FCC PART 27

MEASUREMENT AND TEST REPORT

For

Quectel Wireless Solutions Company Limited

Room501,Building 13,No.99 TianZhou Road,Xuhui District,Shanghai,China

Test Model: EC25-V
FCC ID: XMR201607EC25V

Report Type:	**Product Type:**
Original Report	LTE Module

Test Engineer: **David. Hsu**

Report Number: **RTWK160705002-00**

Report Date: **2016-07-04**

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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Quectel Wireless Solutions Company Limited's product, model number: EC25-V (FCC ID: XMR201607EC25V) or the "EUT" in this report was a LTE Module , which was measured approximately 32mm(L) × 29mm(W) × 2.4mm(H) . rated with input voltage: DC 3.8 V , EUT Operating Voltage Range: 3.3~4.3V.

** Note: The product ' s series model number: EC25-V MiniPCIe, EC25-VD, EC25-VD MiniPCIe. The difference between them was explained in the attached declaration letter.*

** All measurement and test data in this report was gathered from production sample serial number: 20160622001 (Assigned by BACL, Taiwan).The EUT supplied by the applicant was received on 2016-04-22.*

Objective

This type approval report is prepared on behalf of Quectel Wireless Solutions Company Limited in accordance with Part 2, Part 27 of the Federal Communication Commission's rules.

The objective is to determine the compliance of EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability, and band edge.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-Part J as well as the following parts:

Part 27 – Miscellaneous wireless communications services

Applicable Standards: TIA/EIA 603-D.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp. (Taiwan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.81 dB for 30MHz-1GHz.and 4.88 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp.(Taiwan) 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Test site at Bay Area Compliance Laboratories Corp. (Taiwan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 22, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 431084. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D.

The final qualification test was performed with the EUT operating at normal mode.

Equipment Modifications

No modifications were made to the EUT.

Specific accessory equipment

Description	parameter	Serial Number
LTE antenna	PCB Antenna, antenna Gain: 1dBi for700MHz 1dBi for1700MHz	N/A

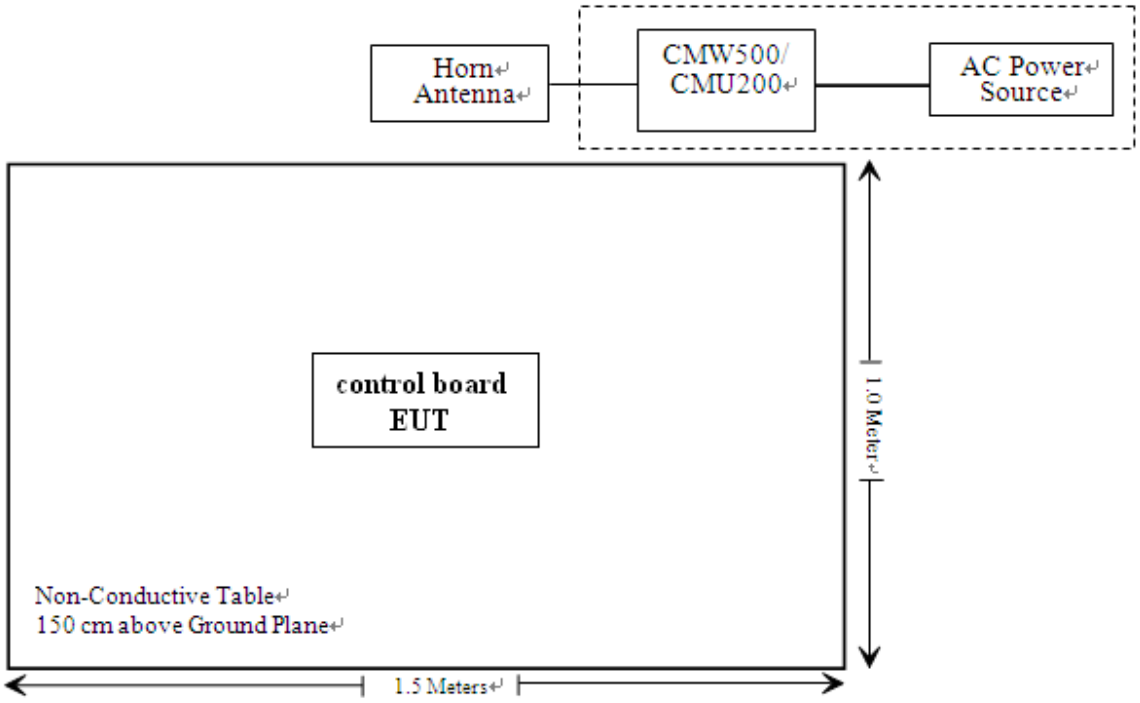
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	1201.0002K50
Dell	Notebook	E6410	N/A
Quectel	Test Fixer	N/A	N/A
Shanghai Jingsai Electronic Techology Co.,Ltd.	ADAPATER I/P: AC 100-240V, 50-60Hz O/P: DC 5V, 2A, 12W	JS-400K	N/A
Quectel Wireless Solutions	Control Board	S2-W2231	MP76121D4000228

External Cable List and Details

Cable Description	Length (m)	From Port	To
USB CABLE	1.0	EUT	Notebook

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§ 2.1047	Modulation Characteristics	Not Applicable
§2.1046;§27.50 (d) (c)	RF Output Power	Compliance
§ 2.1049; §27.53 (c)	Occupied Bandwidth	Compliance
§ 2.1051; §27.53 (c) (h)	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053; §27.53 (c) (h)	Spurious Radiated Emissions	Compliance
§27.53 (c) (h)	Band Edges	Compliance
§ 2.1055; §27.54	Frequency stability	Compliance

FCC §2.1047 - MODULATION CHARACTERISTIC

According to FCC § 2.1047(d) , Part 27 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

FCC§27.50 (d) (c) - RF OUTPUT POWER

Applicable Standards

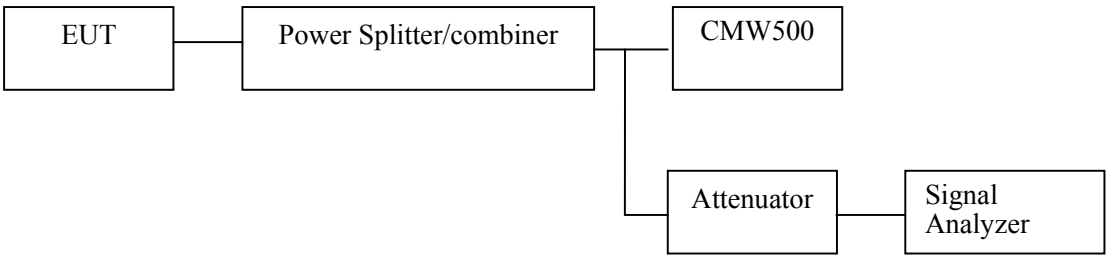
According to §27.50(d), the maximum EIRP must not exceed 1Watts (30 dBm) for 1710-1755 MHz.
The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

According to §27.50(b)(10), the maximum ERP must not exceed 3 Watts (34.77 dBm) for 776-788 MHz.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the simulator (CMW500) and the spectrum analyzer through sufficient attenuation.



Radiated method:

TIA603-D section 2.2.17

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI	100540	2015-07-25	2016-07-24
Agilent	Signal Generator	8648C	3537A01810	2015-07-04	2016-07-03
Sunol Sciences	Broadband Antenna	JB6	A050115	2016-06-15	2017-06-14
EMCO	Horn Antenna	3115	9311-4158	2016-05-08	2017-05-07
ETS	Horn Antenna	3115	6431	2015-11-07	2016-11-06
Rohde & Schwarz	Spectrum Analyzer	FSU 26	200268	2015-07-29	2016-08-28
EMCO	Turn Table	2081-1.21	9709-1885	N.C.R	N.C.R
EMCO	Antenna Tower	2075-2	9707-2060	N.C.R	N.C.R
Controller	EMCO	2090	9709-1256	N.C.R	N.C.R
R&S	Software	EMC32	V9.10.00	NCR	NCR
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
BACL	RF cable	KS-LAB-010	KS-LAB-010	2015-12-16	2016-12-15
Mini	attenuator	10dB	N/A	2016-01-11	2017-01-10

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Taiwan) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by David. Hsu on 2016-07-03.

Conducted Power:

LTE Band 4

Maximum Output Power

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)	Limit (dBm)
1.4 MHz	QPSK	1#0	22.16	23.22	22.48	30
		1#3	22.42	22.55	21.86	
		1#5	22.79	22.68	21.94	
		3#0	23.12	22.01	23.17	
		3#1	23.01	21.73	22.00	
		3#3	22.09	23.00	21.93	
		6#0	22.76	22.43	22.50	
	16-QAM	1#0	23.15	23.18	22.76	
		1#3	21.93	21.74	21.72	
		1#5	23.07	22.68	22.50	
		3#0	21.73	22.98	23.22	
		3#1	23.22	22.89	21.81	
		3#3	21.73	22.85	22.99	
		6#0	22.56	21.92	23.14	
3 MHz	QPSK	1#0	22.65	22.26	21.72	30
		1#7	22.20	22.10	22.78	
		1#14	23.07	21.75	22.84	
		8#0	22.27	23.30	23.28	
		8#4	23.28	22.71	22.06	
		8#7	21.84	22.32	21.72	
		15#0	22.55	22.33	22.68	
	16-QAM	1#0	22.43	21.96	22.56	
		1#7	22.44	22.20	22.31	
		1#14	23.05	22.03	22.29	
		8#0	22.44	22.06	21.80	
		8#4	22.84	22.66	23.18	
		8#7	23.24	22.96	22.78	
		15#0	21.88	23.07	22.54	

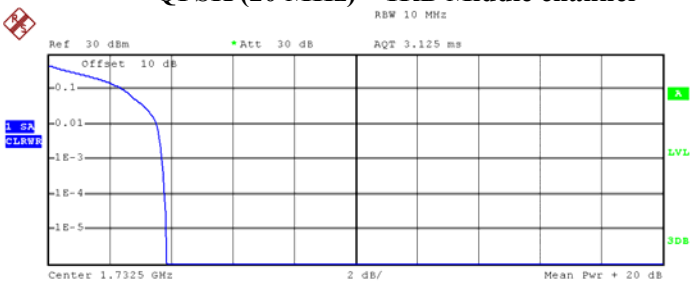
Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)	Limit (dBm)
5 MHz	QPSK	1#0	22.16	21.81	22.80	30
		1#12	23.26	21.75	22.04	
		1#24	21.99	21.80	21.91	
		12#0	22.34	21.73	22.77	
		12#6	21.84	22.83	21.79	
		12#11	22.94	23.17	22.17	
		25#0	21.94	22.58	21.74	
	16-QAM	1#0	21.90	22.94	22.57	
		1#12	22.14	22.67	22.40	
		1#24	23.03	22.68	23.02	
		12#0	23.30	22.49	21.92	
		12#6	22.69	22.27	23.08	
		12#11	22.69	22.20	21.78	
		25#0	21.85	22.92	22.17	
10 MHz	QPSK	1#0	22.65	22.90	22.91	30
		1#24	23.22	22.64	22.50	
		1#49	22.56	23.26	22.65	
		25#0	22.20	22.40	22.14	
		25#12	22.73	22.68	22.36	
		25#24	23.10	22.11	22.56	
		50#0	22.69	23.26	23.07	
	16-QAM	1#0	22.00	22.43	23.01	
		1#24	22.52	23.10	22.76	
		1#49	23.28	22.78	22.42	
		25#0	22.42	21.80	22.53	
		25#12	21.93	22.05	22.60	
		25#24	22.85	23.28	22.06	
		50#0	21.87	21.87	21.87	

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)	Limit (dBm)
15 MHz	QPSK	1#0	23.09	23.00	22.81	30
		1#37	22.57	21.76	22.94	
		1#74	22.12	22.31	22.90	
		36#0	23.02	22.82	22.03	
		36#17	21.85	23.21	21.99	
		36#35	23.15	22.94	22.68	
		75#0	21.83	21.74	21.89	
	16-QAM	1#0	23.14	22.45	22.33	
		1#37	22.62	22.53	22.15	
		1#74	23.26	21.77	23.17	
		36#0	22.49	21.77	22.47	
		36#17	21.85	22.87	23.20	
		36#35	21.85	21.93	22.01	
		75#0	23.29	22.28	22.81	
20 MHz	QPSK	1#0	23.03	23.06	22.27	30
		1#49	23.26	22.30	22.79	
		1#99	22.98	22.88	23.26	
		50#0	23.04	22.79	22.50	
		50#24	21.93	21.91	22.82	
		50#49	22.36	21.83	22.66	
		100#0	22.41	21.95	21.95	
	16-QAM	1#0	22.15	22.36	22.56	
		1#49	21.81	22.90	21.90	
		1#99	23.22	22.64	21.99	
		50#0	22.95	22.21	22.14	
		50#24	21.94	22.57	23.27	
		50#49	22.96	22.26	21.87	
		100#0	22.63	22.02	22.75	

Peak-to-average ratio (PAR)

Test Modulation		Test Bandwidth	Low Channel (dB)	Middle Channel (dB)	High Channel (dB)	Limit (dB)
QPSK	1 RB	20MHz	4.44	3.72	4.28	13.00
	100 RB		6.56	6.36	6.64	13.00
16-QAM	1 RB	20MHz	5.36	4.48	5.36	13.00
	100 RB		7.20	6.96	7.32	13.00

QPSK (20 MHz) – 1RB Middle channel



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	22.14 dBm
Peak	25.99 dBm
Crest	3.85 dB
10 %	2.48 dB
1 %	3.56 dB
.1 %	3.72 dB
.01 %	3.80 dB

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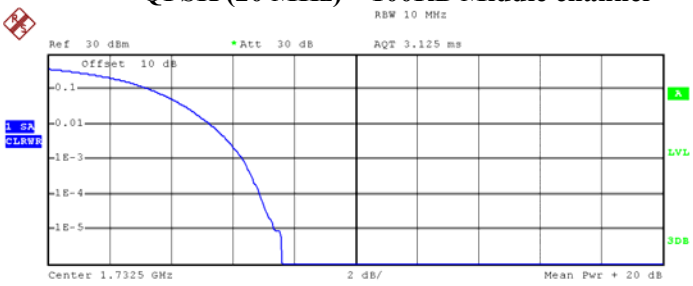
QPSK (20 MHz) – 100RB Middle channel



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	19.98 dBm
Peak	27.61 dBm
Crest	7.63 dB
10 %	3.40 dB
1 %	5.32 dB
.1 %	6.36 dB
.01 %	6.92 dB

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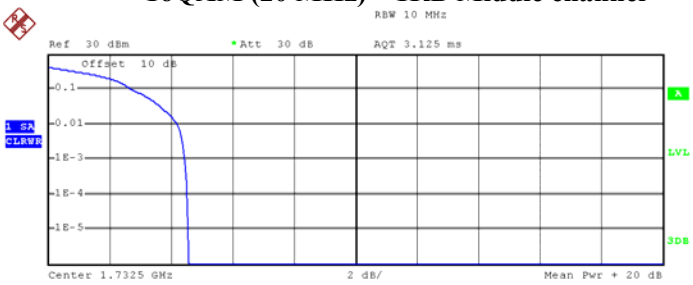
16QAM (20 MHz) – 1RB Middle channel



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	21.44 dBm
Peak	25.99 dBm
Crest	4.55 dB
10 %	2.76 dB
1 %	4.24 dB
.1 %	4.48 dB
.01 %	4.56 dB

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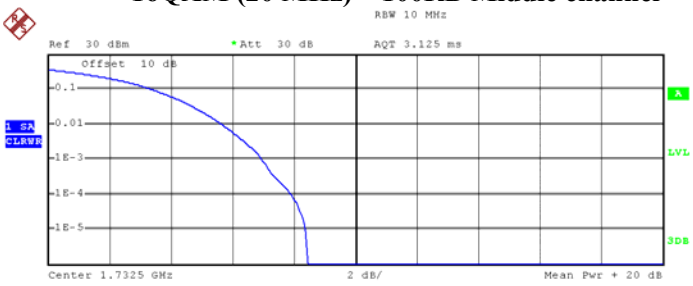
16QAM (20 MHz) – 100RB Middle channel



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	19.03 dBm
Peak	27.47 dBm
Crest	8.45 dB
10 %	3.48 dB
1 %	5.72 dB
.1 %	6.96 dB
.01 %	7.92 dB

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EIRP:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 1.4MHz BW Middle Channel								
1732.500	H	89.02	16	10.9	1.4	25.5	30.00	4.5
1732.500	V	88.02	14.7	10.9	1.4	24.2	30.00	5.8
16-QAM 1.4MHz BW Middle Channel								
1732.500	H	88.91	15.9	10.9	1.4	25.4	30.00	4.6
1732.500	V	87.48	14.2	10.9	1.4	23.7	30.00	6.3
QPSK 3MHz BW Middle Channel								
1732.500	H	88.03	15	10.9	1.4	24.5	30.00	5.5
1732.500	V	87.58	14.3	10.9	1.4	23.8	30.00	6.2
16-QAM 3MHz BW Middle Channel								
1732.500	H	87.51	14.5	10.9	1.4	24.0	30.00	6.0
1732.500	V	86.35	13	10.9	1.4	22.5	30.00	7.5
QPSK 5MHz BW Middle Channel								
1732.500	H	87.20	14.2	10.9	1.4	23.7	30.00	6.3
1732.500	V	86.94	13.6	10.9	1.4	23.1	30.00	6.9
16-QAM 5MHz BW Middle Channel								
1732.500	H	86.11	13.1	10.9	1.4	22.6	30.00	7.4
1732.500	V	85.64	12.3	10.9	1.4	21.8	30.00	8.2
QPSK 10MHz BW Middle Channel								
1732.500	H	85.62	12.6	10.9	1.4	22.1	30.00	7.9
1732.500	V	84.37	11	10.9	1.4	20.5	30.00	9.5
16-QAM 10MHz BW Middle Channel								
1732.500	H	84.52	11.5	10.9	1.4	21.0	30.00	9.0
1732.500	V	83.19	9.9	10.9	1.4	19.4	30.00	10.6
QPSK 15MHz BW Middle Channel								
1732.500	H	84.13	11.1	10.9	1.4	20.6	30.00	9.4
1732.500	V	83.40	10.1	10.9	1.4	19.6	30.00	10.4
16-QAM 15MHz BW Middle Channel								
1732.500	H	83.09	10.1	10.9	1.4	19.6	30.00	10.4
1732.500	V	82.42	9.1	10.9	1.4	18.6	30.00	11.4
QPSK 20MHz BW Middle Channel								
1732.500	H	83.82	10.8	10.9	1.4	20.3	30.00	9.7
1732.500	V	82.47	9.1	10.9	1.4	18.6	30.00	11.4
16-QAM 20MHz BW Middle Channel								
1732.500	H	82.42	9.4	10.9	1.4	18.9	30.00	11.1
1732.500	V	81.48	8.2	10.9	1.4	17.7	30.00	12.3

