

FCC PART 90

TEST REPORT

For

Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District,
Shenzhen, 518057 China

FCC ID: YAMZ1PF4

Report Type: Original Report	Product Type: TETRA Terminal
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Report Number: <u>RDG160321003-00A</u>	
Report Date: <u>2016-05-04</u>	
Reviewed By: <u>RF Engineer</u> <i>Bell Hu</i>	
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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 *Hytera Communications Corporation Limited*'s product, model number: *Z1p F4 (FCC ID: YAMZ1PF4)* or the "EUT" in this report was a *TETRA Terminal*, which was measured approximately: 21 cm (L) x 6 cm (W) x 2.6 cm (H), rated input voltage: DC7.4V from rechargeable Li-ion battery or DC 12.0V charging from adapter.

Adapter Information:

Model: HKA01212010-XQ

Input: AC 100-240V, 50/60Hz, 0.5A

Output: DC12.0V, 1.0A

** All measurement and test data in this report was gathered from production sample serial number: 160321003 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2016-03-21.*

Objective

This test report is prepared on behalf of *Hytera Communications Corporation Limited* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS and DTS submissions with FCC ID: YAMZ1PF4.

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 individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA-603-D and ANSI 63.4-2014.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Shenzhen). 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. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) 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 October 31, 2013. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. 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

Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

Equipment Modifications

No modification was made to the EUT tested.

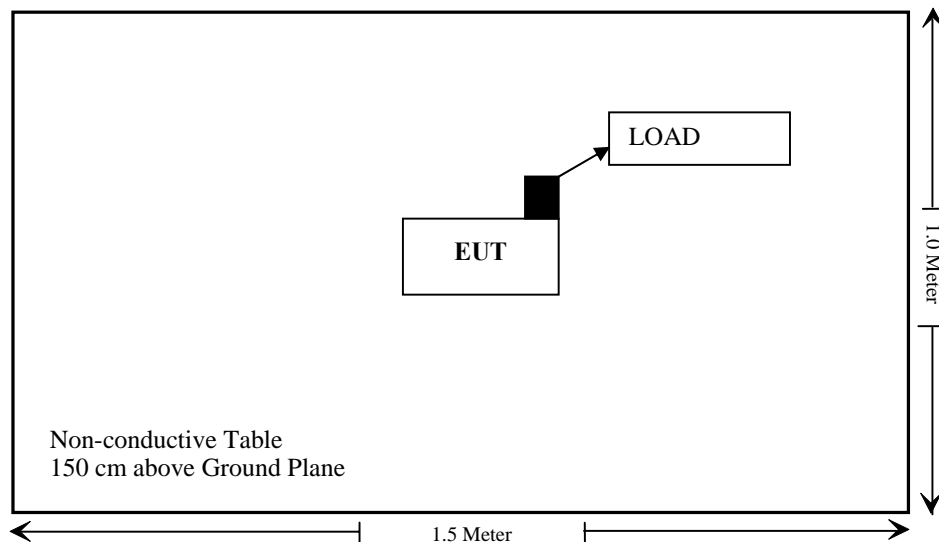
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307(b);§2.1093	RF Exposure	Compliance
§90.205	RF Output Power	Compliance
§2.1047;§90.207	Modulation Characteristic	Not Applicable*
§90.210& §90.221	Adjacent channel power	Compliance
§2.1049;§90.209;	Occupied Bandwidth	Compliance
§2.1051;§90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053;§90.210	Spurious Radiated Emissions	Compliance
§2.1055;§90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Not Applicable*

Not applicable*: Modulation Characteristic test item is not required for digital device.

FCC §1.1307(b) & §2.1093 - RF EXPOSURE

Applicable Standard

According to FCC §1.1307(b) and §2.1093, portable device operates Part 90 should be subjected to routine environmental evaluation for RF exposure prior or equipment authorization or use.

Result: Compliance.

Please refer to SAR Report Number: RDG160321003-20A.

FCC §90.205 - RF OUTPUT POWER

Applicable Standard

FCC §2.1046 and §90.205

Test Procedure

Conducted RF Output Power:

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

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

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
HP Agilent	RF Communication test set	8920A	3325U00859	2015-06-03	2016-06-02
Ducommun technologies	RF Cable	RG-214	3	2015-06-15	2016-06-15
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2015-06-12	2016-06-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-04-28.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

For TMO:

Frequency	Modulation	Channel space(kHZ)	Output Power	Limit
			(dBm)	(dBm)
450.0125	Digital	25	34.19	33.80-35.56
460.000			34.19	33.80-35.56
469.9875			34.36	33.80-35.56

For DMO:

Frequency	Modulation	Channel space(kHZ)	Output Power	Limit
			(dBm)	(dBm)
450.0125	Digital	25	34.21	33.80-35.56
460.000			34.25	33.80-35.56
469.9875			34.30	33.80-35.56

Note: the rated power is 3W (34.77dBm), limit is $3W \times (1-20\%)$ to $3W \times (1+20\%)$

FCC §90.210& §90.221- ADJACENT CHANNEL POWER

Applicable Standard

FCC §2.1046, §90.210& §90.221

§90.221 Adjacent channel power limits.

(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

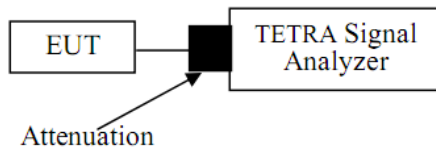
(b)(1) Maximum adjacent power levels for frequencies in the 450-470 MHz band:

Frequency offset	Maximum ACP (dBc) for devices 1 watt and less	Maximum ACP (dBc) for devices above 1 watt
25 kHz	-55 dBc	-60 dBc
50 kHz	-70 dBc	-70 dBc
75 kHz	-70 dBc	-70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply.

