TESTING LABORATORY
CERTIFICATE # 4821.01

FCC PART 27

TEST REPORT

For

Pycom Ltd

High Point 9 Sydenham Road, Guildford Surrey GU1 3RX, Surrey, United Kingdom

FCC ID: 2AJMTFIPY01R

Report Type:	**Product Type:**
Original Report	FiPy Module

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Pycom Ltd's* product, model number: Fipy 1.0 *(FCC ID: 2AJMTFIPY01R)* or the "EUT" in this report was a FiPy Module, which was measured approximately: 55 mm (L) × 20 mm (W) × 10 mm (H).

**All measurement and test data in this report was gathered from production sample serial number: 180305059 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-03-05.*

Objective

This test report is prepared on behalf of *Pycom Ltd* in accordance with Subpart 27 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS, Part 15.247 DTS, Part 15.249 DXX submissions with FCC ID: 2AJMTFIPY01R.

Test Methodology

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

Part 27 – Miscellaneous wireless communications services

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF output power, conducted		±1.5dB
Unwanted Emission, conducted		±1.5dB
Emissions, radiated	Below 1GHz	±4.70dB
	Above 1GHz	±4.80dB
Temperature		±1℃
Supply voltages		±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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.

eMTC Auto Mode: Narrowband and resource blocks per cell BW

Test Item	LTE Band	Bandwidth(MHz)				Modulation		RB setting		Test channel
		5	10	15	20	QPSK	16QAM	NB	TBS Idx	
RF Output Power**	4	√	√	√	√	√	√	0	10	L/M/H
	12	√	√	×	×	√	√	0	10	L/M/H
	13	√	√	×	×	√	√	0	10	L/M/H*
Peak-to-average ratio	4	√	√	√	√	√	√	0	10	M
	12	√	√	×	×	√	√	0	10	M
	13	√	√	×	×	√	√	0	10	M
Radiated power	4	√	√	√	√	√	√	0	10	M
	12	√	√	×	×	√	√	0	10	M
	13	√	√	×	×	√	√	0	10	M
Occupied Bandwidth	4	√	√	√	√	√	√	0	10	M
	12	√	√	×	×	√	√	0	10	M
	13	√	√	×	×	√	√	0	10	M
Spurious Emissions at Antenna Terminal	4	√	√	√	√	√	√	0	10	M
	12	√	√	×	×	√	√	0	10	M
	13	√	√	×	×	√	√	0	10	M
Field Strength of Spurious Radiation	4	√	√	√	√	√	√	0	10	M
	12	√	√	×	×	√	√	0	10	M
	13	√	√	×	×	√	√	0	10	M
Band Edge**	4	√	√	√	√	√	√	0/3@5MHz BW 0/7@10MHz BW 0/11@15MHz BW 0/15@20MHz BW	10	L/H
	12	√	√	×	×	√	√	0/3@5MHz BW 0/7@10MHz BW	10	L/H
	13	√	√	×	×	√	√	0/3@5MHz BW 0/7@10MHz BW	10	M*
Frequency stability	4	√	√	√	√	√	√	0	10	M
	12	√	√	×	×	√	√	0	10	M
	13	√	√	×	×	√	√	0	10	M

Note *: only middle channel with LTE band 13 @10MHz bandwidth.
Note**: Both RB 0 and RB 6 were test for QPSK, both RB 0 and RB 5 were test for 16QAM. other item only test RB 6 with QPSK and RB 5 with 16QAM.

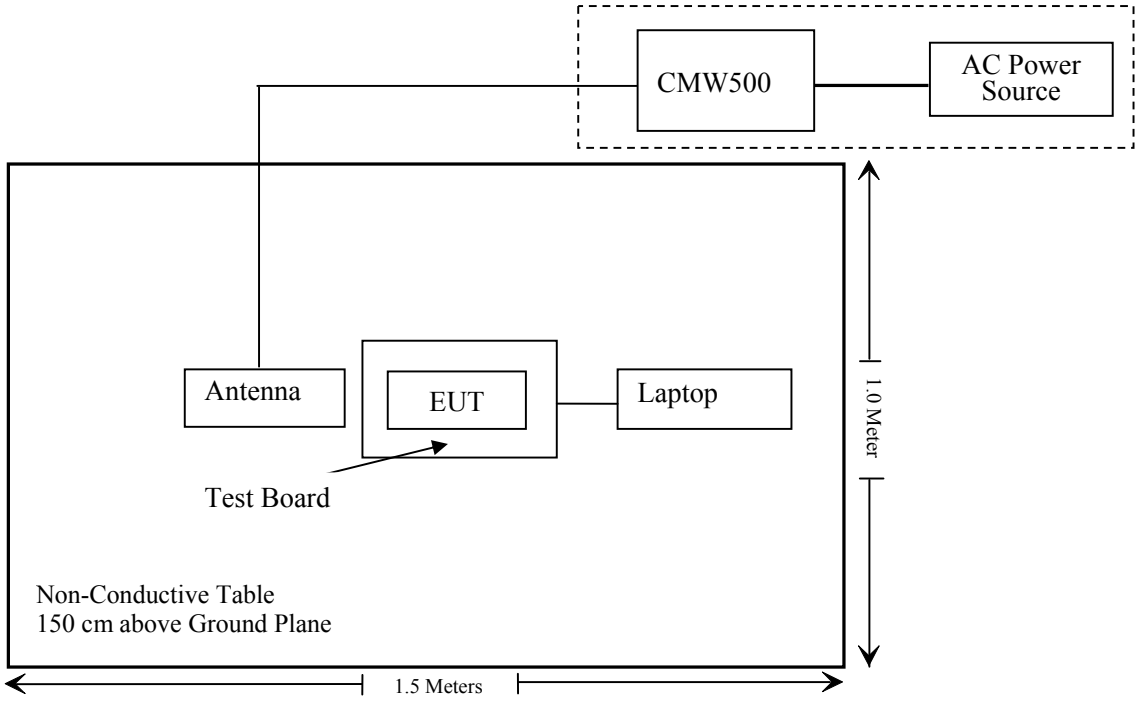
Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	1201.002K50-116218-UY
DELL	Laptop	E6410	GYXJ3A00 JSD2
Pycom Ltd	Expansion Board	/	1630001501