Note:
1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
2) Absolute Level = SG Level - Cable loss + Antenna Gain

3) Margin = Limit-Absolute Level
4) The unit of antenna gain is dBd for frequency below 1GHz and dBi for frequency above 1GHz.
5) The substituted antenna (dipole antenna) was the same as 80 MHz half wave length, therefor the antenna gain is negative blew 80 MHz

LTE Band 13:

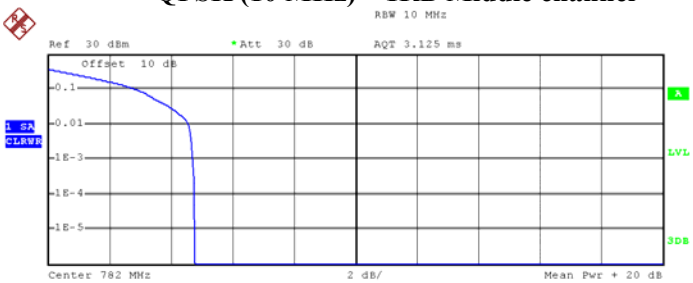
Maximum Output Power

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)	Limit (dBm)
5 MHz	QPSK	1#0	22.34	22.96	22.79	34.77
		1#12	22.36	22.88	23.20	
		1#24	22.36	22.29	22.91	
		12#0	21.97	21.84	23.04	
		12#6	23.19	22.98	21.90	
		12#11	23.14	22.52	22.34	
		25#0	22.45	22.29	21.91	
	16-QAM	1#0	22.42	23.17	22.76	
		1#12	22.60	23.26	21.91	
		1#24	22.89	21.78	22.63	
		12#0	21.72	22.51	22.37	
		12#6	23.24	22.84	22.39	
		12#11	22.52	22.36	23.01	
		25#0	21.92	22.08	22.41	
10 MHz	QPSK	1#0	/	23.19	/	34.77
		1#24	/	21.81	/	
		1#49	/	22.08	/	
		25#0	/	22.23	/	
		25#12	/	22.84	/	
		25#24	/	22.25	/	
		50#0	/	23.05	/	
	16-QAM	1#0	/	23.29	/	
		1#24	/	22.05	/	
		1#49	/	21.84	/	
		25#0	/	22.75	/	
		25#12	/	22.71	/	
		25#24	/	22.54	/	
		50#0	/	22.80	/	

Peak-to-average ratio (PAR)

Test Modulation		Test Bandwidth	Low Channel (dB)	Middle Channel (dB)	High Channel (dB)	Limit (dB)
QPSK	1 RB	10MHz	/	4.72	/	13.00
	50 RB		/	5.56	/	13.00
16-QAM	1 RB	10MHz	/	5.88	/	13.00
	50 RB		/	6.40	/	13.00

QPSK (10 MHz) – 1RB Middle channel

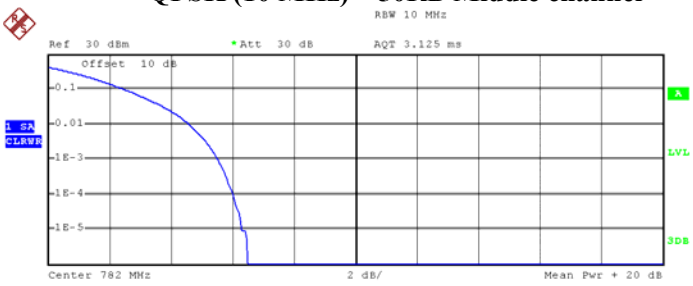


Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	21.91 dBm
Peak	26.70 dBm
Crest	4.79 dB
10 %	2.96 dB
1 %	4.60 dB
.1 %	4.72 dB
.01 %	4.80 dB

Date: 3.JUL.2016 04:46:15

QPSK (10 MHz) – 50RB Middle channel

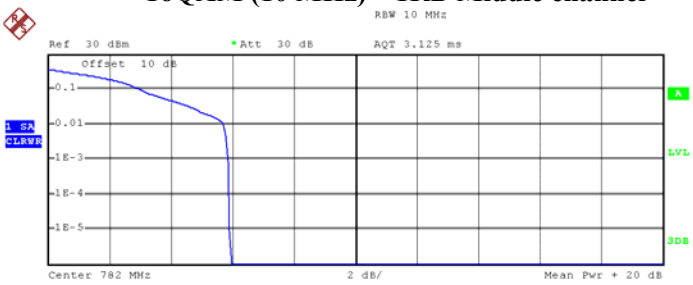


Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	20.47 dBm
Peak	26.98 dBm
Crest	6.51 dB
10 %	2.56 dB
1 %	4.64 dB
.1 %	5.56 dB
.01 %	6.04 dB

Date: 3.JUL.2016 04:45:34

16QAM (10 MHz) – 1RB Middle channel

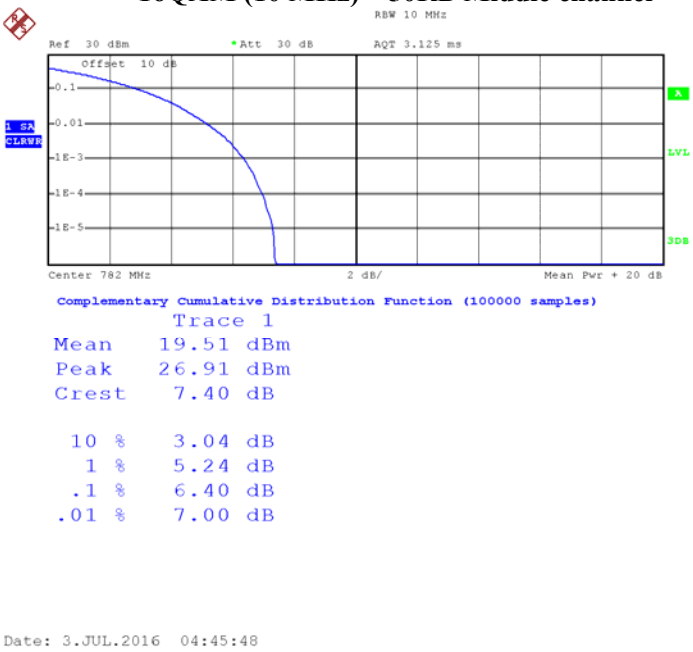


Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	20.37 dBm
Peak	26.34 dBm
Crest	5.97 dB
10 %	3.08 dB
1 %	5.72 dB
.1 %	5.88 dB
.01 %	5.92 dB

Date: 3.JUL.2016 04:46:05

16QAM (10 MHz) – 50RB Middle channel



ERP:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 5MHz BW Middle Channel								
782	H	94.12	18.6	0	0.9	17.7	34.77	17.07
782	V	98.58	26	0	0.9	25.1	34.77	9.67
16-QAM 5MHz BW Middle Channel								
782	H	93.33	17.8	0	0.9	16.9	34.77	17.87
782	V	97.82	25.2	0	0.9	24.3	34.77	10.47
QPSK 10MHz BW Middle Channel								
782	H	92.9	17.4	0	0.9	16.5	34.77	18.27
782	V	97.63	25	0	0.9	24.1	34.77	10.67
16-QAM 10MHz BW Middle Channel								
782	H	92.01	16.5	0	0.9	15.6	34.77	17.4
782	V	96.75	24.1	0	0.9	23.2	34.77	9.8

Note:
1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
2) Absolute Level = SG Level - Cable loss + Antenna Gain
3) Margin = Limit-Absolute Level
4) The unit of antenna gain is dBd for frequency below 1GHz and dBi for frequency above 1GHz.
5) The substituted antenna (dipole antenna) was the same as 80 MHz half wave length, therefor the antenna gain is negative blew 80 MHz

FCC § 2.1049; §27.53 (c) - OCCUPIED BANDWIDTH

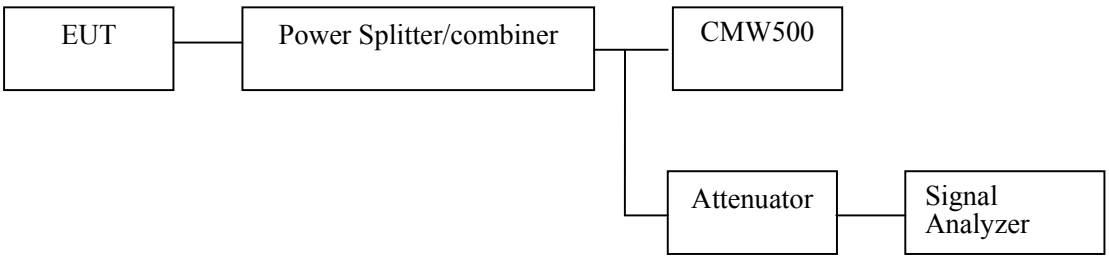
Applicable Standards

FCC 47 §2.1049, §27.53.

Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 5 kHz (Cellular /PCS) & 100 kHz (WCDMA) and the 26 dB & 99% bandwidth was recorded.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde &Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
R&S	Wideband Radio Communication tester	CMW500	1201.002K50-146520-wh	2015-11-23	2016-11-23
Mini	Splitter	ZFRSC-14-S+	SF019411452	2016-01-11	2017-01-10
BACL	RF cable	KS-LAB-020	KS-LAB-020	2016-01-11	2017-01-10
Mini	attenuator	10dB	N/A	2016-01-11	2017-01-10

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Taiwan) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	21 ℃
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

The testing was performed by David. Hsu on 2016-07-03.

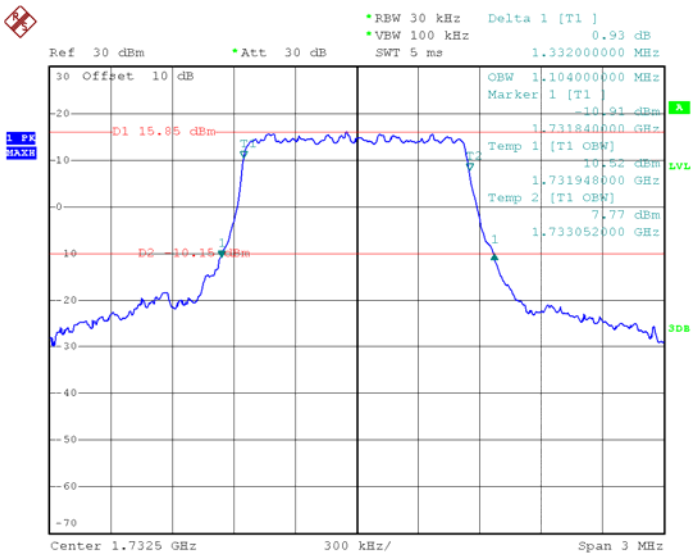
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables and plots.

LTE Band 4:

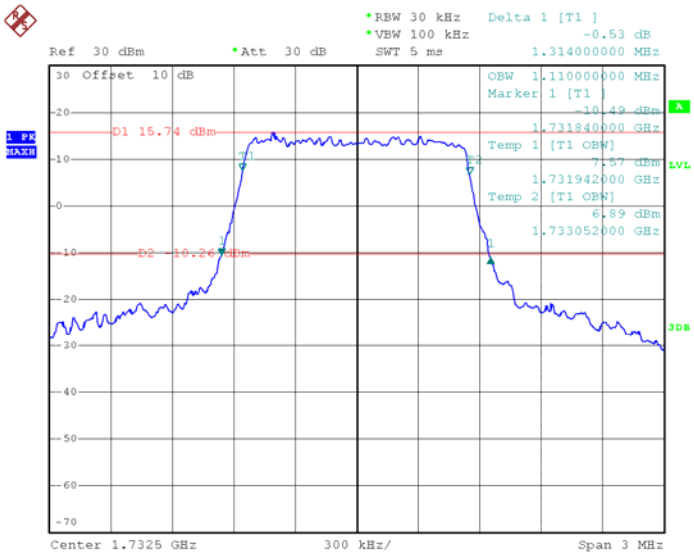
Test Modulation	Test Bandwidth	Test Channel	99% Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	1.4MHz	Middle	1.104	1.332
	3MHz		2.740	3.084
	5MHz		4.540	5.040
	10MHz		9.080	10.320
	15MHz		13.500	14.880
	20MHz		17.920	19.600
16-QAM	1.4MHz	Middle	1.110	1.314
	3MHz		2.772	3.084
	5MHz		4.520	5.080
	10MHz		9.080	10.280
	15MHz		13.500	14.880
	20MHz		17.920	19.600

