TEST REPORT

No. B18N01230-LTE

for

RED Technologies LLC

Mobile phone

Model Name: H1T1000

FCC ID: 2AOYWH1T1000

with

Hardware Version: DVT

Software Version: H1T1000.005ho.01.00.01d.403

Issued Date: 2018-08-16

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

Test Laboratory:

Designation Number: CN1210

SAICT, Shenzhen Academy of Information and Communications Technology

Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China 518026.

Tel: +86(0)755-33322000, Fax: +86(0)755-33322001

Email: yewu@caict.ac.cn, website: www.cszit.com

REPORT HISTORY

Report Number	Revision	Description	Issue Date
B18N01230-LTE	Rev.1	1st edition	2018-08-16

NOTE: The EUT is a variant model of H1A1000（FCC ID：2AOYWH1T1000）. All the original values of this report are quoted directly from B18N01018.

CONTENTS

1. Test Laboratory

1.1. Testing Location

Company Name:	Shenzhen Academy of Information and Communications Technology
Address:	Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China
Postal Code:	518026
Telephone:	+86(0)755-33322000
Fax:	+86(0)755-33322001

1.2. Testing Environment

Normal Temperature:	15-35℃
Relative Humidity:	20-75%

1.3. Project data

Testing Start Date:	2018-06-25
Testing End Date:	2018-07-25

1.4. Signature

Lai Minghua
(Prepared this test report)

Yang Zi'an
(Reviewed this test report)

Zhang Hao
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	RED Technologies LLC
Address /Post:	34 Parker, Irvine, California, United States
Contact Person:	Doug Kwon
Contact Email	Doug.kwon@Red.com
Telephone:	9492067900 ext 7794
Fax:	/

2.2. Manufacturer Information

Company Name:	RED Technologies LLC
Address /Post:	34 Parker, Irvine, California, United States
Contact Person:	Doug Kwon
Contact Email	Doug.kwon@Red.com
Telephone:	9492067900 ext 7794
Fax:	/

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Mobile phone
Model Name	H1T1000
FCC ID	2AOYWH1T1000
Frequency Bands	LTE Band 14,26
Antenna	Integrated
Extreme vol. Limits	3.65VDC to 4.3VDC (nominal: 3.85VDC)
Extreme temp. Tolerance	-30°C to +50°C
Condition of EUT as received	No abnormality in appearance

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Sample Arrival Date
UT01aa	/	DVT	H1T1000.005ho.01.0 0.01d.403	2018-06-25

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description
AE1	Battery
AE2	Charger

AE1

Model	/
Manufacturer	/
Capacitance	/

AE2

Model	/
Manufacturer	/

*AE ID: is used to identify the test sample in the lab internally.

3.4. General Description

The Equipment Under Test (EUT) is a model TD-LTE mobile phone with integrated antenna. It consists of normal options: lithium battery, charger. Manual and specifications of the EUT were provided to fulfil the test.

4. Reference Documents

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	10-1-17 Edition
FCC Part 90	PRIVATE LAND MOBILE RADIO SERVICES	10-1-17 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio Service	2015

5. LABORATORY ENVIRONMENT

Control room / conducted chamber did not exceed following limits along the RF testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. =20 %, Max. = 80 %
Shielding effectiveness	> 110 dB
Electrical insulation	>2 MΩ
Ground system resistance	< 0.5 Ω

Fully-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 15 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio （VSWR）	≤ 6 dB, from 1 to 18 GHz，3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	F	Fail
	NA	Not applicable
	NM	Not measured
Location Column	A/B/C/D	The test is performed in test location A, B, C or D which are described in section 1.1 of this report

LTE Band 14

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/90.635	A.1	P
2	Field Strength of Spurious Radiation	2.1053/90.691	A.2	P
3	Frequency Stability	2.1055/90.213	A.3	P
4	Occupied Bandwidth	2.1049/90.1215	A.4	P
5	Emission Bandwidth	2.1049/90.1215	A.5	P
6	Band Edge Compliance	2.1051/90.691	A.6	P
7	Conducted Spurious Emission	2.1051/90.691	A.7	P
8	Peak to Average Power Ratio	90.635	A.8	P

LTE Band 26

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/90.635	A.1	P
2	Field Strength of Spurious Radiation	2.1053/90.691	A.2	P
3	Frequency Stability	2.1055/90.213	A.3	P
4	Occupied Bandwidth	2.1049/90.1215	A.4	P
5	Emission Bandwidth	2.1049/90.1215	A.5	P
6	Band Edge Compliance	2.1051/90.691	A.6	P
7	Conducted Spurious Emission	2.1051/90.691	A.7	P
8	Peak to Average Power Ratio	90.635	A.8	P

7. Test Equipments Utilized

NO.	Description	TYPE	Manufacture	series number	CAL DUE DATE
1	Test Receiver	ESR7	R&S	101676	2018-11-29
2	BiLog Antenna	3142E	ETS	00224831	2021-05-17
3	Horn Antenna	3117	ETS-lindgren	00066577	2019-04-05
4	Horn Antenna	QSH-SL-18-26-S-20	Q-par	17013	2020-01-15
5	Antenna	SBA 9113	Schwarzbeck	814	/
6	Antenna	SBA 9112	Schwarzbeck	302	/
7	Antenna	QWH-SL-18-40-K-SG	Q-par	15979	2020-01-16
8	preamplifier	83017A	Agilent	MY39501110	/
9	Signal Generator	SMB100A	R&S	179725	2018-11-29
10	Fully Anechoic Chamber	FACT3-2.0	ETS-Lindgren	1285	2020-07-20
11	Spectrum Analyzer	FSV40	R&S	101192	2019-05-22
12	Universal Radio Communication Tester	CMW500	R&S	152499	2019-07-19
13	Universal Radio Communication Tester	CMW500	R&S	129146	2019-04-24
14	Spectrum Analyzer	FSU	R&S	200679	2018-12-13
15	Temperature Chamber	SH-241	ESPECs	92007516	2018-11-14
16	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2018-11-14

Test software

Item	Name	Vesion
Radiated	EMC32	Version 10.01.00

ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

Reference

FCC: CFR Part 2.1046, 90.635

A.1.1 Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation.

This result contains peak output power and ERP/EIRP measurements for the EUT.

In all cases, output power is within the specified limits.

A.1.2 Conducted

A.1.2.1 Method of Measurements

The EUT was set up for the max output power with pseudo random data modulation.

These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each bandwidth.

A.1.2.2 Measurement result

LTE Band 14

Antenna Gain: -2.11dBi

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
QPSK	790.5	23305	5	1	0	21.8	19.7
				1	24	21.2	19.1
				12	6	21.2	19.1
				25	0	21.6	19.5
	793	23330		1	0	21.2	19.1
				1	24	21.2	19.1
				12	6	21.6	19.5
				25	0	21.8	19.7
	795.5	23355		1	0	21.2	19.1
				1	24	21.2	19.1
				12	6	21.6	19.5
				25	0	21.8	19.7

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
16QAM	790.5	23305	5	1	0	20.8	18.7
				1	24	20.3	18.2
				12	6	20.4	18.3
				25	0	20.2	18.1
	793	23330		1	0	20.4	18.3
				1	24	20.2	18.1
				12	6	20.8	18.7
				25	0	20.3	18.2
	795.5	23355		1	0	20.4	18.3
				1	24	20.2	18.1
				12	6	20.8	18.7
				25	0	20.5	18.4

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
QPSK	793	23330	10	1	0	22.6	20.5
				1	49	22.5	20.4
				24	12	21.6	19.5
				50	0	21.6	19.5

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
16QAM	793	23330	10	1	0	22.2	20.1
				1	24	22.1	20.0
				12	6	20.7	18.6
				25	0	20.6	18.5

Note: Expanded measurement uncertainty is U = 0.488 dB, k = 1.96

LTE Band 26

Antenna Gain:-2.33dBi

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
QPSK	814.7	26697	1.4	1	0	22.2	19.9
				1	5	22.1	19.8
				3	2	22.1	19.8
				6	0	21.1	18.8
	831.5	26865		1	0	22.0	19.7
				1	5	22.1	19.8
				3	2	22.1	19.8
				6	0	21.1	18.8
	848.3	27033		1	0	21.8	19.5
				1	5	21.8	19.5
				3	2	21.9	19.6
				6	0	20.8	18.5

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
16QAM	814.7	26697	1.4	1	0	21.1	18.8
				1	5	21.2	18.9
				3	2	21.4	19.1
				6	0	20.2	17.9
	831.5	26865		1	0	21.2	18.9
				1	5	21.2	18.9
				3	2	21.0	18.7
				6	0	20.1	17.8
	848.3	27033		1	0	21.0	18.7
				1	5	21.0	18.7
				3	2	21.1	18.8
				6	0	19.9	17.6

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
QPSK	815.5	26705	3	1	0	22.3	20.0
				1	14	22.1	19.8
				8	4	21.2	18.9
				15	0	21.3	19.0
	831.5	26865		1	0	22.1	19.8
				1	14	22.2	19.9
				8	4	21.2	18.9
				15	0	21.1	18.8
	847.5	27025		1	0	22.0	19.7
				1	14	21.9	19.6
				8	4	21.0	18.7
				15	0	21.0	18.7

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
16QAM	815.5	26705	3	1	0	21.9	19.6
				1	14	21.8	19.5
				8	4	20.4	18.1
				15	0	20.3	18.0
	831.5	26865		1	0	21.3	19.0
				1	14	21.3	19.0
				8	4	20.1	17.8
				15	0	20.2	17.9
	847.5	27025		1	0	21.1	18.8
				1	14	21.1	18.8
				8	4	20.0	17.7
				15	0	20.1	17.8

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
QPSK	816.5	26715	5	1	0	22.4	20.1
				1	24	22.2	19.9
				12	6	21.2	18.9
				25	0	21.2	18.9
	831.5	26865		1	0	22.2	19.9
				1	24	22.2	19.9
				12	6	21.1	18.8
				25	0	21.2	18.9
	846.5	27015		1	0	22.0	19.7
				1	24	22.0	19.7
				12	6	21.0	18.7
				25	0	21.0	18.7

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
16QAM	816.5	26715	5	1	0	21.3	19.0
				1	24	21.2	18.9
				12	6	20.2	17.9
				25	0	20.3	18.0
	831.5	26865		1	0	21.5	19.2
				1	24	21.4	19.1
				12	6	20.2	17.9
				25	0	20.2	17.9
	846.5	27015		1	0	21.1	18.8
				1	24	21.0	18.7
				12	6	20.0	17.7
				25	0	20.1	17.8

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
QPSK	819	26740	10	1	0	22.3	20.0
				1	49	22.1	19.8
				24	12	21.2	18.9
				50	0	21.2	18.9
	831.5	26865		1	0	22.1	19.8
				1	49	22.1	19.8
				24	12	21.2	18.9
				50	0	21.2	18.9
	844	26990		1	0	22.2	19.9
				1	49	22.0	19.7
				24	12	21.0	18.7
				50	0	21.1	18.8

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
16QAM	819	26740	10	1	0	21.8	19.5
				1	49	21.7	19.4
				24	12	20.3	18.0
				50	0	20.2	17.9
	831.5	26865		1	0	21.3	19.0
				1	49	21.3	19.0
				24	12	20.2	17.9
				50	0	20.2	17.9
	844	26990		1	0	21.3	19.0
				1	49	21.1	18.8
				24	12	20.0	17.7
				50	0	20.1	17.8

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
QPSK	821.5	26765	15	1	0	22.3	20.0
				1	74	22.0	19.7
				40	18	21.2	18.9
				75	0	21.2	18.9
	831.5	26865		1	0	22.2	19.9
				1	74	22.1	19.8
				40	18	21.2	18.9
				75	0	21.2	18.9
	841.5	26965		1	0	22.2	19.9
				1	74	21.9	19.6
				40	18	21.1	18.8
				75	0	21.0	18.7

Modulation	Carrier frequency (MHz)	UL Channel	BW	RB Size	RB Offset	Conducted Average (dBm)	EIRP Average(dBm)
16QAM	821.5	26765	15	1	0	21.9	19.6
				1	74	21.7	19.4
				40	18	20.2	17.9
				75	0	20.2	17.9
	831.5	26865		1	0	21.4	19.1
				1	74	21.3	19.0
				40	18	20.3	18.0
				75	0	20.2	17.9
	841.5	26965		1	0	21.7	19.4
				1	74	21.4	19.1
				40	18	20.1	17.8
				75	0	20.1	17.8

A.1.3 Radiated

A.1.3.1 Description

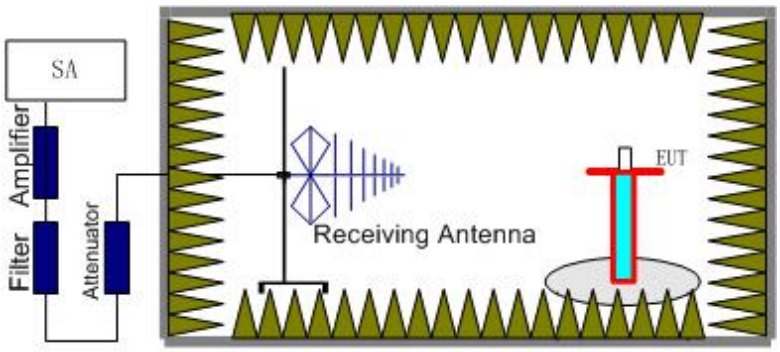
This is the test for the maximum radiated power from the EUT.

Rule Part 90.635 specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 90.635 specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

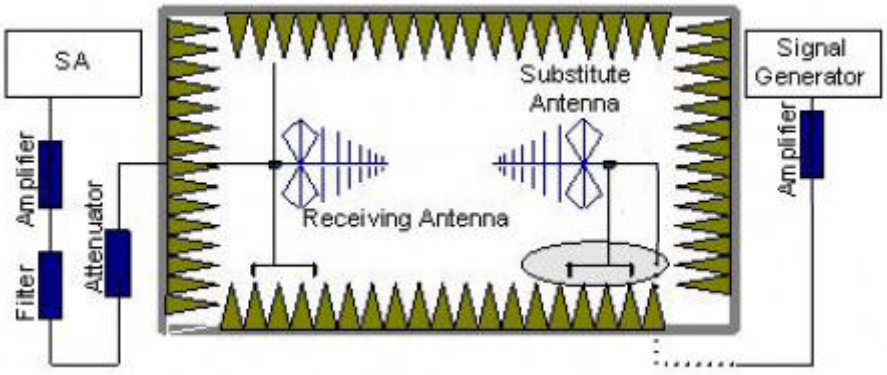
A.1.3.2 Method of Measurement

The measurements procedures in TIA-603-E-2016 are used.

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded.

The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. An amplifier should be connected to the Signal Source output port. And the cable should be connected between the amplifier and the substitution antenna.
   The cable loss (P_{cl}), the substitution antenna Gain (G_a) and the amplifier Gain (P_{Ag}) should be recorded after test.
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.

A.1.3.3 Measurement result

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Frequency (MHz)	Peak ERP (dBm)	PcaCable loss(dB)	Ga Antenna Gain (dBi)	Correction (dB)	Pmea (dBm)	Polarization
788.0	21.11	-3.4	8.3	2.15	18.36	Vertical
793.0	21.01	-3.4	8.3	2.15	18.26	Vertical
797.9	20.72	-3.4	8.3	2.15	17.97	Vertical

LTE Band 26

Frequency (MHz)	Peak ERP (dBm)	PcaCable loss(dB)	Ga Antenna Gain (dBi)	Correction (dB)	Pmea (dBm)	Polarization
815.58	20.27	-3.4	8.3	2.15	17.52	Vertical
831.50	21.08	-3.4	8.3	2.15	18.33	Vertical
847.42	20.96	-3.4	8.3	2.15	18.21	Vertical

ANALYZER SETTINGS:

RBW = VBW = 8MHz for occupied bandwidths equal to or less than 5MHz.

RBW = VBW = 20MHz for occupied bandwidths equal to or greater than 10MHz.

Note: The maximum value of expanded measurement uncertainty for this test item is *U* = 4.92dB(30MHz-3GHz)/4.88dB(3GHz-18GHz)/5.66dB(18GHz-40GHz), *k* = 2

A.2 FIELD STRENGTH OF SPURIOUS RADIATION

Reference

FCC: CFR 2.1053, 90.691.

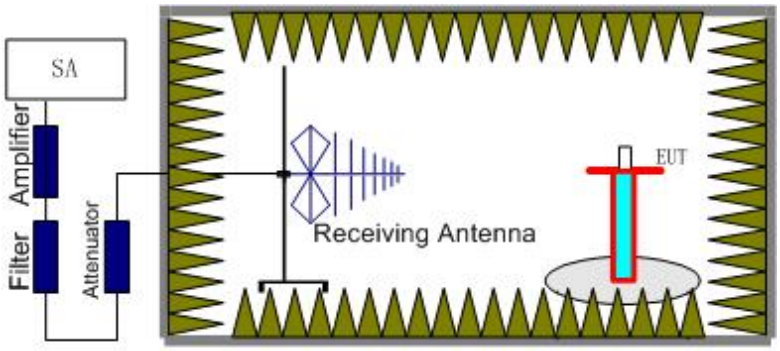
A.2.1 Measurement Method

The measurements procedures in TIA-603-E-2016 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

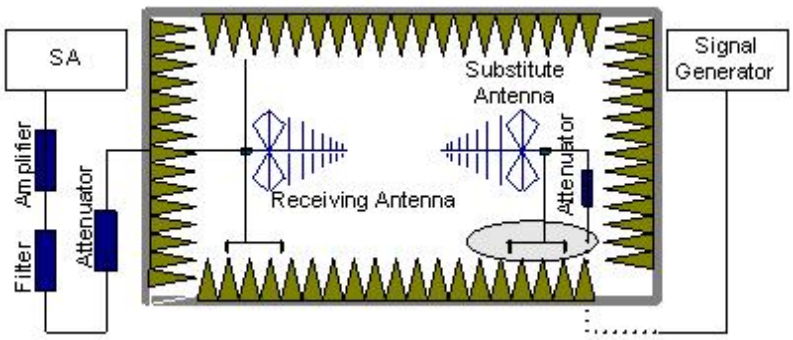
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 90.691. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 14, 26

The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is

connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain (G_a) should be recorded after test.
   An amplifier should be connected in for the test.
   The Path loss (P_{pl}) is the summation of the cable loss and the gain of the amplifier.
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.

A.2.2 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 14, 26. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE Bands 14, 26 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

LTE Band 14

Channel 23280

Frequency (MHz)	Power (dBm)	Limited (dBm)	Polarization
1648.37	-52.82	-13	Vertical
1665.85	-51.50	-13	Vertical
2535.18	-43.53	-13	Vertical
2574.04	-44.40	-13	Horizontal
8965.21	-40.22	-13	Vertical
9970.91	-36.29	-13	Vertical

Channel 23330

Frequency (MHz)	Power (dBm)	Limited (dBm)	Polarization
1648.58	-52.54	-13	Vertical
1665.36	-50.78	-13	Vertical
2536.33	-43.98	-13	Horizontal
2577.31	-44.09	-13	Horizontal
8962.84	-39.38	-13	Vertical
9968.96	-36.67	-13	Vertical

Channel 23379

Frequency (MHz)	Power (dBm)	Limited (dBm)	Polarization
1648.10	-52.94	-13	Vertical
1667.82	-51.21	-13	Vertical
2536.08	-43.65	-13	Horizontal
2573.63	-43.45	-13	Vertical
8962.10	-40.20	-13	Vertical
9971.35	-36.29	-13	Vertical

LTE Band 26

Channel 26740

Frequency (MHz)	Power (dBm)	Limited (dBm)	Polarization
1646.60	-52.53	-13	Vertical
1668.20	-51.26	-13	Vertical
2534.31	-43.83	-13	Vertical
2576.54	-43.59	-13	Horizontal
8962.29	-40.18	-13	Vertical
9969.72	-36.49	-13	Vertical

Channel 26865

Frequency (MHz)	Power (dBm)	Limited (dBm)	Polarization
1649.38	-52.79	-13	Vertical
1667.75	-51.10	-13	Vertical
2532.88	-44.10	-13	Horizontal
2576.47	-44.01	-13	Vertical
8962.54	-39.88	-13	Vertical
9969.87	-36.04	-13	Vertical

Channel 26990

Frequency (MHz)	Power (dBm)	Limited (dBm)	Polarization
1648.82	-52.38	-13	Vertical
1667.62	-51.44	-13	Horizontal
2534.08	-43.57	-13	Vertical
2576.60	-44.23	-13	Vertical
8962.61	-40.20	-13	Vertical
9970.18	-36.79	-13	Vertical

Note: The maximum value of expanded measurement uncertainty for this test item is U = 4.92dB(30MHz-3GHz)/4.88dB(3GHz-18GHz)/5.66dB(18GHz-40GHz), k = 2

A.3 FREQUENCY STABILITY

Reference

FCC: CFR Part 2.1055, 90.213.

A.3.1 Method of Measurement

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 ℃ increments from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

A.3.2 Measurement Limit

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 90.213, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.65VDC and 4.3VDC, with a nominal voltage of 3.85VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance from -5.4% to 10.8%. For the purposes of measuring frequency stability these voltage limits are to be used.