Test Procedure

The RF output of the transmitter was connected to the input of the TETRA Signal Analyzer through sufficient attenuation.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AEROFLEX	TETRA Signal Analyzer	2310	231001/173	2016-03-11	2017-03-10

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) 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**

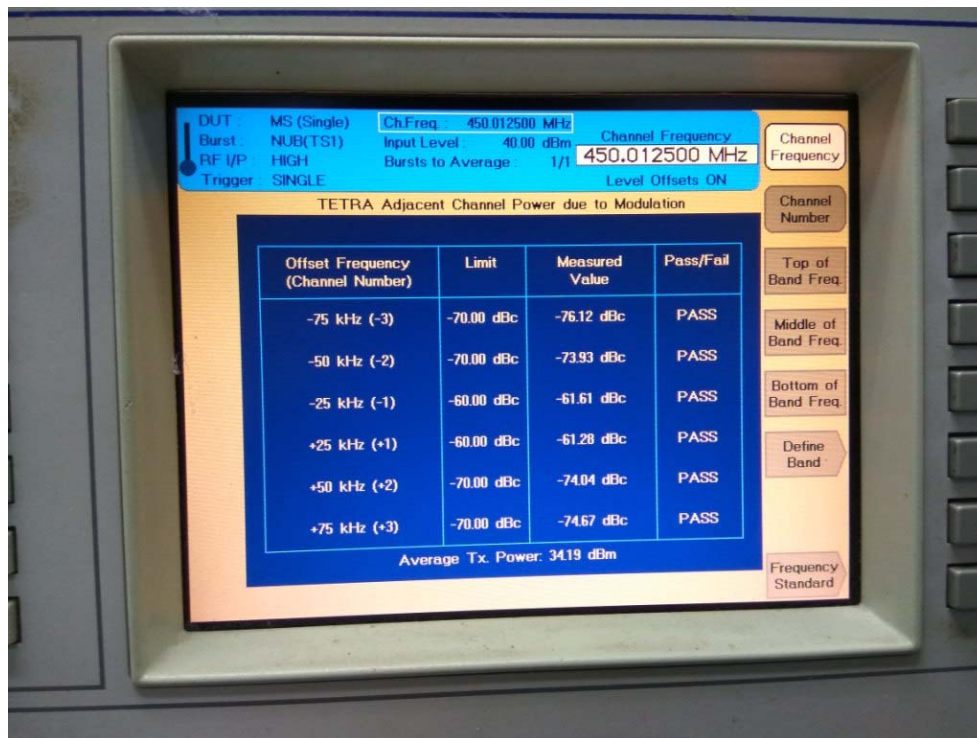
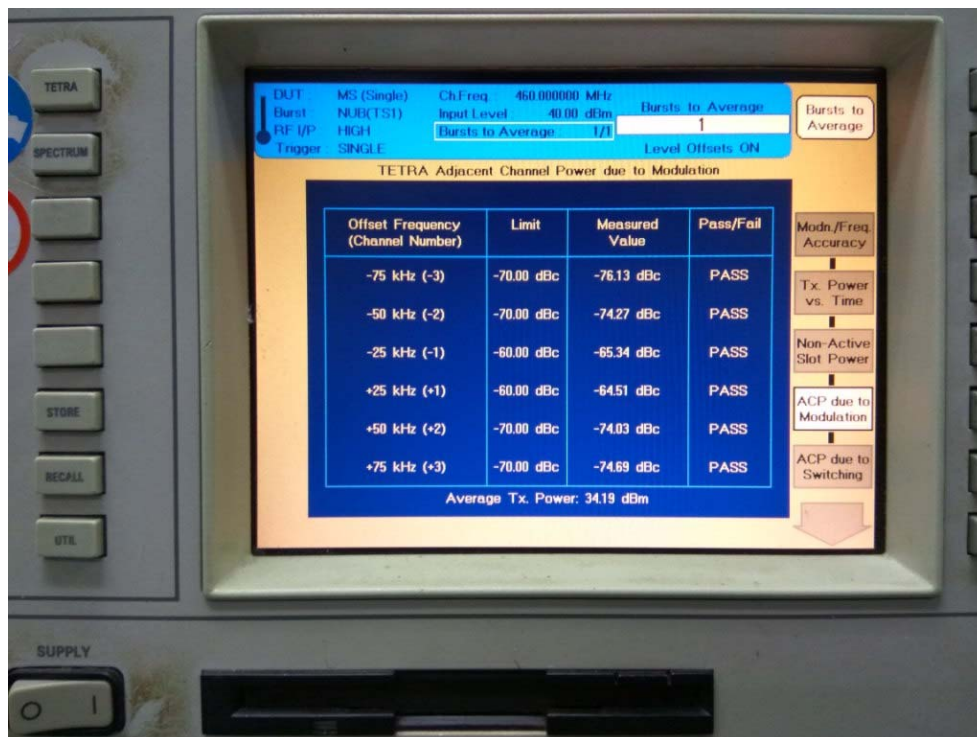
Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