QPSK (1.4 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



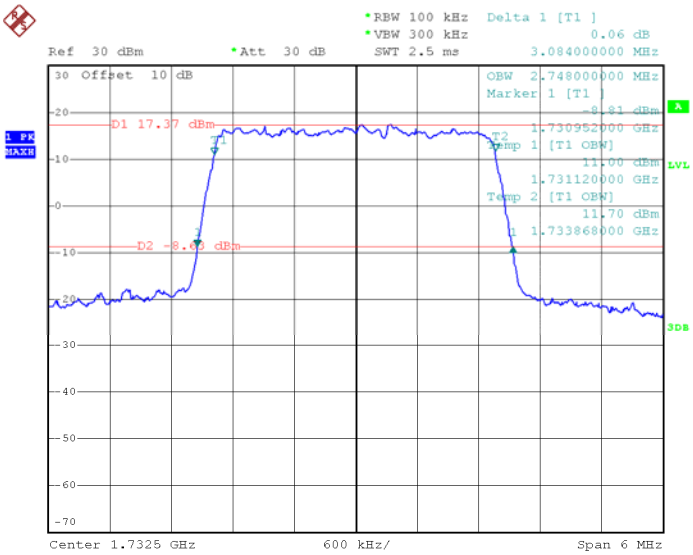
Date: 3.JUL.2016 05:18:27

16-QAM (1.4 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



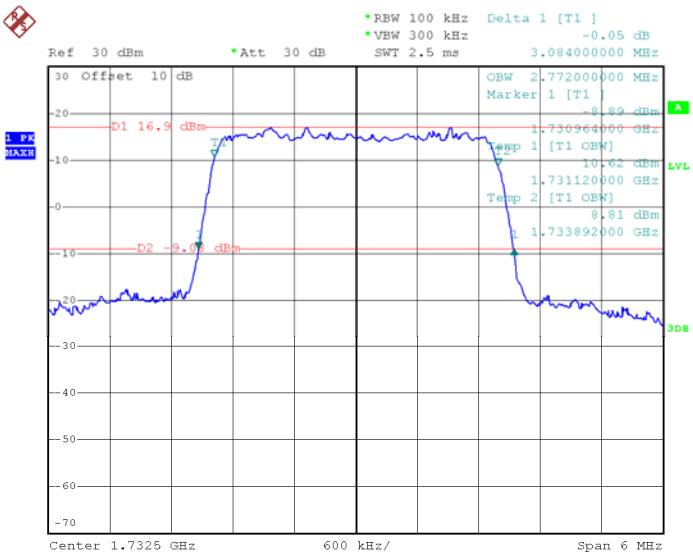
Date: 3.JUL.2016 05:19:34

QPSK (3.0MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



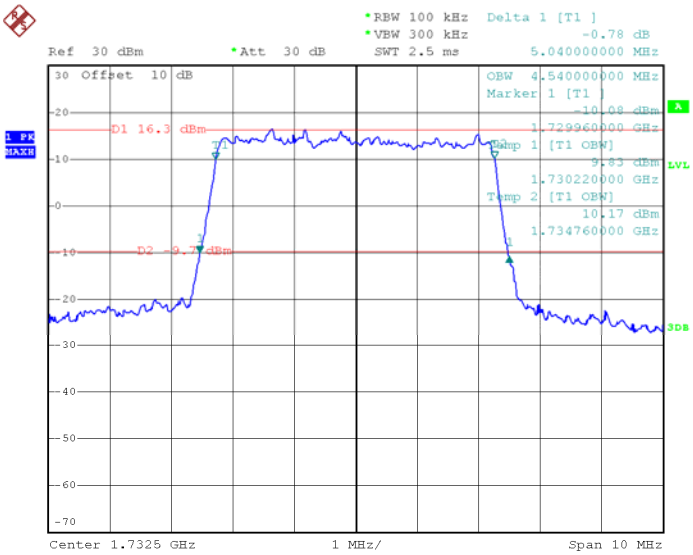
Date: 3.JUL.2016 05:15:59

16-QAM (3.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



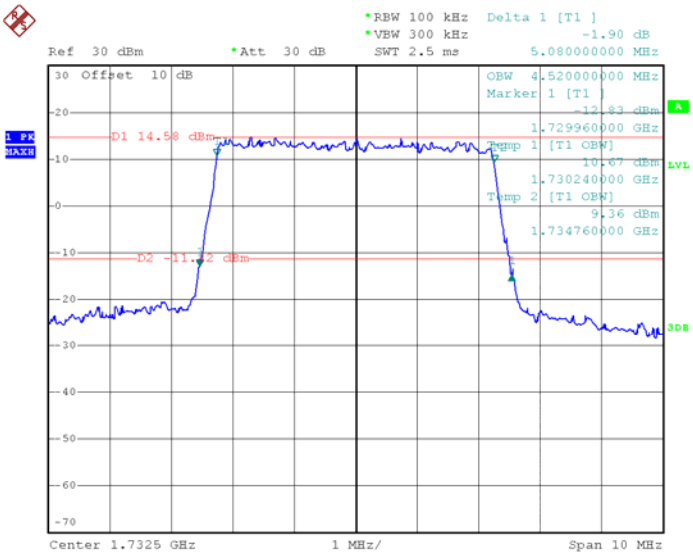
Date: 3.JUL.2016 05:17:08

QPSK (5.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



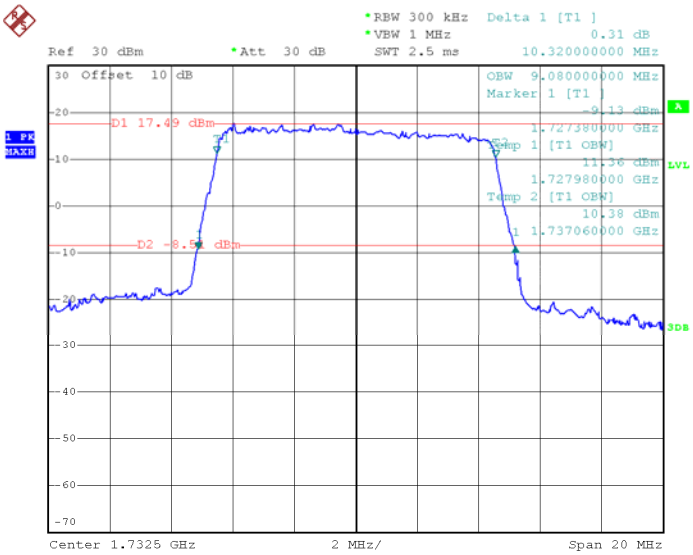
Date: 3.JUL.2016 05:13:22

16-QAM (5.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



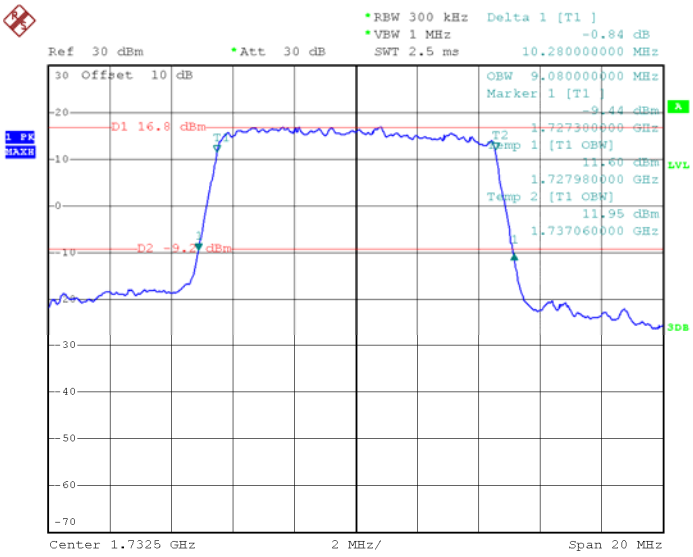
Date: 3.JUL.2016 05:12:09

QPSK (10.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



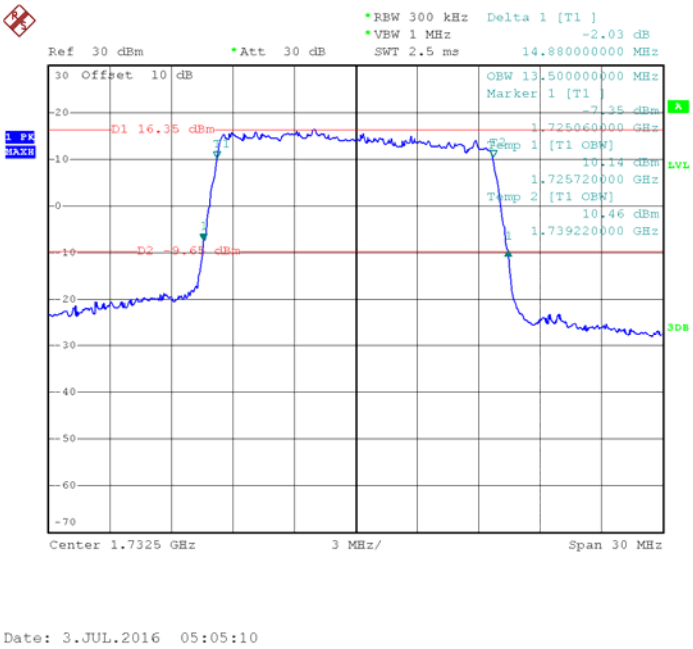
Date: 3.JUL.2016 05:07:43

16-QAM (10.0MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



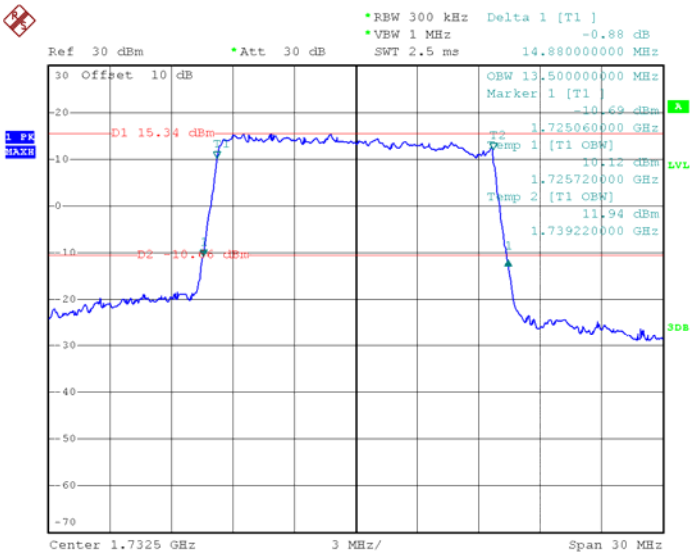
Date: 3.JUL.2016 05:10:38

QPSK (15.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



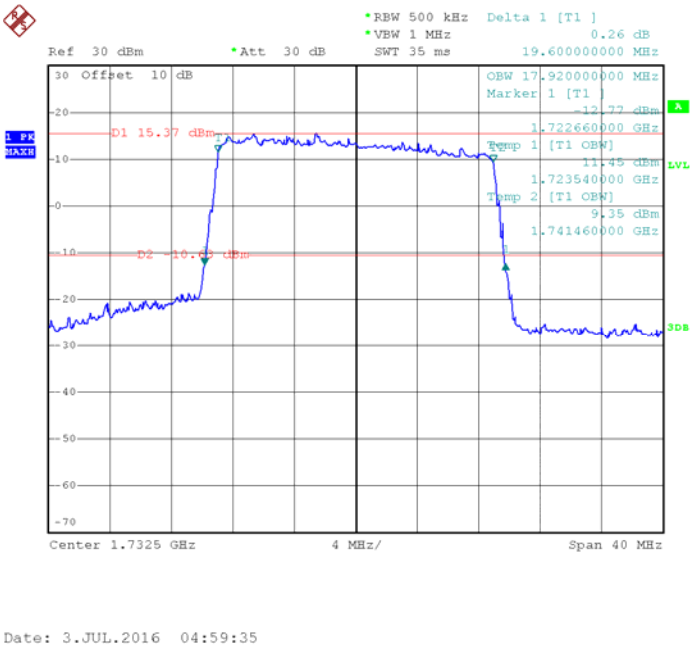
Date: 3.JUL.2016 05:05:10

16-QAM (15.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel

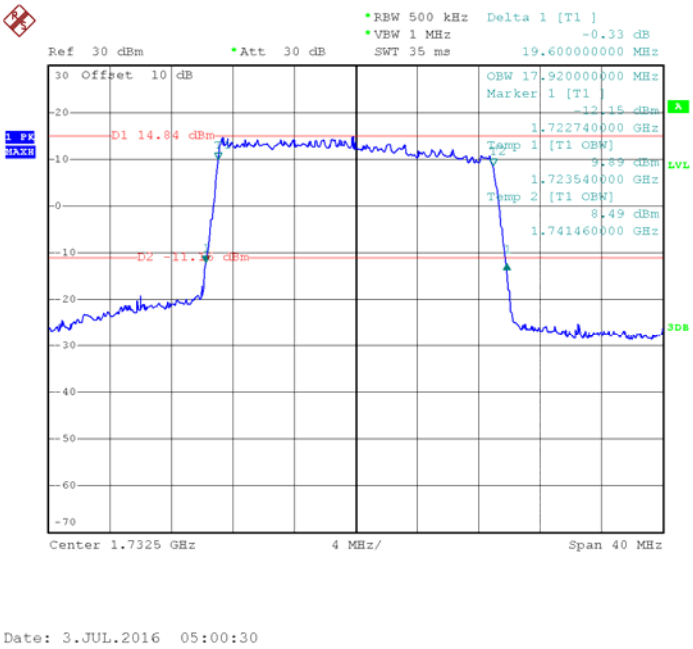


Date: 3.JUL.2016 05:06:17

QPSK (20.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



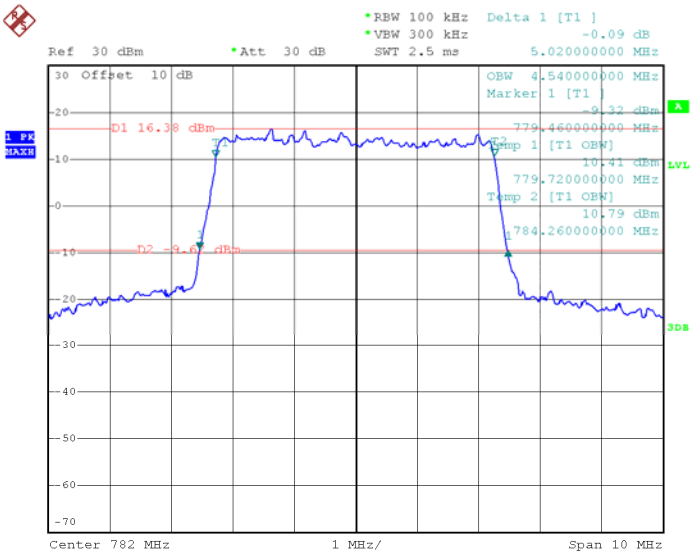
16-QAM (20.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



LTE Band 13:

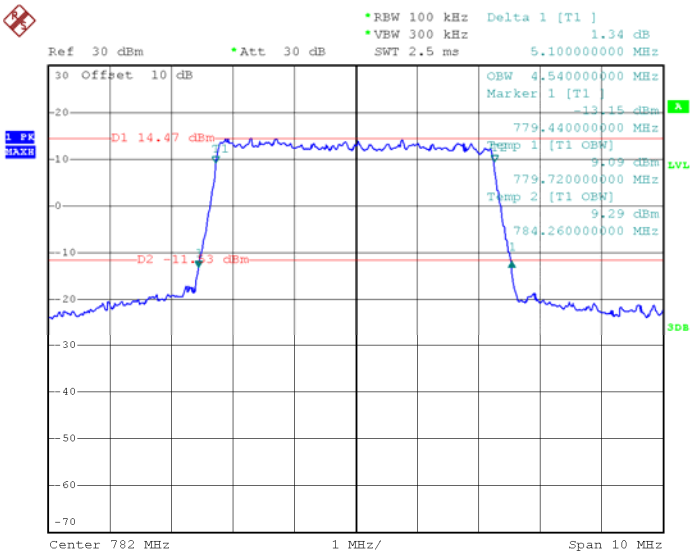
Test Modulation	Test Bandwidth	Test Channel	99% Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	5MHz	Middle	4.540	5.020
	10MHz		9.160	10.360
16-QAM	5MHz	Middle	4.540	5.100
	10MHz		9.160	10.360

QPSK (5.0MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



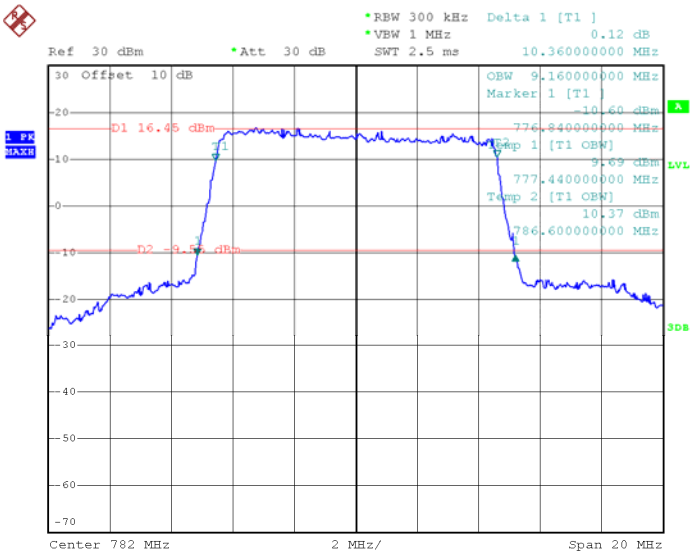
Date: 3.JUL.2016 04:41:36

16-QAM (5.0MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



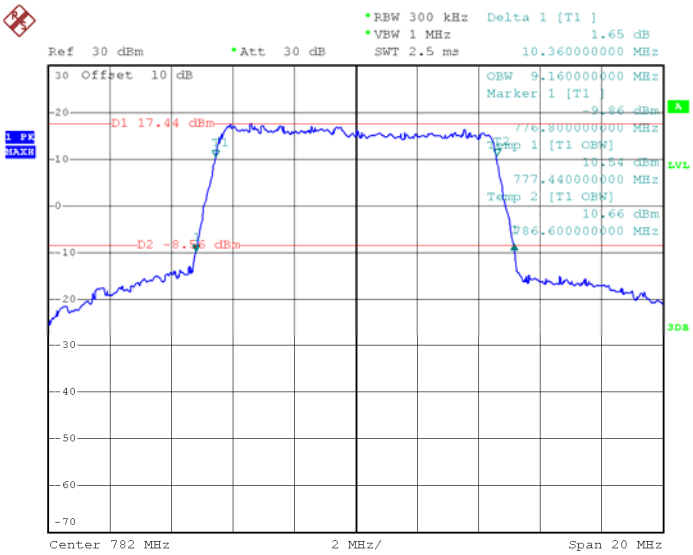
Date: 3.JUL.2016 04:43:13

QPSK (10.0 MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



Date: 3.JUL.2016 04:44:08

16-QAM (10.0MHz) - 99% Occupied & 26 dB Bandwidth, Middle channel



Date: 3.JUL.2016 04:44:54

FCC§ 2.1051;§27.53 (c) (h)-SPURIOUS EMISSIONS AT ANTENNA TERMINALS

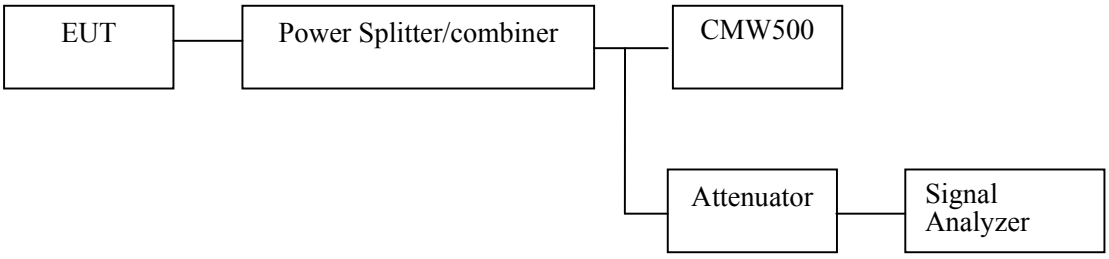
Applicable Standards

FCC §2.1051, §27.53(c)(h).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde &Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
R&S	Wideband Radio Communication tester	CMW500	1201.002K50-146520-wh	2015-11-23	2016-11-23
Mini	Splitter	ZFRSC-14-S+	SF019411452	2016-01-11	2017-01-10
BACL	RF cable	KS-LAB-020	KS-LAB-020	2016-01-11	2017-01-10
Mini	attenuator	10dB	N/A	2016-01-11	2017-01-10

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Taiwan) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

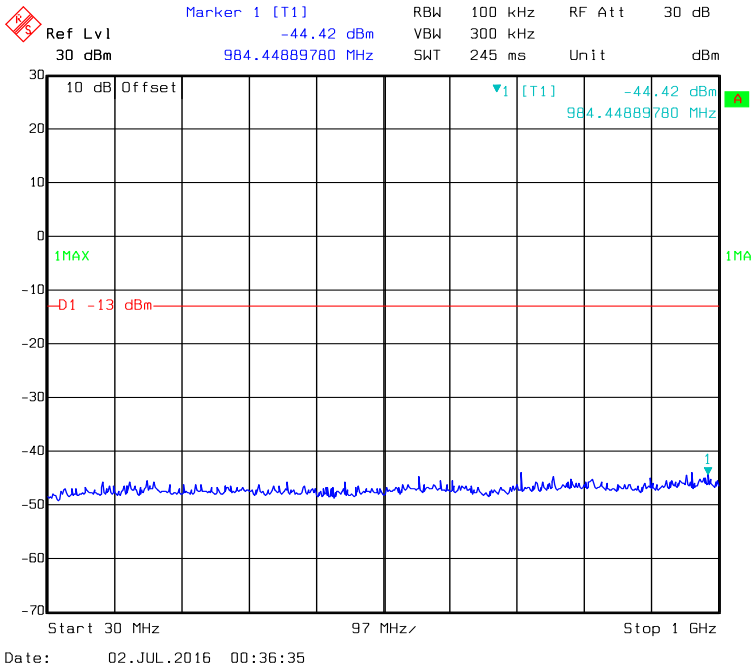
Temperature:	20~23 ℃
Relative Humidity:	48~50 %
ATM Pressure:	100.5~101.0kPa

The testing was performed by David. Hsu on 2016-07-02.

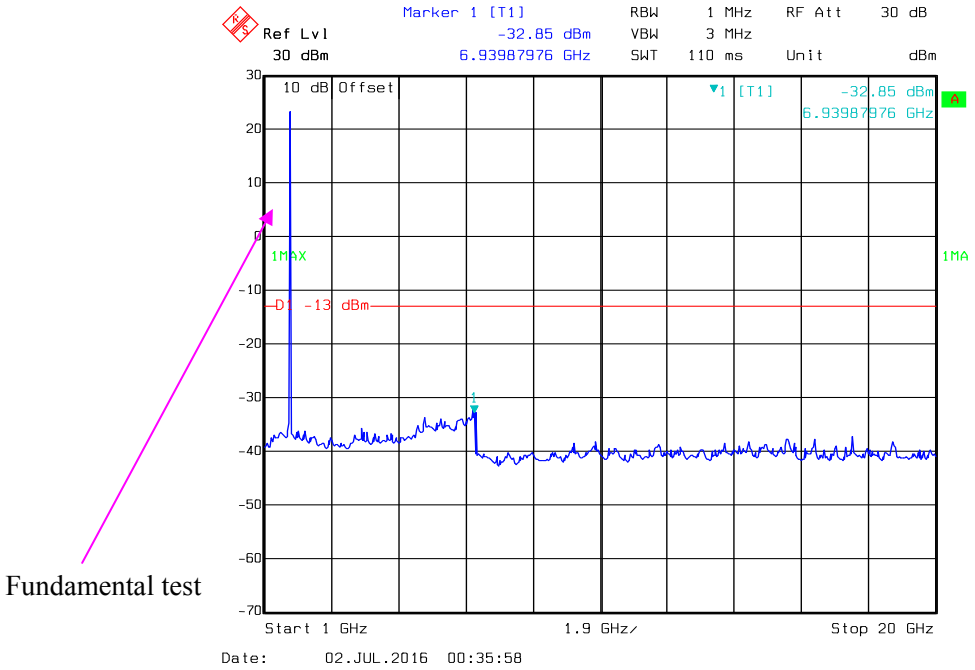
Please refer to the following plots.