A.4.3 Measurement results

LTE Band 14

Band	BW	Test Result (ppm)@NV		Test Result (ppm)@NT	
		Temperature(°C)		Voltage	
14	5	-30	0.003	LV	0.001
		-20	0.004		
		-10	0.000		
		0	0.000		
		10	-0.004		
		20	0.002	HV	0.005
		30	0.004		
		40	0.004		
		50	0.001		
	10	-30	-0.003	LV	0.001
		-20	-0.003		
		-10	0.002		
		0	-0.002		
		10	0.003		
		20	-0.002	HV	-0.002
		30	0.000		
		40	-0.006		
		50	0.001		

LTE Band 26

Band	BW	Test Result (ppm)@NV		Test Result (ppm)@NT	
		Temperature(°C)		Voltage	
26	1.4	-30	0.000	LV	-0.001
		-20	0.000		
		-10	0.014		
		0	0.002		
		10	-0.009		
		20	0.019	HV	-0.008
		30	-0.009		
		40	0.002		
		50	-0.003		
	3	-30	0.001	LV	0.004
		-20	0.002		
		-10	-0.001		
		0	0.000		
		10	0.003		
		20	0.002	HV	0.001
		30	0.005		
		40	0.004		
		50	0.005		
	5	-30	-0.001	LV	0.005
		-20	0.002		
		-10	0.007		
		0	0.001		
		10	0.000		
		20	-0.002	HV	0.006
		30	0.004		
		40	0.005		
		50	0.010		
	10	-30	-0.001	LV	0.002
		-20	0.009		
		-10	0.003		
		0	-0.004		
		10	0.002		
		20	0.005	HV	0.005
		30	-0.002		
		40	0.004		
		50	0.013		

	15	-30	0.005	LV	0.006
		-20	0.006		
		-10	0.004		
		0	0.005		
		10	0.007		
		20	0.008	HV	0.004
		30	0.003		
		40	0.006		
		50	0.001		

Expanded measurement uncertainty is 10Hz, k = 2

A.4 OCCUPIED BANDWIDTH

Reference

FCC: CFR Part 2.1049, 90.1215.

A.4.1 Occupied Bandwidth Results

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.

d) Set the detection mode to peak, and the trace mode to max hold.

e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

LTE Band 14

Band	Carrier frequency (MHz)	Channel(Low)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
14	790.5	23305	5	1	0	0.217	Fig.1	0.239	Fig.5
				1	24	0.217	Fig.2	0.239	Fig.6
				12	6	2.171	Fig.3	2.171	Fig.7
				25	0	4.493	Fig.4	4.493	Fig.8

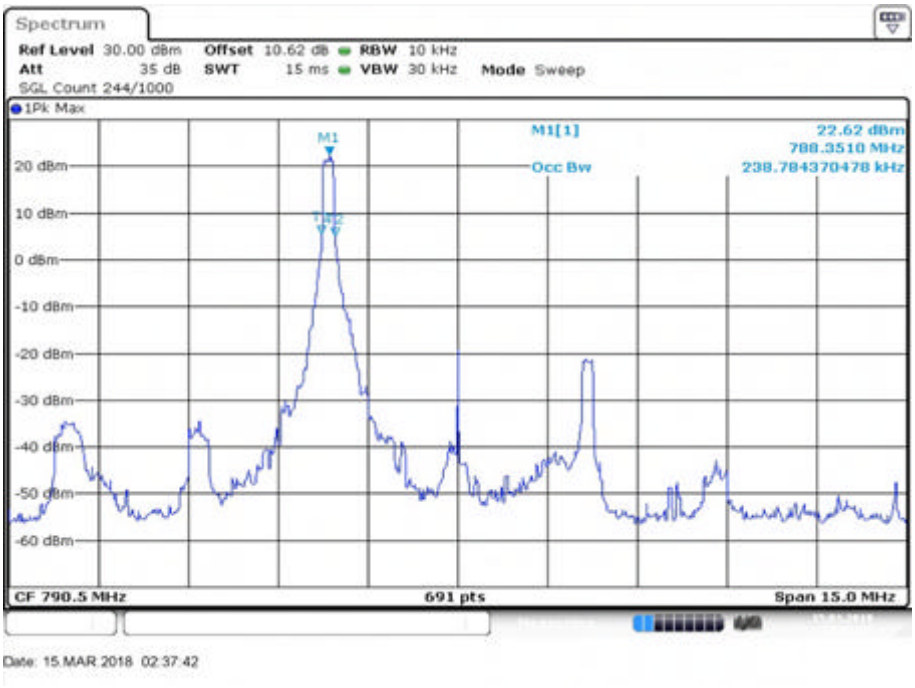


Fig.1

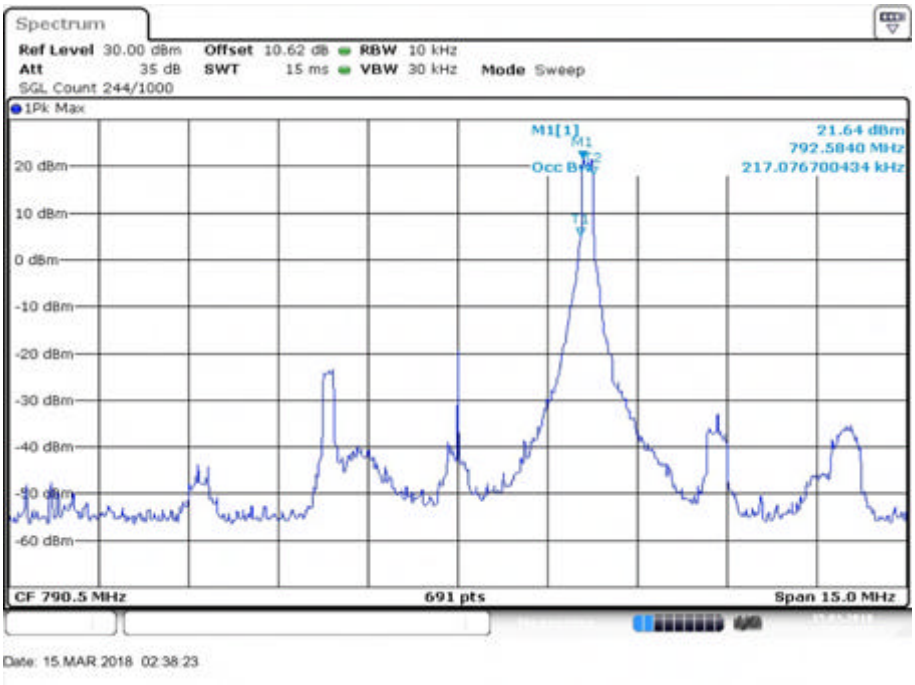


Fig.2

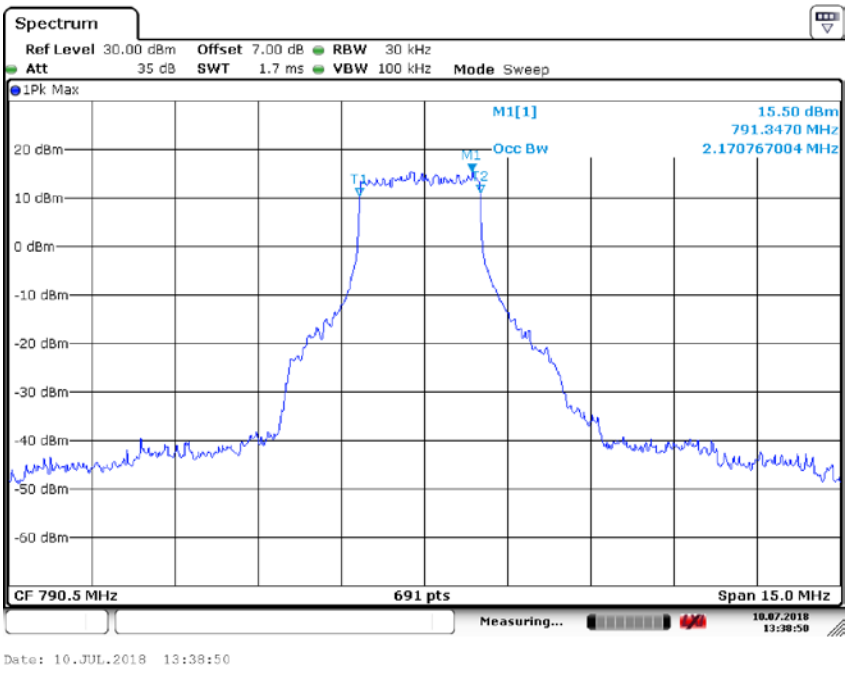


Fig.3

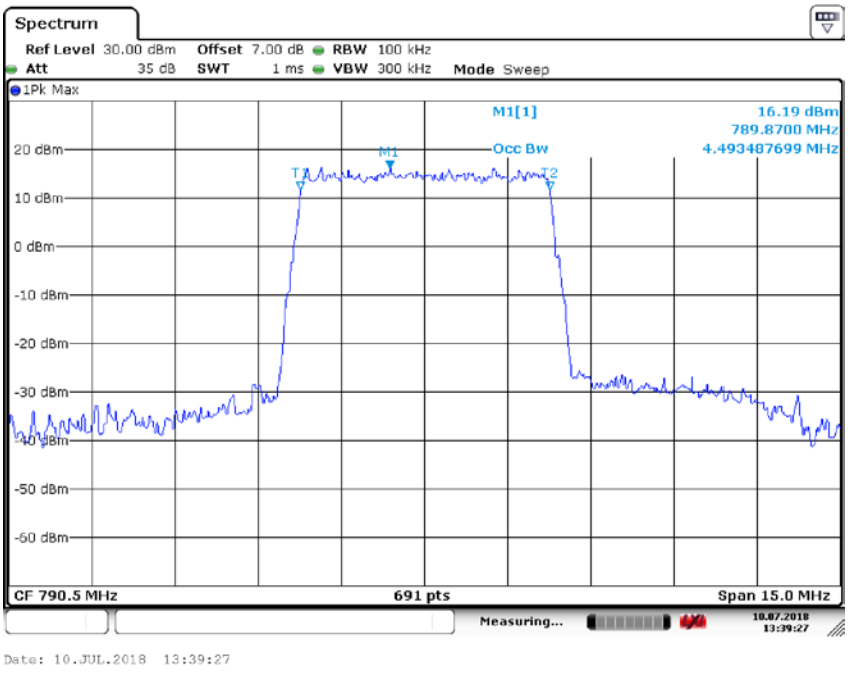


Fig.4

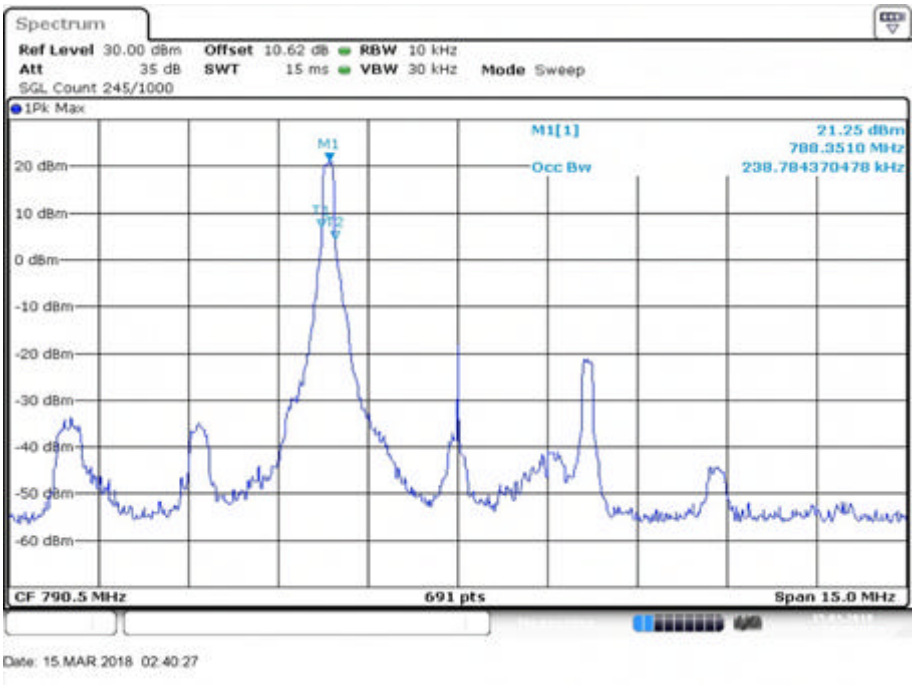


Fig.5

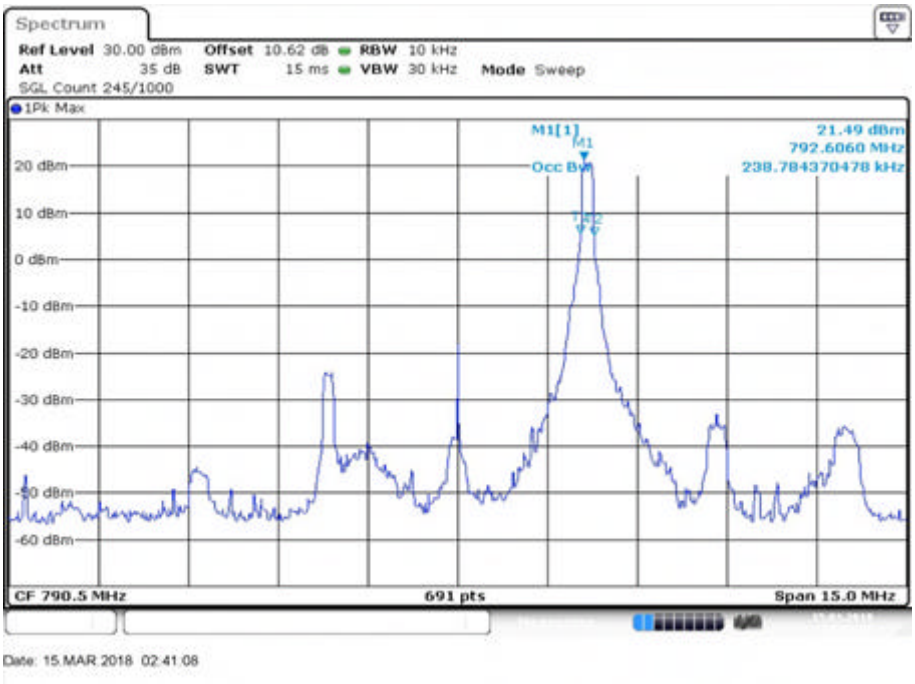


Fig.6

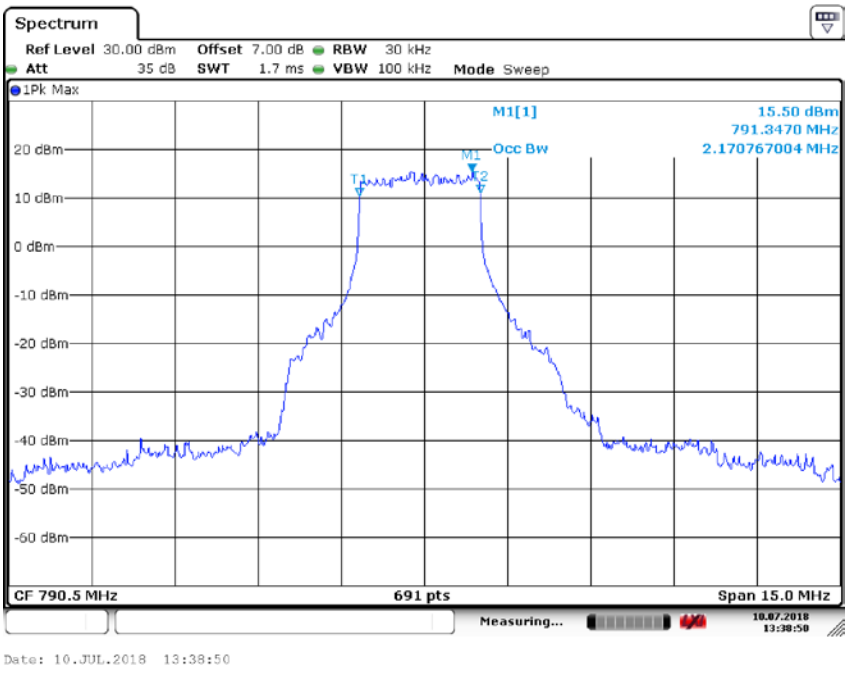


Fig.7

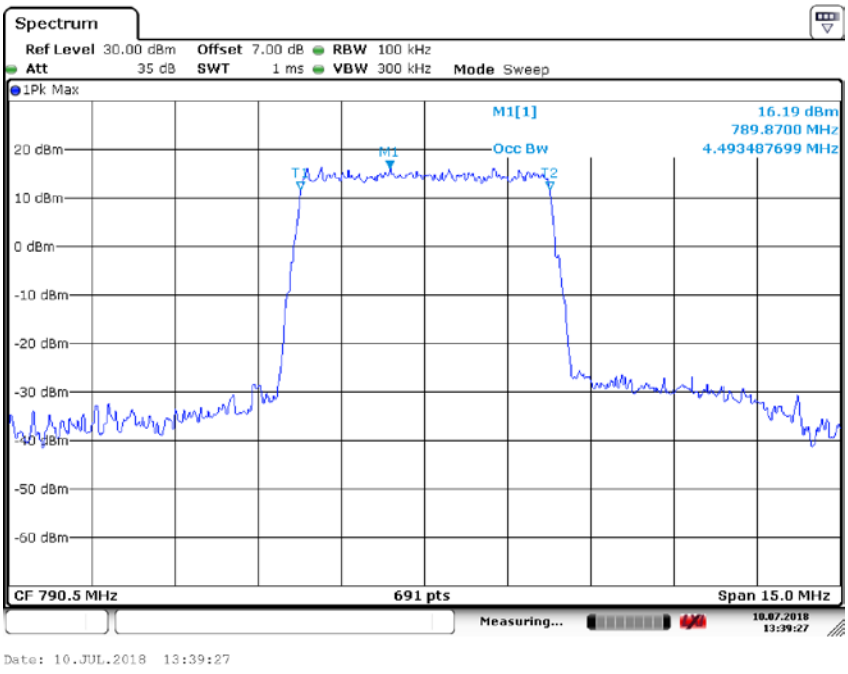


Fig.8

Band	Carrier frequency (MHz)	Channel(Mid)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
14	793	23330	5	1	0	0.239	Fig.1	0.239	Fig.5
				1	24	0.239	Fig.2	0.239	Fig.6
				12	6	2.192	Fig.3	2.192	Fig.7
				25	0	4.515	Fig.4	4.515	Fig.8