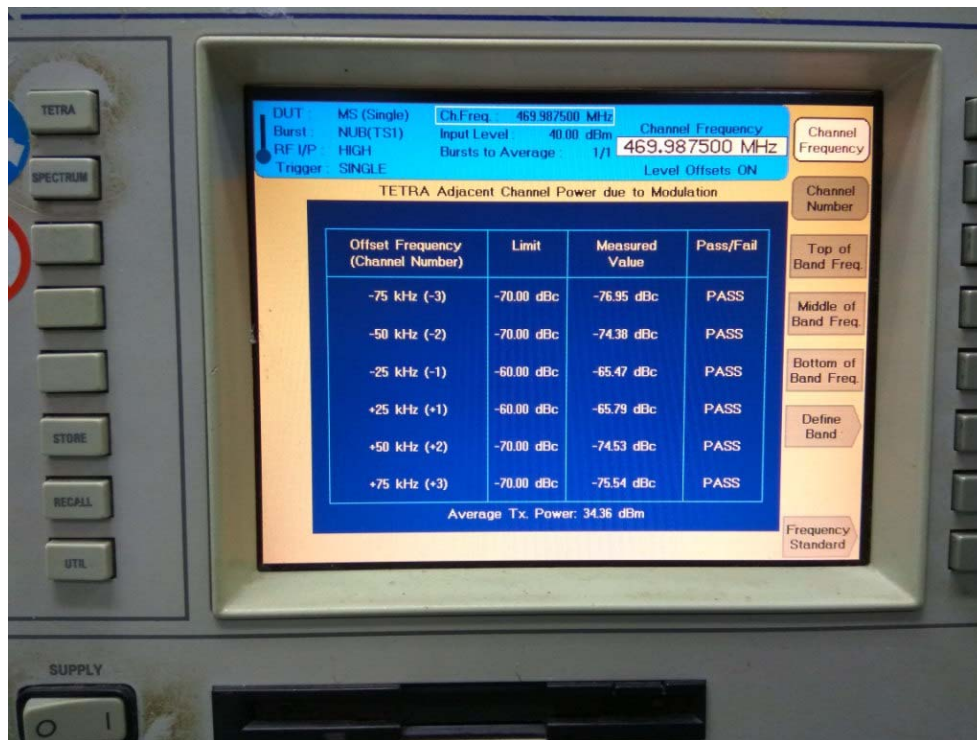
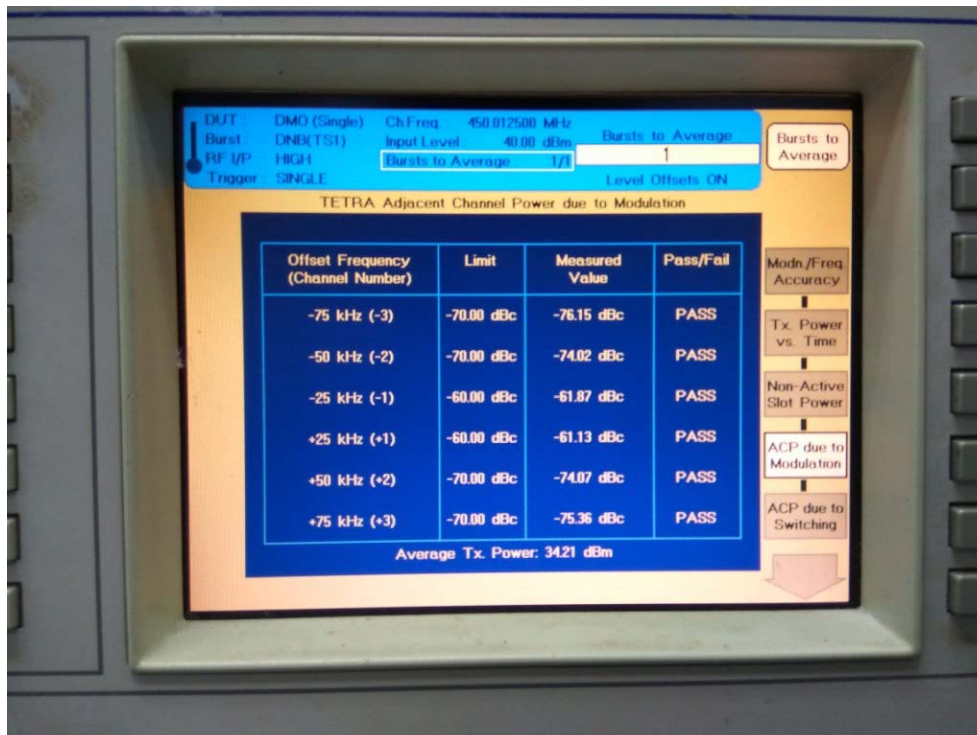
The testing was performed by Simon Wang on 2016-04-25.

Test Mode: Transmitting

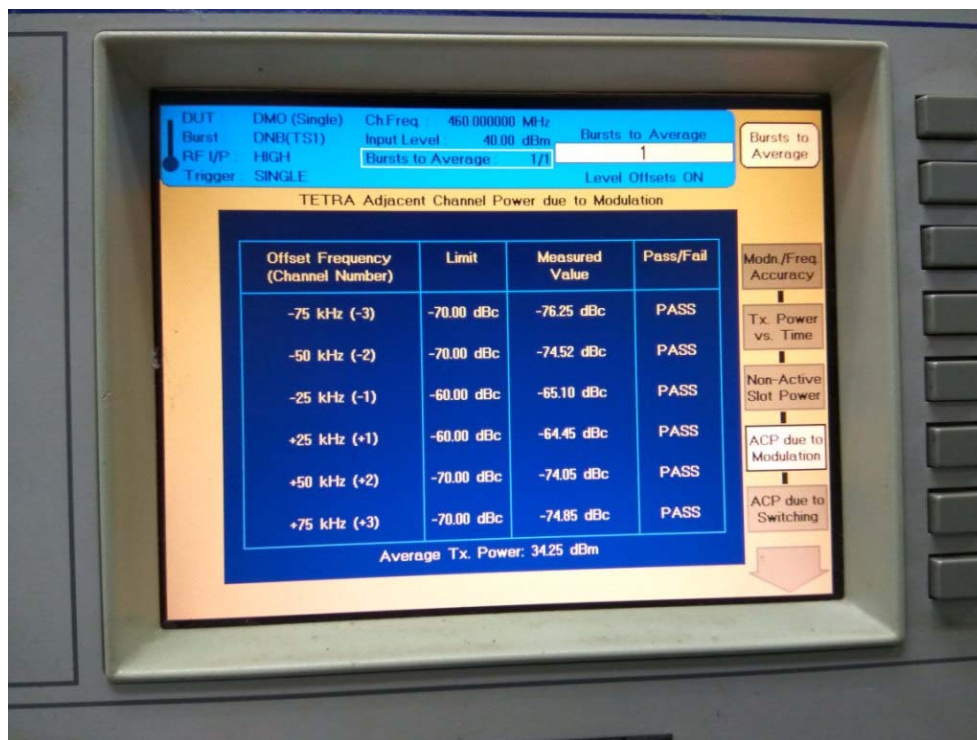
Test Result: Compliance. Please refer to following table.