LTE Band 4:

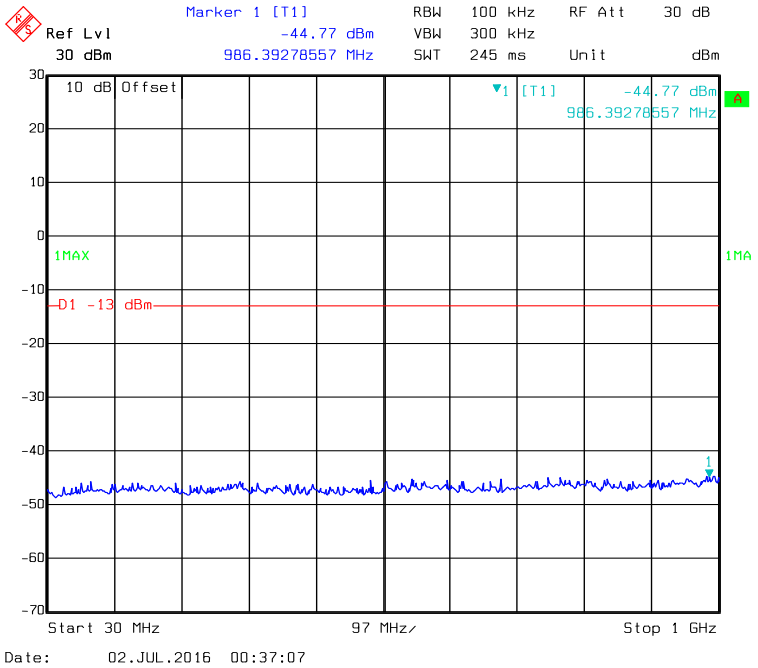
30 MHz - 1 GHz (1.4 MHz, Middle Channel)



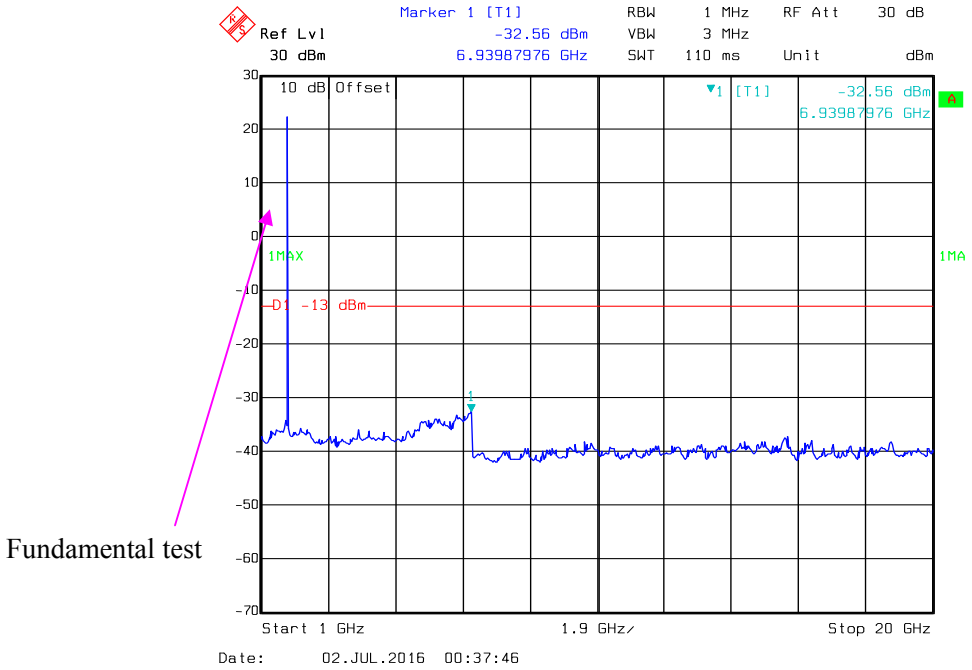
1 GHz – 20 GHz (1.4 MHz, Middle Channel)



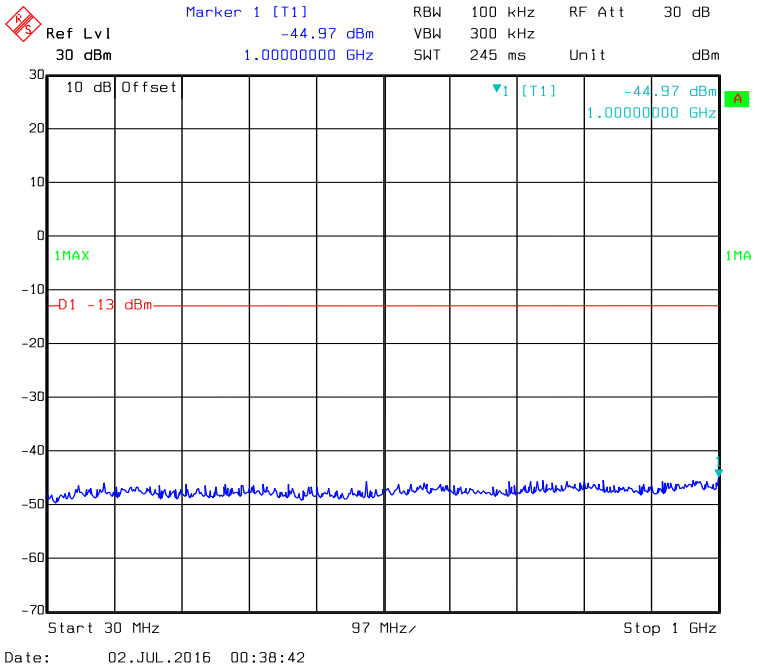
30 MHz - 1 GHz (3.0 MHz, Middle Channel)



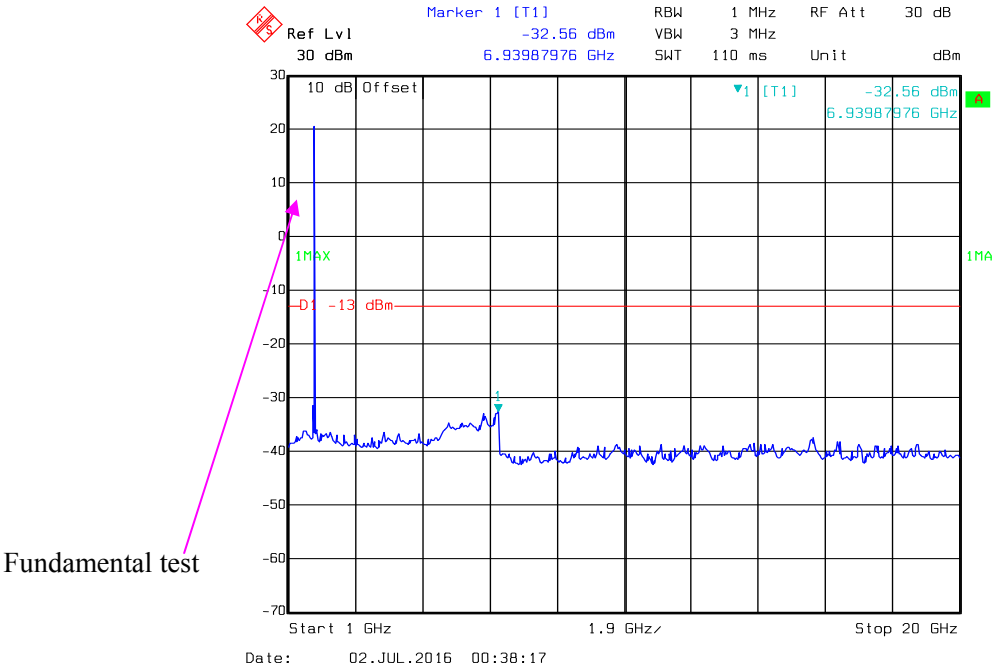
1 GHz – 20 GHz (3.0 MHz, Middle Channel)



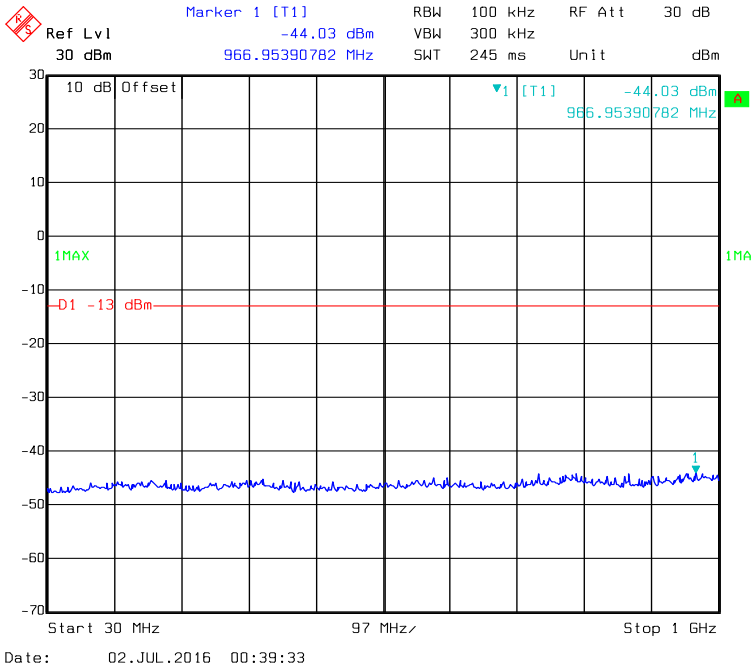
30 MHz - 1 GHz (5.0 MHz, Middle Channel)



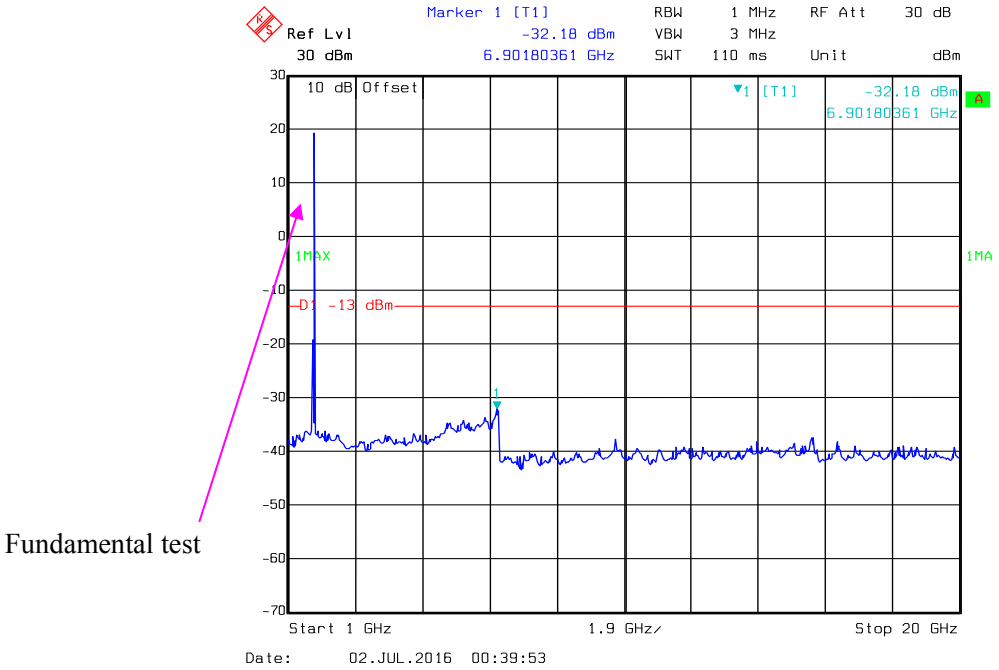
1 GHz – 20 GHz (5.0 MHz, Middle Channel)



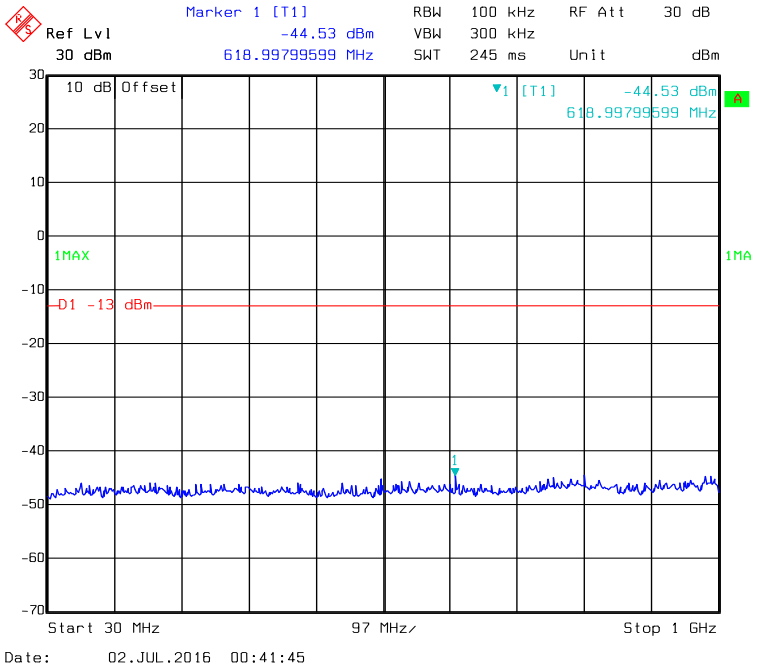
30 MHz - 1 GHz (10.0 MHz, Middle Channel)



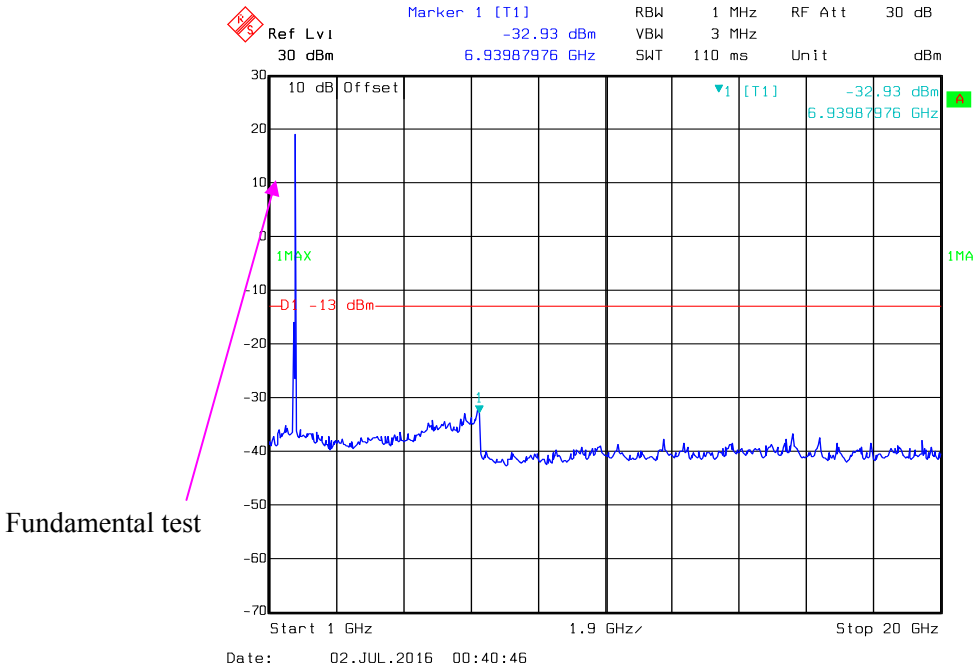
1 GHz –20 GHz (10.0 MHz, Middle Channel)



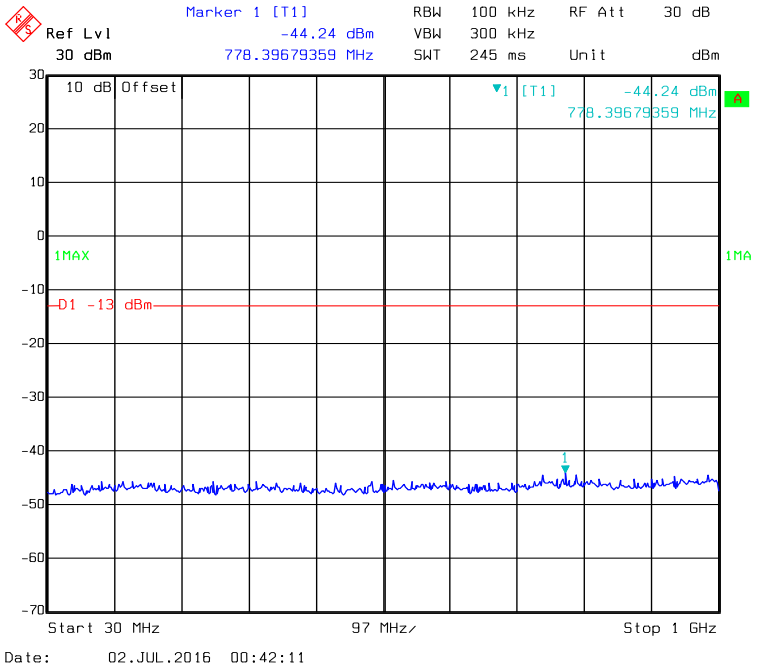
30 MHz - 1 GHz (15.0 MHz, Middle Channel)



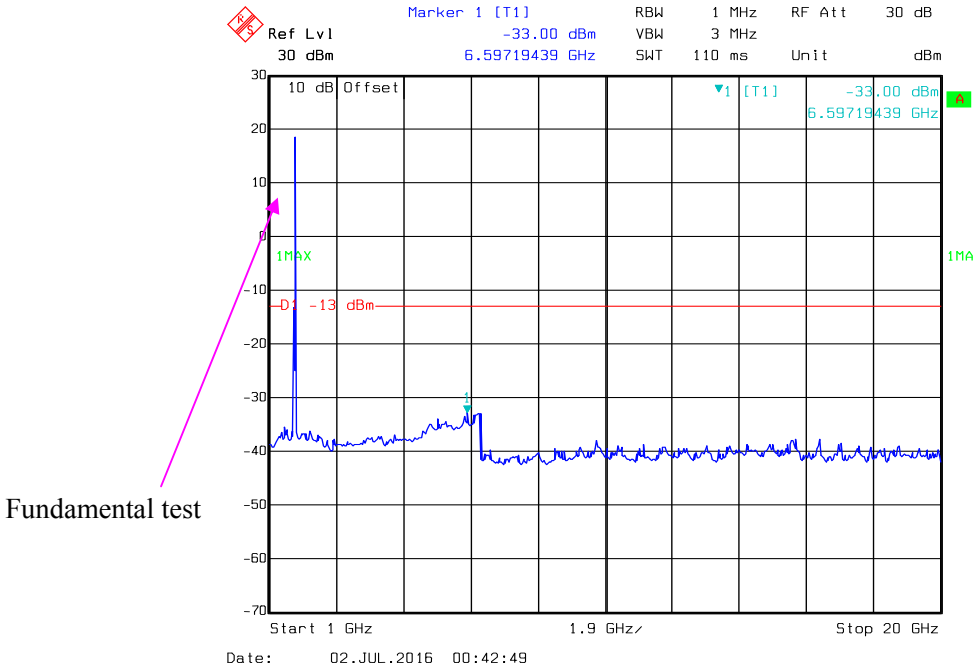
1 GHz –20 GHz (15.0 MHz, Middle Channel)