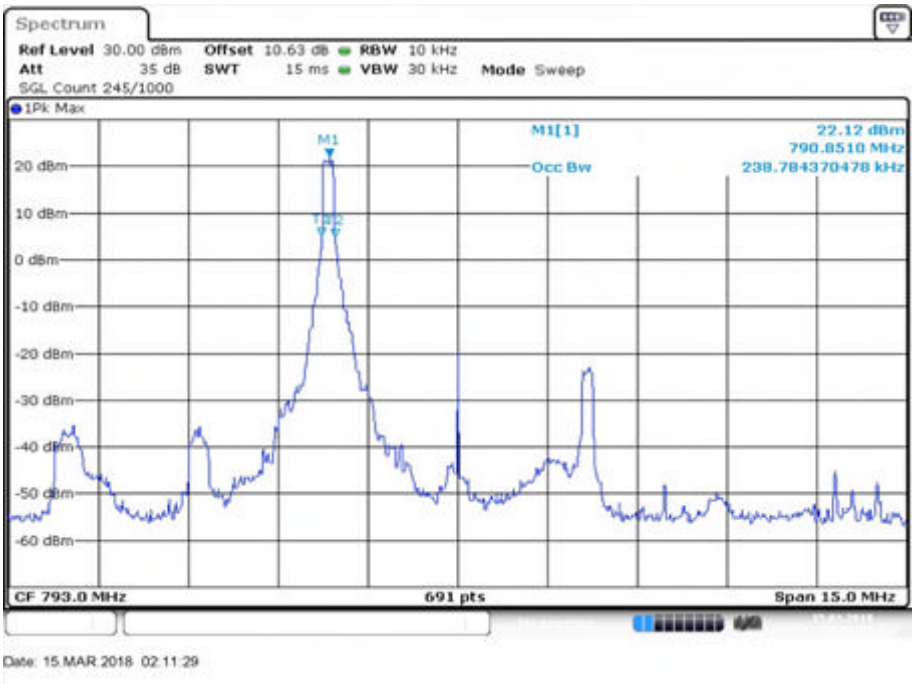


Fig.1

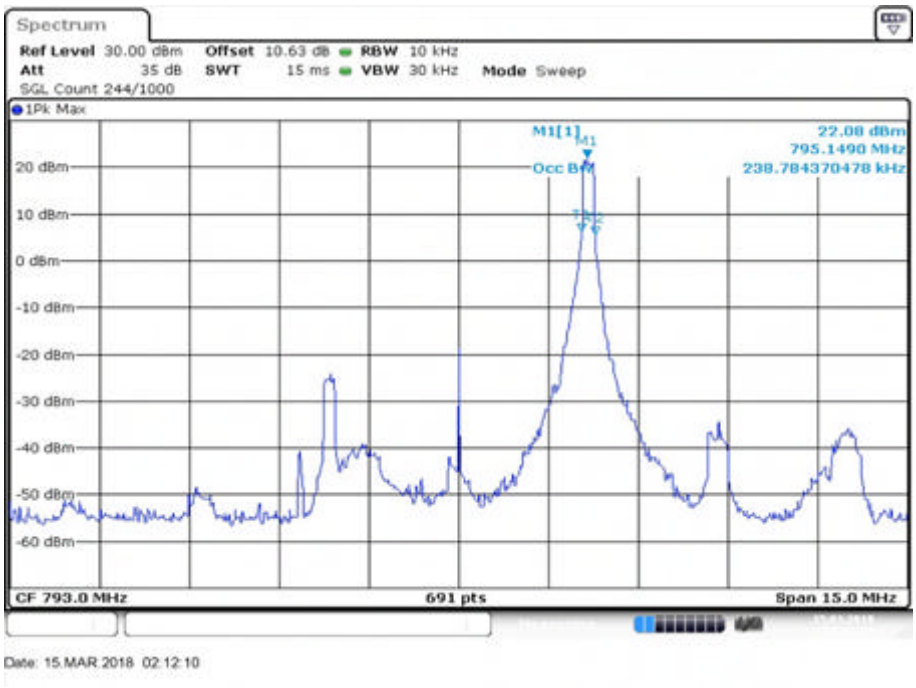


Fig.2

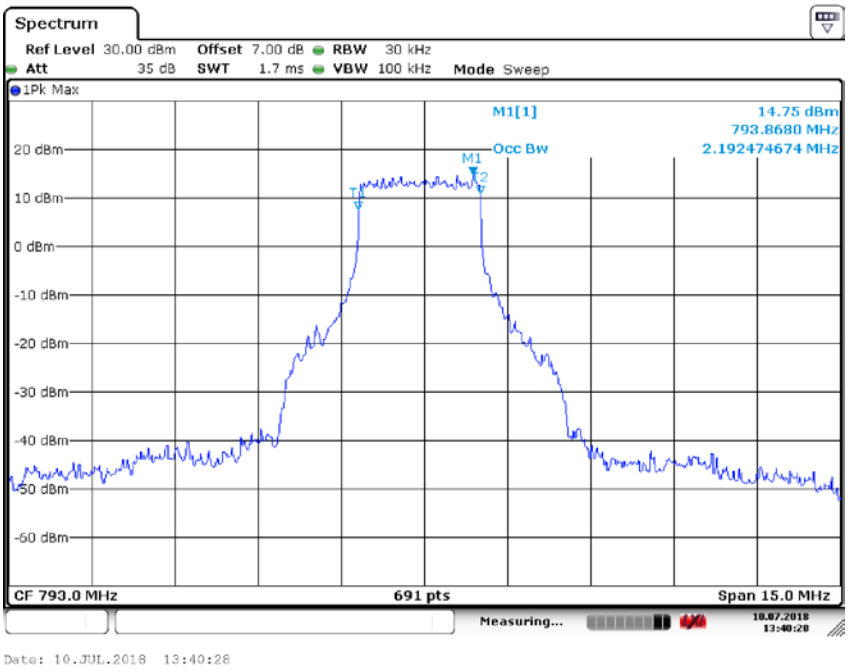


Fig.3

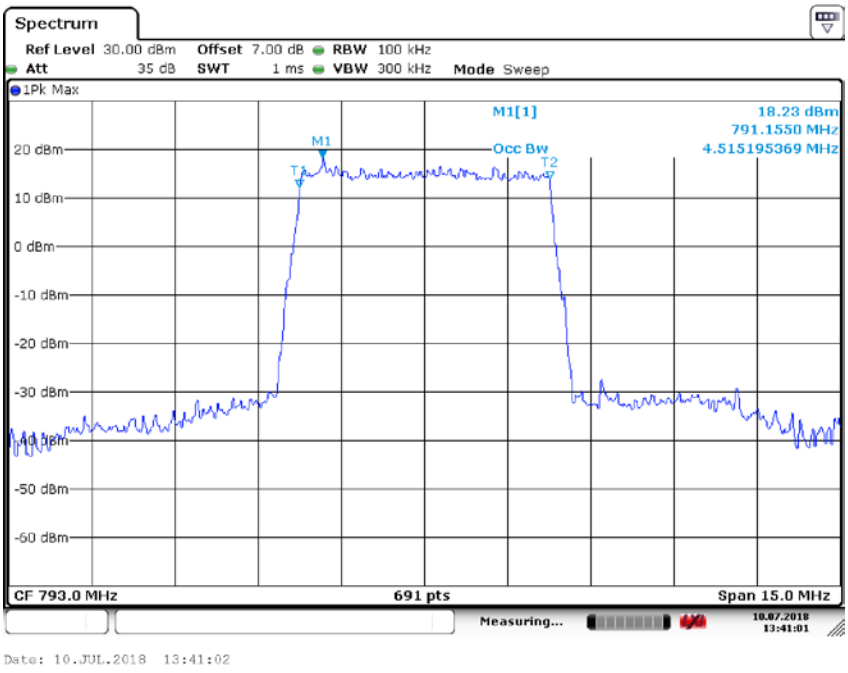


Fig.4

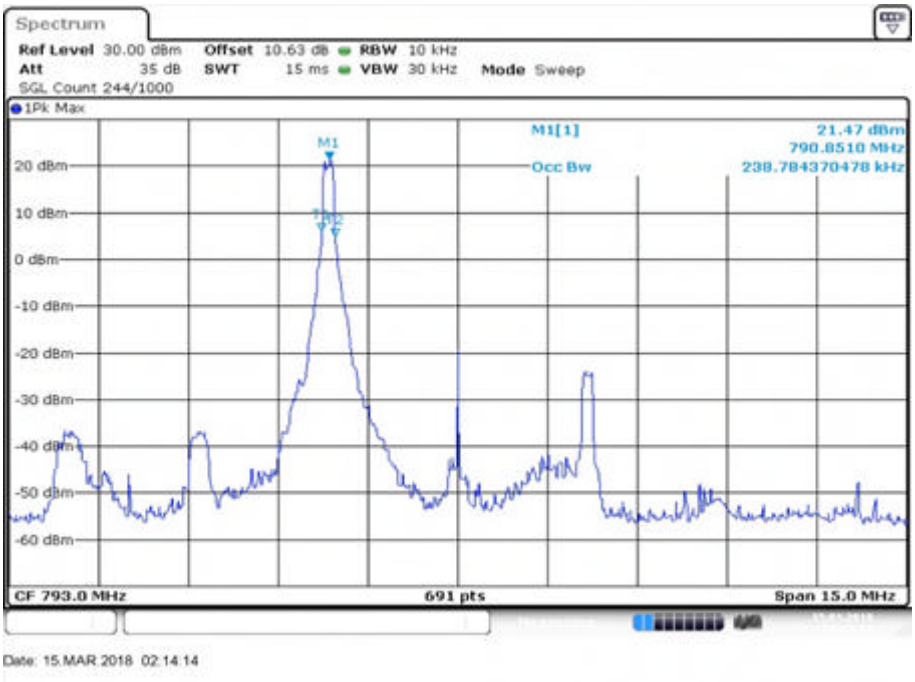


Fig.5

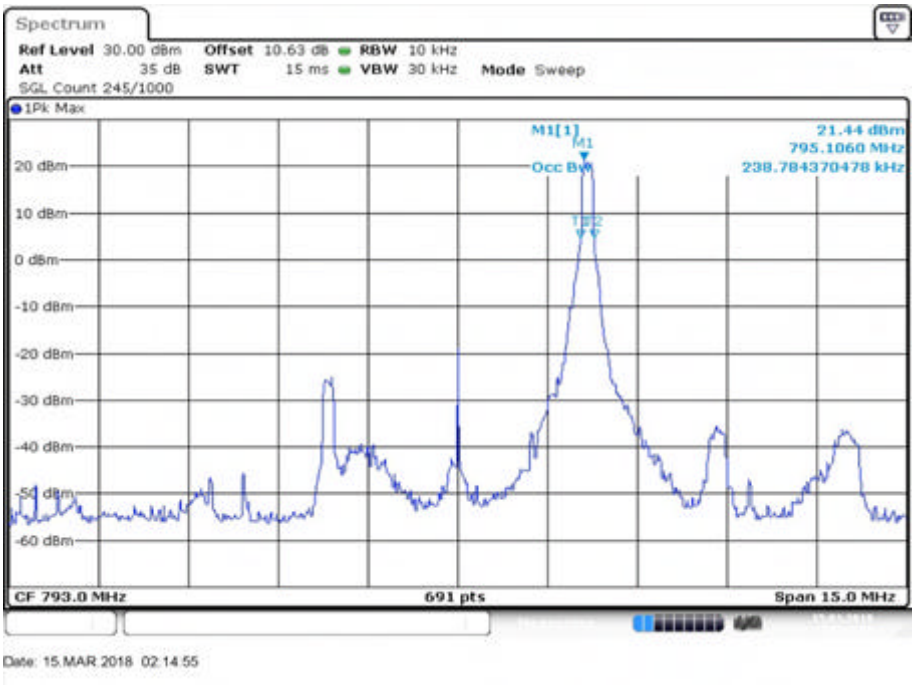


Fig.6

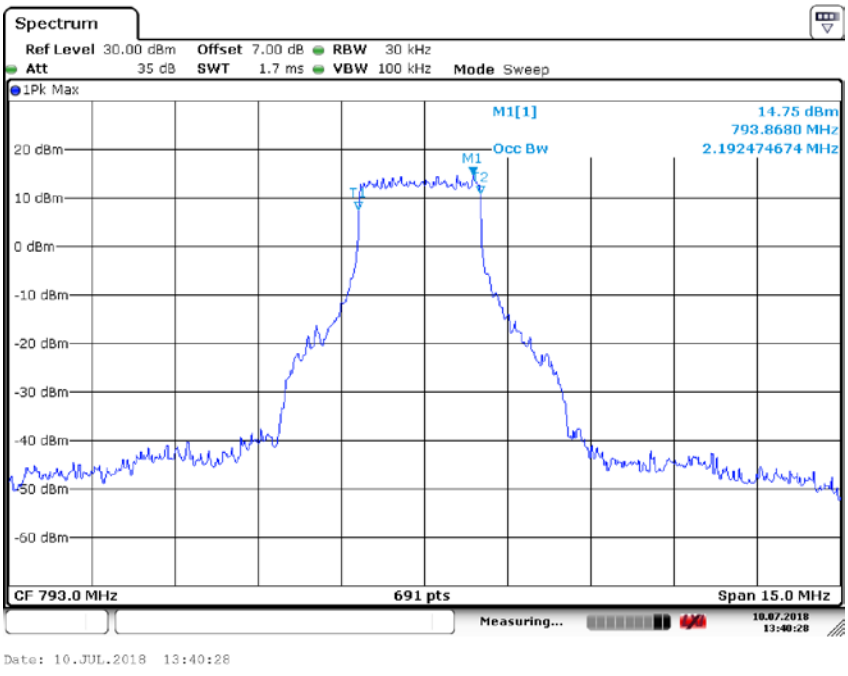


Fig.7

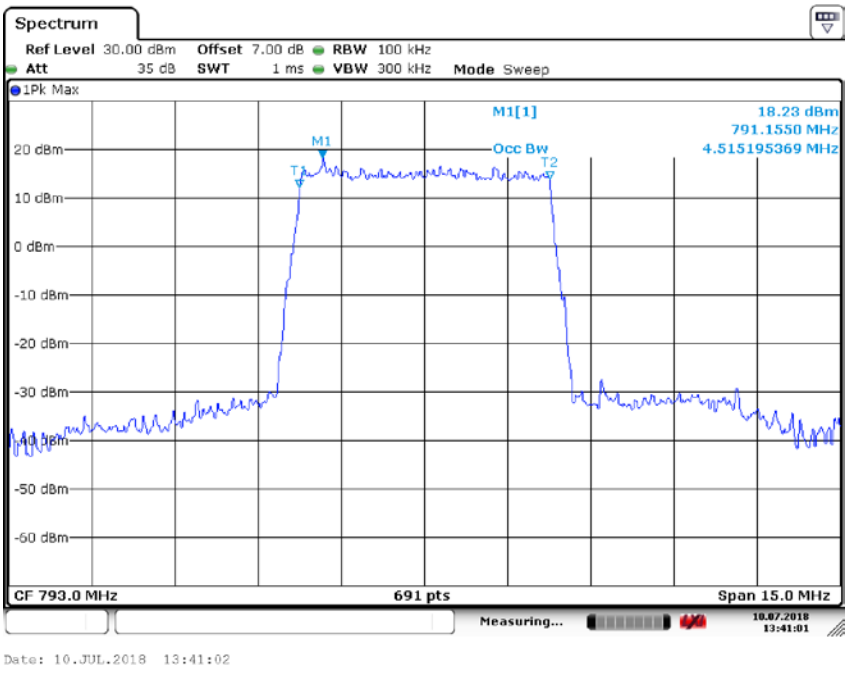


Fig.8

Band	Carrier frequency (MHz)	Channel(High)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
14	795.5	23355	5	1	0	0.239	Fig.1	0.195	Fig.5
				1	24	0.217	Fig.2	0.239	Fig.6
				12	6	2.171	Fig.3	2.171	Fig.7
				25	0	4.515	Fig.4	4.515	Fig.8