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

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

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017-12-22	2020-12-21
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-04-24	2019-04-24
Sunol Sciences	Bi-log Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2017-05-21	2018-05-21
HP	Amplifier	HP8447E	1937A01046	2017-11-19	2018-05-21
Anritsu	Signal Generator	68369B	004114	2017-12-24	2018-12-24
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR
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	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	104PEA	218124002	2017-11-19	2018-05-21
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2018-04-24	2019-04-24
Ducommun technologies	RF Cable	RG-214	1	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	2	2017-11-19	2018-05-21
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2017-12-29	2020-12-28
Ducommun technologies	Horn Antenna	ARH-4223-02	1007726-03	2017-12-29	2020-12-28
Ducommun technologies	Pre-amplifier	ALN-22093530-01	991373-01	2017-08-03	2018-08-03

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2017-12-21	2018-12-21
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR
Agilent	ESG Vector Signal Generator	E4438C	MY42080875	2018-05-09	2019-05-09
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2018-04-24	2019-04-24
Ducommun technologies	RF Cable	RG-214	3	Each Time	
WEINSCHEL	3dB Attenuator	N/A	N/A	Each Time	
N/A	Power Splitter	N/A	N/A	2017-05-21	2018-05-21

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

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 § 2.1046, §27.50(b)(c) (d) - RF OUTPUT POWER

Applicable Standard

According to §27.50(b), Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

According to §27.50(c), Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

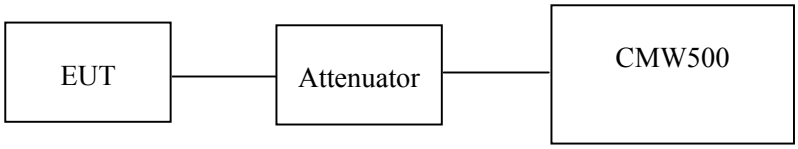
According to §27.50(d), the maximum EIRP must not exceed 1Watts (30dBm) for 1710-1755MHz.

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMW500 through sufficient attenuation.



Radiated method:

TIA 603-D section 2.2.17

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-14.

LTE Band 4:

Maximum Output Power

Bandwidth (MHz)	Modulation	RB size/ NB Index	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5.0	QPSK	RB Size=0, Index=10	22.41	22.52	22.34
		RB Size=6, Index=10	22.15	22.10	22.22
	16QAM	RB Size=0, Index=10	22.24	22.18	22.23
		RB Size=5, Index=10	22.56	22.76	22.88
10.0	QPSK	RB Size=0, Index=10	22.38	22.25	22.57
		RB Size=6, Index=10	22.44	22.39	22.42
	16QAM	RB Size=0, Index=10	22.64	22.45	22.55
		RB Size=5, Index=10	22.442	22.24	22.45
15.0	QPSK	RB Size=0, Index=10	22.34	22.42	22.4
		RB Size=6, Index=10	22.41	22.52	22.3
	16QAM	RB Size=0, Index=10	22.50	22.34	22.3
		RB Size=5, Index=10	22.62	22.5	22.4
20.0	QPSK	RB Size=0, Index=10	22.55	22.55	22.25
		RB Size=6, Index=10	22.46	22.75	22.34
	16QAM	RB Size=0, Index=10	22.62	22.34	22.76
		RB Size=5, Index=10	22.28	22.25	22.46

Peak-to-average ratio (PAR)

Bandwidth	Modulation	Middle Channel (dB)	PAR Limit (dB)	Result
5MHz	QPSK	5.61	13	Pass
	16QAM	5.31	13	Pass
10MHz	QPSK	5.58	13	Pass
	16QAM	5.68	13	Pass
15MHz	QPSK	5.13	13	Pass
	16QAM	5.49	13	Pass
20MHz	QPSK	5.77	13	Pass
	16QAM	5.86	13	Pass

QPSK:

Frequency (MHz)	Receiver Reading (dBµV)	Turn table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		
Middle Channel									
5 MHz Bandwidth									
1732.50	86.25	83	1.3	H	13.1	1.30	9.10	20.9	30
1732.50	84.24	126	1.4	V	11.7	1.30	9.10	19.5	30
10 MHz Bandwidth									
1732.50	85.31	179	1.5	H	12.3	1.30	9.10	20.1	30
1732.50	84.15	341	1.3	V	11.8	1.30	9.10	19.6	30
15 MHz Bandwidth									
1732.50	85.51	162	1.4	H	12.4	1.30	9.10	20.2	30
1732.50	83.40	10	1.6	V	10.9	1.30	9.10	18.7	30
20 MHz Bandwidth									
1732.50	85.23	189	1.3	H	12.0	1.30	9.10	19.8	30
1732.50	84.11	349	1.5	V	11.5	1.30	9.10	19.3	30

16QAM:

Frequency (MHz)	Receiver Reading (dBµV)	Turn table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		
Middle Channel									
5 MHz Bandwidth									
1732.50	86.65	10	1.5	H	13.5	1.30	9.10	21.3	30
1732.50	85.32	175	1.5	V	12.7	1.30	9.10	20.5	30
10 MHz Bandwidth									
1732.50	86.10	196	1.6	H	13.1	1.30	9.10	20.9	30
1732.50	84.96	130	1.4	V	12.5	1.30	9.10	20.3	30
15 MHz Bandwidth									
1732.50	86.34	160	1.3	H	13.2	1.30	9.10	21	30
1732.50	85.46	172	1.3	V	12.8	1.30	9.10	20.6	30
20 MHz Bandwidth									
1732.50	85.21	114	1.4	H	11.8	1.30	9.10	19.6	30
1732.50	84.72	19	1.6	V	12.1	1.30	9.10	19.9	30

LTE Band 12:

Bandwidth (MHz)	Modulation	RB size/ NB Index	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5	QPSK	RB Size=1, Index=10	22.21	22.31	23.24
		RB Size=6, Index=10	21.99	22.12	22.34
	16QAM	RB Size=1, Index=10	22.05	21.89	22.41
		RB Size=5, Index=10	22.13	22.34	22.12
10	QPSK	RB Size=1, Index=10	22.35	22.55	22.37
		RB Size=6, Index=10	22.31	22.24	22.13
	16QAM	RB Size=1, Index=10	22.15	22.27	22.11
		RB Size=5, Index=10	21.96	22.16	22.31

Peak-to-average ratio (PAR)

Bandwidth	Modulation	Middle Channel (dB)	PAR Limit (dB)	Result
5MHz	QPSK	4.93	13	Pass
	16QAM	5.15	13	Pass
10MHz	QPSK	5.24	13	Pass
	16QAM	5.03	13	Pass

EIRP:

QPSK:

Frequency (MHz)	Receiver Reading (dBµV)	Turn table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		
Middle Channel									
5 MHz Bandwidth									
707.5	90.21	275	1.4	H	20.8	0.62	0	20.18	34.77
707.5	90.00	130	1.6	V	21.1	0.62	0	20.48	34.77
10 MHz Bandwidth									
707.5	90.43	79	1.5	H	20.7	0.62	0	20.08	34.77
707.5	89.98	186	1.3	V	20.5	0.62	0	19.88	34.77

16QAM:

Frequency (MHz)	Receiver Reading (dBµV)	Turn table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		
Middle Channel									
5MHz Bandwidth									
707.5	89.56	186	1.5	H	20.1	0.62	0	19.48	34.77
707.5	89.63	173	1.7	V	20.9	0.62	0	20.28	34.77
10 MHz Bandwidth									
707.5	89.63	105	1.6	H	19.9	0.62	0	19.28	34.77
707.5	89.30	320	1.5	V	19.8	0.62	0	19.18	34.77

Note:
All above data were tested with no amplifier
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

LTE Band 13:

Bandwidth (MHz)	Modulation	RB size/ NB Index	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5	QPSK	RB Size=1, Index=10	22.04	22.32	22.39
		RB Size=6, Index=10	22.14	22.42	22.14
	16QAM	RB Size=1, Index=10	22.21	22.28	22.06
		RB Size=5, Index=10	22.19	22.23	22.29
10	QPSK	RB Size=1, Index=10	/	22.51	/
		RB Size=6, Index=10	/	22.36	/
	16QAM	RB Size=1, Index=10	/	22.16	/
		RB Size=5, Index=10	/	22.67	/

Peak-to-average ratio (PAR)

Bandwidth	Modulation	Middle Channel (dB)	PAR Limit (dB)	Result
5MHz	QPSK	5.96	13	Pass
	16QAM	6.05	13	Pass
10MHz	QPSK	6.15	13	Pass
	16QAM	6.21	13	Pass

EIRP:

QPSK:

Frequency (MHz)	Receiver Reading (dBµV)	Turn table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		
Middle Channel									
5 MHz Bandwidth									
782	90.23	277	1.2	H	20.7	0.65	0	20.05	34.77
782	90.01	41	1.4	V	20.5	0.65	0	19.85	34.77
10 MHz Bandwidth									
782	90.24	166	1.4	H	20.7	0.65	0	20.05	34.77
782	90.14	158	1.3	V	19.8	0.65	0	19.15	34.77

16QAM:

Frequency (MHz)	Receiver Reading (dBµV)	Turn table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		
Middle Channel									
5MHz Bandwidth									
782	90.12	49	1.6	H	20.7	0.65	0	20.05	34.77
782	89.96	168	1.8	V	20.5	0.65	0	19.85	34.77
10 MHz Bandwidth									
782	90.21	360	1.5	H	20.7	0.65	0	20.05	34.77
782	89.21	157	1.4	V	20.0	0.65	0	19.35	34.77

Note:
All above data were tested with no amplifier
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

FCC §2.1049 & §27.53 - OCCUPIED BANDWIDTH

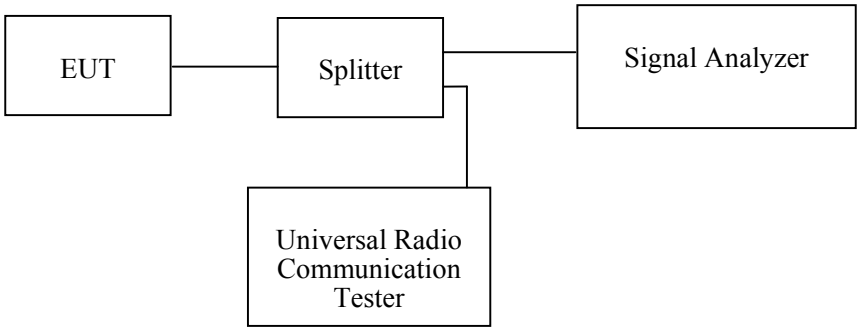
Applicable Standard

FCC 47 §2.1049 and §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 1% to 5% of the anticipated emission bandwidth and the 26 dB & 99% bandwidth was recorded.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-13 and 2018-05-14.

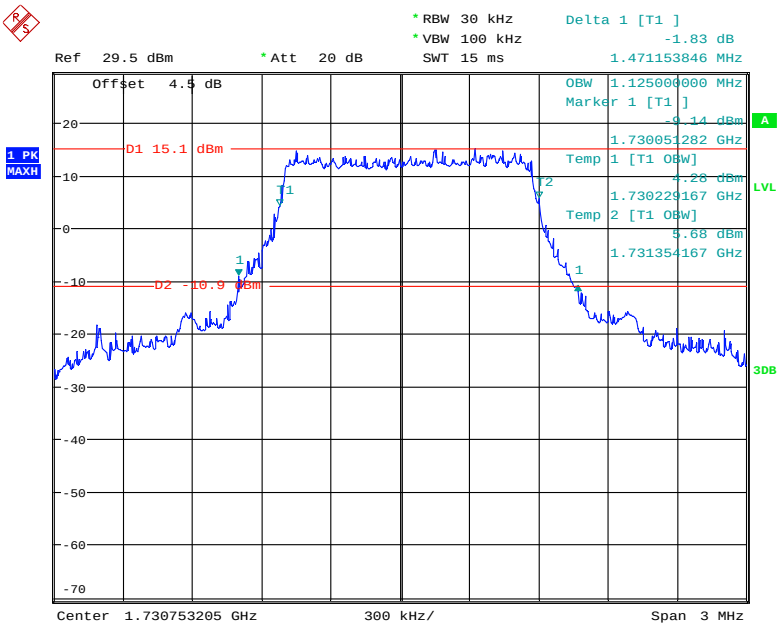
EUT operation mode: Transmitting

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

LTE Band 4: (Middle Channel)

Bandwidth (MHz)	Modulation	99% Occupied Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
5.0	QPSK	1.125	1.471
	16QAM	1.000	1.529
10.0	QPSK	1.135	1.462
	16QAM	0.990	1.462
15.0	QPSK	1.130	1.457
	16QAM	1.014	1.457
20.0	QPSK	1.130	1.471
	16QAM	0.966	1.457