30 MHz - 1 GHz (20.0 MHz, Middle Channel)

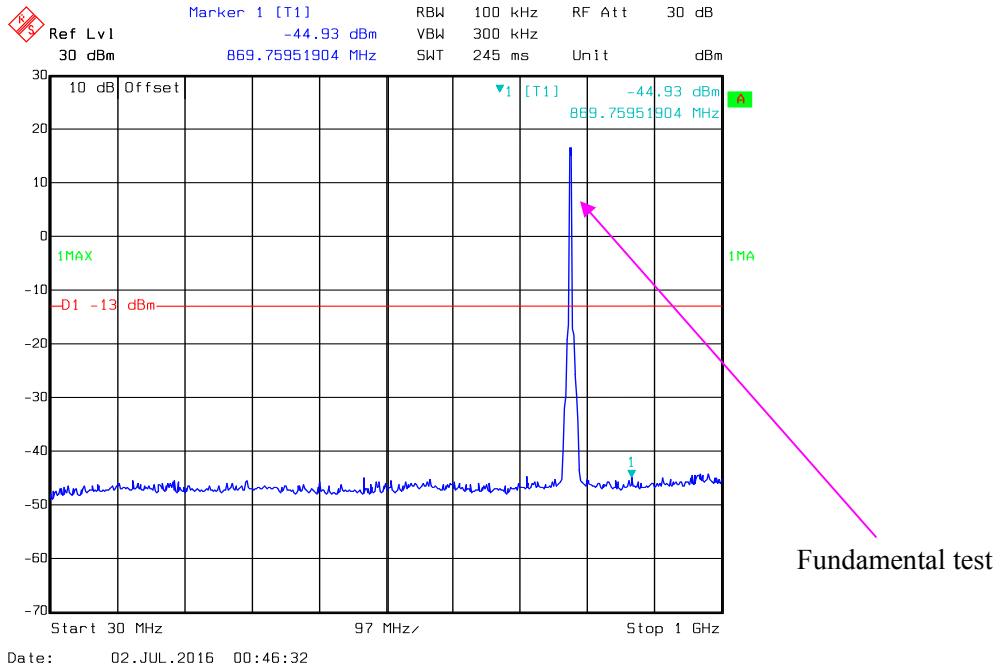


1 GHz –20 GHz (20.0 MHz, Middle Channel)

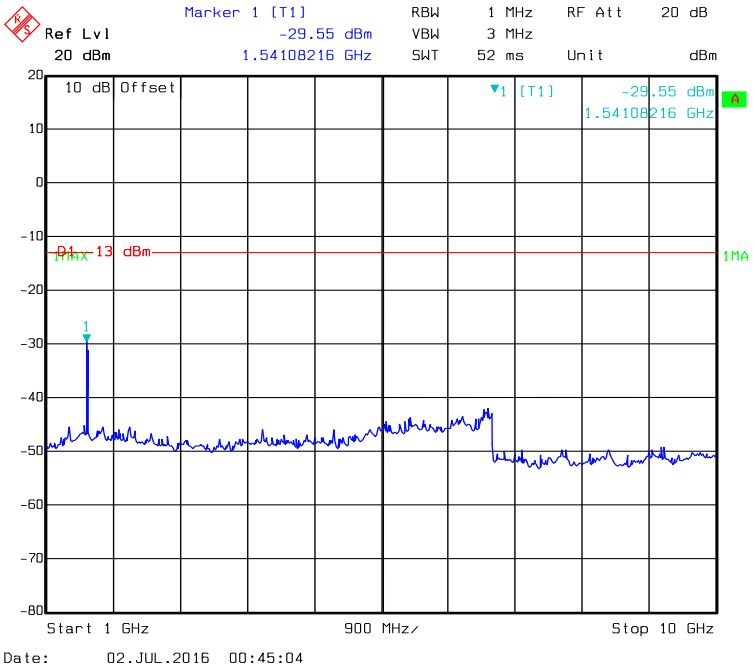


LTE Band 13:

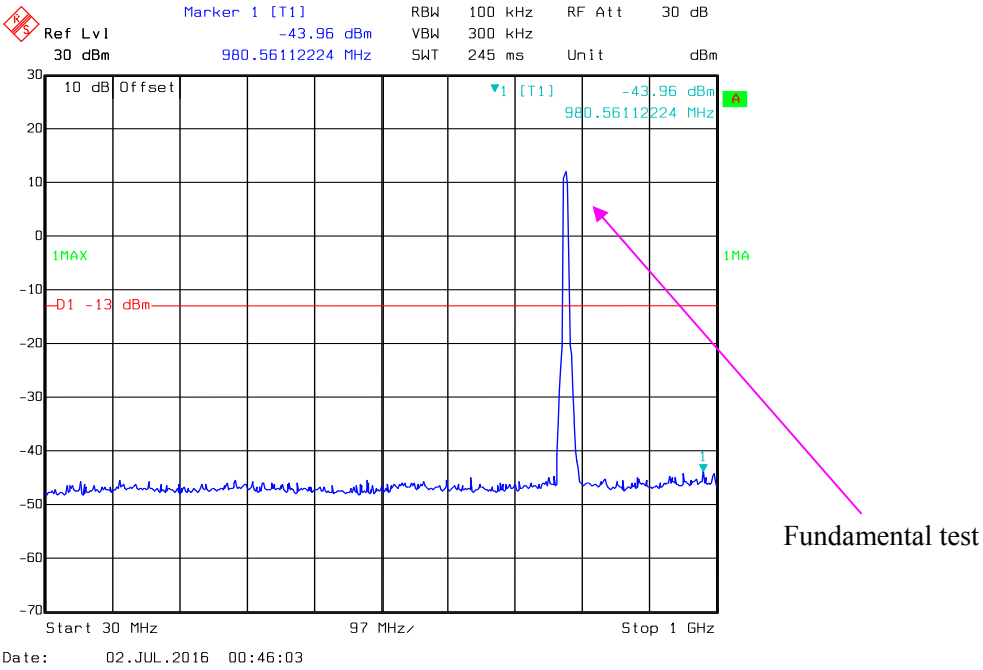
30 MHz - 1 GHz (5.0 MHz, Middle Channel)



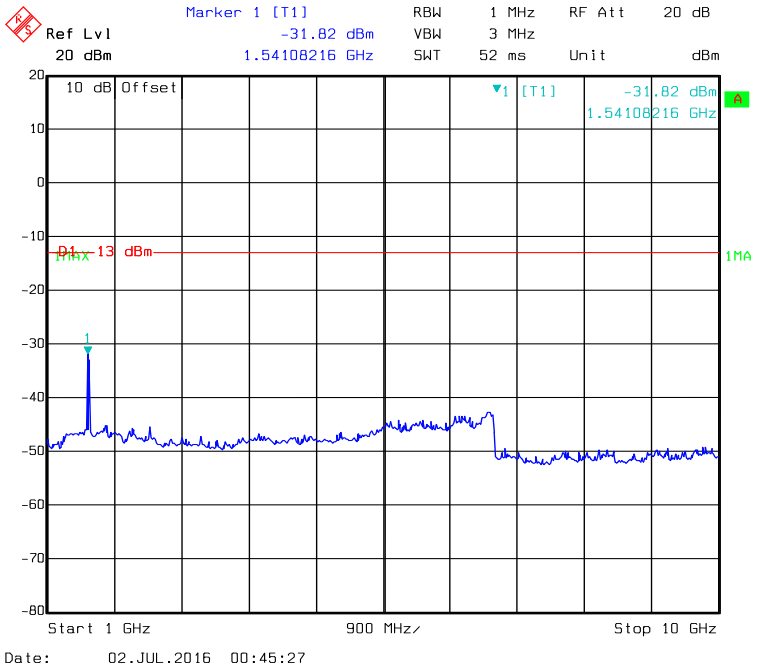
1 GHz – 10 GHz (5.0 MHz, Middle Channel)



30 MHz - 1 GHz (10.0 MHz, Middle Channel)



1 GHz –10 GHz (10.0 MHz, Middle Channel)



FCC § 2.1053; §27.53 (c) (h) SPURIOUS RADIATED EMISSIONS

Applicable Standards

FCC § 2.1053, § 27.53(c)(h)

For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TX pwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Sonoma	Amplifier	310N	130601	2016-07-02	2017-07-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100540	2015-07-25	2016-07-24
Sunol Sciences	Broadband Antenna	JB6	A050115	2016-06-15	2017-06-14
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2015-11-07	2016-11-06
Mini	Amplifier	ZVA-213-S+	460901516	2015-08-21	2016-08-21
EMCO	Horn Antenna	3115	9311-4158	2016-05-08	2017-05-07
ETS	Horn Antenna	3115	6431	2015-11-07	2016-11-06
Rohde & Schwarz	Spectrum Analyzer	FSU 26	200268	2015-07-29	2016-08-28
EMCO	Turn Table	2081-1.21	9709-1885	N.C.R	N.C.R
EMCO	Antenna Tower	2075-2	9707-2060	N.C.R	N.C.R
Controller	EMCO	2090	9709-1256	N.C.R	N.C.R
R&S	Software	EMC32	V9.10.00	NCR	NCR
HP	Signal Generator	E4421B	3426A01336	2015-11-04	2016-11-03
BACL	RF cable	KS - LAB - 012	KS - LAB - 012	2015-12-16	2016-12-15
BACL	RF cable	KS - LAB - 010	KS - LAB - 010	2015-12-16	2016-12-15

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Taiwan) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0kPa

The testing was performed by David. Hsu on 2016-05-04&2016-05-31.

Test mode: Transmitting

Test mode: Transmitting (Pre-scan with Low, Middle, High channel, and the worse case data as below)

EC25-V

30 MHz ~ 20 GHz:

Band 4：

QPSK:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 1.4MHzHz Bandwidth Middle Channel								
3465.000	H	34.66	-62.3	13.9	1.9	-50.3	-13.0	37.3
3465.000	V	38.08	-58.1	13.9	1.9	-46.1	-13.0	33.1
5197.500	H	33.49	-57.5	14.0	2.3	-45.8	-13.0	32.8
5197.500	V	35.16	-57.4	14.0	2.3	-45.7	-13.0	32.7
249.100	H	36.32	-71.8	0.0	0.5	-72.3	-13.0	59.3
290.800	V	37.19	-67.9	0.0	0.5	-68.4	-13.0	55.4

16-QAM:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
16-QAM 1.4MHzHz Bandwidth Middle Channel								
3465.000	H	33.72	-63.2	13.9	1.9	-51.2	-13.0	38.2
3465.000	V	37.81	-58.4	13.9	1.9	-46.4	-13.0	33.4
5197.500	H	33.09	-57.9	14.0	2.3	-46.2	-13.0	33.2
5197.500	V	34.82	-57.7	14.0	2.3	-46.0	-13.0	33.0
249.100	H	36.77	-71.4	0.0	0.5	-71.9	-13.0	58.9
290.800	V	37.45	-67.7	0.0	0.5	-68.2	-13.0	55.2

Band 13：

QPSK:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 5MHzHz Bandwidth Middle Channel								
1564.000	H	33.48	-67.8	9.9	1.4	-59.3	-13.0	46.3
1564.000	V	37.70	-64.2	9.9	1.4	-55.7	-13.0	42.7
2346.000	H	38.31	-58.3	11.7	2	-48.6	-13.0	35.6
2346.000	V	41.38	-54.4	11.7	2	-44.7	-13.0	31.7
283.700	H	36.73	-70.9	0.0	0.5	-71.4	-13.0	58.4
319.400	V	37.46	-65.1	0.0	0.5	-65.6	-13.0	52.6

16-QAM:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
16-QAM 5MHzHz Bandwidth Middle Channel								
1564.000	H	32.62	-68.7	9.9	1.4	-60.2	-13.0	47.2
1564.000	V	36.27	-65.7	9.9	1.4	-57.2	-13.0	44.2
2346.000	H	36.49	-60.1	11.7	2	-50.4	-13.0	37.4
2346.000	V	40.75	-55.1	11.7	2	-45.4	-13.0	32.4
283.700	H	36.18	-71.5	0.0	0.5	-72.0	-13.0	59.0
319.400	V	37.80	-64.8	0.0	0.5	-65.3	-13.0	52.3

Note:
1) Absolute Level = SG Level - Cable loss + Antenna Gain
2) Margin = Limit- Absolute Level

EC25-V MiniPCIe

30 MHz ~ 20 GHz:

Band 4：

QPSK:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 1.4MHzHz Bandwidth Middle Channel								
3465	H	33.59	-63.1	13.9	1.9	-51.1	-13	38.1
3465	V	37.98	-59.6	13.9	1.9	-47.6	-13	34.6
5198	H	34.59	-58.7	14	2.3	-47	-13	34
5198	V	36.15	-59.3	14	2.3	-47.6	-13	34.6
258	H	33.56	-73.7	0	0.5	-74.2	-13	61.2
291	V	36.89	-69.4	0	0.5	-69.9	-13	56.9

16-QAM:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
16-QAM 1.4MHzHz Bandwidth Middle Channel								
3465	H	33.89	-63	13.9	1.9	-51	-13	38
3465	V	37.15	-59.24	13.9	1.9	-47.24	-13	34.24
5198	H	33.17	-56.14	14	2.3	-44.44	-13	31.44
5198	V	35.38	-58.73	14	2.3	-47.03	-13	34.03
258	H	31.67	-75.8	0	0.5	-76.3	-13	63.3
291	V	35.75	-66.87	0	0.5	-67.37	-13	54.37

Band 13：

QPSK:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 5MHzHz Bandwidth Middle Channel								
1564	H	30.31	-70.1	9.9	1.4	-61.6	-13	48.6
1564	V	33.89	-68.31	9.9	1.4	-59.81	-13	46.81
2346	H	34.25	-62.47	11.7	2	-52.77	-13	39.77
2346	V	38.43	-56.87	11.7	2	-47.17	-13	34.17
283	H	32.34	-68.59	0	0.5	-69.09	-13	56.09
319	V	36.13	-66.51	0	0.5	-67.01	-13	54.01

16-QAM:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
16-QAM 5MHzHz Bandwidth Middle Channel								
1564	H	32.16	-72.36	9.9	1.4	-63.86	-13	50.86
1564	V	35.18	-66.98	9.9	1.4	-58.48	-13	45.48
2346	H	34.69	-63.65	11.7	2	-53.95	-13	40.95
2346	V	39.58	-57.68	11.7	2	-47.98	-13	34.98
283	H	34.26	-63.68	0	0.5	-64.18	-13	51.18
319	V	36.31	-66.05	0	0.5	-66.55	-13	53.55

Note:
1) Absolute Level = SG Level - Cable loss + Antenna Gain
2) Margin = Limit- Absolute Level

FCC §27.53 (c)(h) - BAND EDGES

Applicable Standards

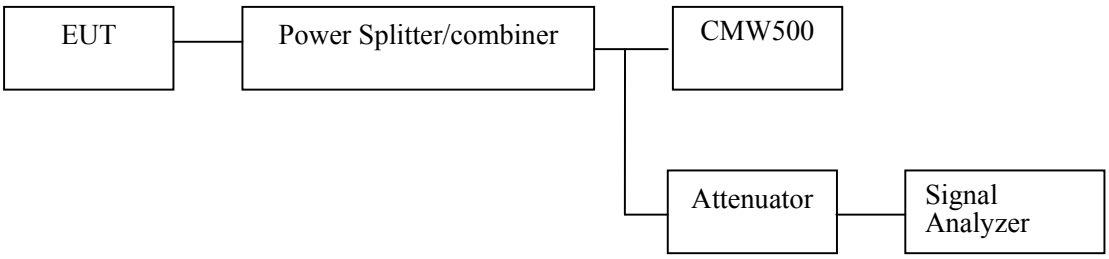
According to FCC §27.53 (c)(h), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Test Procedure

The RF output of the transmitter was connected to the simulator (CMW500) and the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde &Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
R&S	Wideband Radio Communication tester	CMW500	1201.002K50-146520-wh	2015-11-23	2016-11-23
Mini	Splitter	ZFRSC-14-S+	SF019411452	2016-01-11	2016-07-10
BACL	RF cable	KS-LAB-020	KS-LAB-020	2016-01-11	2016-07-10
Mini	attenuator	10dB	N/A	2016-01-11	2016-07-10

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Taiwan) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	20~23 ℃
Relative Humidity:	48~52 %
ATM Pressure:	100.5~101.0kPa

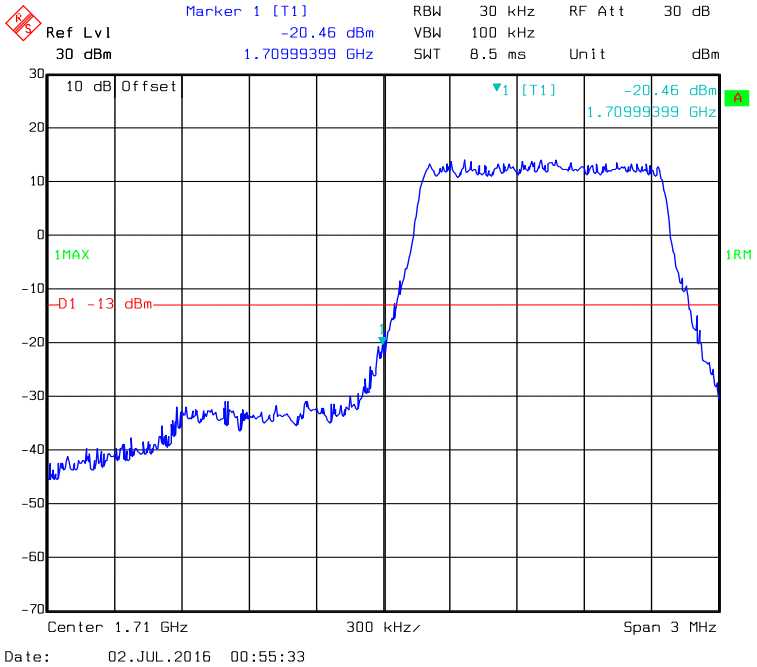
The testing was performed by David. Hsu on 2016-07-02.