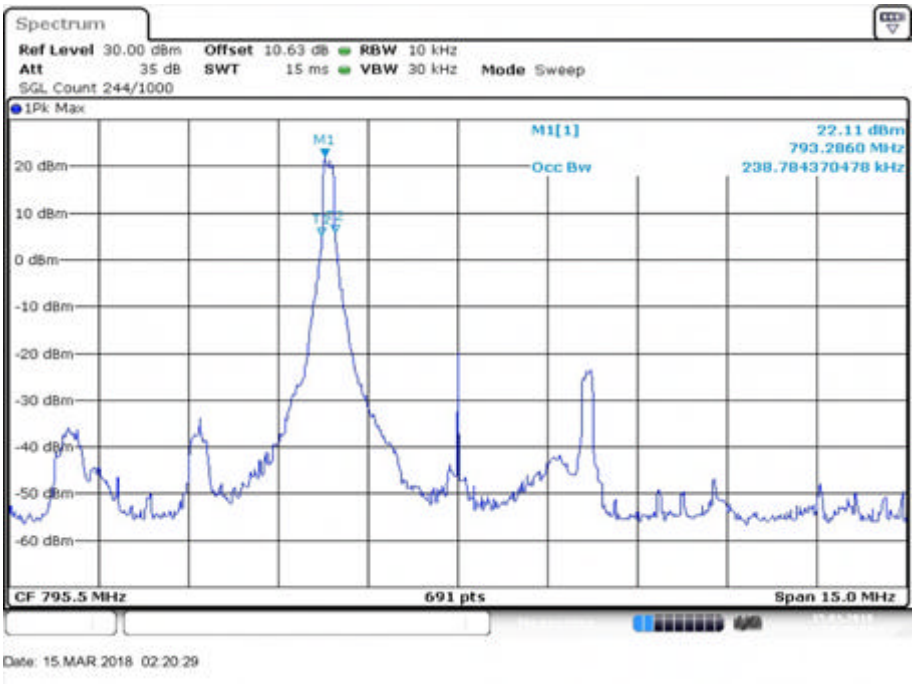


Fig.1

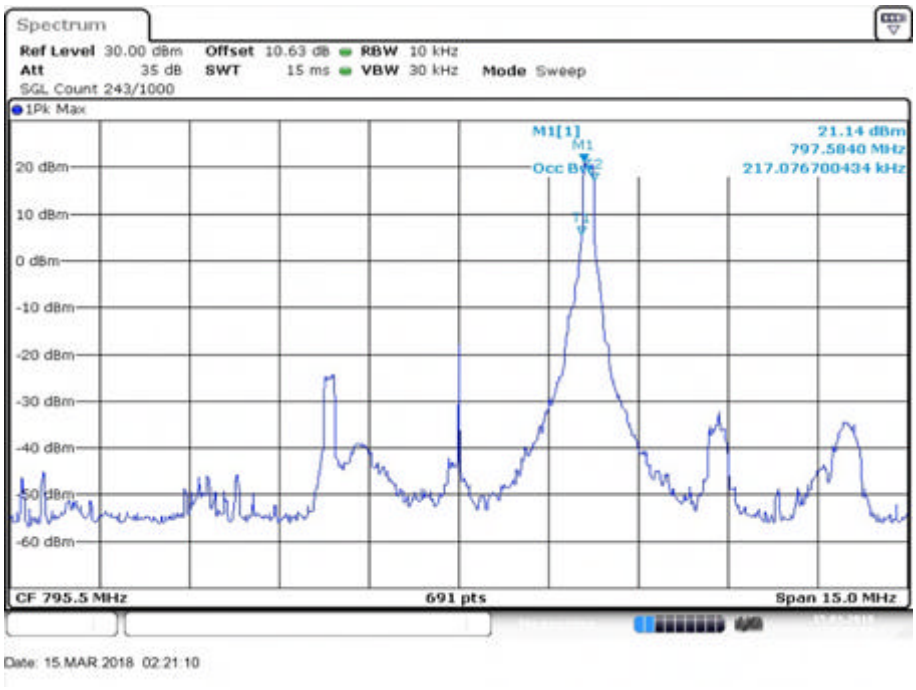


Fig.2

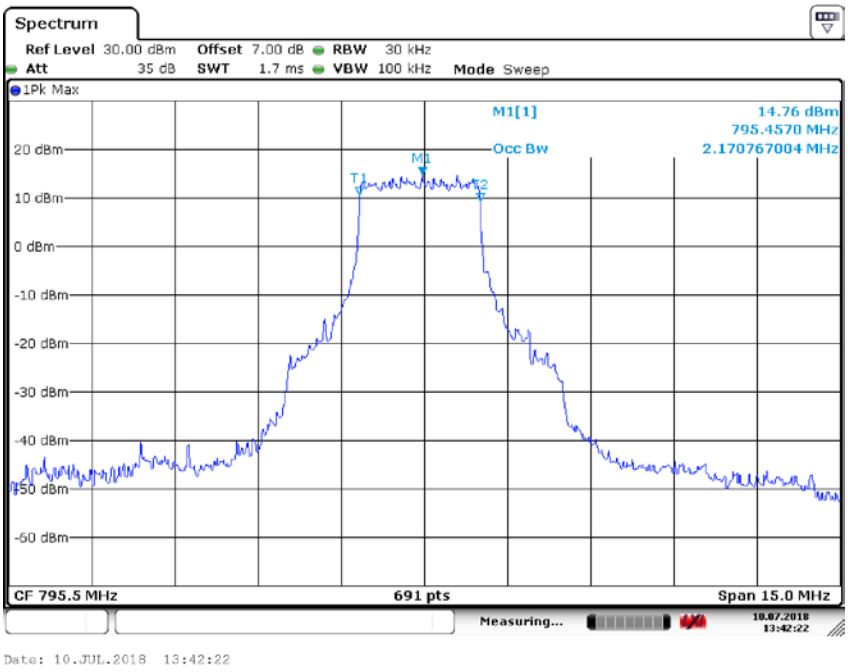


Fig.3

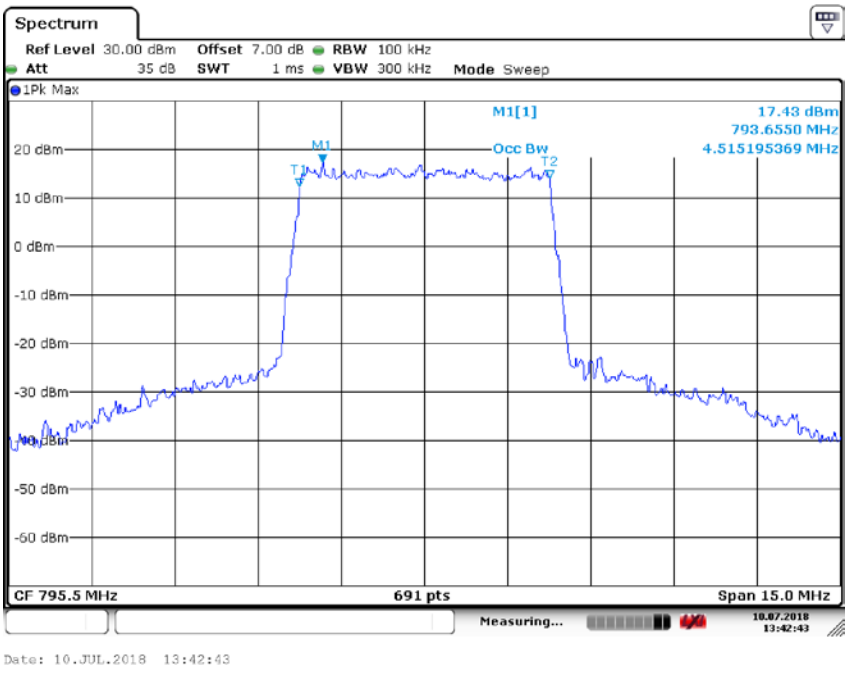


Fig.4

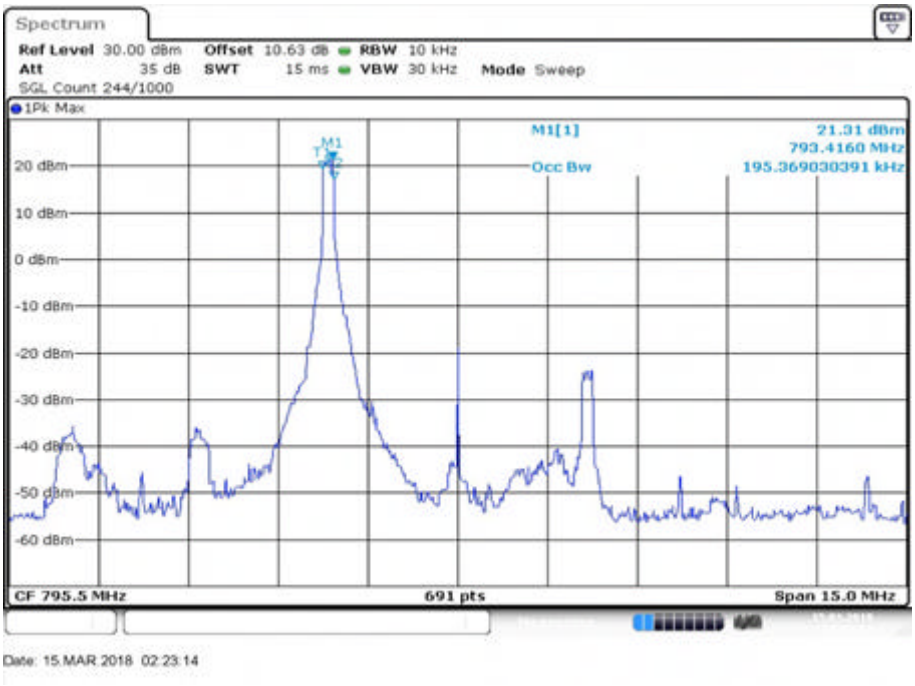


Fig.5

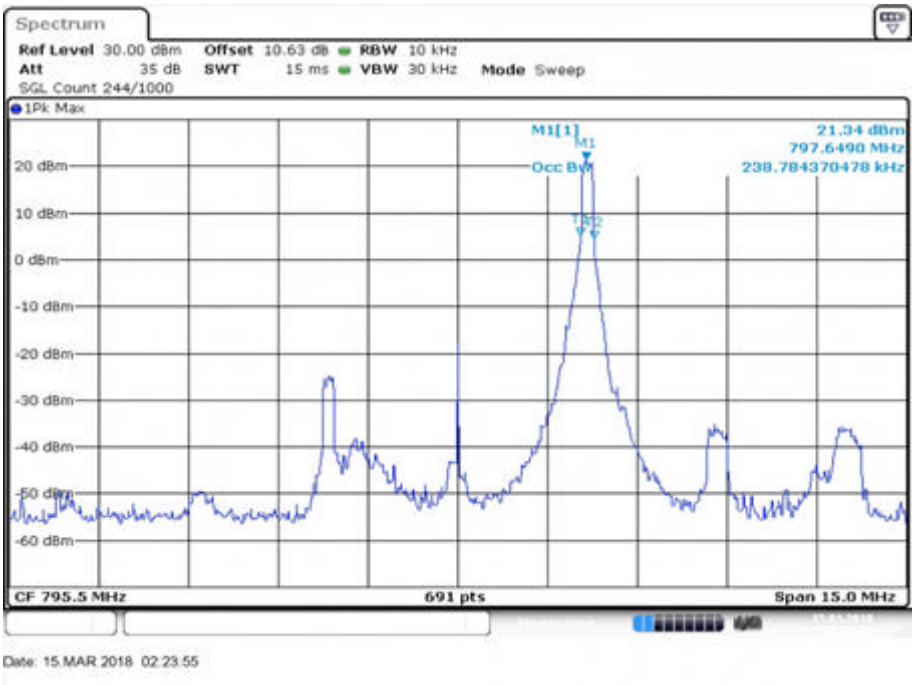


Fig.6

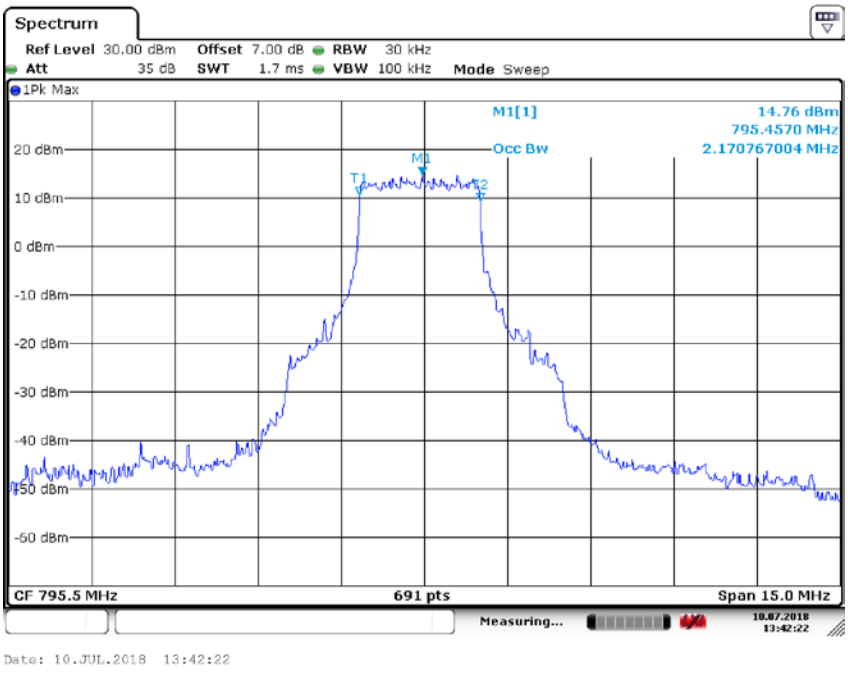


Fig.7

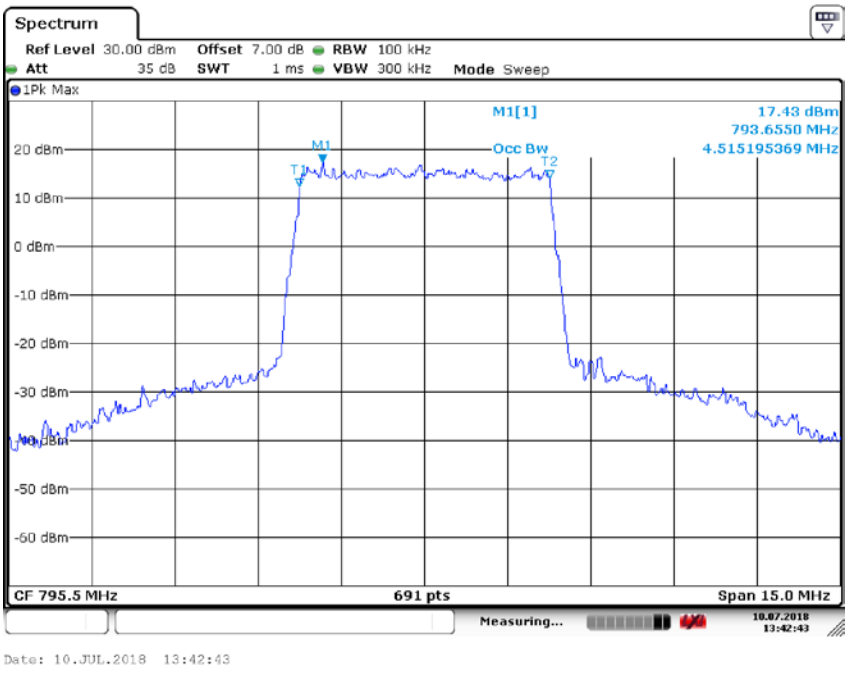


Fig.8

Band	Carrier frequency (MHz)	Channel(Low)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
14	793	23330	10	1	0	0.217	Fig.1	0.217	Fig.5
				1	49	0.217	Fig.2	0.217	Fig.6
				24	12	4.385	Fig.3	4.342	Fig.7
				50	0	9.074	Fig.4	9.030	Fig.8

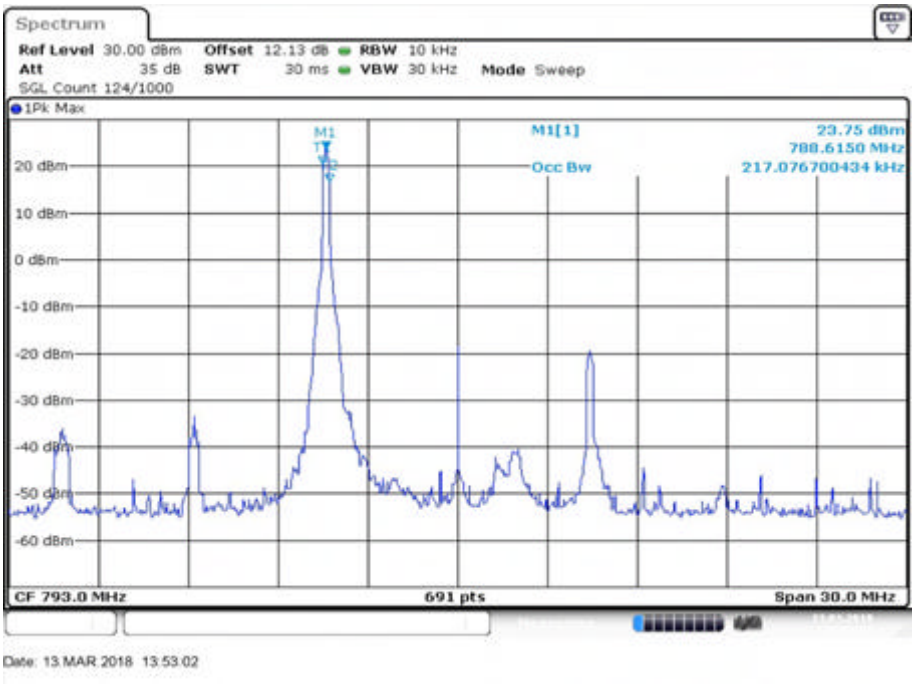


Fig.1

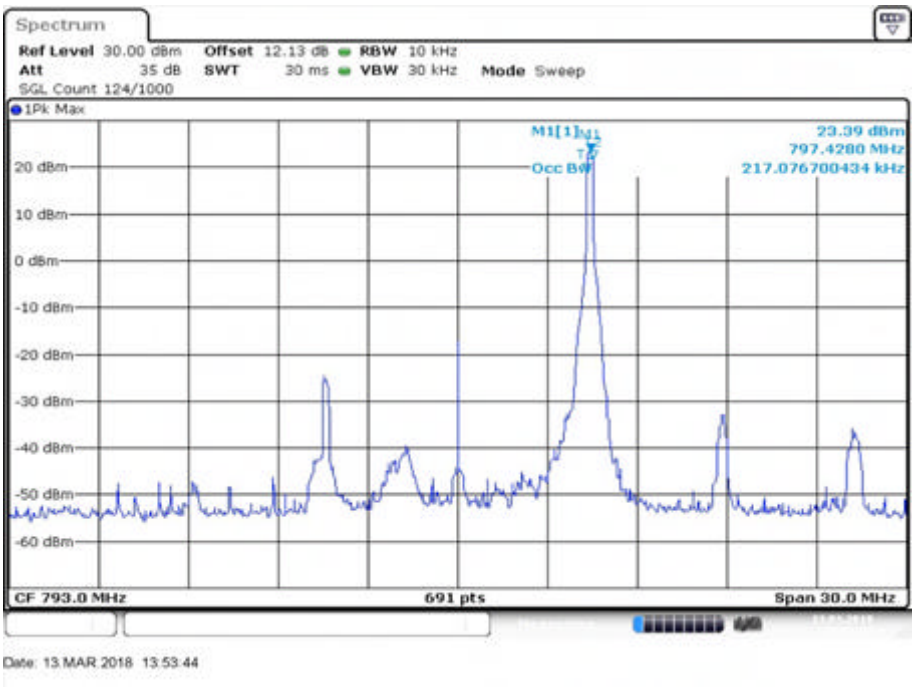


Fig.2

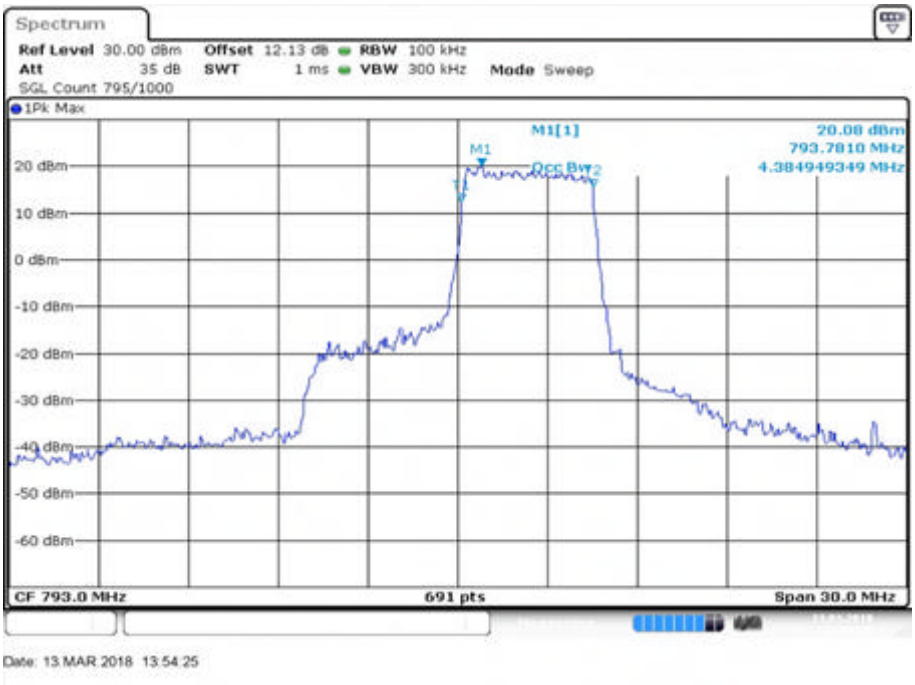


Fig.3

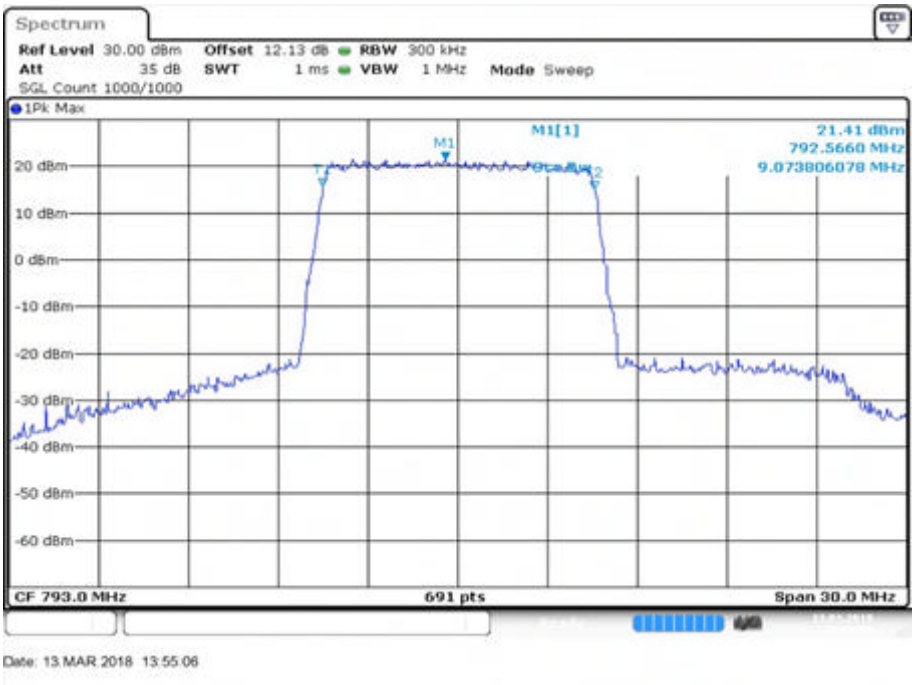


Fig.4

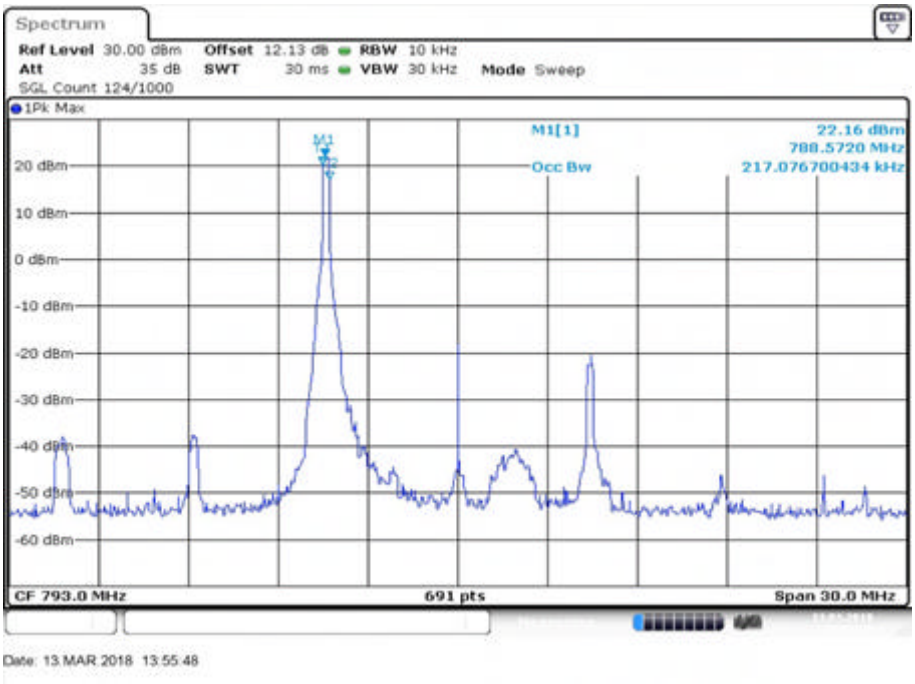


Fig.5

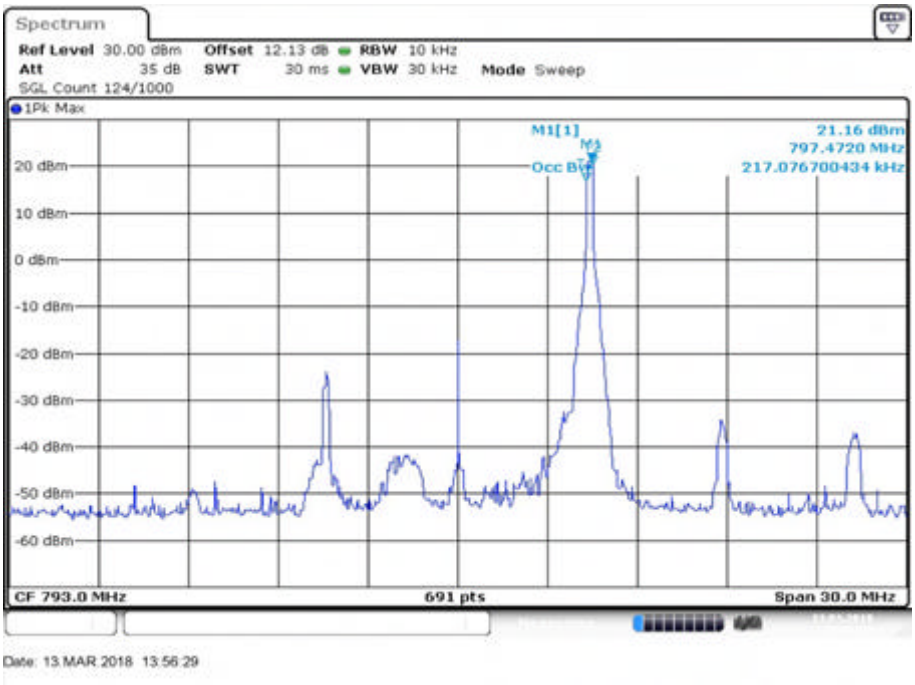


Fig.6

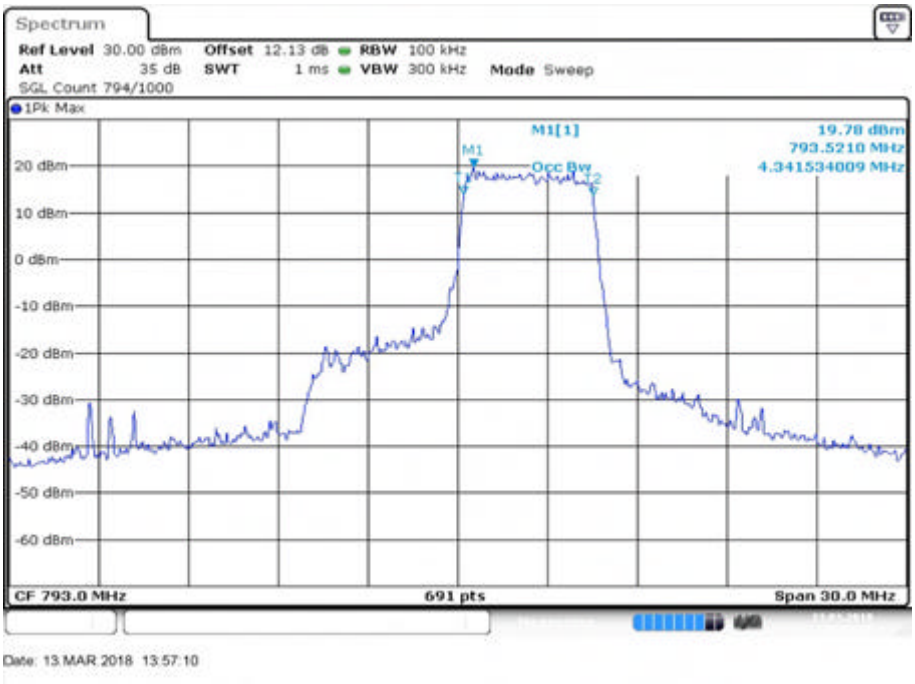


Fig.7

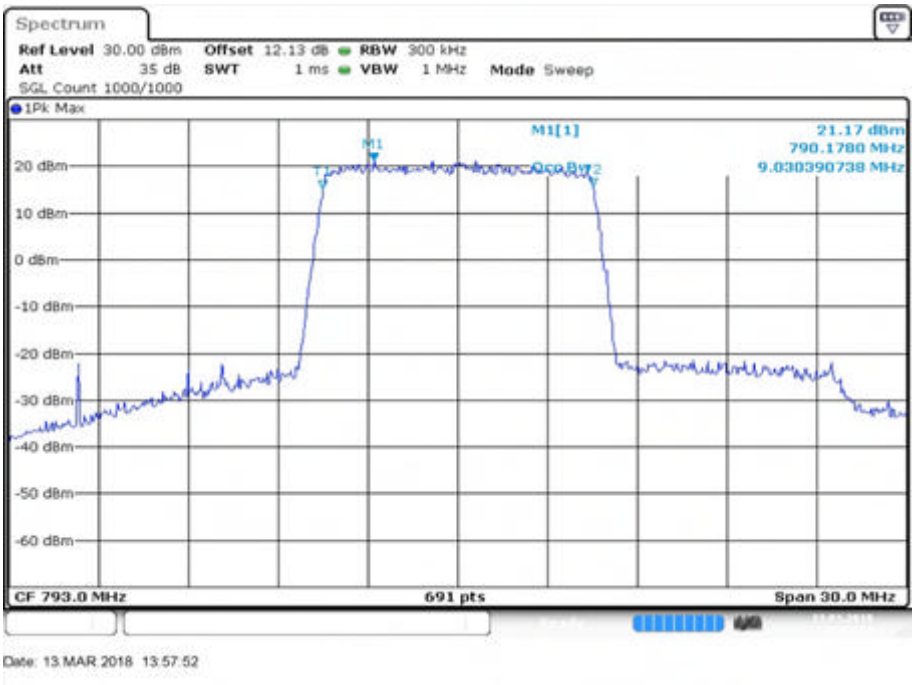


Fig.8

Band	Carrier frequency (MHz)	Channel(Mid)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
14	793	23330	10	1	0	0.217	Fig.1	0.217	Fig.5
				1	49	0.217	Fig.2	0.217	Fig.6
				24	12	4.342	Fig.3	4.342	Fig.7
				50	0	9.074	Fig.4	9.074	Fig.8