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



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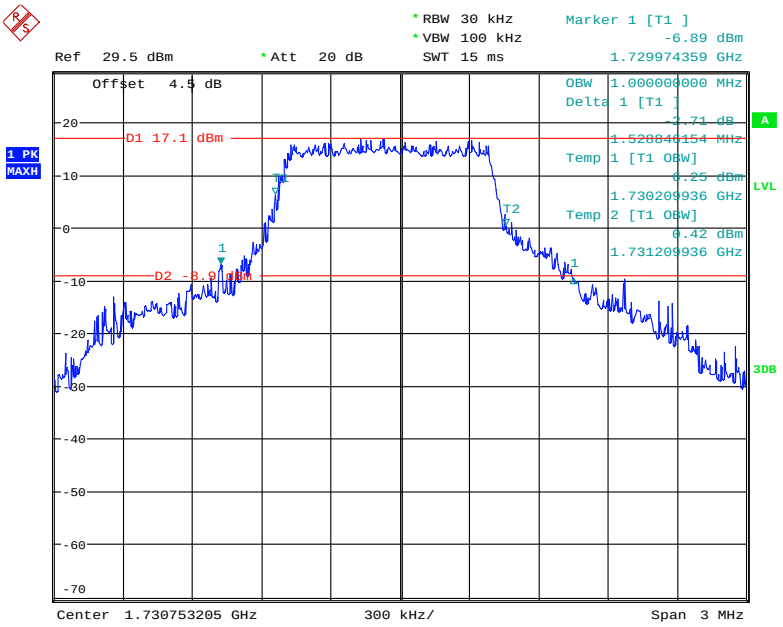
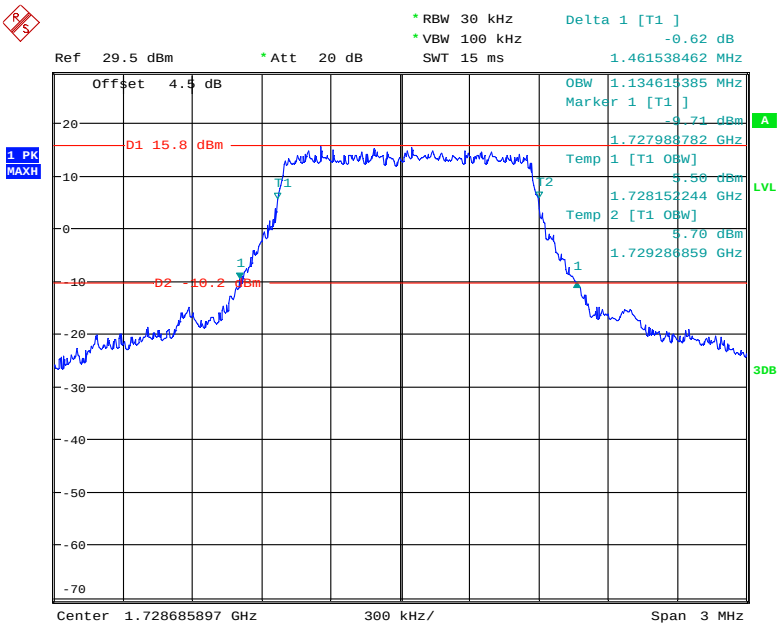
16-QAM (5.0 MHz) - 26 dB Bandwidth & 99% Occupied Bandwidth, Middle channel



