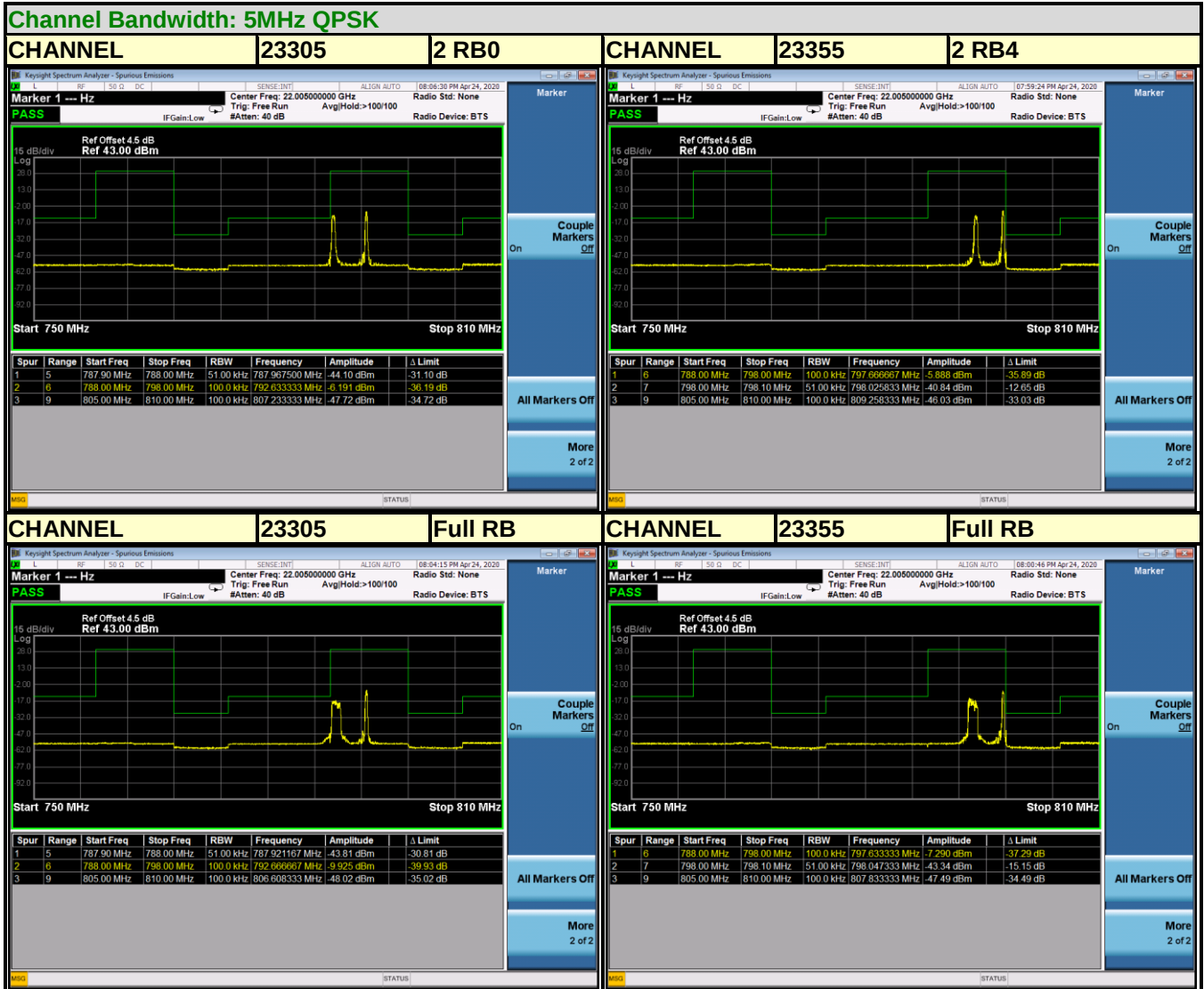


BUREAU
VERITAS

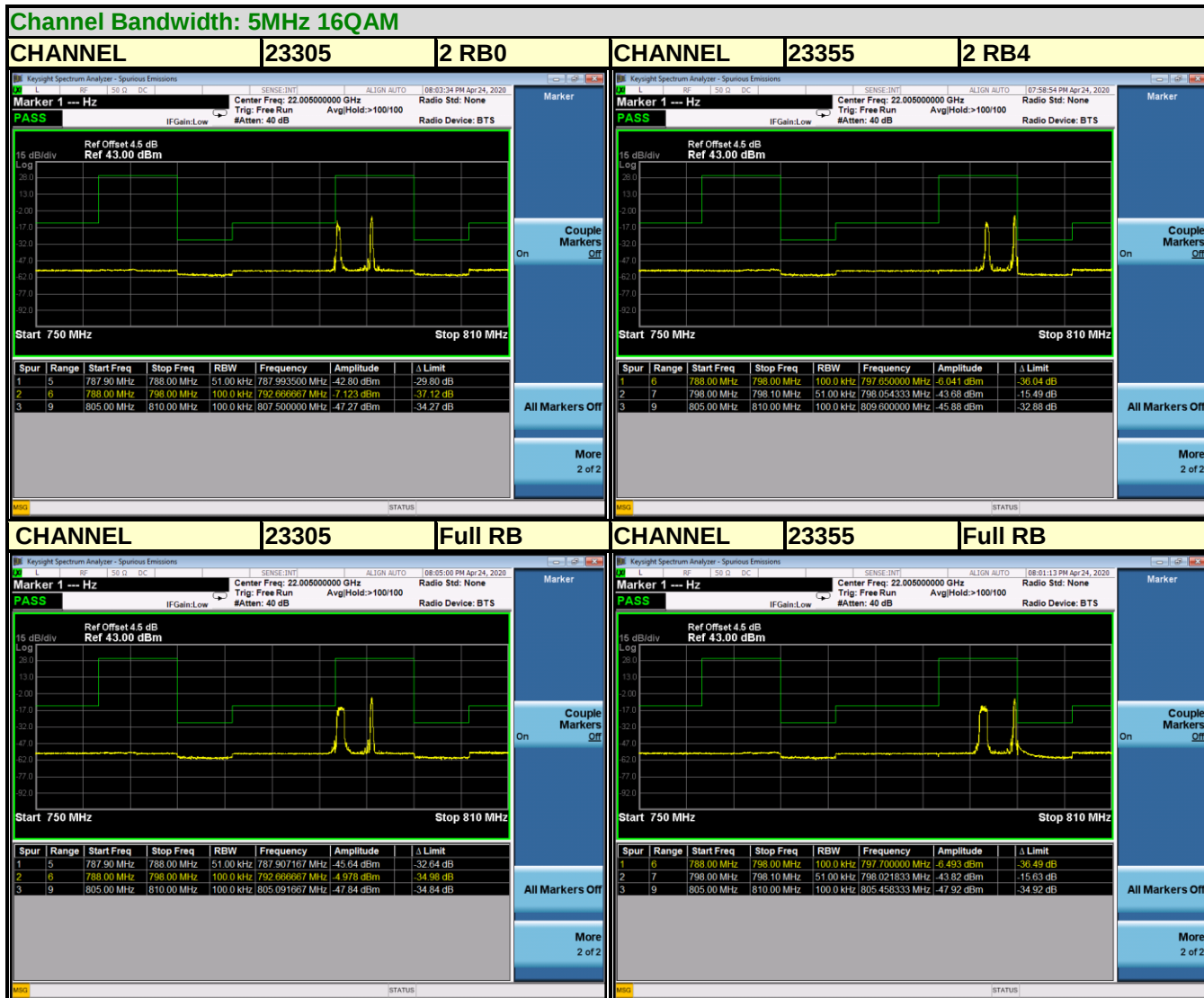
Test Report No.: RF191122W002-5

3.5.4 TEST RESULTS

LTE CAT-M BAND 14



LTE CAT-M BAND 14





BUREAU
VERITAS

Test Report No.: RF191122W002-5

LTE CAT-M BAND 14

Channel Bandwidth: 10MHz QPSK





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Test Report No.: RF191122W002-5

Channel Bandwidth: 10MHz 16QAM



LTE CAT-M BAND 26

Channel Bandwidth: 1.4MHz QPSK