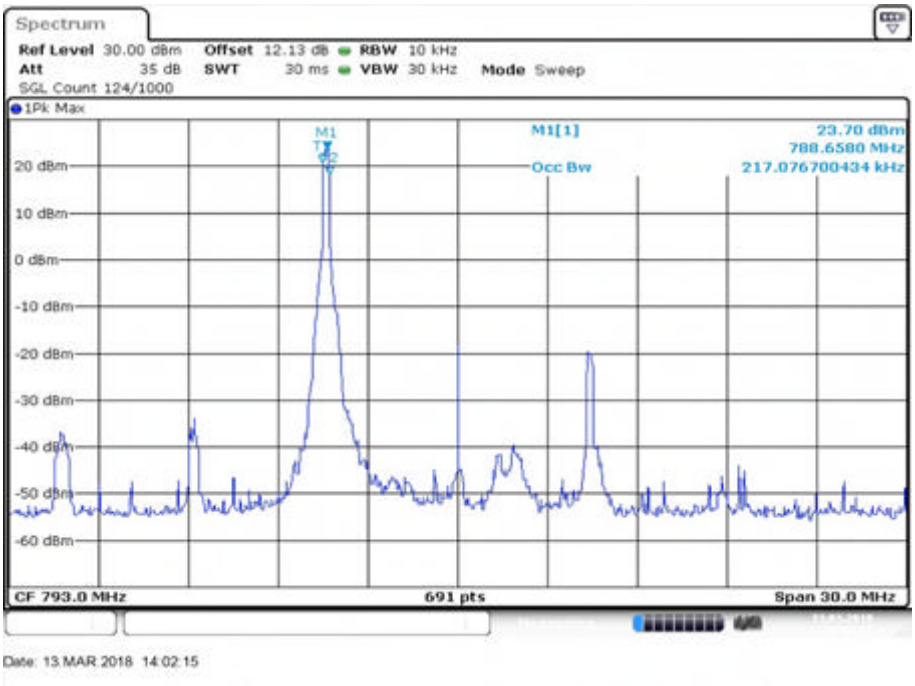


Fig.1

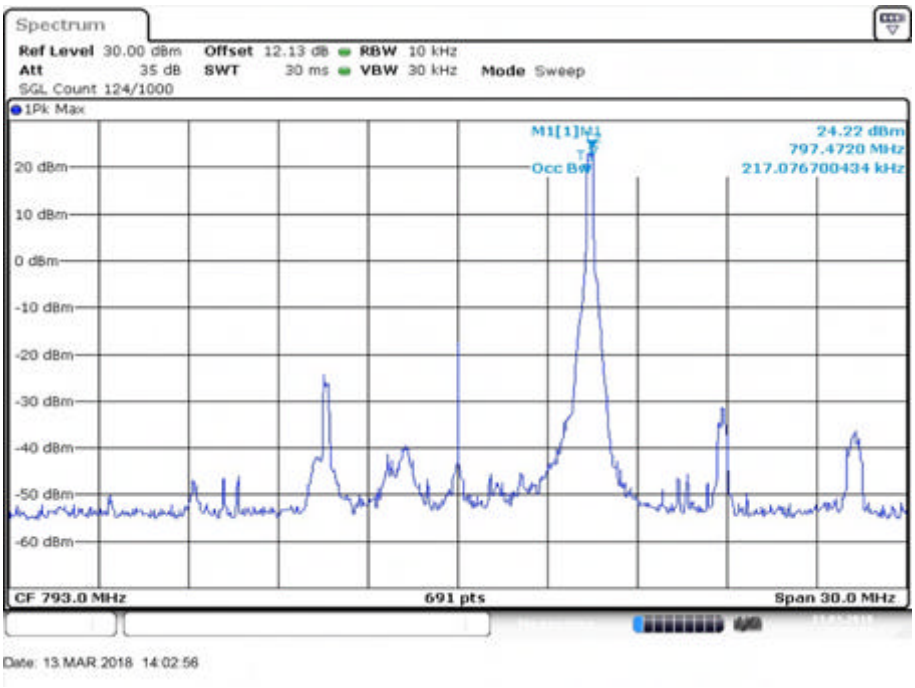


Fig.2

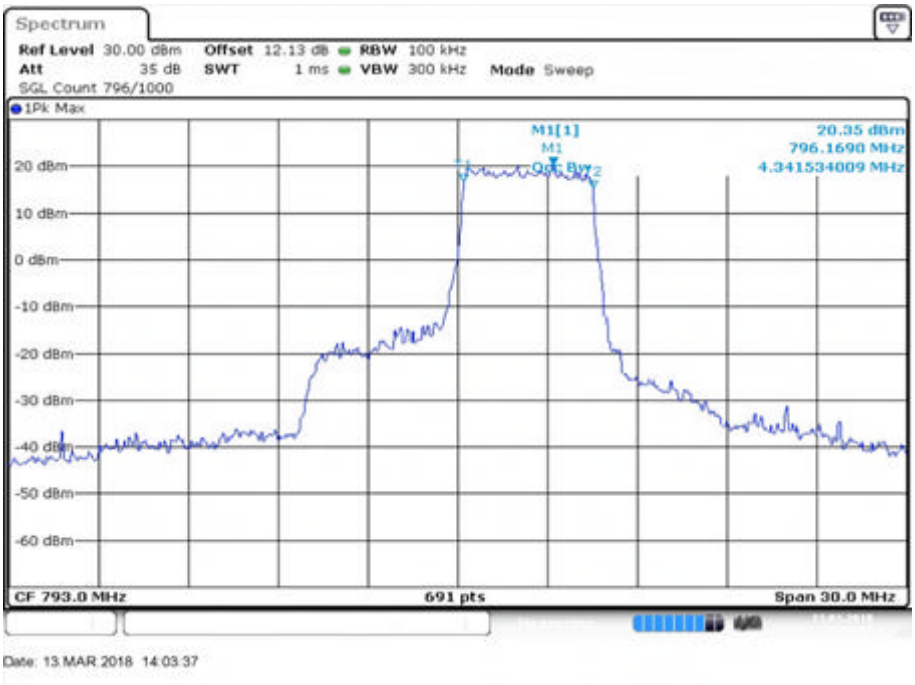


Fig.3

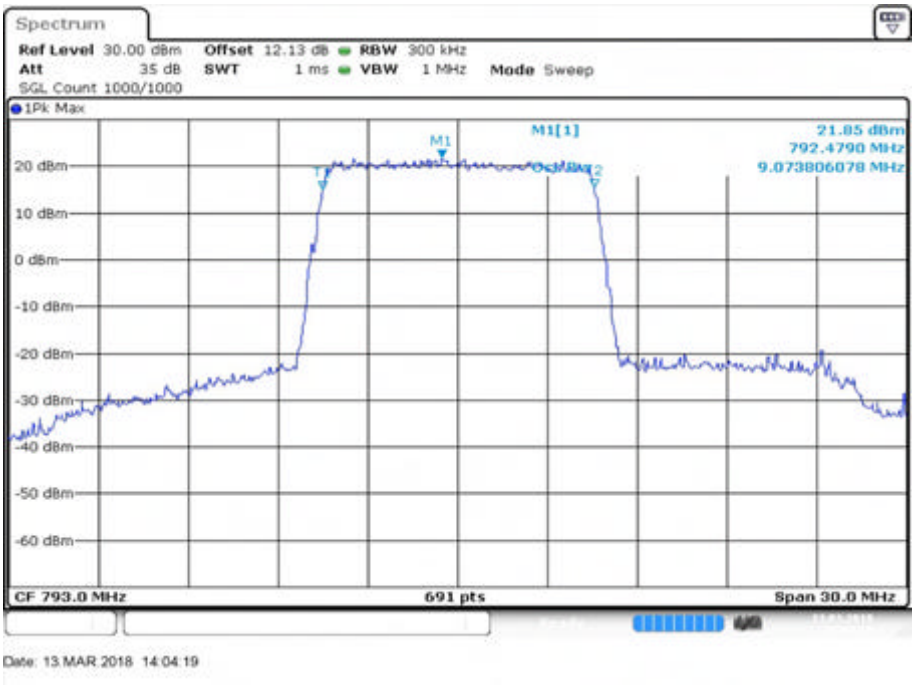


Fig.4

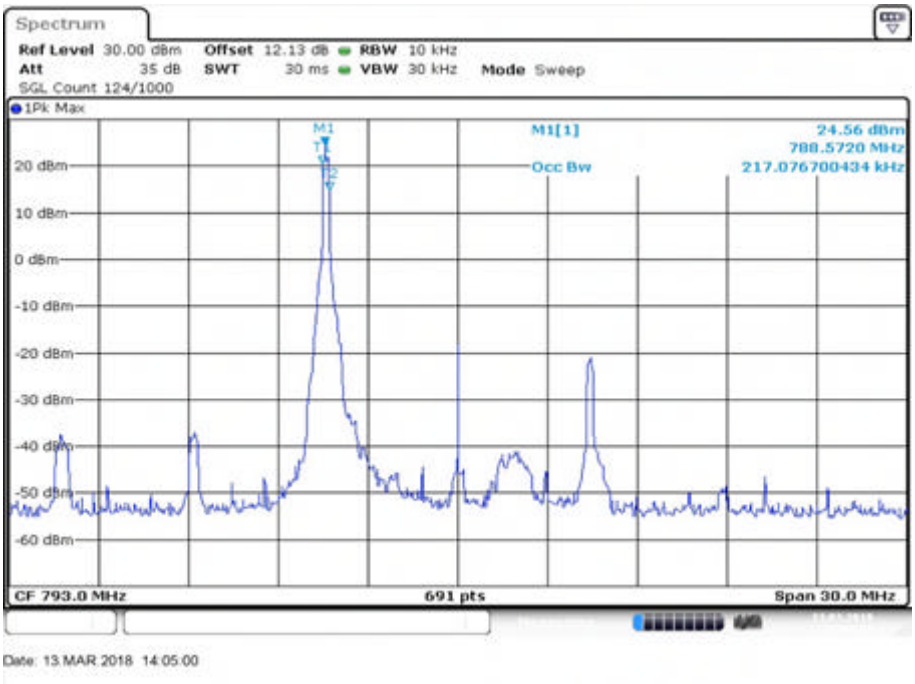


Fig.5

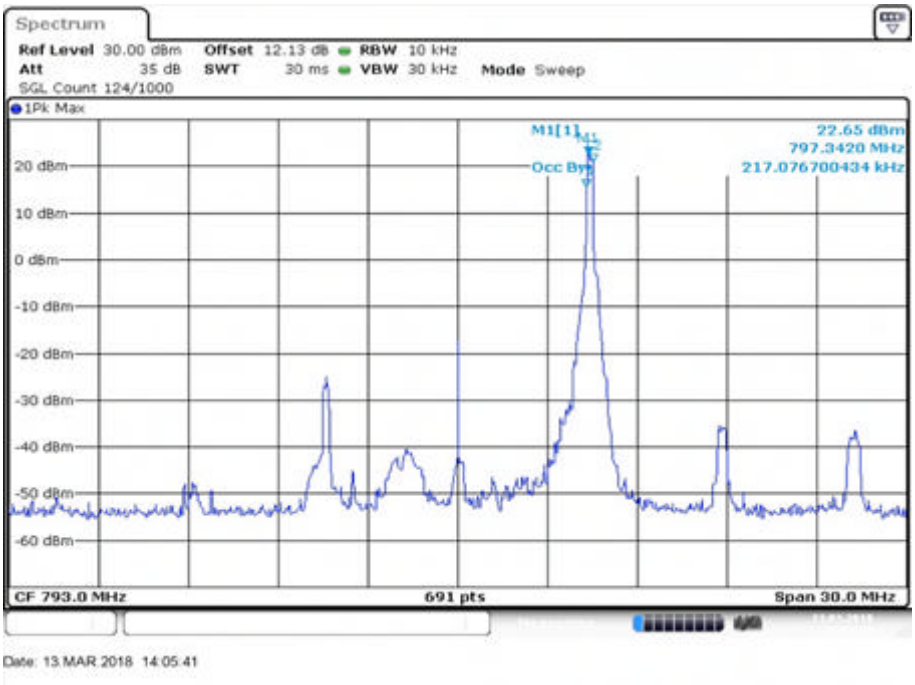


Fig.6

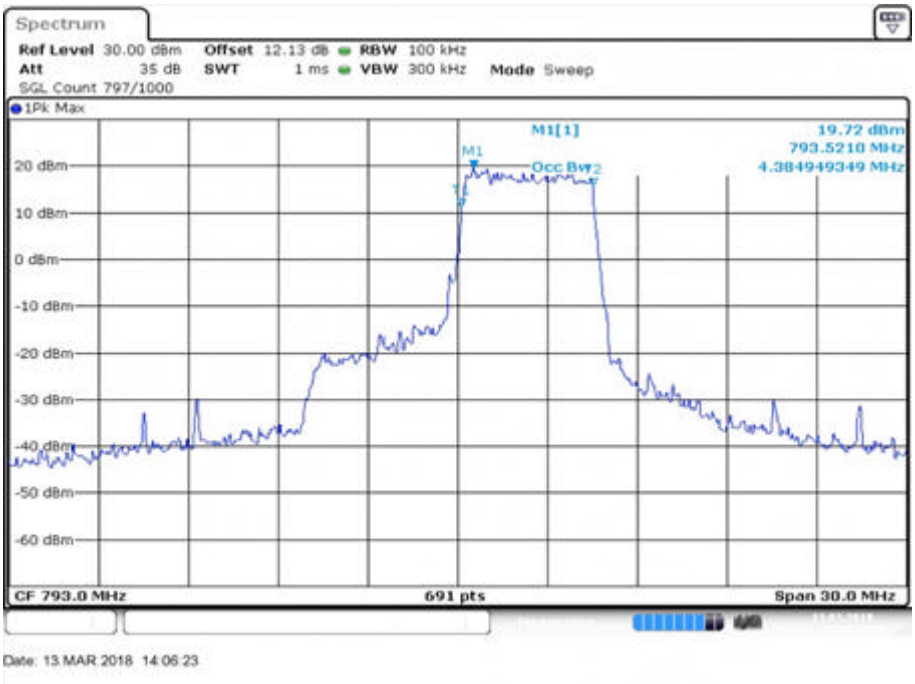


Fig.7

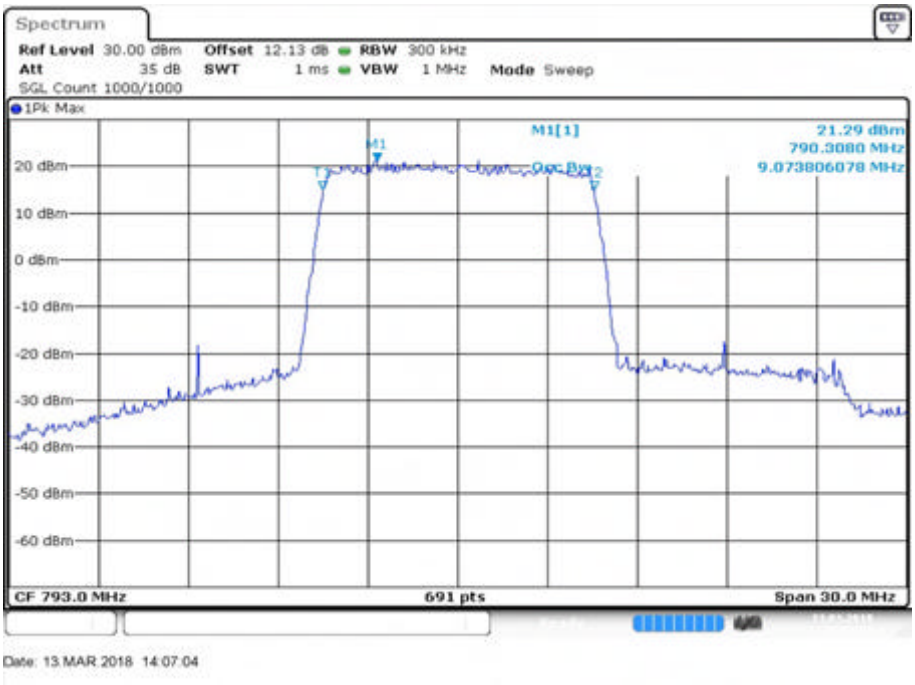


Fig.8

Band	Carrier frequency (MHz)	Channel(High)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
14	793	23330	10	1	0	0.217	Fig.1	0.217	Fig.5
				1	49	0.217	Fig.2	0.217	Fig.6
				24	12	4.342	Fig.3	4.342	Fig.7
				50	0	9.074	Fig.4	9.030	Fig.8