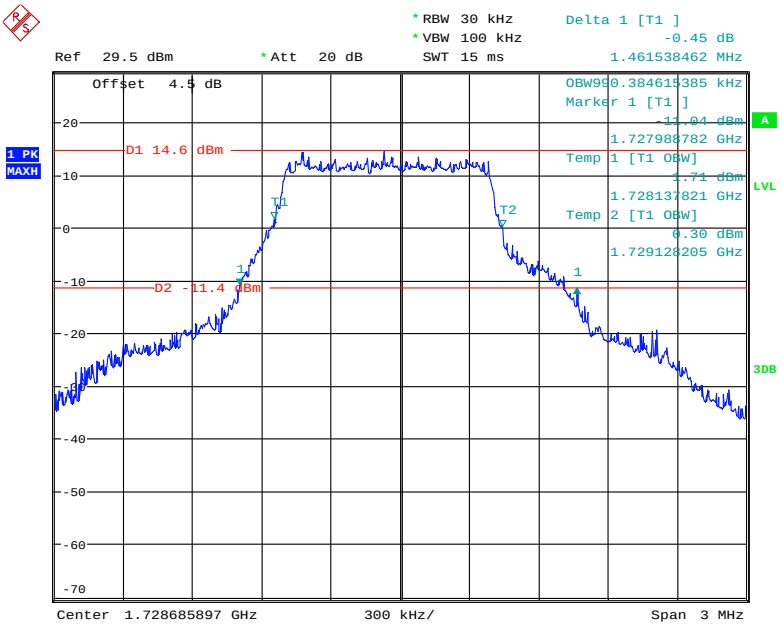
Date: 13.MAY.2018 19:18:44

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



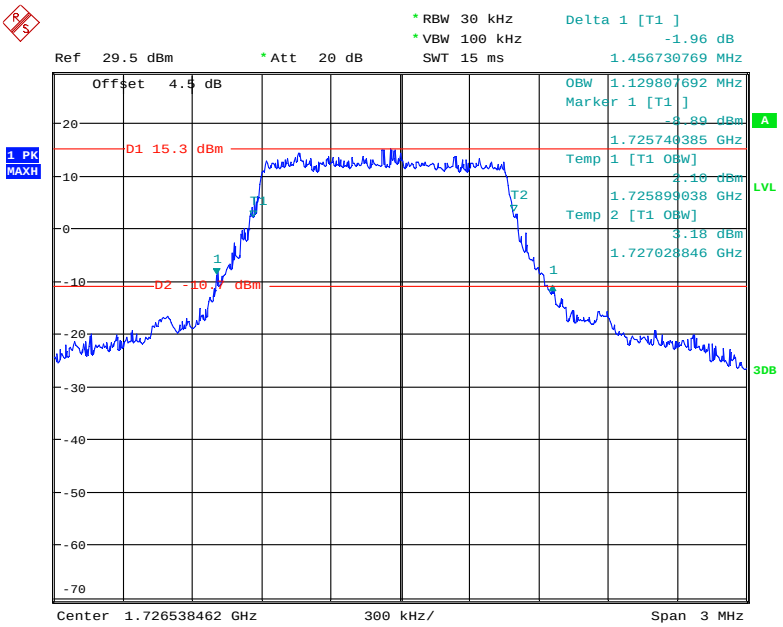
Date: 13.MAY.2018 19:22:57

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



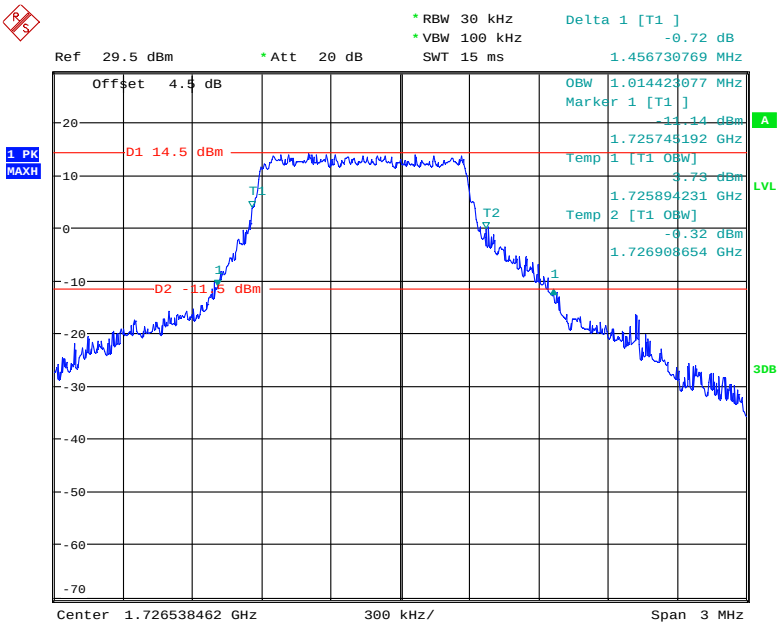
Date: 13.MAY.2018 19:25:00

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



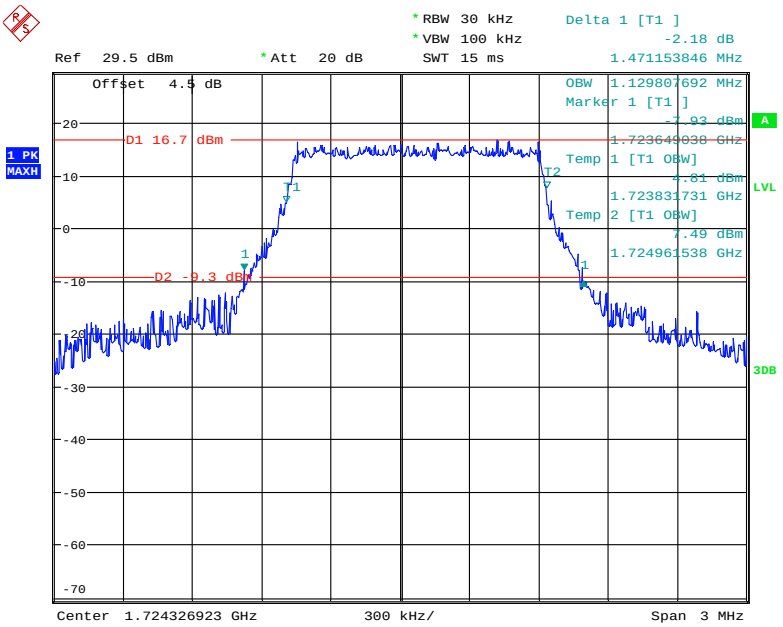
Date: 13.MAY.2018 19:31:57

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