Operational Mode	Channel Frequency (MHz)	Channel Separation (KHz)	Frequency offset (KHz)	Adjacent Channel Ratio(dB)	Limit (dB)
TMO	450.0125	25	-75	-76.12	-70
			-50	-73.93	-70
			-25	-61.61	-60
			+25	-61.28	-60
			+50	-74.06	-70
			+75	-74.67	-70
	460	25	-75	-76.13	-70
			-50	-74.27	-70
			-25	-65.34	-60
			+25	-64.51	-60
			+50	-74.03	-70
			+75	-74.69	-70
	469.9875	25	-75	-76.95	-70
			-50	-74.38	-70
			-25	-65.47	-60
			+25	-65.79	-60
			+50	-74.53	-70
			+75	-75.54	-70
DMO	450.0125	25	-75	-76.15	-70
			-50	-74.02	-70
			-25	-61.87	-60
			+25	-61.13	-60
			+50	-74.07	-70
			+75	-75.36	-70
	460	25	-75	-76.25	-70
			-50	-74.52	-70
			-25	-65.10	-60
			+25	-64.45	-60
			+50	-74.05	-70
			+75	-74.85	-70
	469.9875	25	-75	-76.46	-70
			-50	-74.54	-70
			-25	-65.18	-60
			+25	-64.57	-60
			+50	-73.93	-70
			+75	-75.04	-70

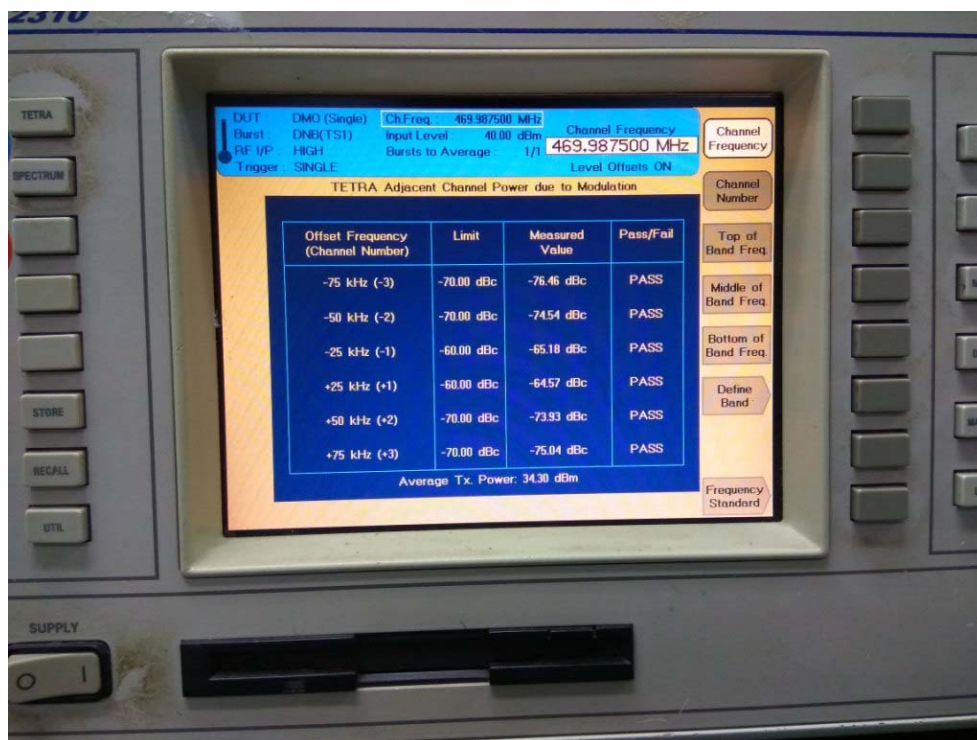
Adjacent Channel Power for Frequency 450.0125 MHz (Modulation: TMO)**Adjacent Channel Power for Frequency 460 MHz (Modulation: TMO)**

Adjacent Channel Power for Frequency 469.9875MHz (Modulation: TMO)**Adjacent Channel Power for Frequency 450.0125 MHz (Modulation: DMO)**

Adjacent Channel Power for Frequency 460 MHz (Modulation: DMO)



Adjacent Channel Power for Frequency 469.9875 MHz (Modulation: DMO)



FCC §2.1049 & §90.209 – OCCUPIED BANDWIDTH

Applicable Standard

FCC §2.1049, §90.209

90.209 Bandwidth limitations

(a) Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant. In those cases where §2.202 of this chapter does not provide a formula for the computation of necessary bandwidth, the occupied bandwidth, as defined in part 2 of this chapter, may be used in lieu of the necessary bandwidth.

(b) The maximum authorized single channel bandwidth of emission corresponding to the type of emission specified in §90.207 is as follows:

(5) Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table.

STANDARD CHANNEL SPACING/BANDWIDTH

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25 ²		
25-50	20	20
72-76	20	20
150-174	¹ 7.5	¹ 3 ²⁰ /11.25/6
216-220 ⁵	6.25	20/11.25/6
220-222	5	4
406-512 ²	¹ 6.25	¹ 3 ²⁰ /11.25/6
806-809/851-854	12.5	20
809-824/854-869	25	20
896-901/935-940	12.5	13.6
902-928 ⁴		
929-930	25	20
1427-1432 ⁵	12.5	12.5
³ 2450-2483.5 ²		
Above 2500 ²		

⁶ Operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the Adjacent Channel Power limits of §90.221.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
Ducommun technologies	RF Cable	RG-214	3	2015-06-15	2016-06-15
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2015-06-12	2016-06-12

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

Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band ± 50 kHz from the carrier frequency.