EUT operation mode: Transmitting

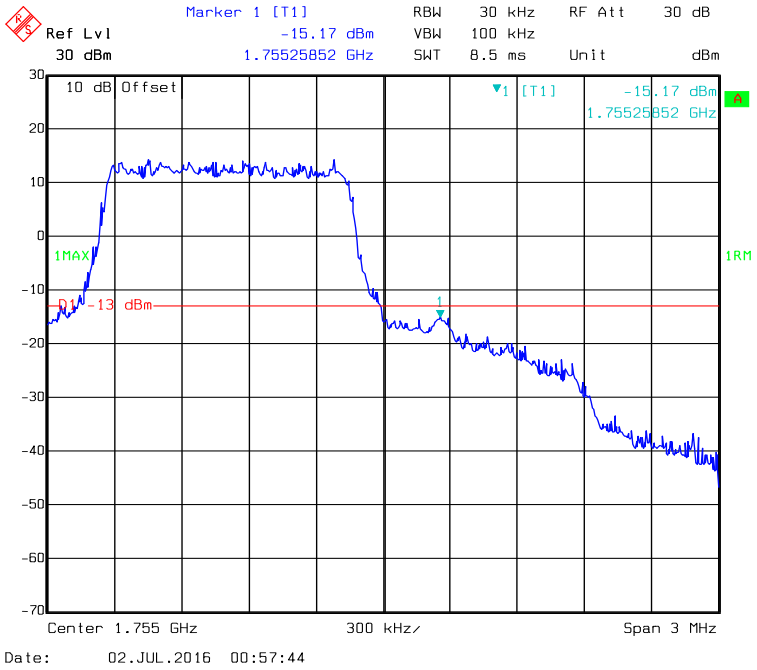
Test Result: Compliance. Please refer to the following plots.

LTE Band 4:

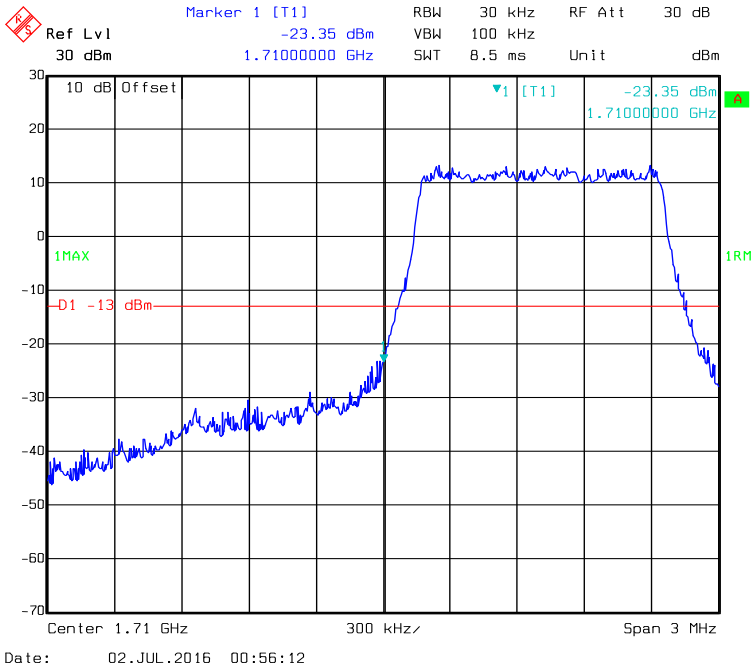
QPSK (1.4 MHz, FULL RB) - Left Band Edge



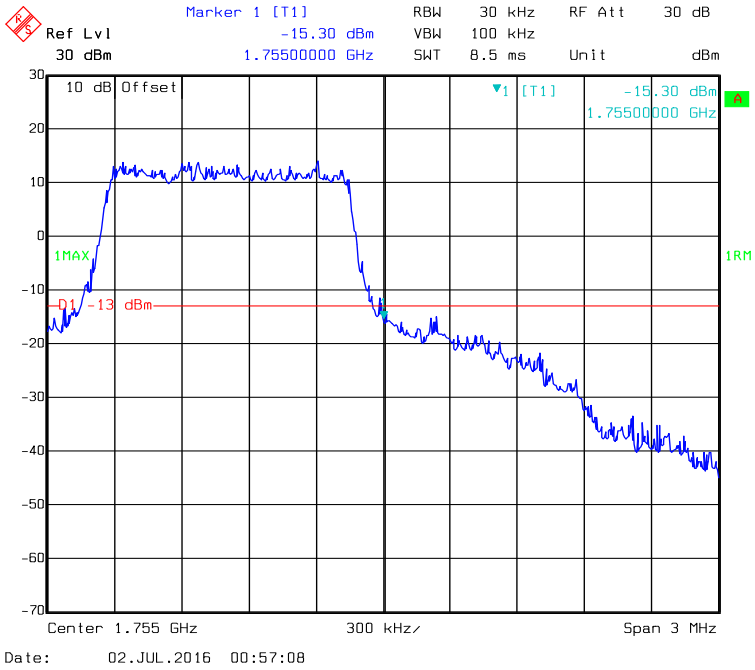
QPSK (1.4 MHz, FULL RB) - Right Band Edge



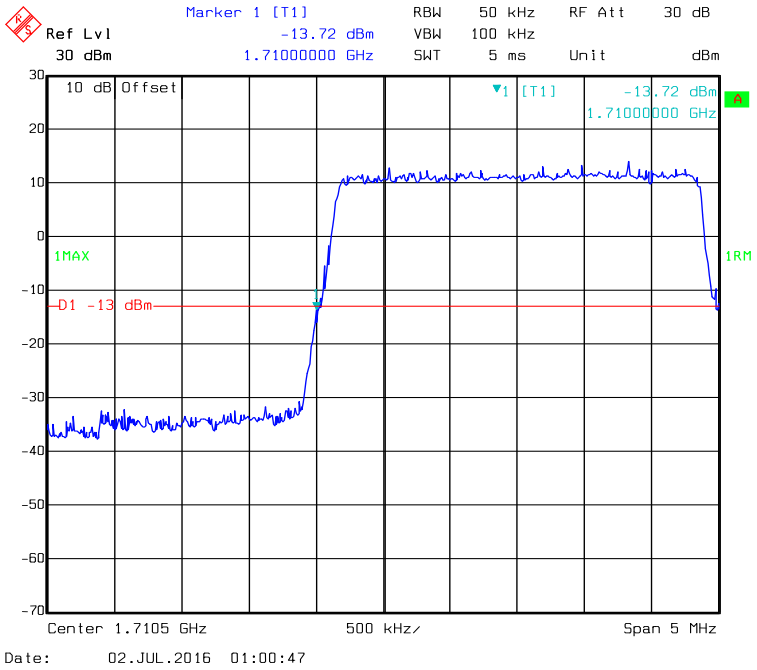
16-QAM (1.4 MHz, FULL RB) - Left Band Edge



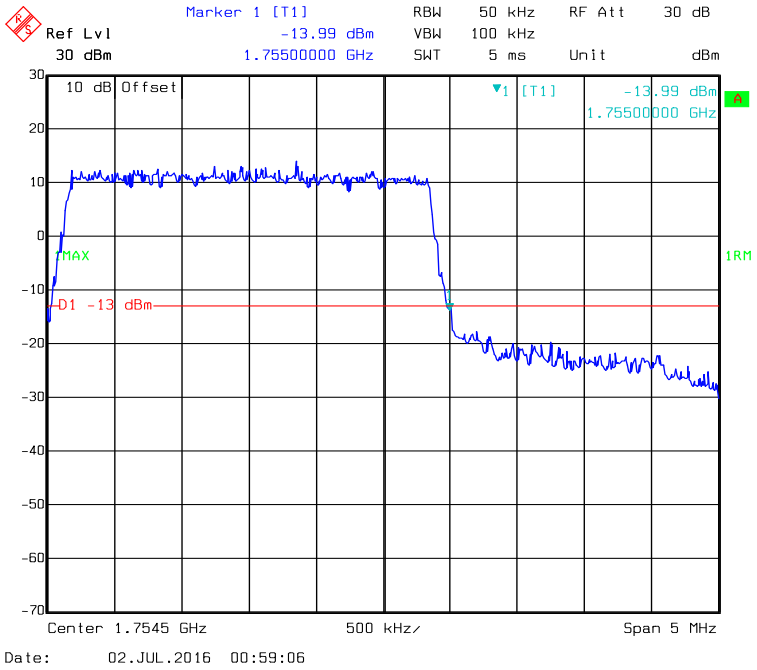
16-QAM (1.4 MHz, FULL RB) - Right Band Edge



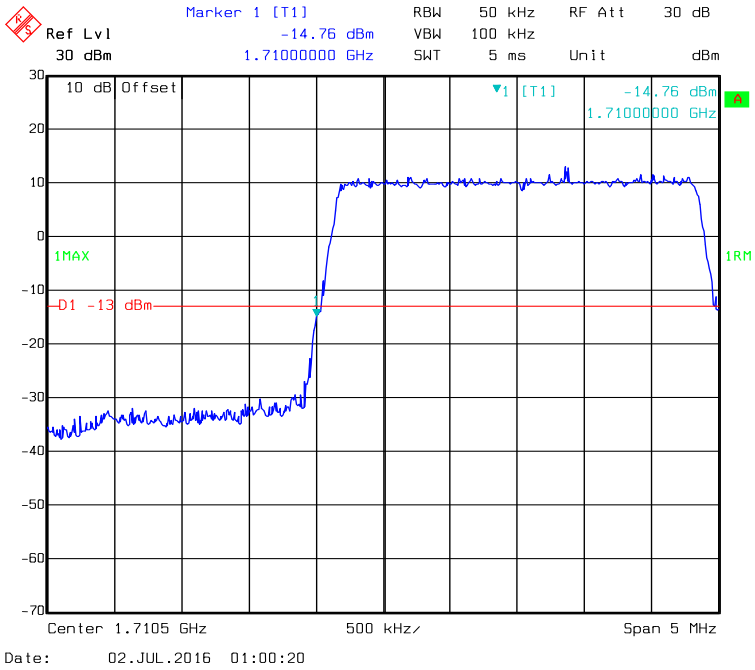
QPSK (3.0 MHz, FULL RB) - Left Band Edge



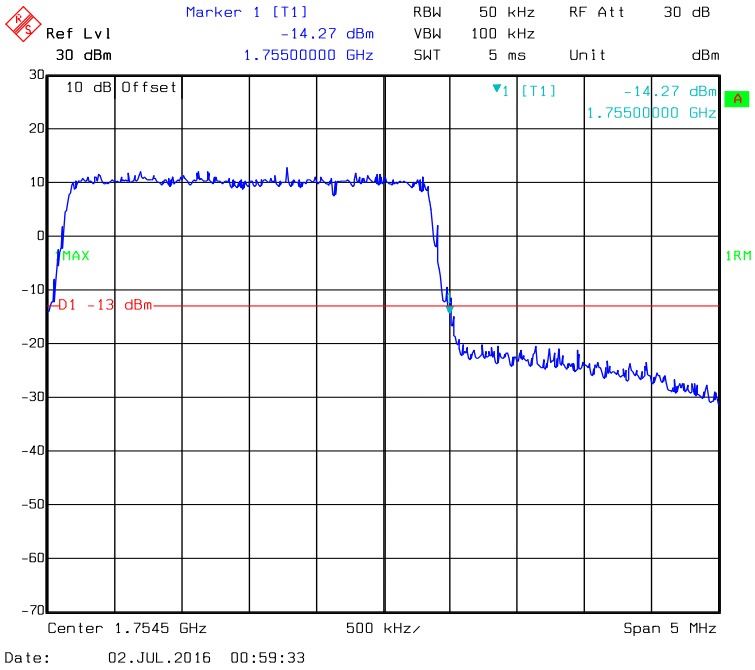
QPSK (3.0 MHz, FULL RB) - Right Band Edge



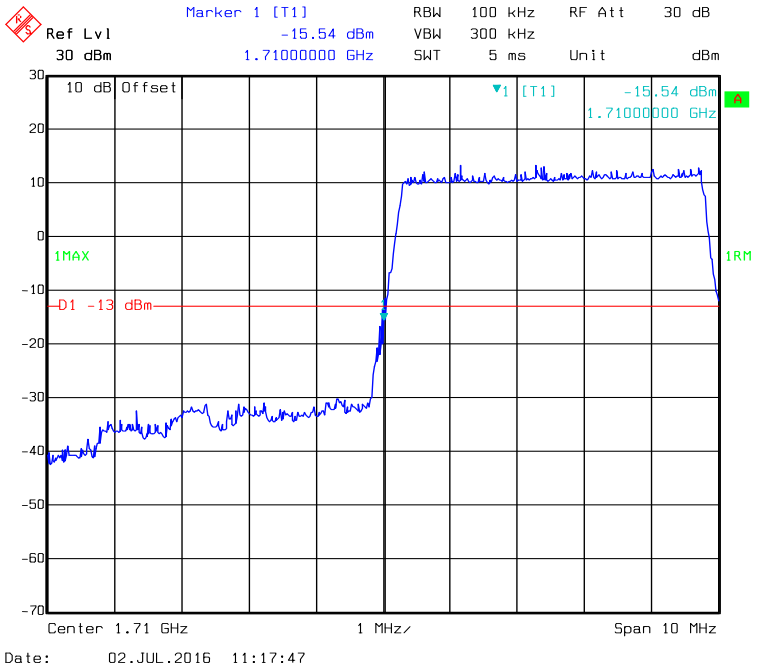
16-QAM (3.0 MHz, FULL RB) - Left Band Edge



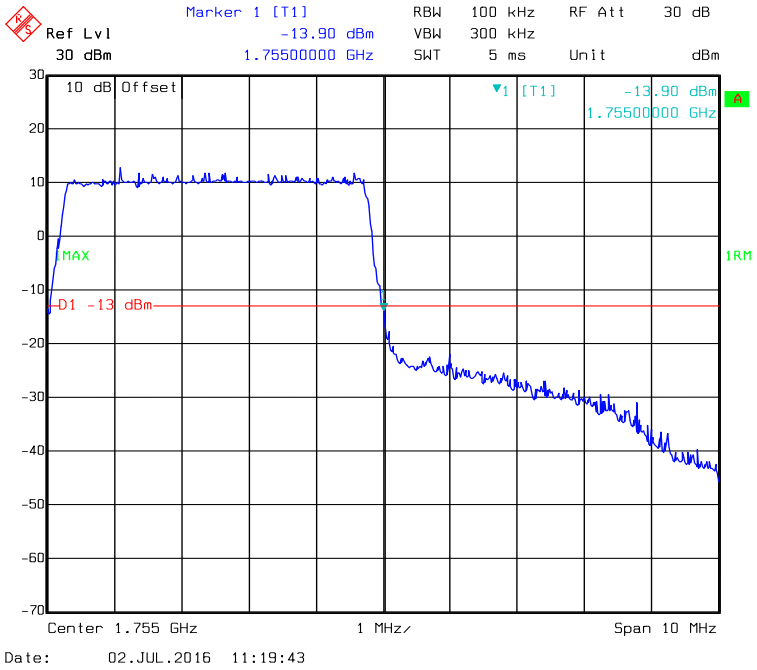
16-QAM (3.0 MHz, FULL RB) - Right Band Edge



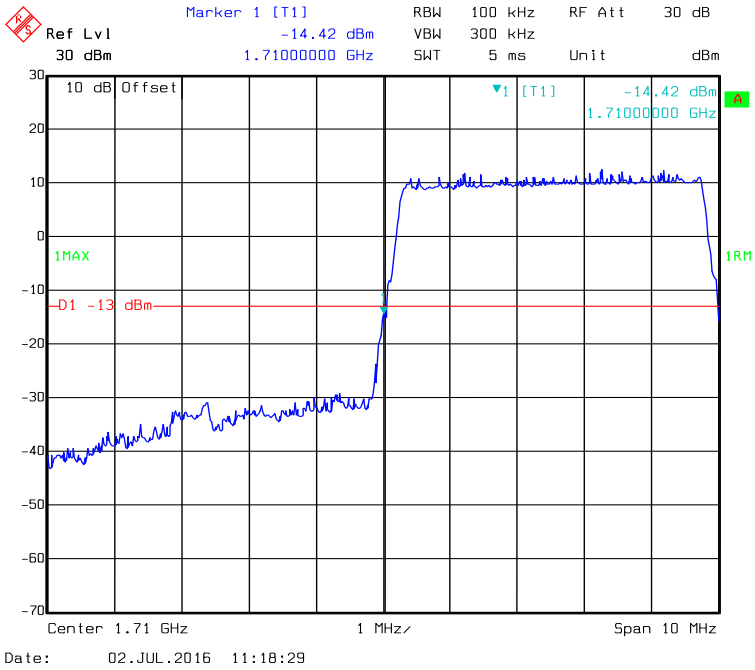
QPSK (5.0 MHz, FULL RB) - Left Band Edge



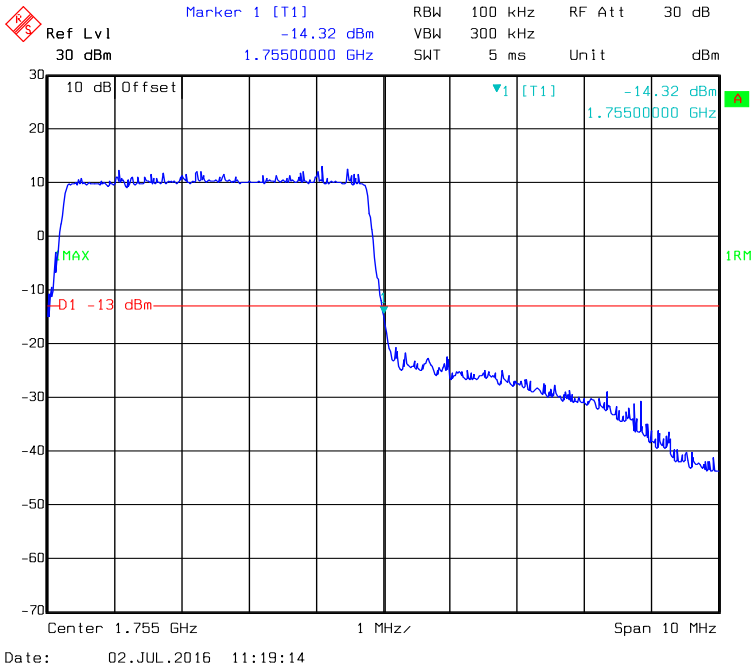
QPSK (5.0 MHz, FULL RB) - Right Band Edge