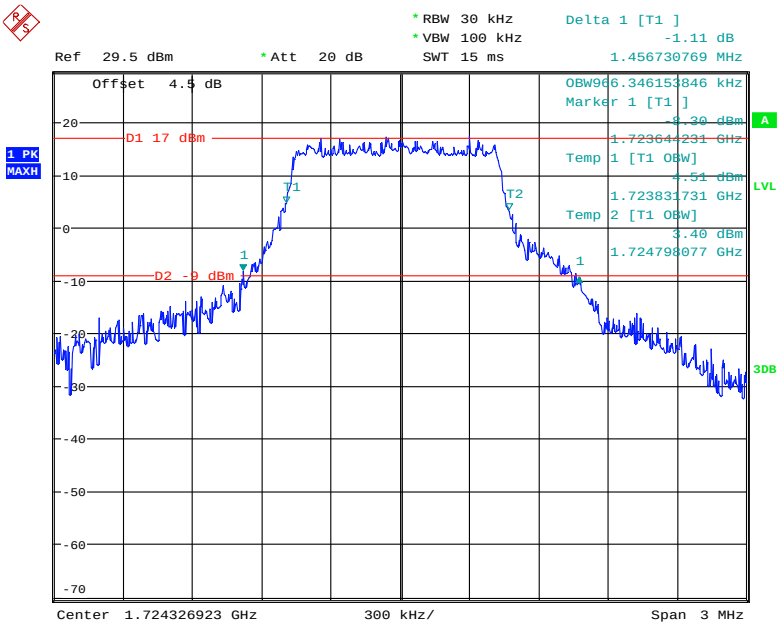
Date: 13.MAY.2018 19:33:45

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



Date: 14.MAY.2018 00:25:50

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

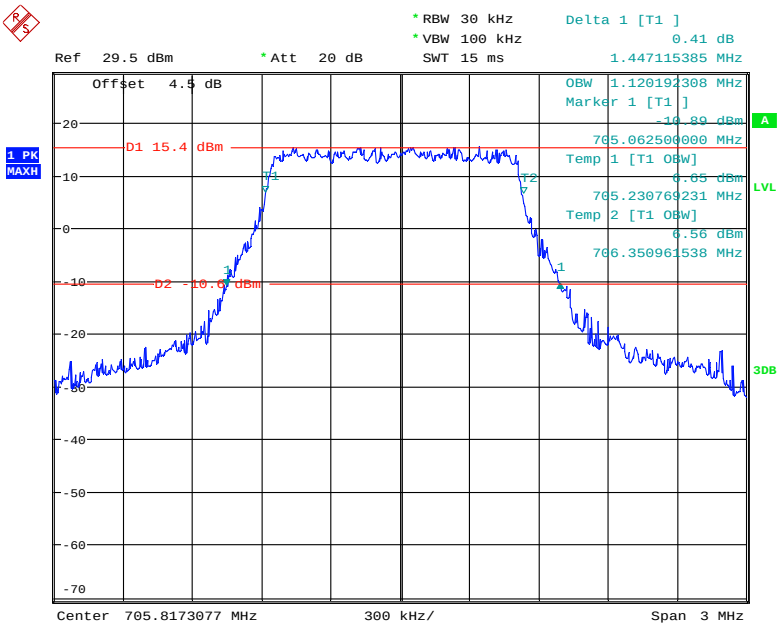


Date: 14.MAY.2018 00:27:03

LTE Band 12: (Middle Channel)

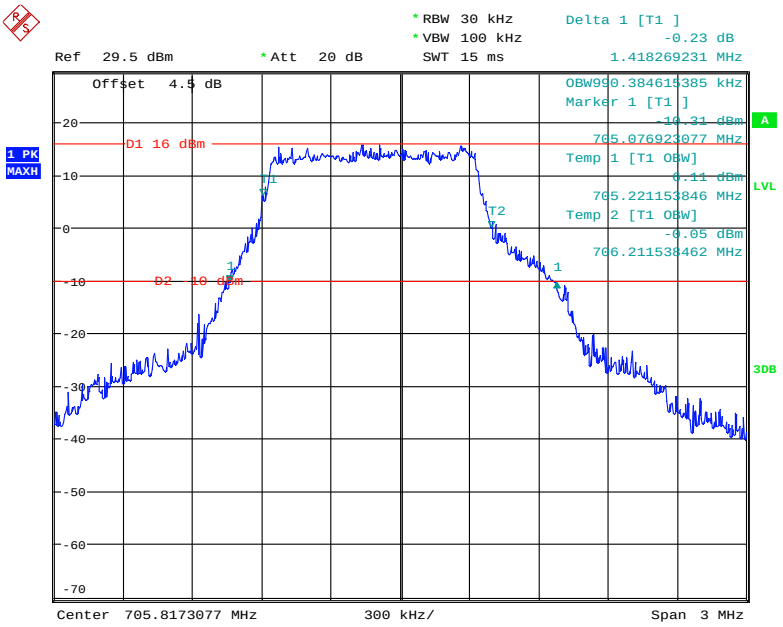
Bandwidth (MHz)	Modulation	99% Occupied Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
5.0	QPSK	1.120	1.447
	16QAM	0.990	1.418
10.0	QPSK	1.139	1.500
	16QAM	0.990	1.490