Test Data**Environmental Conditions**

Temperature:	20~25 °C
Relative Humidity:	48~52 %
ATM Pressure:	100.0~101.0 kPa

The testing was performed by Simon Wang on 2016-04-25 and 2016-04-28.

Test Mode: Transmitting

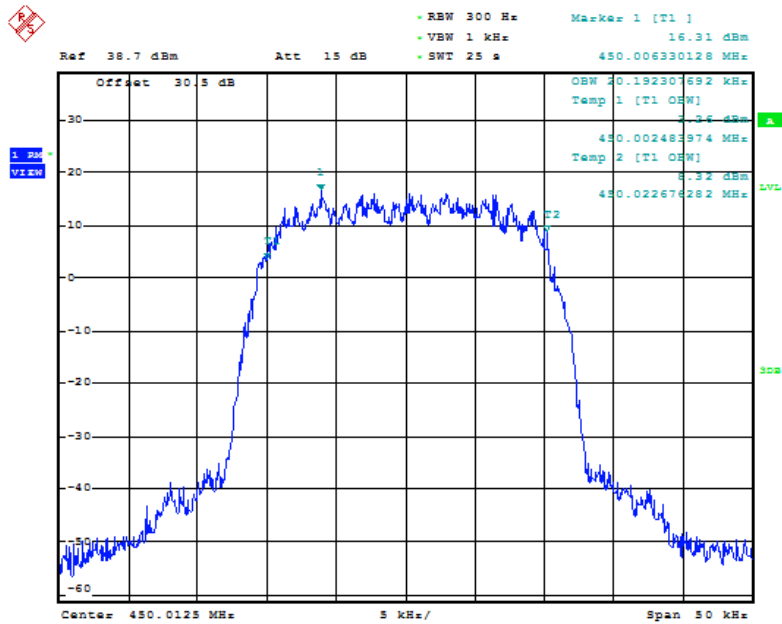
Please refer to the emission mask hereinafter table and plots.

Modulation	Channel space(kHz)	Frequency(MHz)	99% Bandwidth(kHz)	Authorize Bandwidth (kHz)
TMO	25	450.0125	20.192	22
		460.0000	20.192	
		469.9875	20.112	

Modulation	Channel space(kHz)	Frequency(MHz)	99% Bandwidth(kHz)	Authorize Bandwidth (kHz)
DMO	25	450.0125	20.112	22
		460.0000	20.112	
		469.9875	20.032	

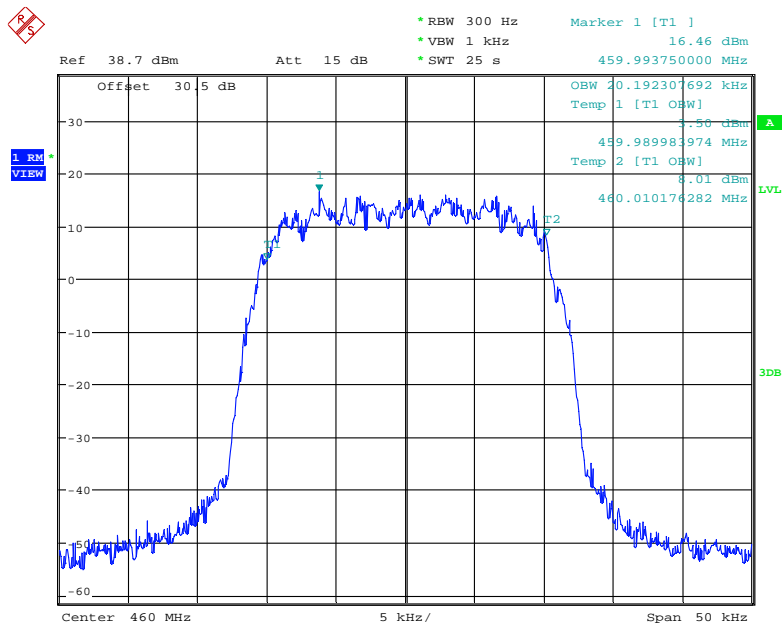
For TMO:

99% Occupied Bandwidth 25 kHz, 450.0125 MHz



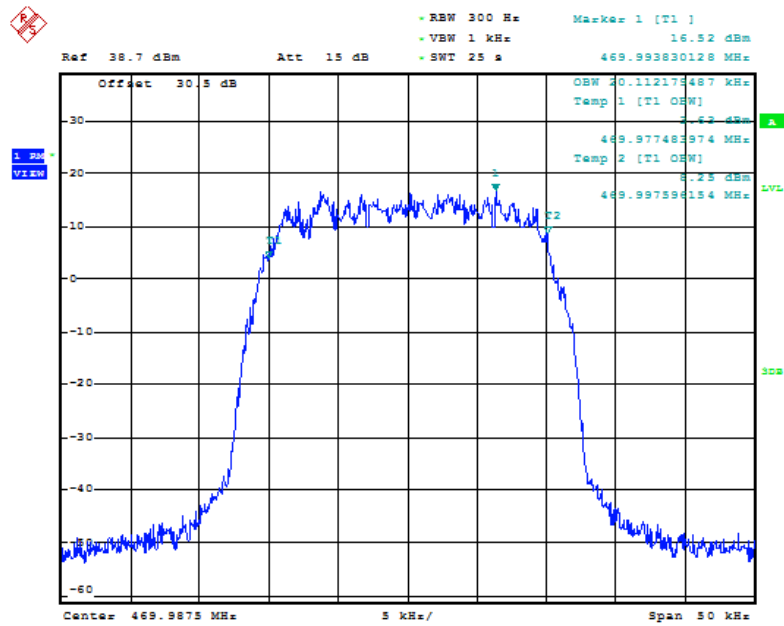
Date: 25.APR.2016 00:55:01

99% Occupied Bandwidth 25 kHz, 460.0000 MHz



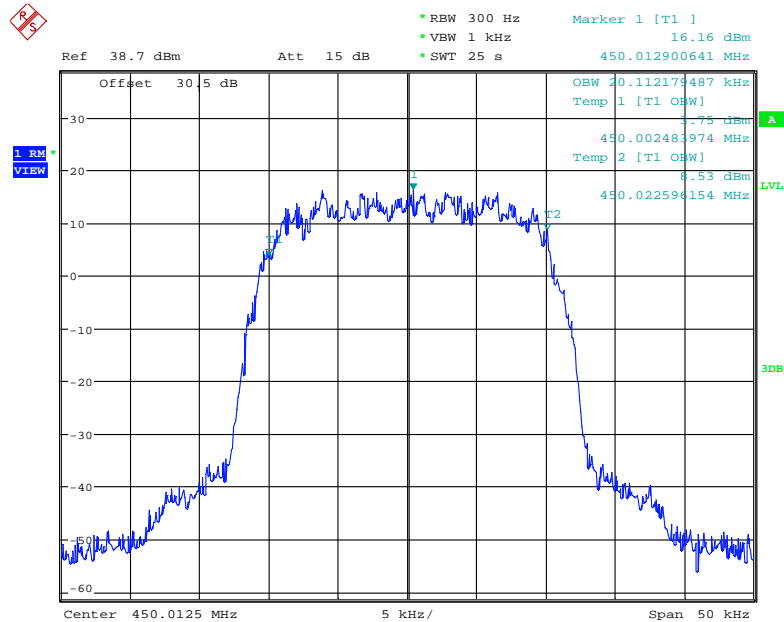
Date: 25.APR.2016 01:03:20

99% Occupied Bandwidth 25 kHz, 469.98750 MHz



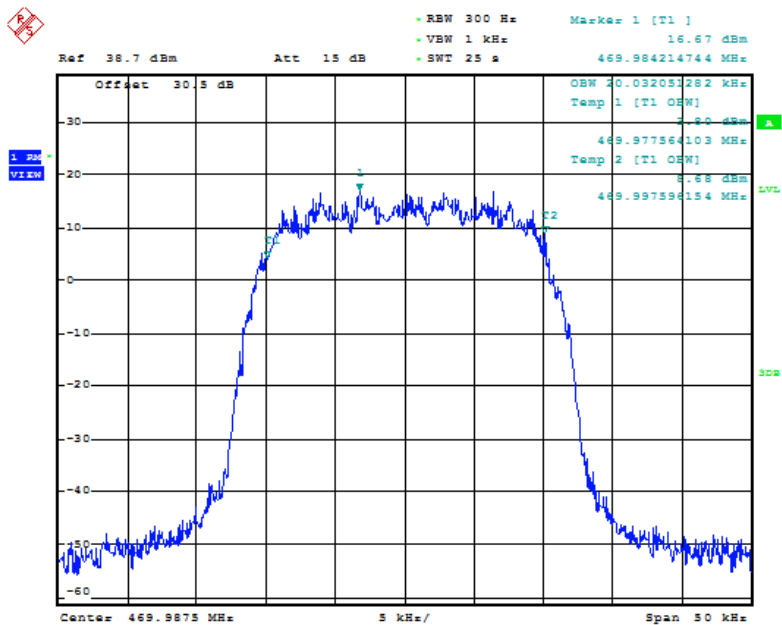
For DMO:

99% Occupied Bandwidth 25 kHz, 450.0125 MHz



[illegible]

99% Occupied Bandwidth 25 kHz, 469.98750 MHz



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FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least $43 + 10 \log (P_{\text{watts}})$ dB.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
Ducommun technologies	RF Cable	RG-214	3	2015-06-15	2016-06-15
WEINSCHL	10dB Attenuator	5324	AU0709	2015-06-18	2016-06-18

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

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for below 1GHz, and 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Test Data

Environmental Conditions

Temperature:	21 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

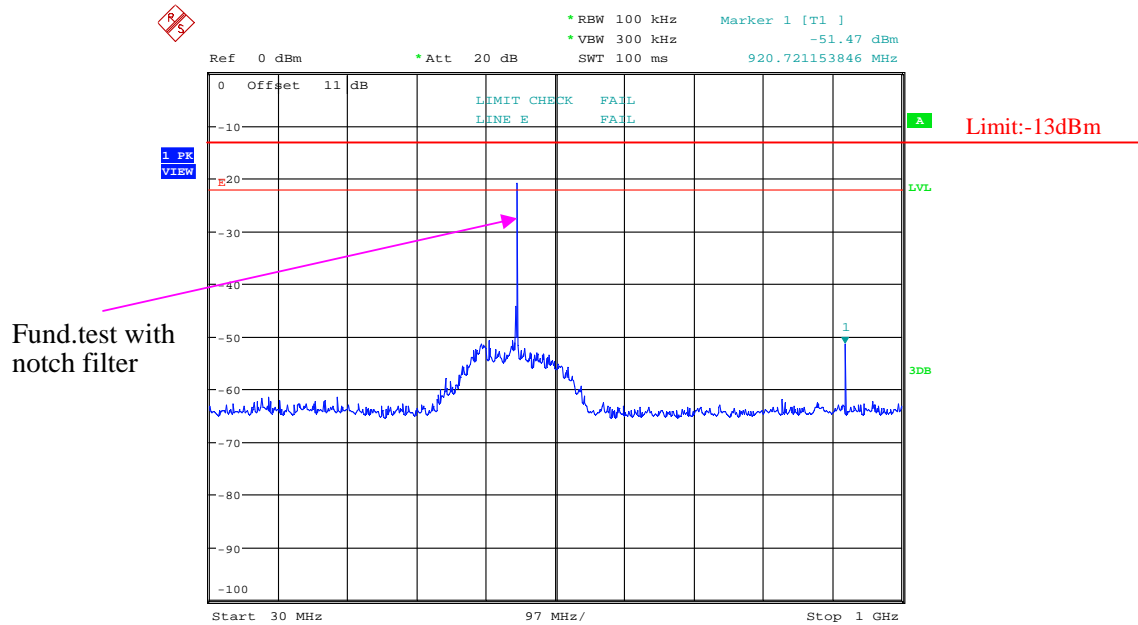
The testing was performed by Simon Wang on 2016-04-25.