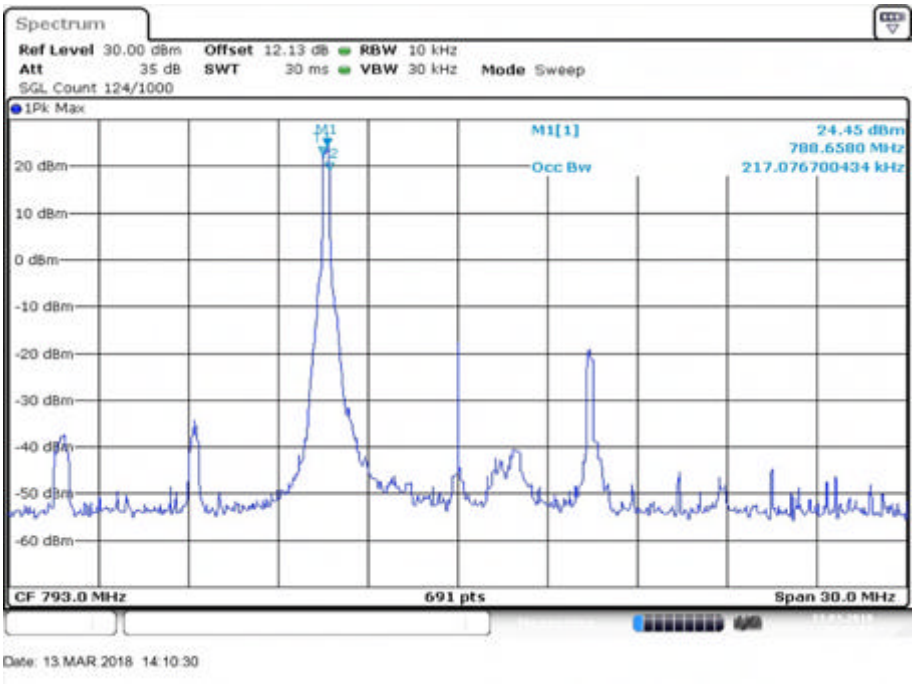


Fig.1

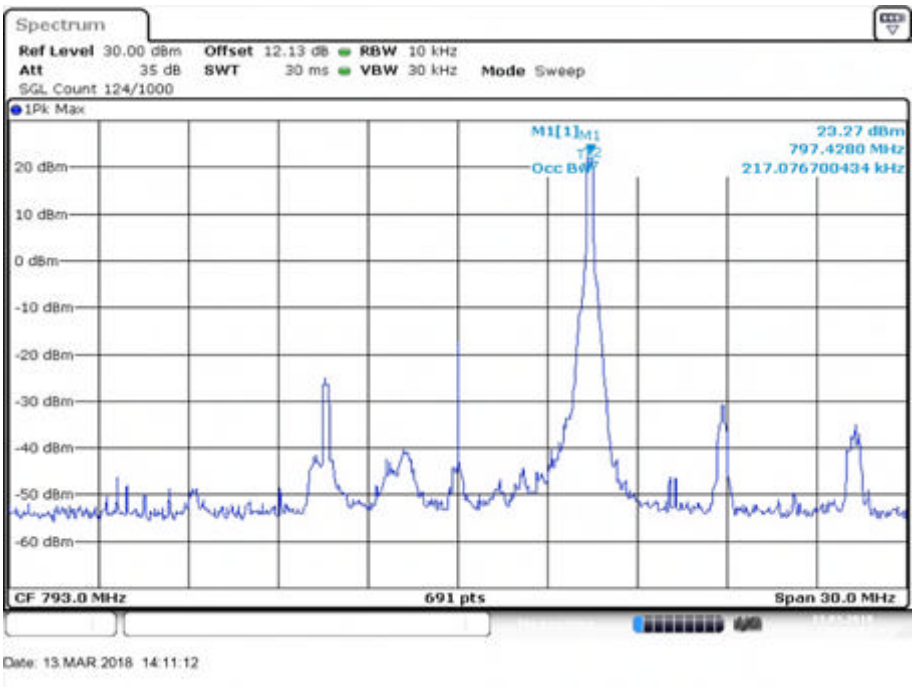


Fig.2

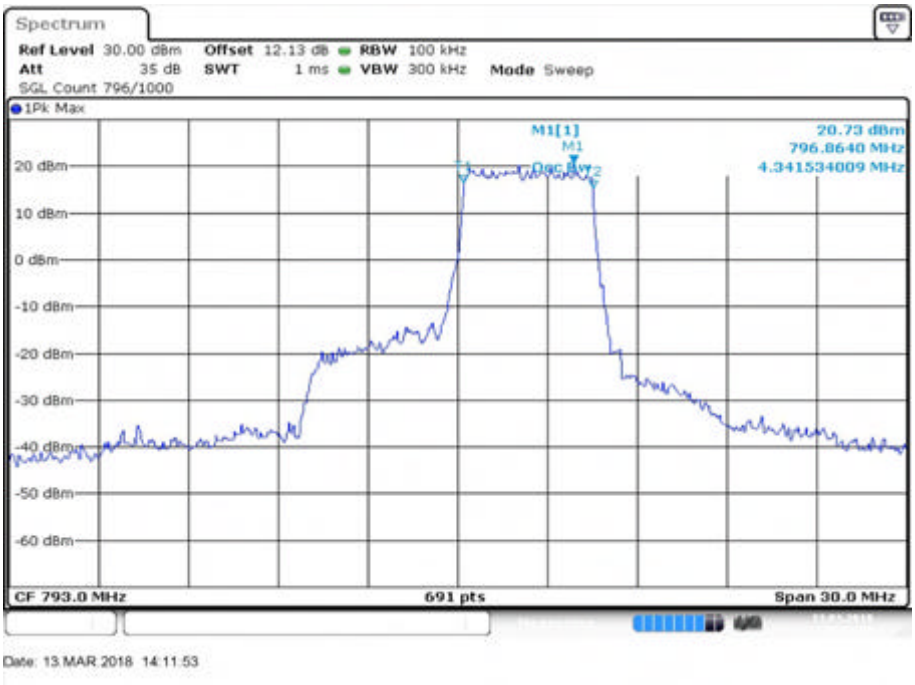


Fig.3

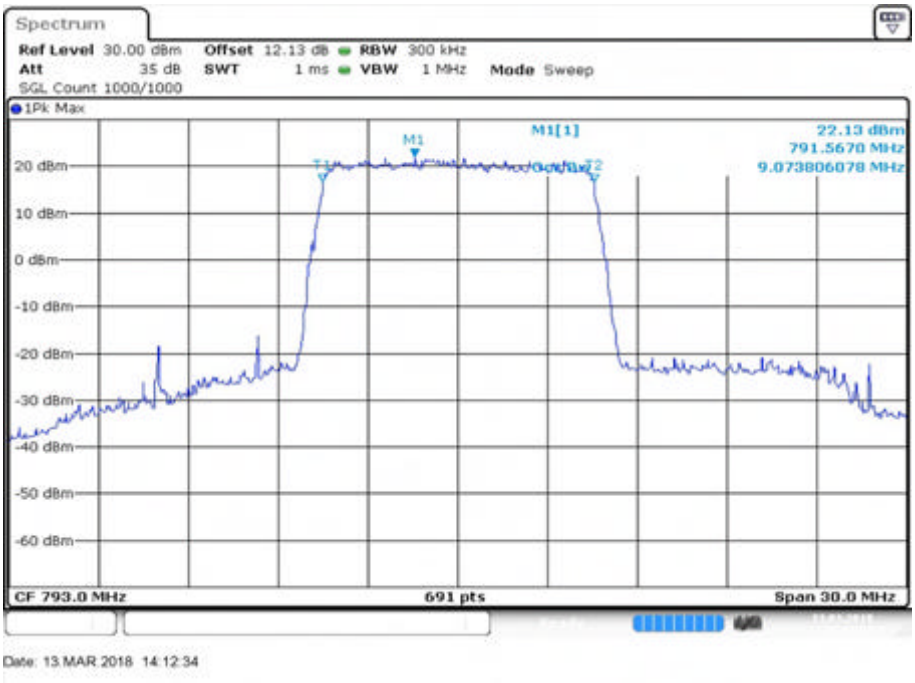


Fig.4

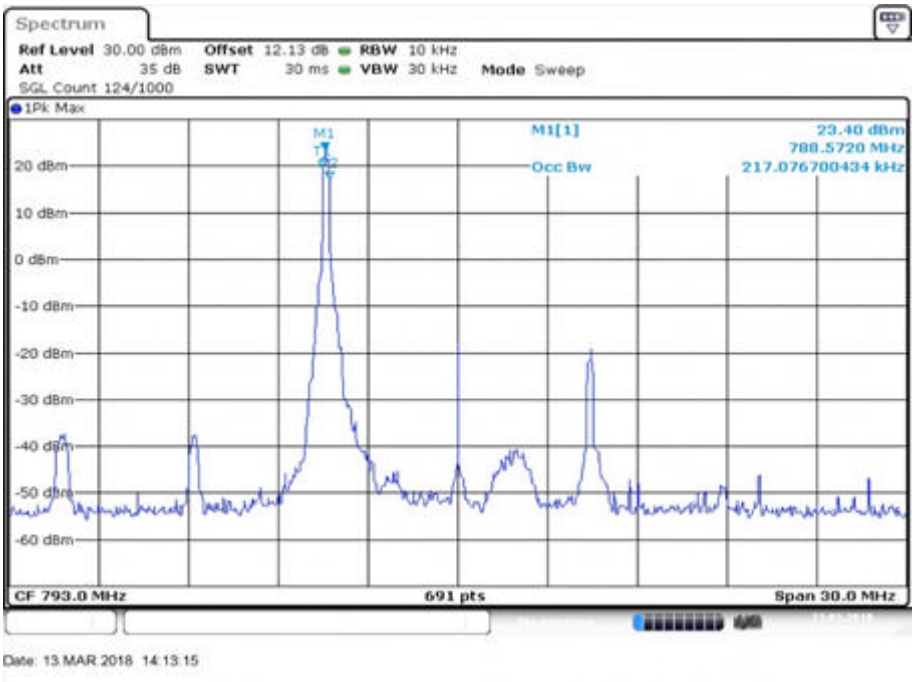


Fig.5

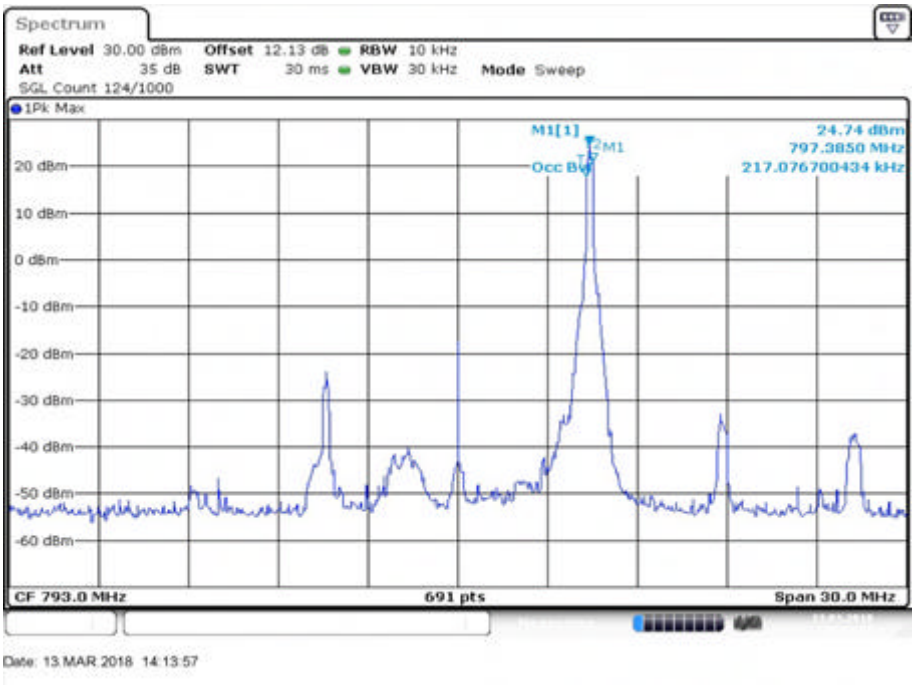


Fig.6

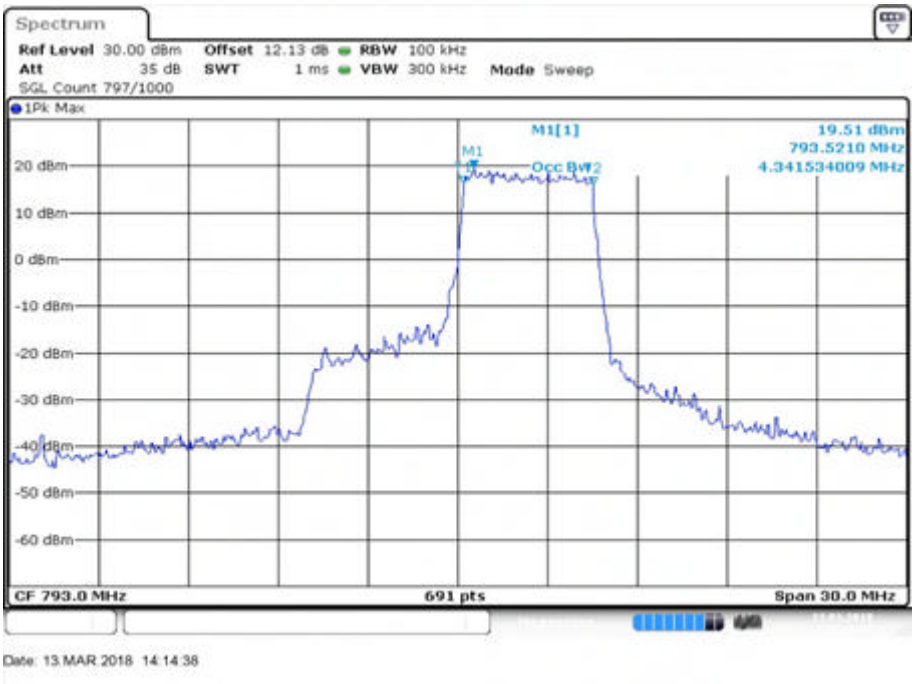


Fig.7

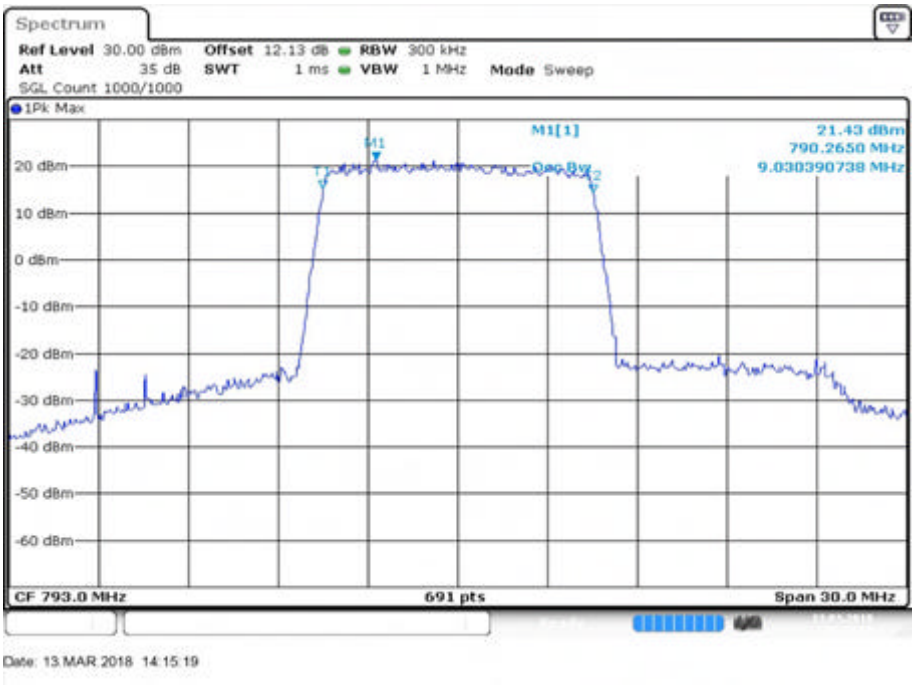


Fig.8

Note: Expanded measurement uncertainty is U = 3428Hz, k = 2

LTE Band 26

Band	Carrier frequency (MHz)	Channel(Low)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
26	814.7	26697	1.4	1	0	0.207	Fig.1	0.213	Fig.5
				1	5	0.213	Fig.2	0.213	Fig.6
				3	2	0.565	Fig.3	0.571	Fig.7
				6	0	1.094	Fig.4	1.094	Fig.8