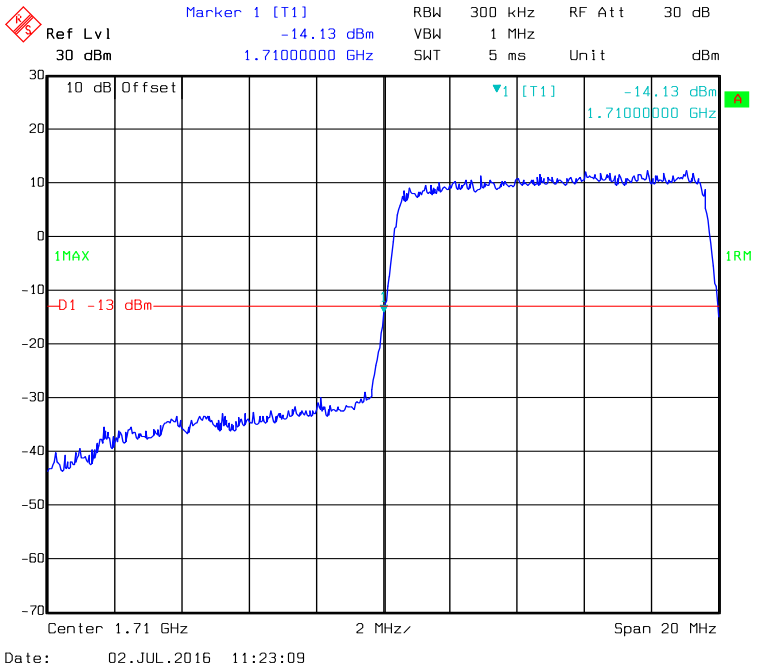
16-QAM (5.0 MHz, FULL RB) - Left Band Edge



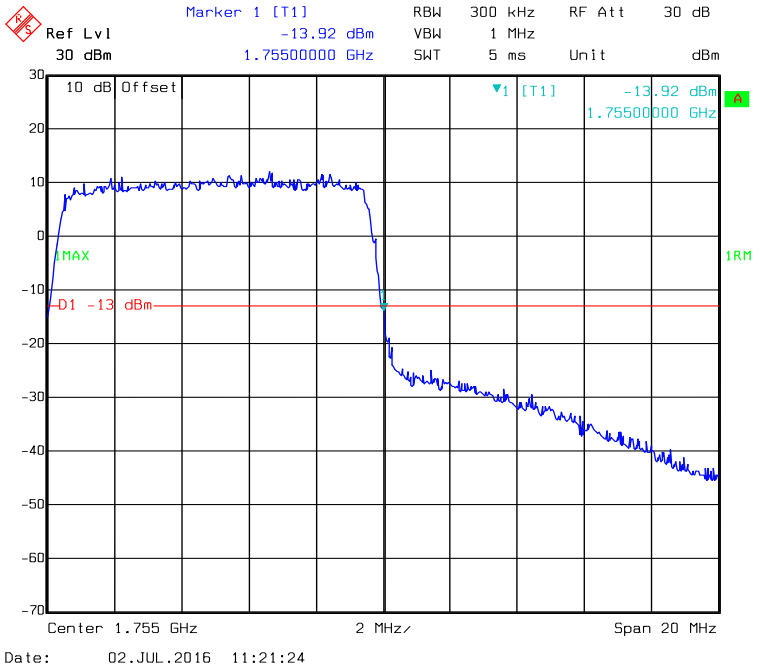
16-QAM (5.0 MHz, FULL RB) - Right Band Edge



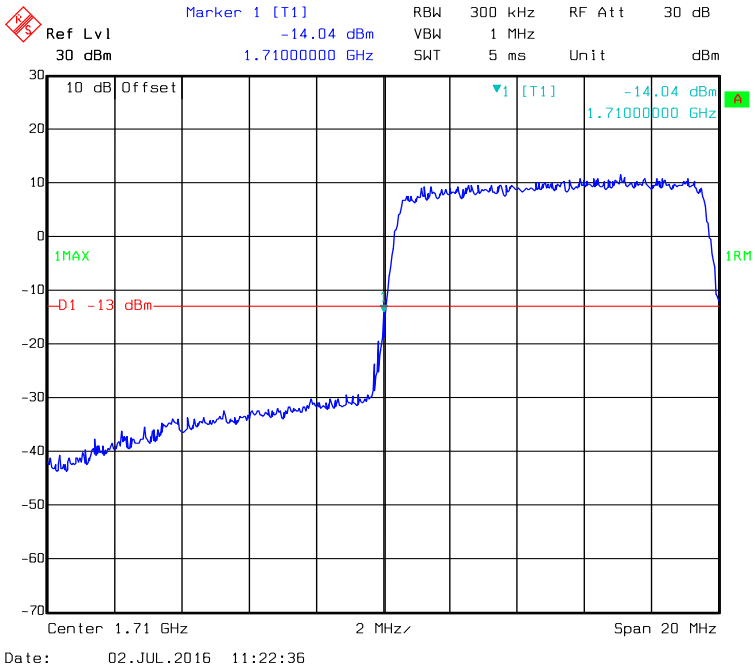
QPSK (10.0MHz, FULL RB) - Left Band Edge



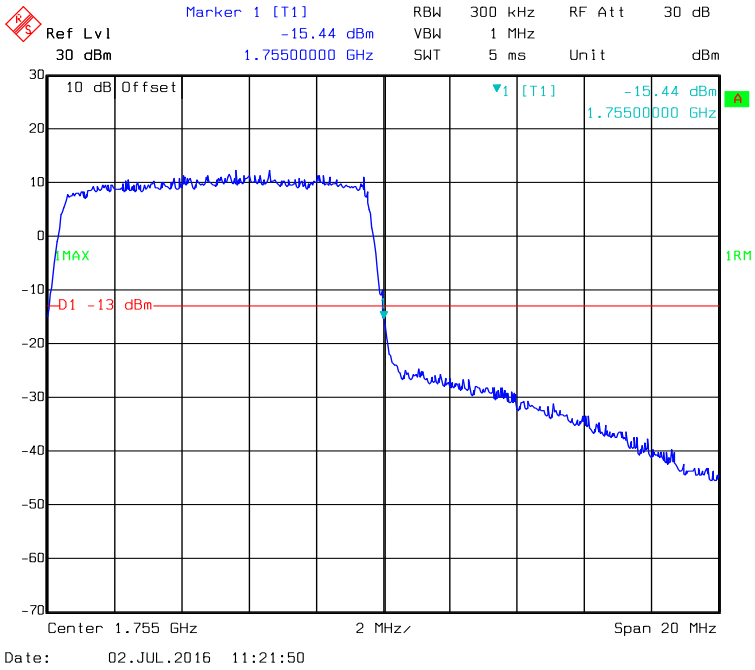
QPSK (10.0MHz, FULL RB) - Right Band Edge



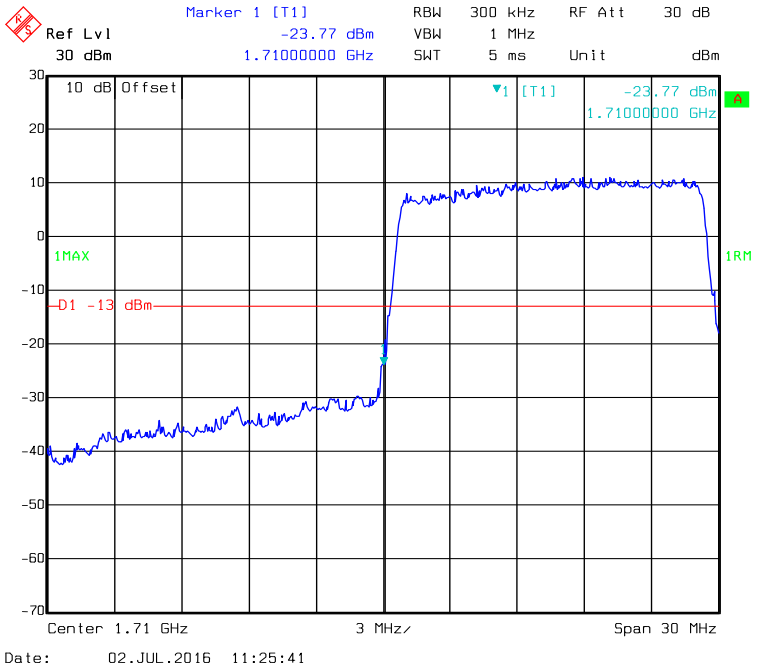
16-QAM (10.0 MHz, FULL RB) - Left Band Edge



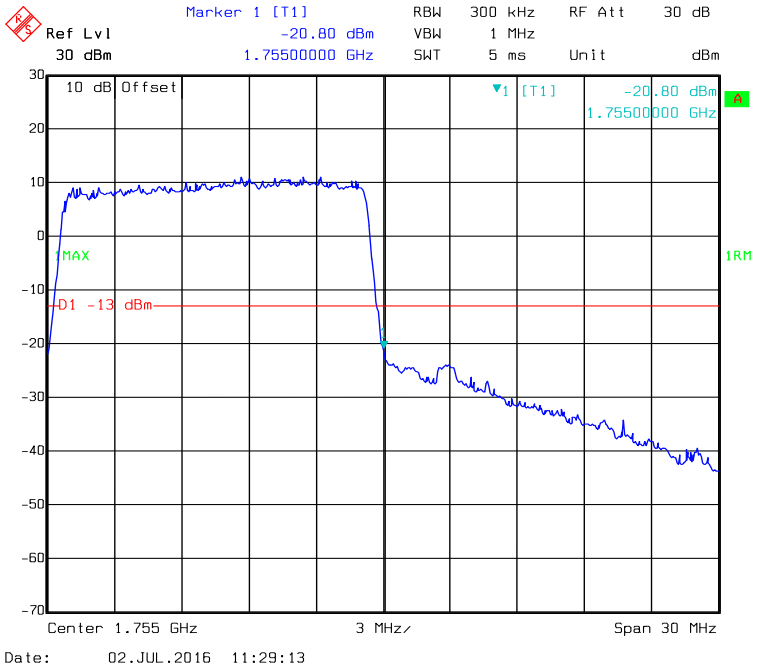
16-QAM (10.0 MHz, FULL RB) - Right Band Edge



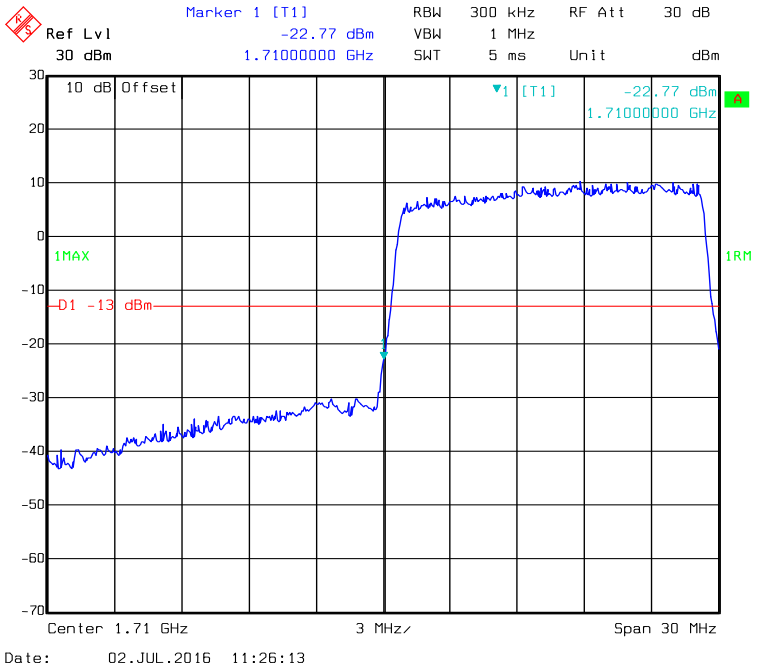
QPSK (15.0MHz, FULL RB) - Left Band Edge



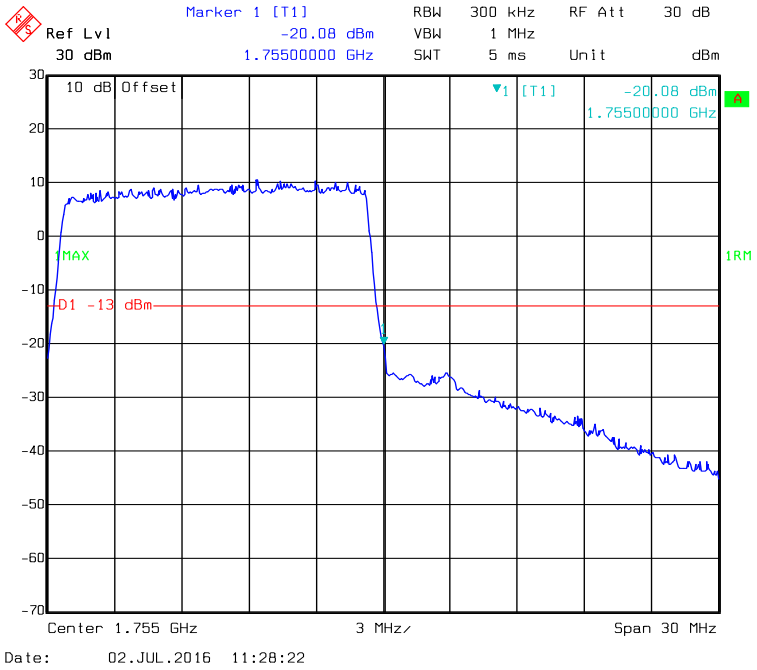
QPSK (15.0MHz, FULL RB) - Right Band Edge



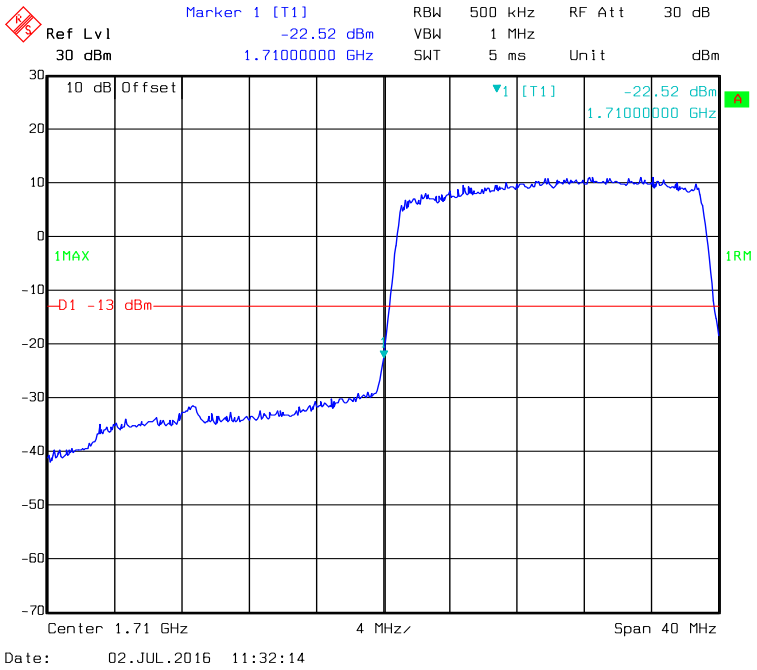
16-QAM (15.0 MHz, FULL RB) - Left Band Edge



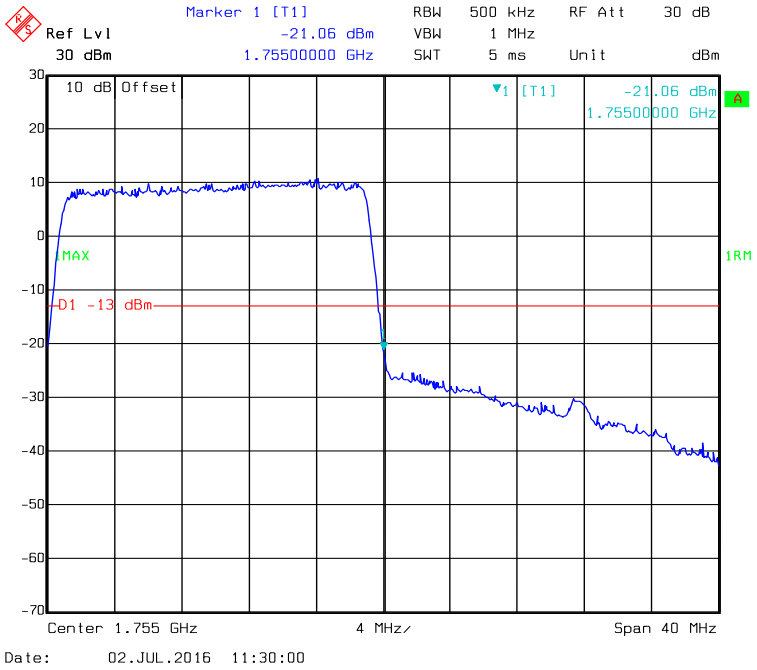
16-QAM (15.0 MHz, FULL RB) - Right Band Edge



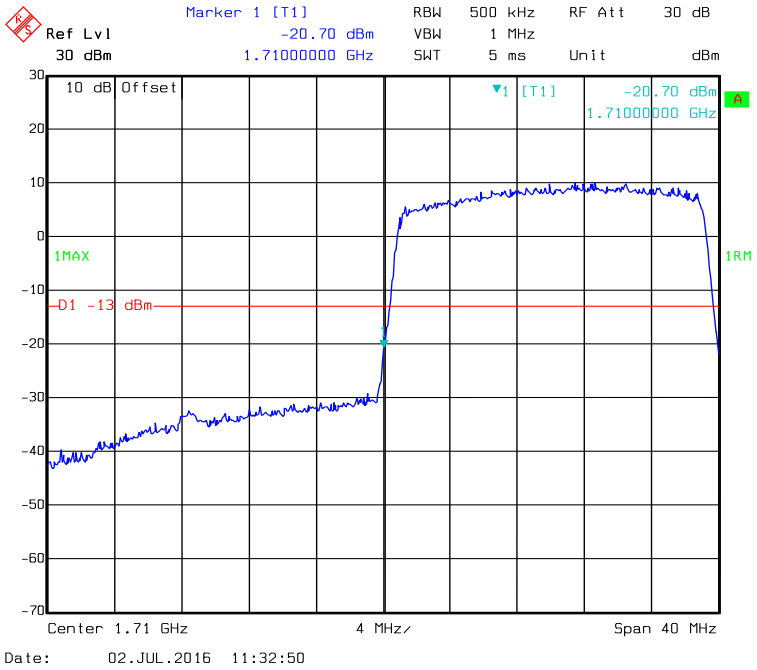
QPSK (20.0MHz, FULL RB) - Left Band Edge