Test Mode: Transmitting

Please refer to the following plots.

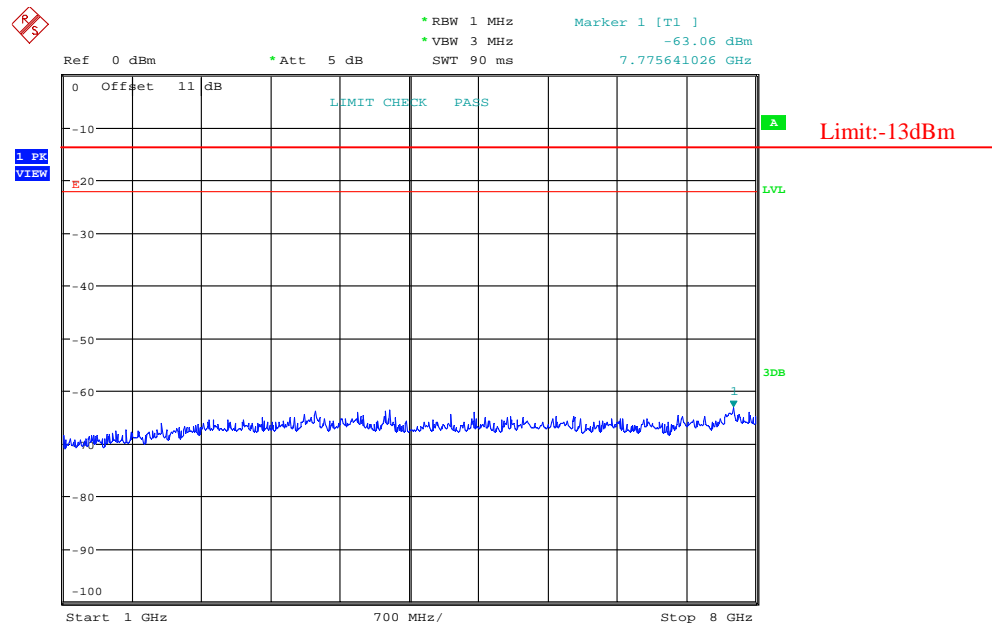
For TMO:

30 MHz – 1 GHz, Spacing Channel 25 kHz, 460.0000 MHz



Date: 25.APR.2016 23:12:39

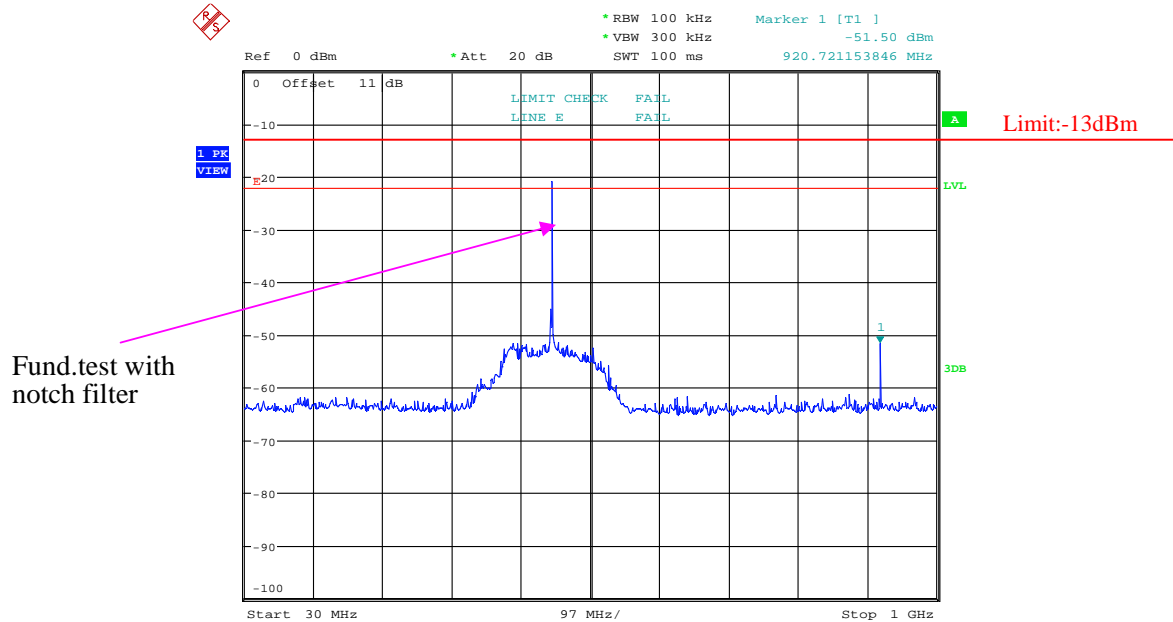
1 GHz – 8 GHz, Spacing Channel 25 kHz, 460.0000 MHz