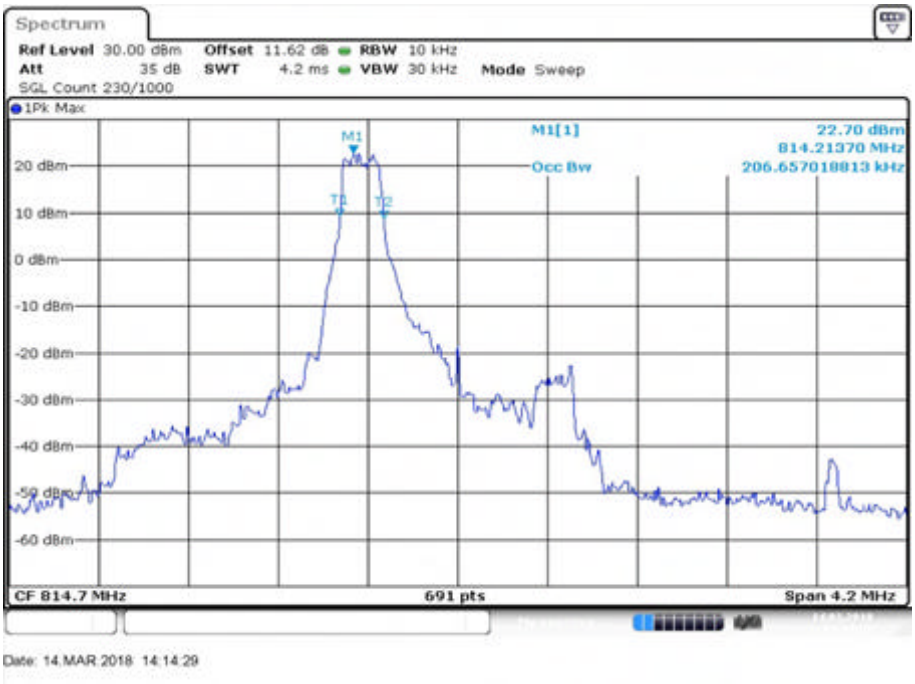


Fig.1

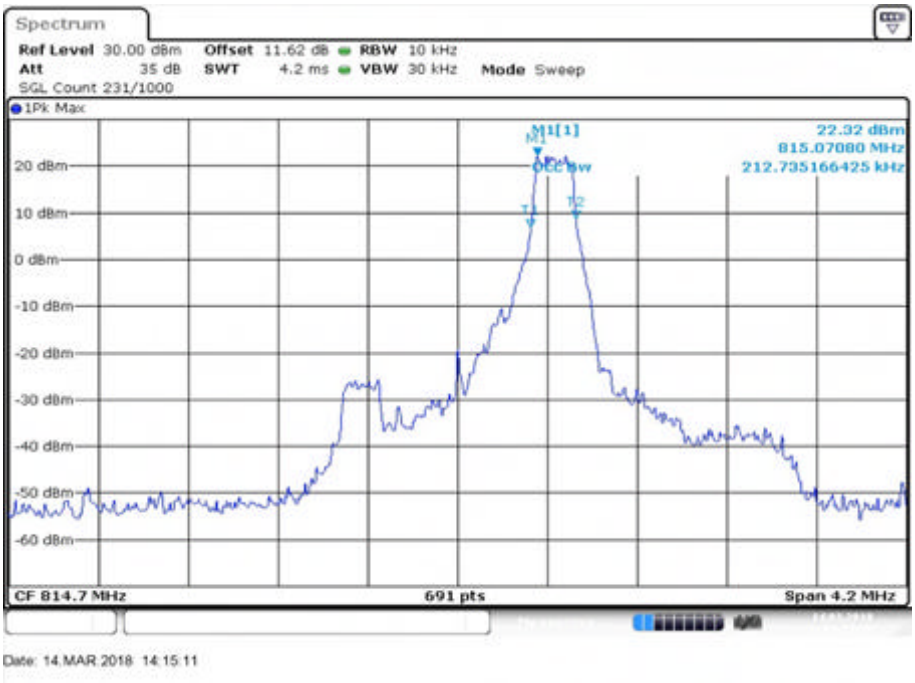


Fig.2

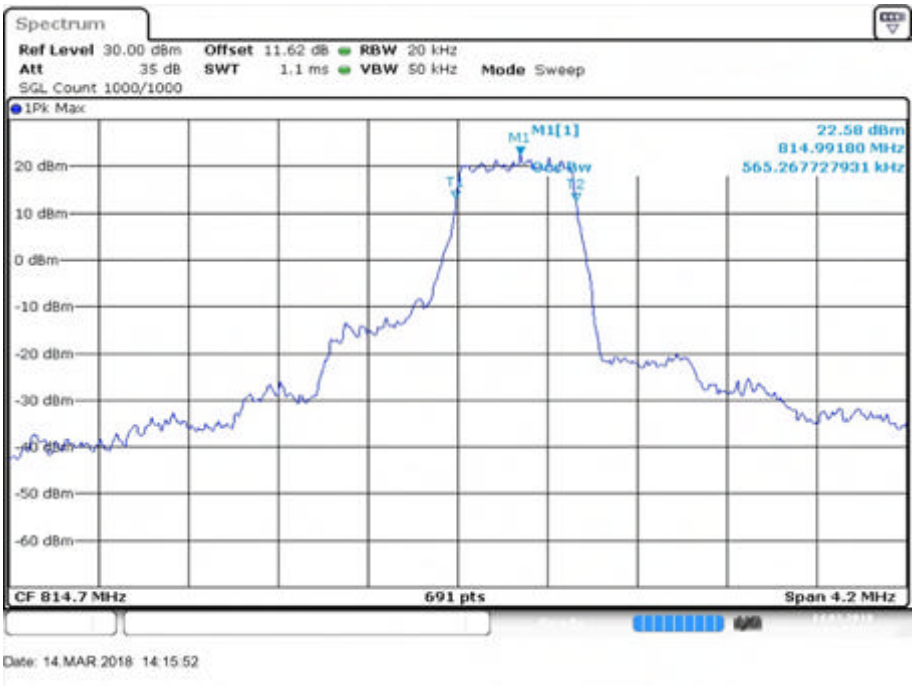


Fig.3

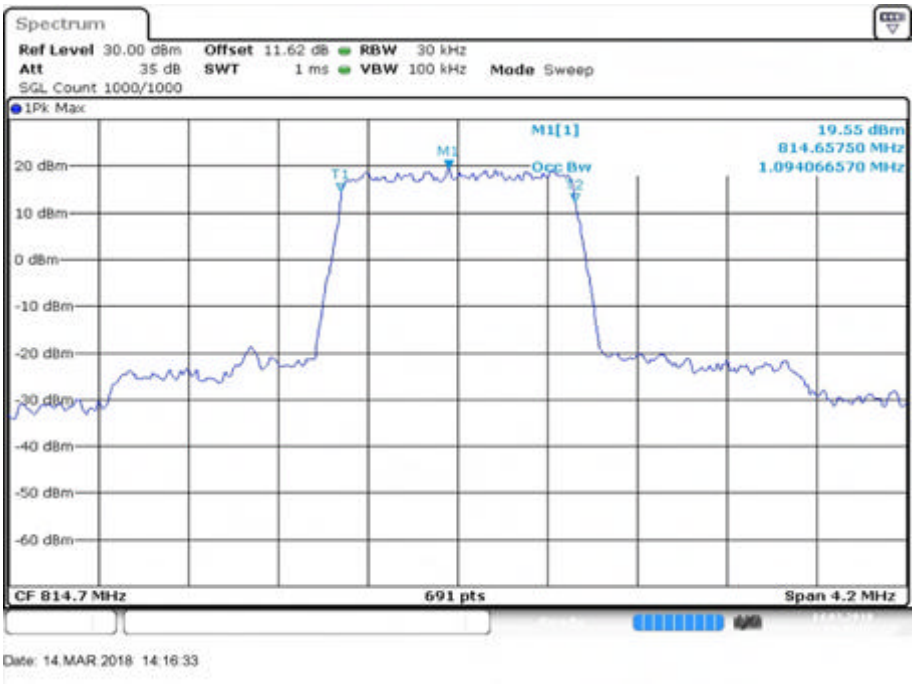


Fig.4

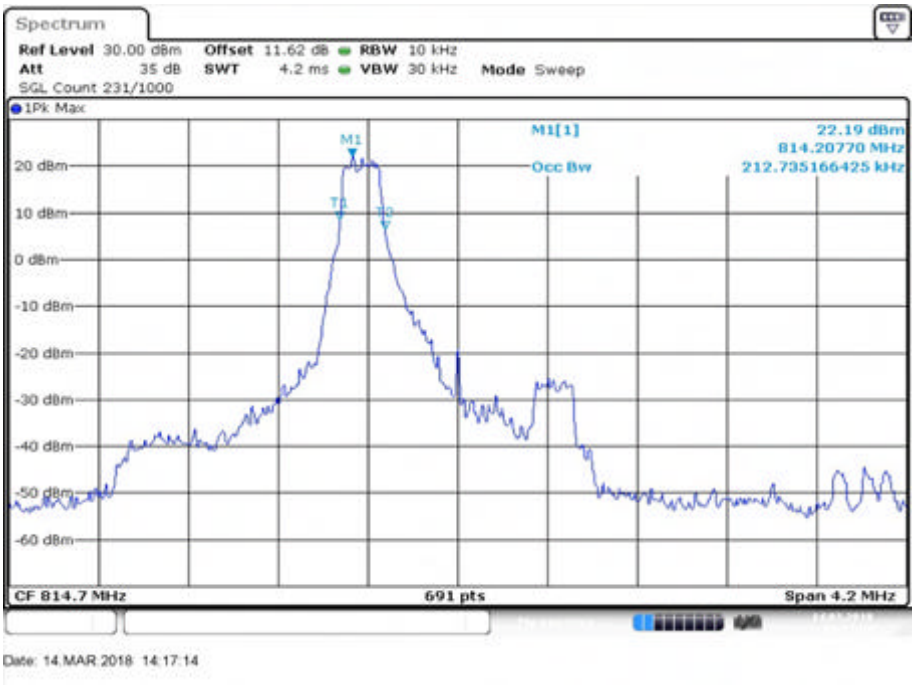


Fig.5

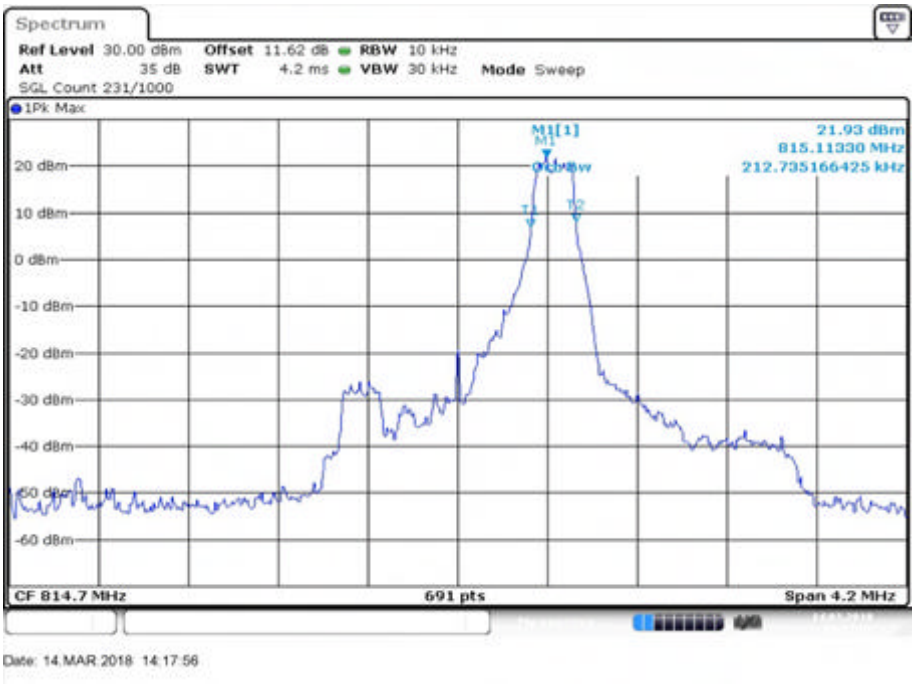


Fig.6

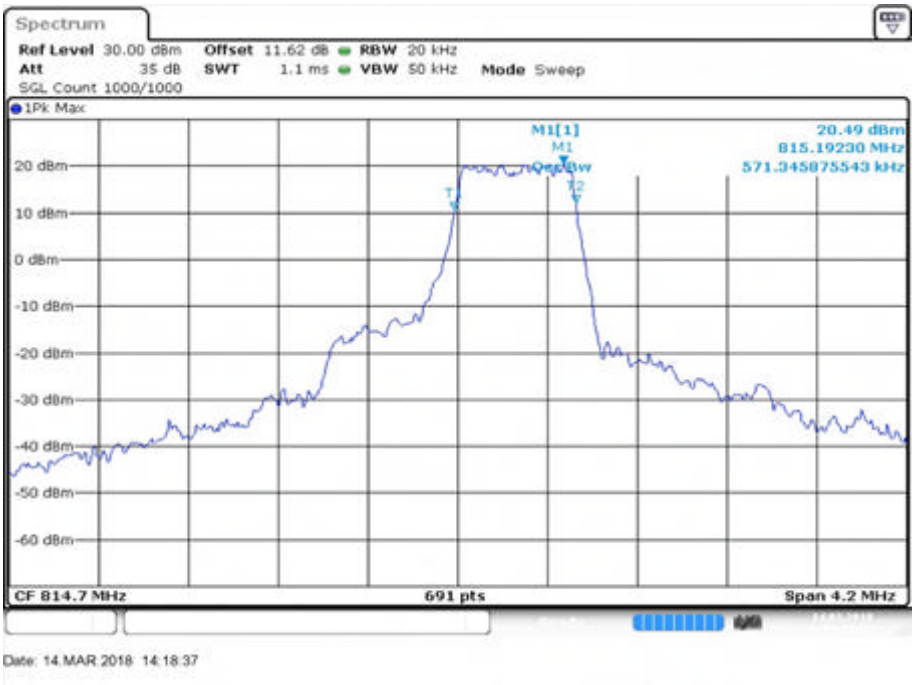


Fig.7

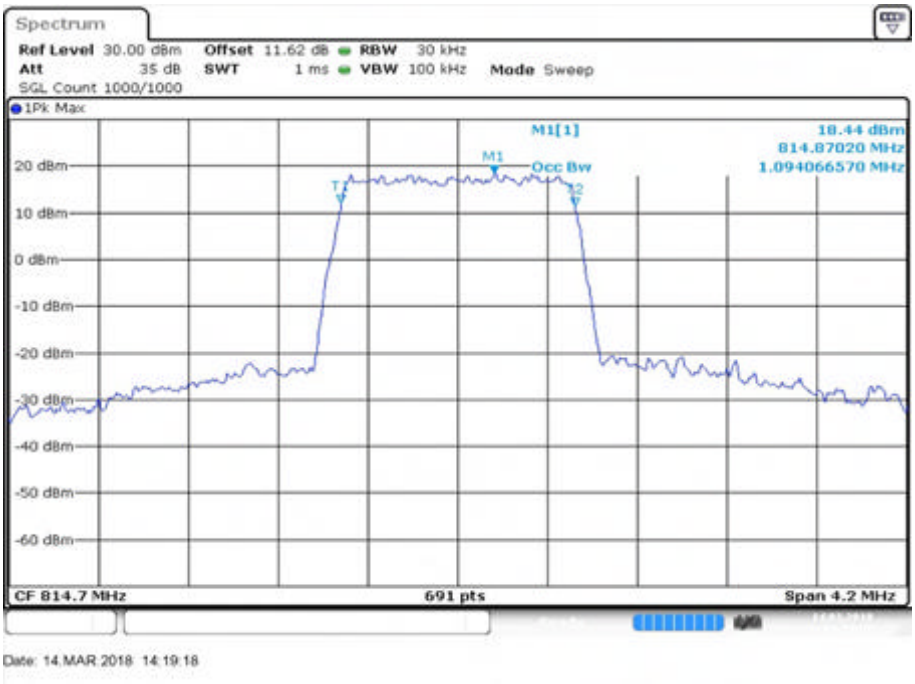


Fig.8

Band	Carrier frequency (MHz)	Channel(Mid)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
26	831.5	26865	1.4	1	0	0.207	Fig.1	0.213	Fig.5
				1	5	0.207	Fig.2	0.207	Fig.6
				3	2	0.565	Fig.3	0.571	Fig.7
				6	0	1.094	Fig.4	1.100	Fig.8

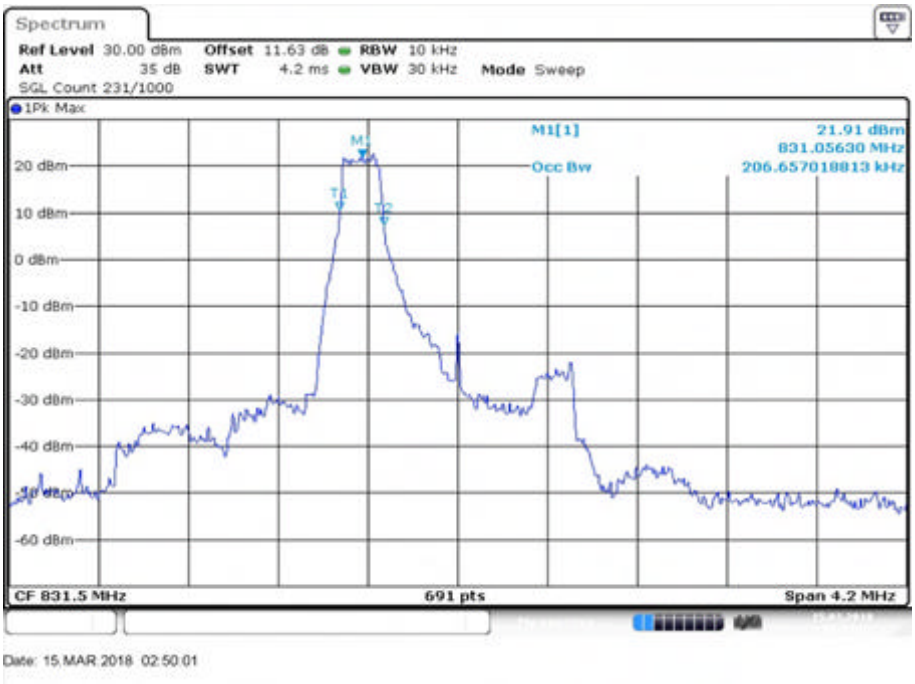


Fig.1

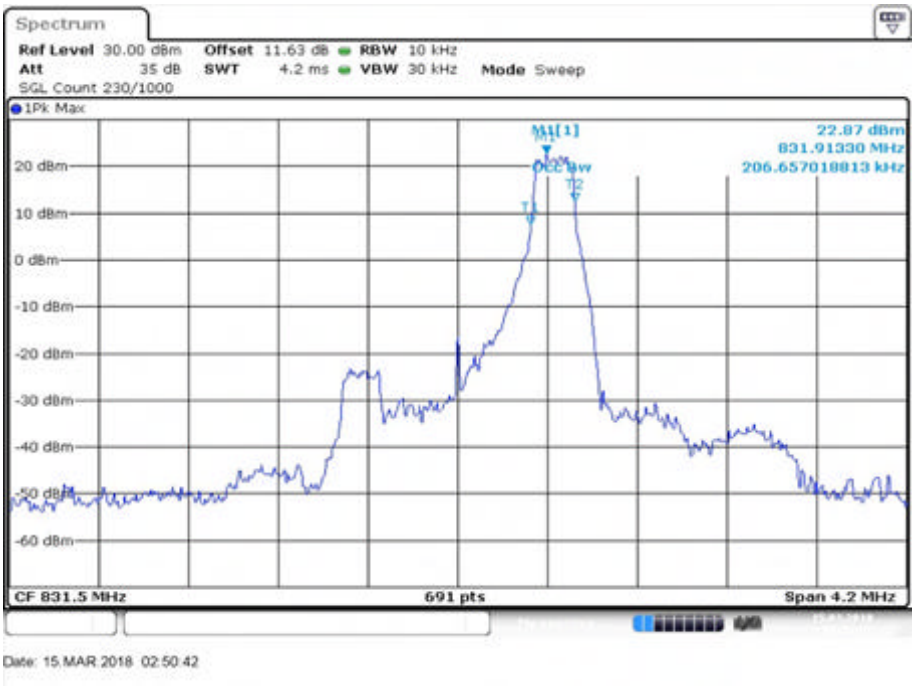


Fig.2

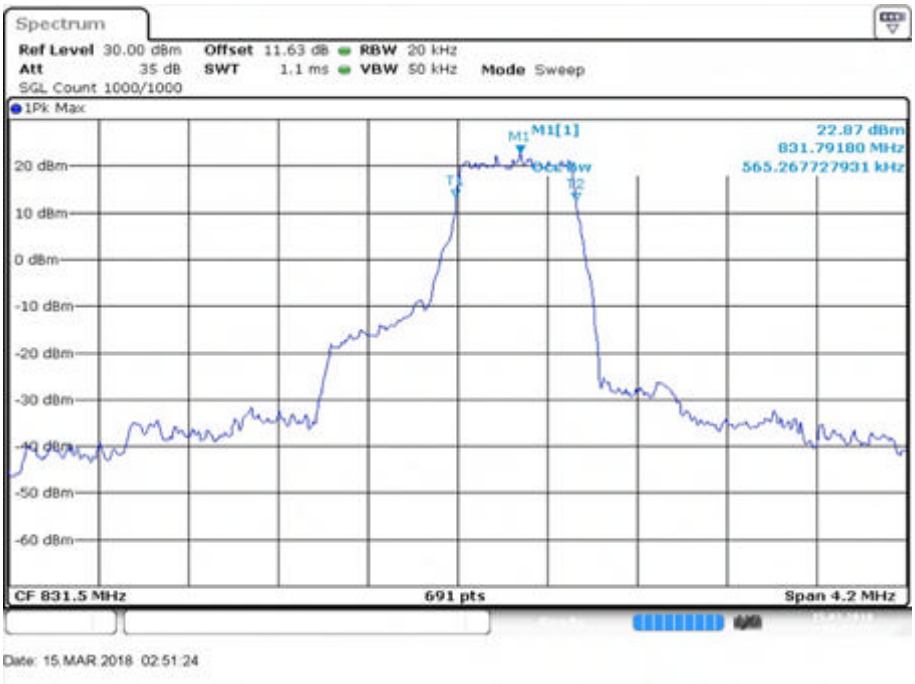


Fig.3

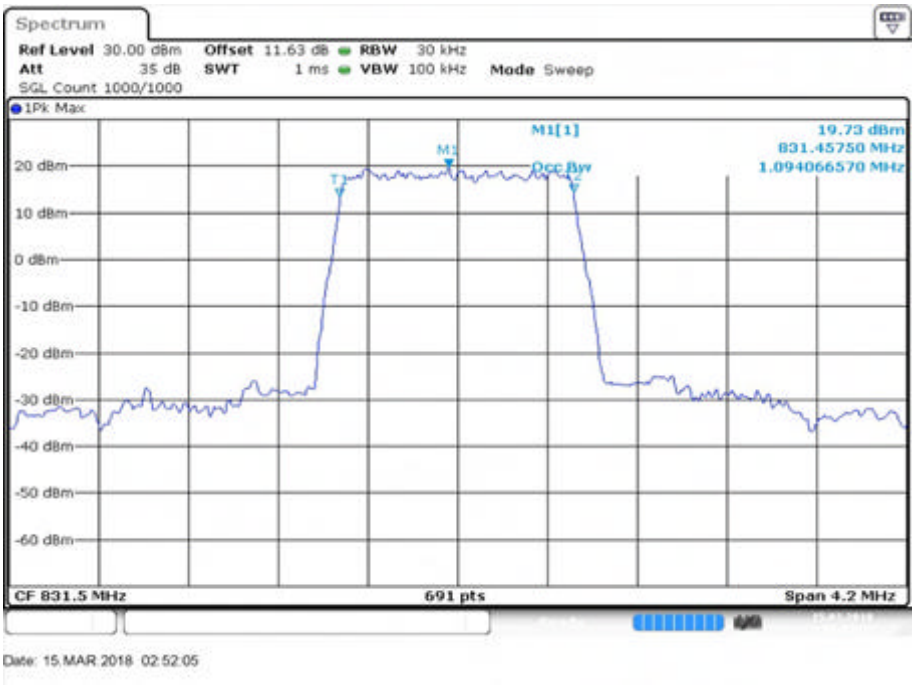


Fig.4

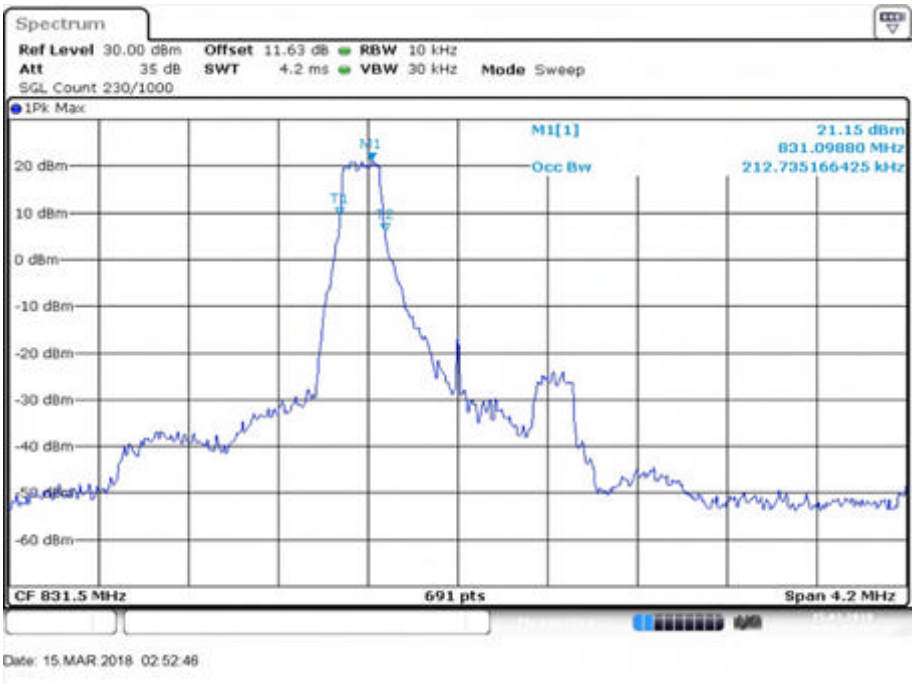


Fig.5

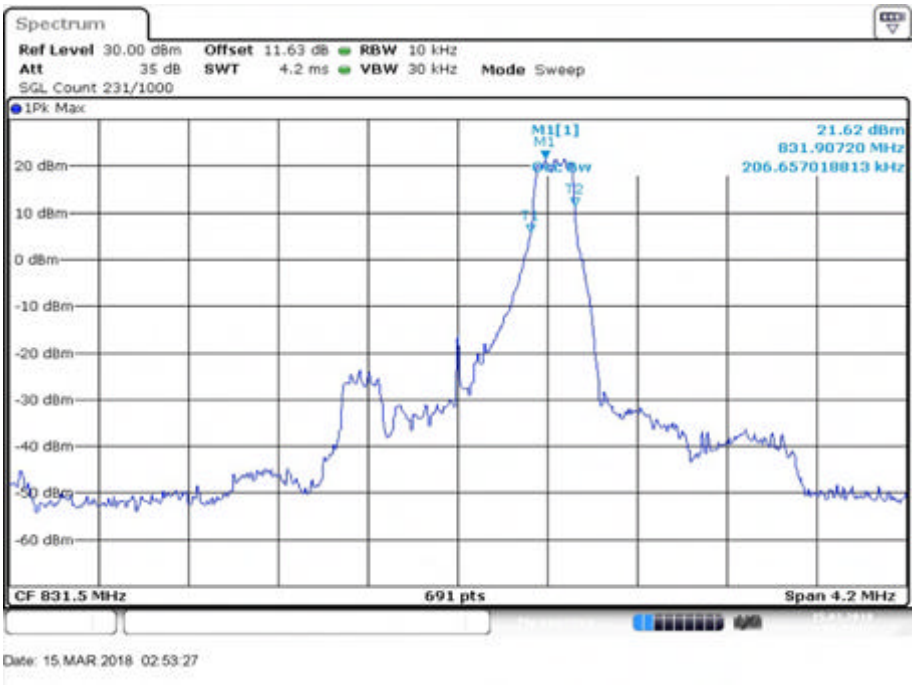


Fig.6

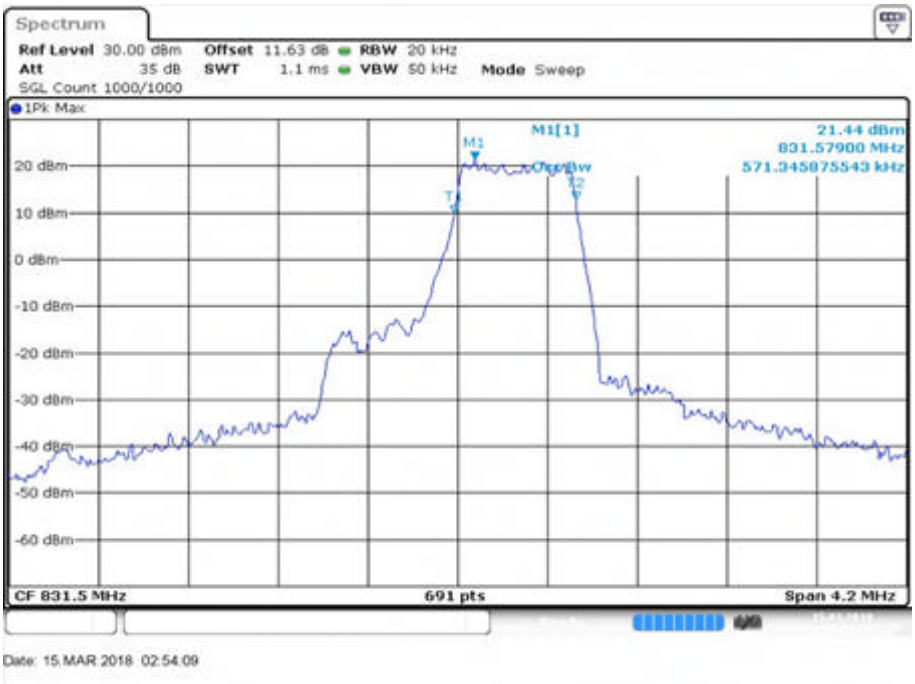


Fig.7

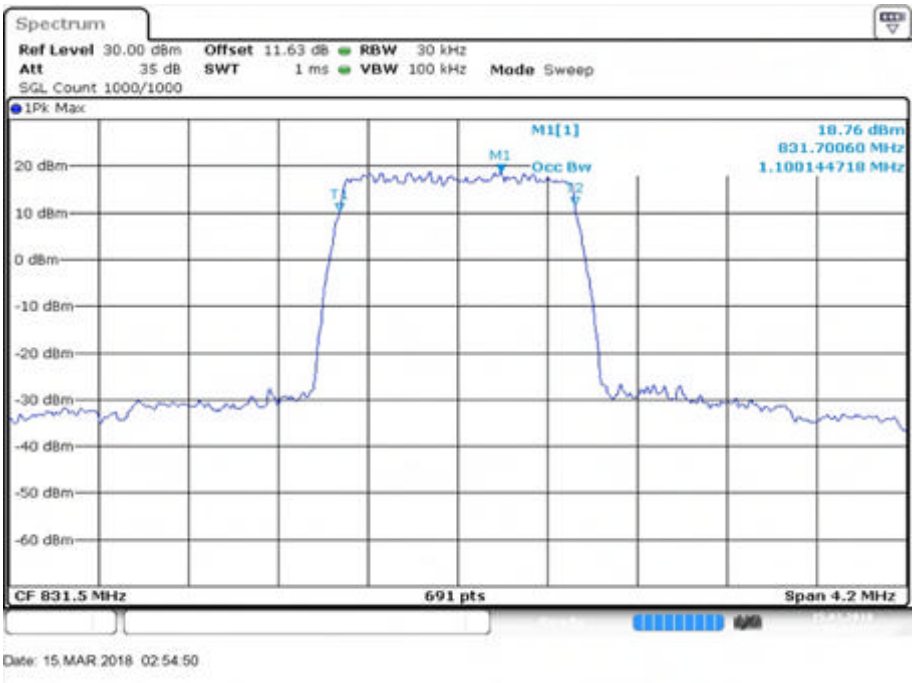


Fig.8

Band	Carrier frequency (MHz)	Channel(High)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
26	848.3	27033	1.4	1	0	0.207	Fig.1	0.213	Fig.5
				1	5	0.213	Fig.2	0.207	Fig.6
				3	2	0.565	Fig.3	0.565	Fig.7
				6	0	1.094	Fig.4	1.100	Fig.8