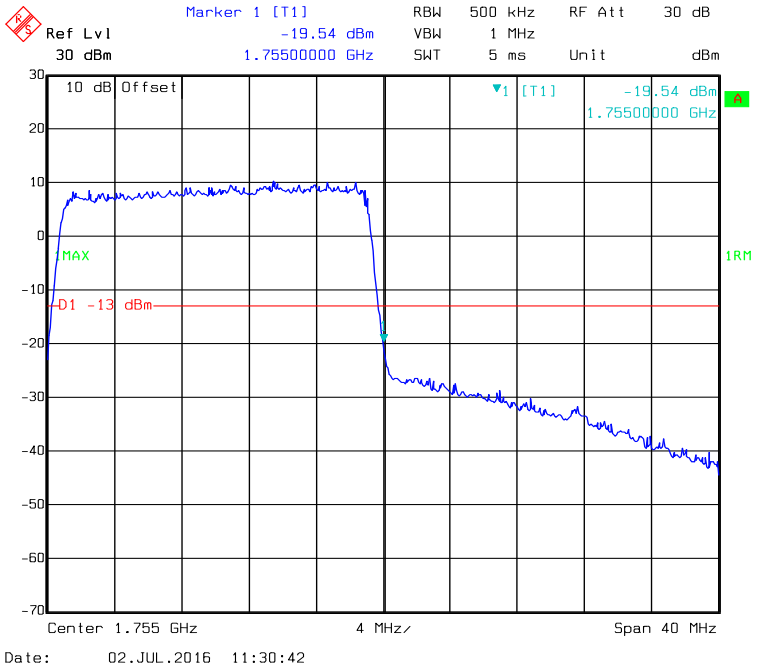
QPSK (20.0MHz, FULL RB) - Right Band Edge



16-QAM (20.0 MHz, FULL RB) - Left Band Edge

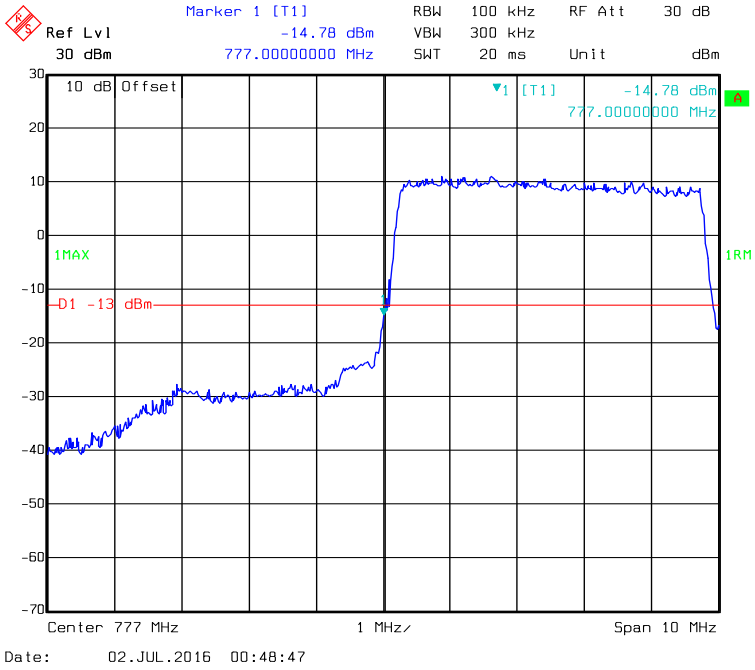


16-QAM (20.0 MHz, FULL RB) - Right Band Edge

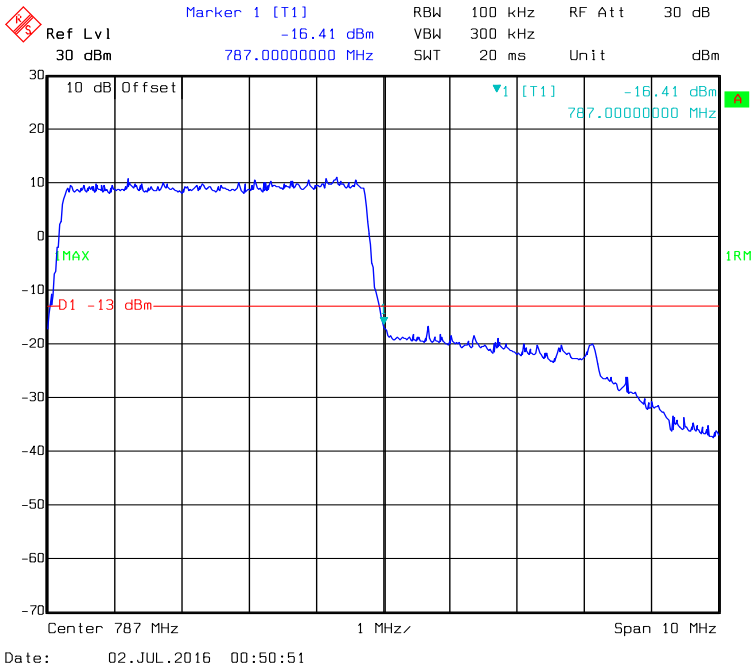


LTE Band 13:

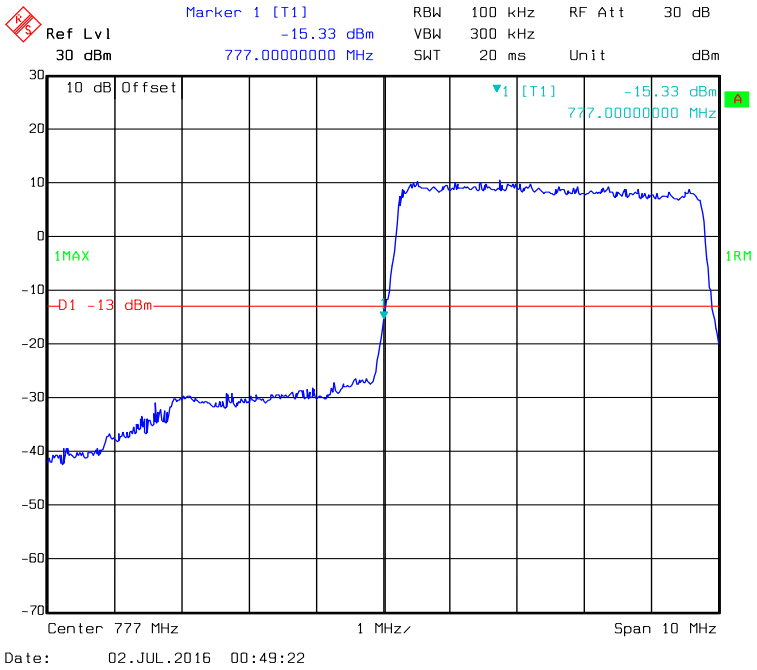
QPSK (5.0 MHz, FULL RB) - Left Band Edge



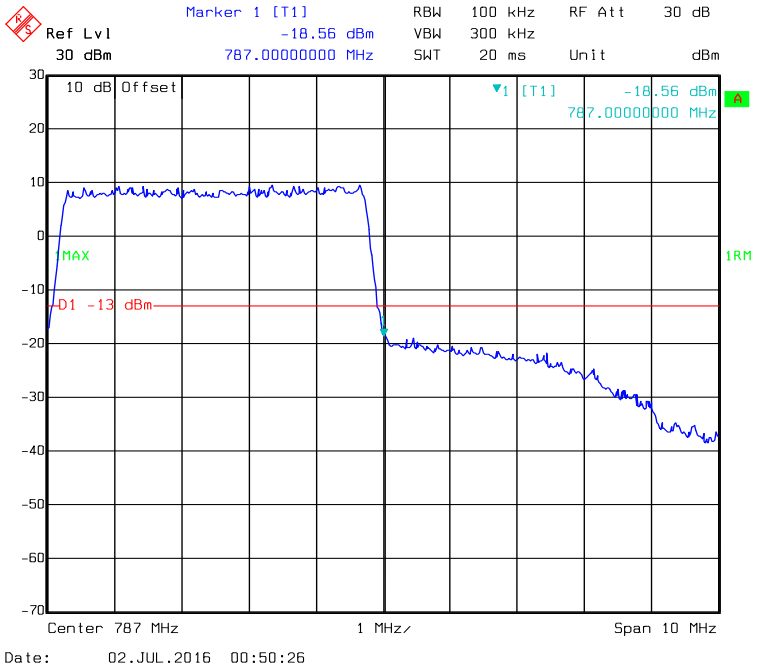
QPSK (5.0 MHz, FULL RB) - Right Band Edge



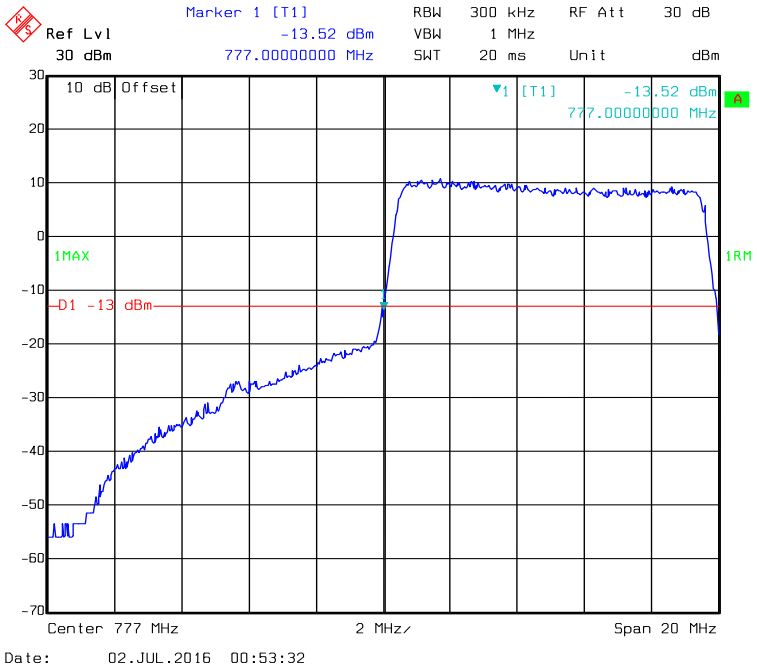
16-QAM (5.0 MHz, FULL RB) - Left Band Edge



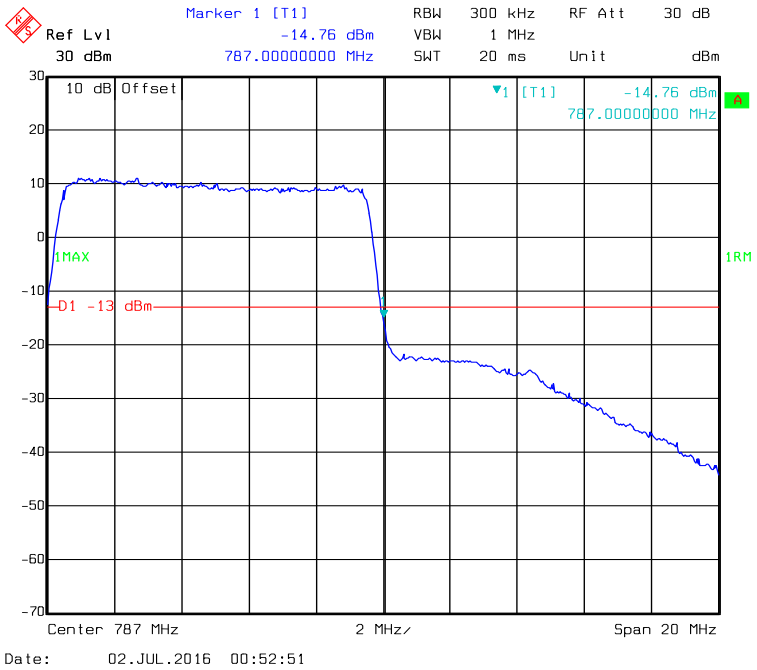
16-QAM (5.0 MHz, FULL RB) - Right Band Edge



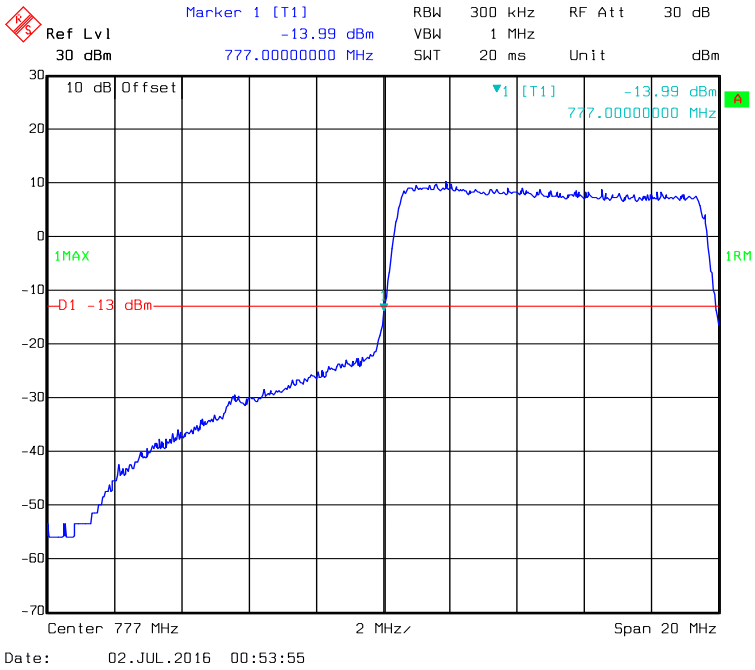
QPSK (10.0MHz, FULL RB) - Left Band Edge



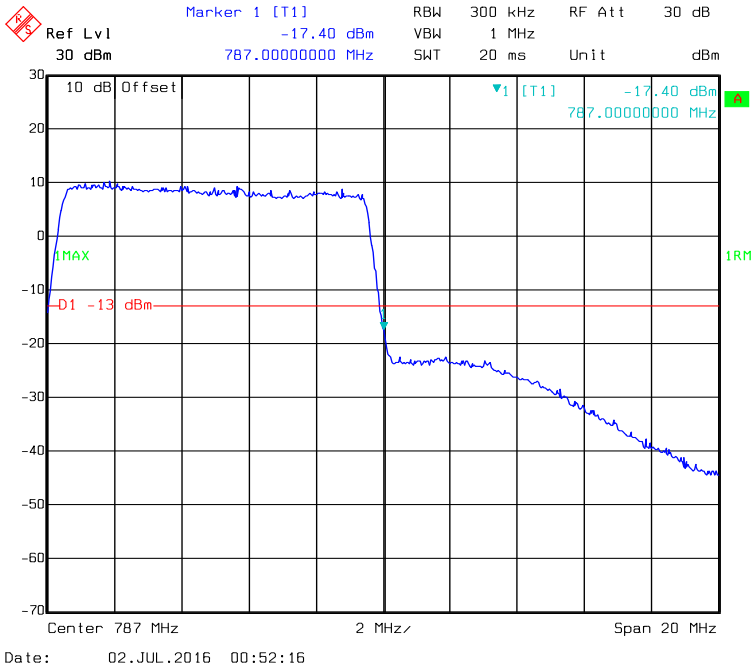
QPSK (10.0MHz, FULL RB) - Right Band Edge



16-QAM (10.0 MHz, FULL RB) - Left Band Edge



16-QAM (10.0 MHz, FULL RB) - Right Band Edge



FCC § 2.1055; §27.54 - FREQUENCY STABILITY

Applicable Standards

FCC § 2.1055, & §27.54.

According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.
:

Frequency Tolerance for Transmitters in the Public Mobile Services

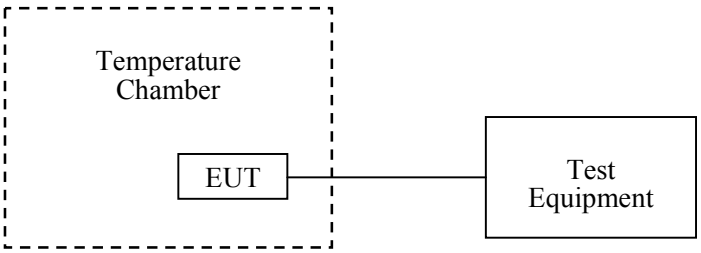
Frequency Range (MHz)	Base, fixed (ppm)	Mobile > 3 watts (ppm)	Mobile ≤ 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde &Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
BACL	Temperature Chamber	BTH - 150	30023	2015-11-12	2016-11-11
R&S	Wideband Radio Communication tester	CMW500	1201.002K50 -146520-wh	2015-11-23	2016-11-23
Mini	Splitter	ZFRSC-14-S+	SF019411452	2016-01-11	2017-01-10
BACL	RF cable	KS-LAB-020	KS-LAB-020	2016-01-11	2017-01-10
Mini	attenuator	10dB	N/A	2016-01-11	2017-01-10

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Taiwan) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0kPa

The testing was performed by David. Hsu on 2016-07-02.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables.

Band 4:

10.0 MHz Middle Channel, f_o =1732.5 MHz (QPSK)				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	3.8	-9.26	-0.0053	pass
-20		-9.24	-0.0053	pass
-10		-9.30	-0.0054	pass
0		-9.18	-0.0053	pass
10		-9.20	-0.0053	pass
20		-9.23	-0.0053	pass
30		-8.83	-0.0051	pass
40		-8.91	-0.0051	pass
50		-8.75	-0.0051	pass
25	V min.= 3.3	-8.79	-0.0051	pass
25	V max.= 4.3	-8.81	-0.0051	pass

10.0 MHz Middle Channel, f_o =1732.5 MHz (16QAM)				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	3.8	-10.16	-0.0059	pass
-20		-9.97	-0.0058	pass
-10		-9.60	-0.0055	pass
0		-9.72	-0.0056	pass
10		-10.67	-0.0062	pass
20		-8.94	-0.0052	pass
30		-10.08	-0.0058	pass
40		-10.54	-0.0061	pass
50		-9.38	-0.0054	pass
25	V min.= 3.3	-10.25	-0.0059	pass
25	V max.= 4.3	-10.13	-0.0058	pass

LTE Band 13:

10.0 MHz Middle Channel, f_o =782.0 MHz (QPSK)				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	3.8	6.93	0.0089	pass
-20		7.04	0.0090	pass
-10		7.09	0.0091	pass
0		7.00	0.0090	pass
10		6.96	0.0089	pass
20		6.91	0.0088	pass
30		6.97	0.0089	pass
40		7.09	0.0091	pass
50		7.05	0.0090	pass
25	V min.= 3.3	6.97	0.0089	pass
25	V max.= 4.3	6.98	0.0089	pass

10.0 MHz Middle Channel, f_o =782.0MHz (16QAM)				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	3.8	8.28	0.0106	pass
-20		8.11	0.0104	pass
-10		8.16	0.0104	pass
0		8.09	0.0103	pass
10		8.25	0.0105	pass
20		8.35	0.0107	pass
30		8.42	0.0108	pass
40		8.23	0.0105	pass
50		8.15	0.0104	pass
25	V min.= 3.3	8.23	0.0105	pass
25	V max.= 4.3	8.17	0.0104	pass

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