Date: 25.APR.2016 23:15:58

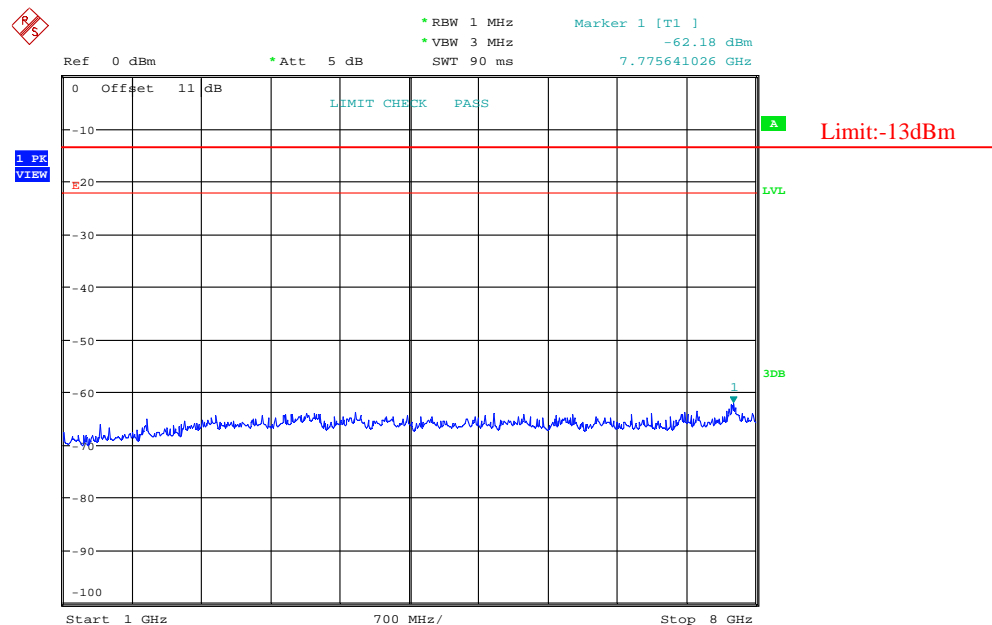
For DMO:

30 MHz – 1 GHz, Spacing Channel 25 kHz, 460.0000 MHz



Date: 25.APR.2016 23:13:57

1 GHz – 8 GHz, Spacing Channel 25 kHz, 460.0000 MHz



Date: 25.APR.2016 23:17:30

FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §90.210

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2015-12-15	2016-112-14
HP	Amplifier	HP8447E	1937A01046	2015-05-06	2016-05-05
Sunol Sciences	Bi-log Antenna	JB1	A040904-2	2014-12-07	2017-12-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-29	2017-12-28
HP	Synthesized Sweeper	HP 8341B	2624A00116	2015-07-02	2016-07-01
Mini	Amplifier	ZVA-183-S+	5969001149	2016-04-23	2017-04-23
A.H. System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2015-06-15	2016-06-15
Ducommun technologies	RF Cable	104PEA	218124002	2015-06-15	2016-06-15
Ducommun technologies	RF Cable	RG-214	1	2015-06-15	2016-06-15
Ducommun technologies	RF Cable	RG-214	2	2015-06-15	2016-06-15
COM POWER	Dipole Antenna	AD-100	041000	2015-08-18	2016-08-18

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

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 teeth 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 (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB $=50+10 \log_{10}$ (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

Spurious attenuation limit in dB $=55+10 \log_{10}$ (power out in Watts) for EUT with a 6.25 kHz channel bandwidth.

Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-04-27.

Test Mode: Transmitting

TX:

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Part 90	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
TMO 460.0 MHz										
920	24.27	11	2.3	H	-72.7	0.70	0	-73.40	-13.00	60.40
920	24.93	161	1.9	V	-72.1	0.70	0	-72.80	-13.00	59.80
1380	43.85	358	2.2	H	-65.8	1.20	6.40	-60.60	-13.00	47.60
1380	43.49	358	1.2	V	-66.2	1.20	6.40	-61.00	-13.00	48.00
TMO 460.0 MHz										
920	24.24	110	1.7	H	-72.8	0.70	0	-73.50	-13.00	60.50
920	24.97	103	1.6	V	-72.0	0.70	0	-72.70	-13.00	59.70
1380	44.34	117	2.0	H	-64.7	1.20	6.40	-59.50	-13.00	46.50
1380	43.39	270	2.0	V	-67.8	1.20	6.40	-62.60	-13.00	49.60

Note:

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

,

FCC §2.1055 & §90.213- FREQUENCY STABILITY**Applicable Standard**

FCC §2.1055 and §90.213

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Hewlett-Packard	Frequency Counter	5343A	2232A00827	2013-05-09	2016-05-08
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2015-11-01	2016-10-31
Ducommun technologies	RF Cable	RG-214	3	2015-06-15	2016-06-15
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2015-06-12	2016-06-12
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR

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

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 a frequency counter 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 counter.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-04-28.

Test Mode: Transmitting

For TMO:

Reference Frequency: 460 MHz, Limit: 5 ppm, 25 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	7.4	460.000049	0.11
40	7.4	460.000047	0.10
30	7.4	460.000056	0.12
20	7.4	460.000050	0.11
10	7.4	460.000058	0.13
0	7.4	460.000049	0.11
-10	7.4	460.000055	0.12
-20	7.4	460.000052	0.11
-30	7.4	460.000051	0.11
Frequency Stability versus Input Voltage			
20	6.3	460.000051	0.11

For DMO:

Reference Frequency: 460.0125 MHz, Limit: 5 ppm, 25 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	7.4	460.000052	0.11
40	7.4	460.000055	0.12
30	7.4	460.000058	0.13
20	7.4	460.000046	0.10
10	7.4	460.000056	0.12
0	7.4	460.000045	0.10
-10	7.4	460.000057	0.12
-20	7.4	460.000054	0.12
-30	7.4	460.000056	0.12
Frequency Stability versus Input Voltage			
20	6.3	460.000054	0.12

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