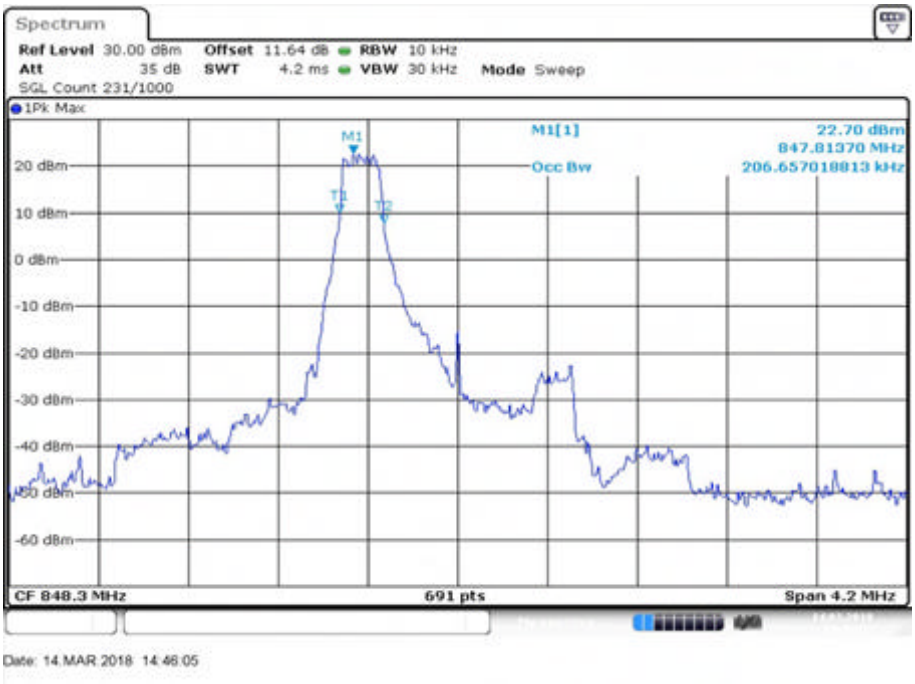


Fig.1

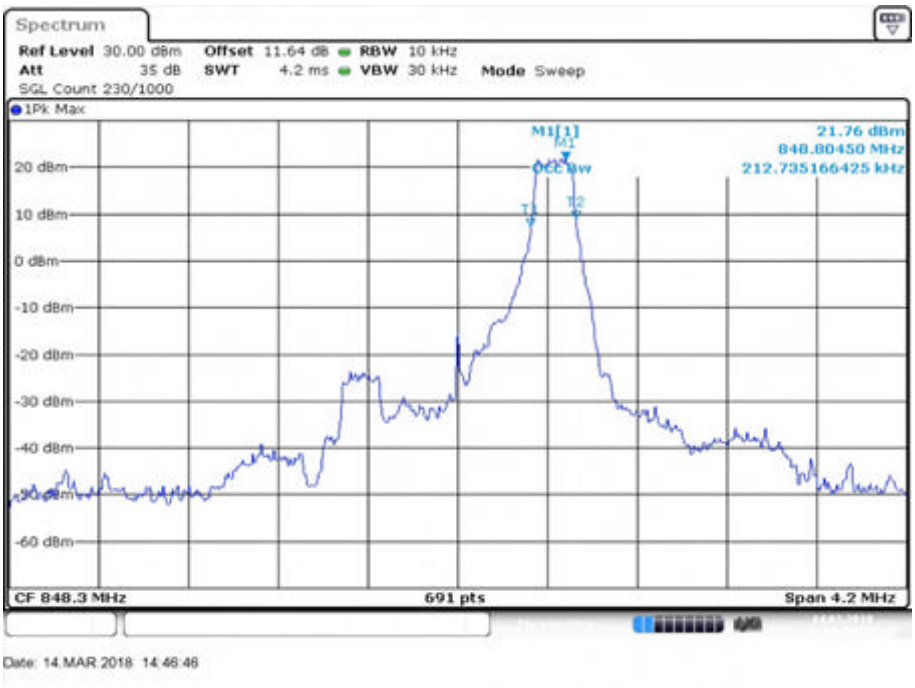


Fig.2

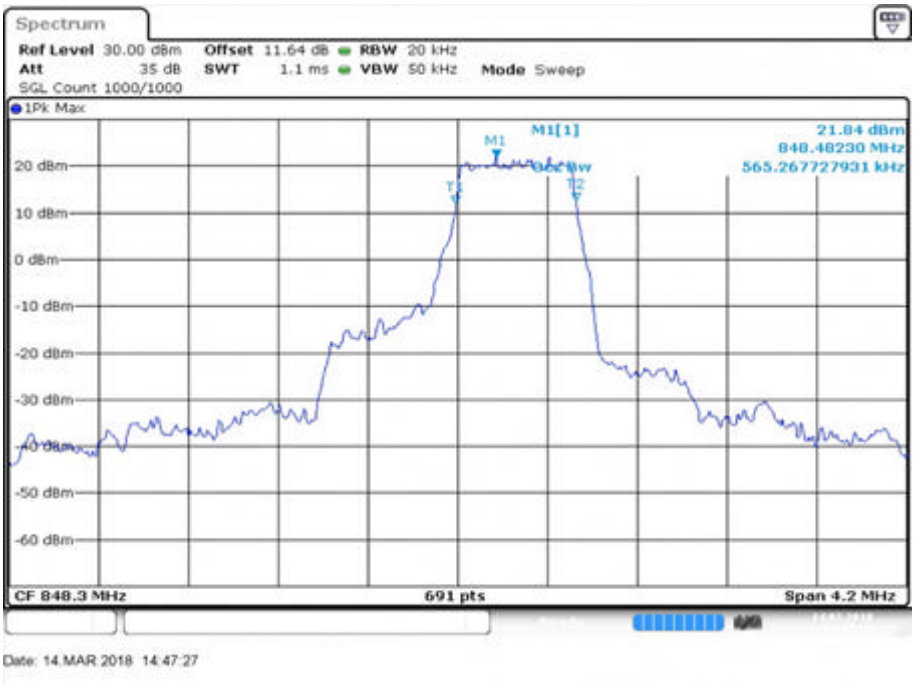


Fig.3

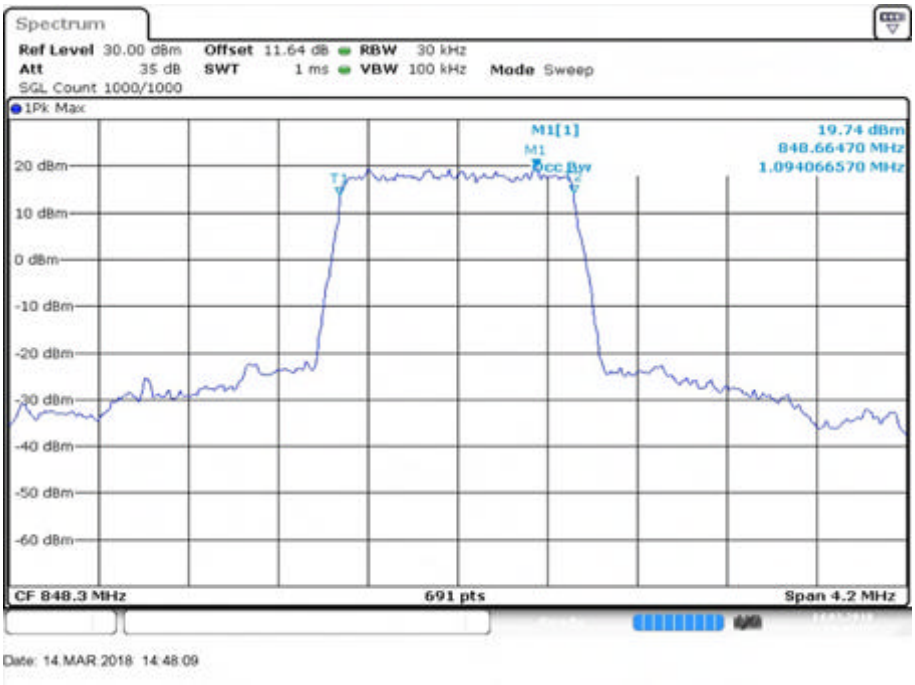


Fig.4

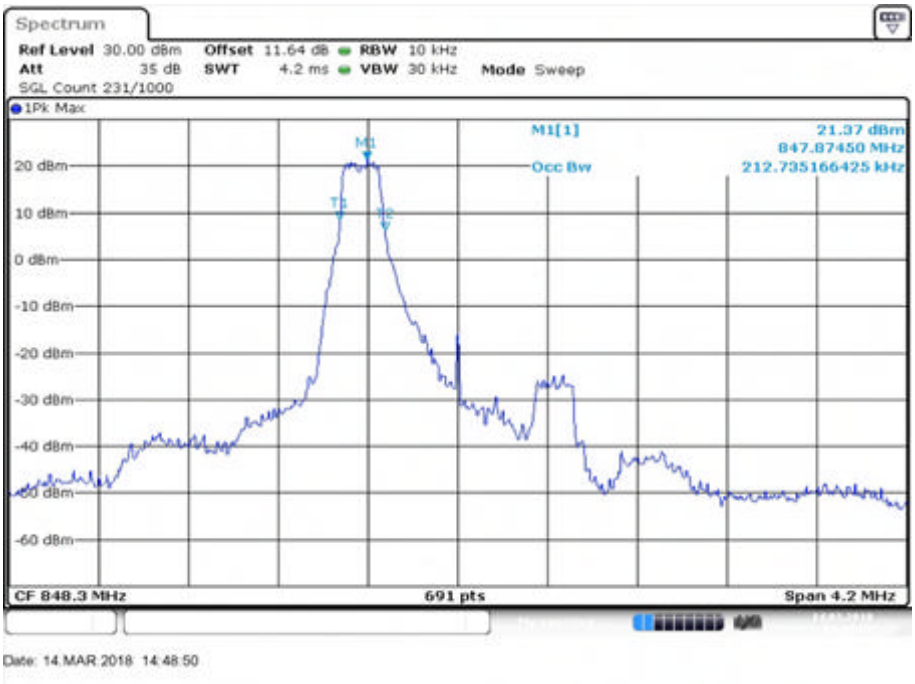


Fig.5

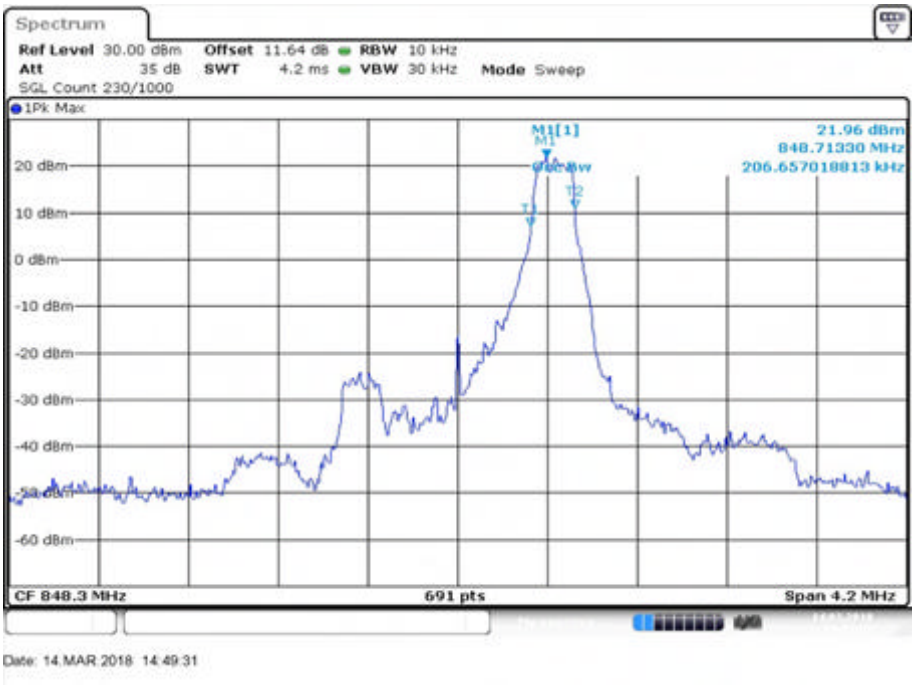


Fig.6

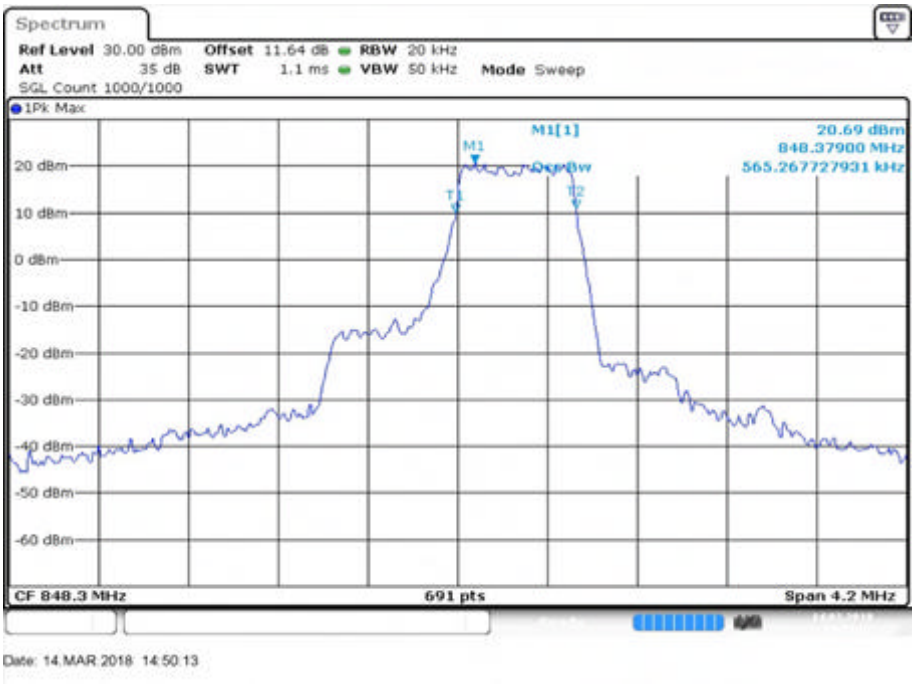


Fig.7

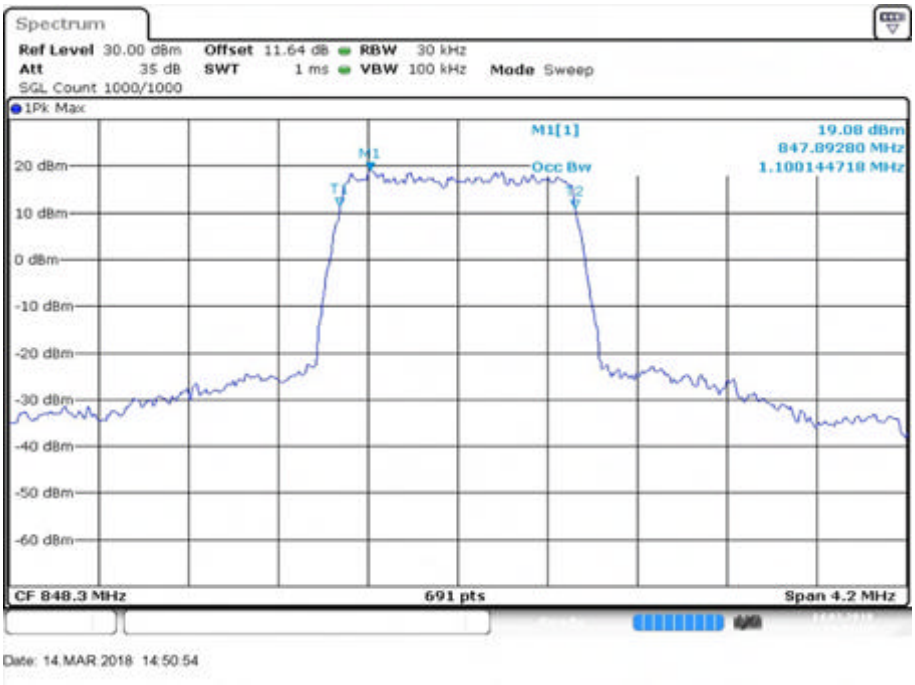


Fig.8

Band	Carrier frequency (MHz)	Channel(Low)	BW	RB Size	RB Offset	Bandwidth of 99% Power (MHz)			
						QPSK		16-QAM	
26	815.5	26705	3	1	0	0.208	Fig.1	0.208	Fig.5
				1	14	0.221	Fig.2	0.221	Fig.6
				8	4	1.472	Fig.3	1.446	Fig.7
				15	0	2.735	Fig.4	2.735	Fig.8

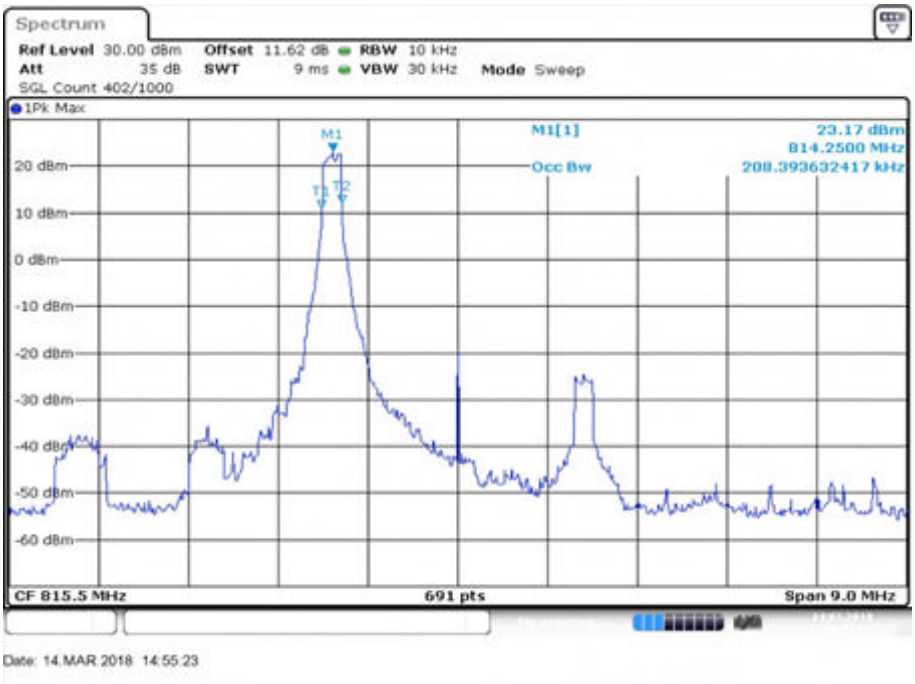


Fig.1

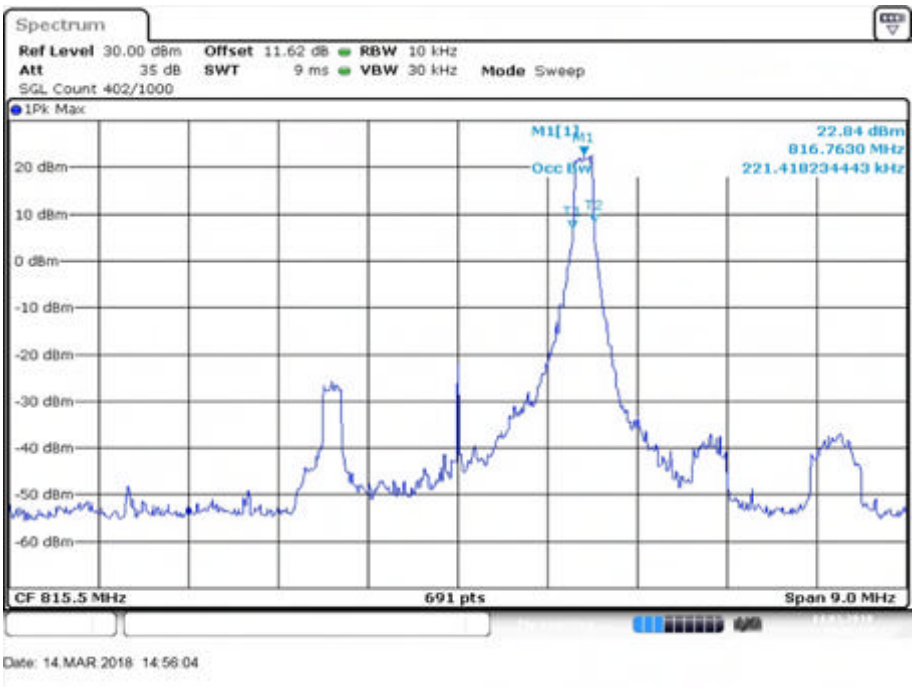


Fig.2

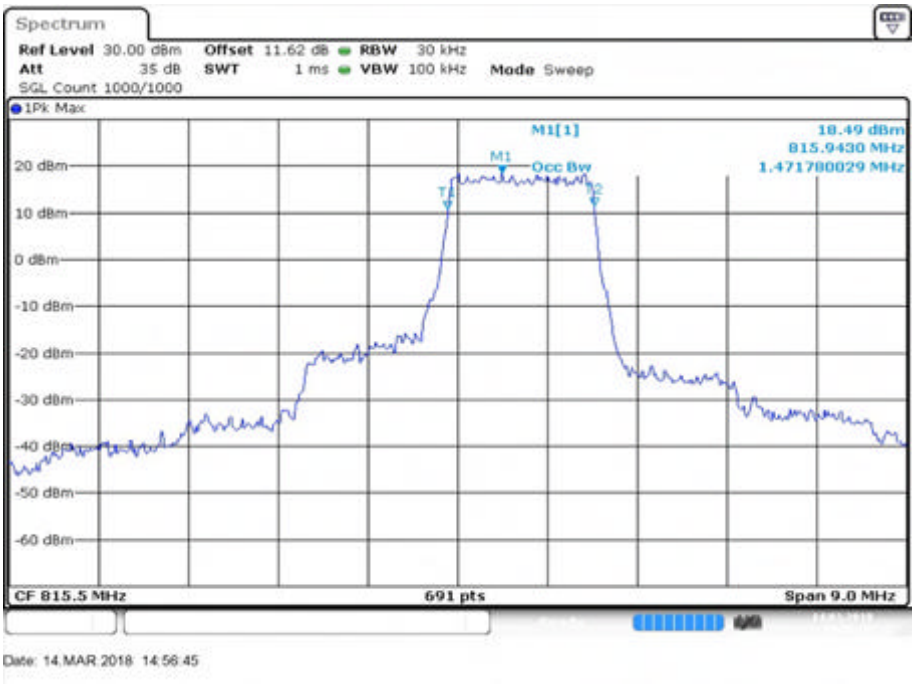


Fig.3