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



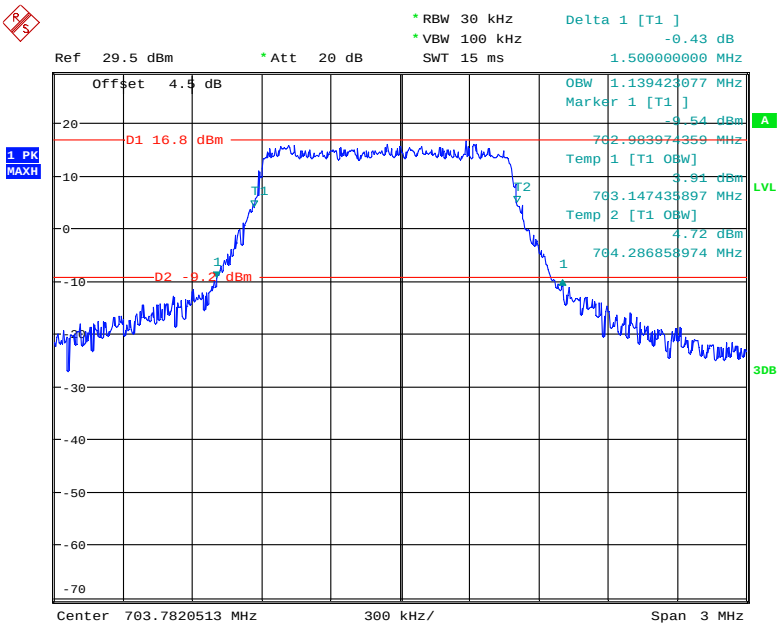
Date: 13.MAY.2018 19:39:49

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



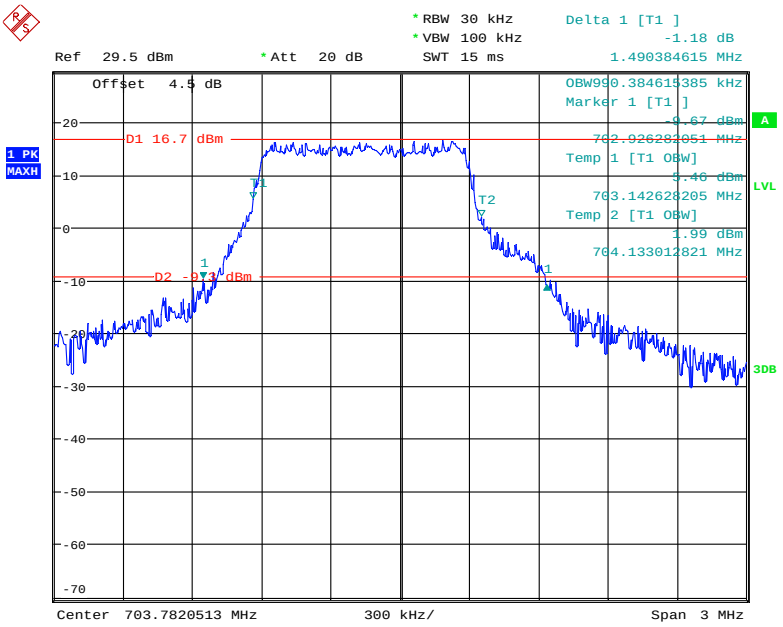
Date: 13.MAY.2018 19:41:48

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



Date: 14.MAY.2018 00:21:12

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

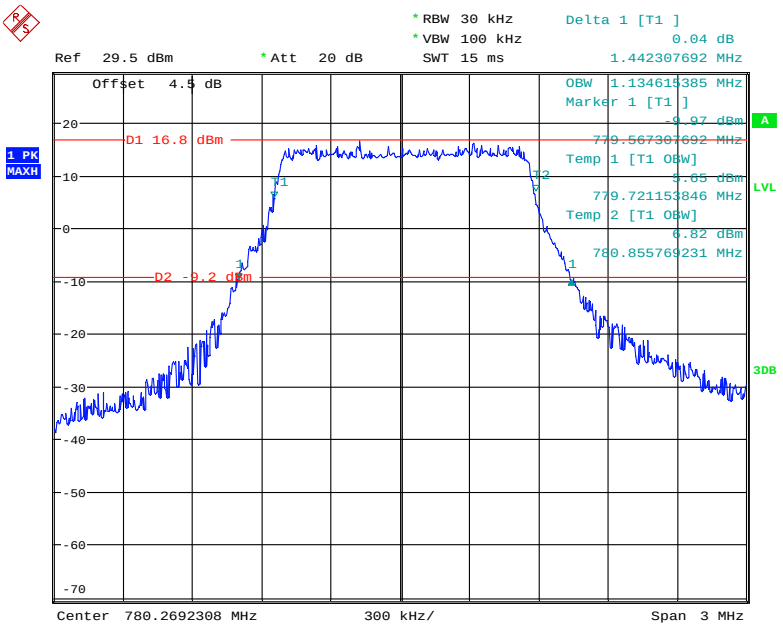


Date: 14.MAY.2018 00:22:55

LTE Band 13: (Middle Channel)

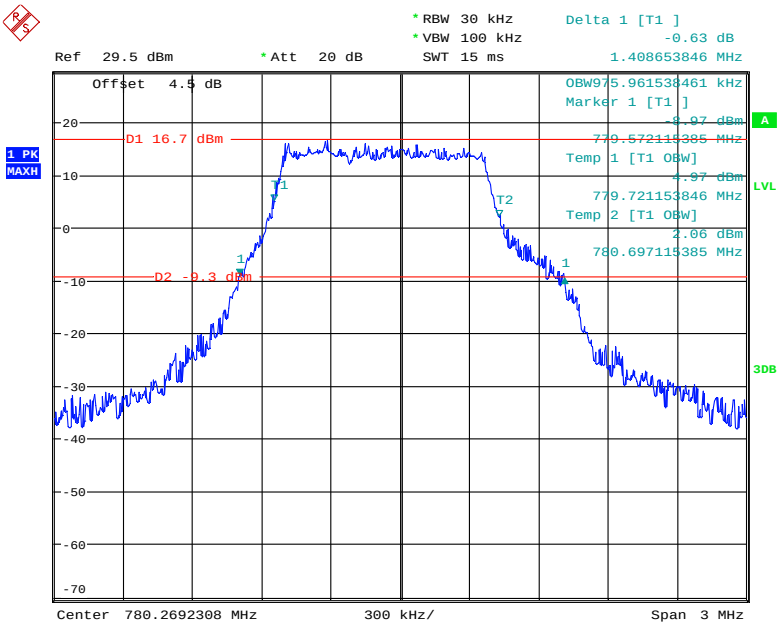
Bandwidth (MHz)	Modulation	99% Occupied Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
5.0	QPSK	1.135	1.442
	16QAM	0.976	1.409
10.0	QPSK	1.135	1.572
	16QAM	0.986	1.486

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



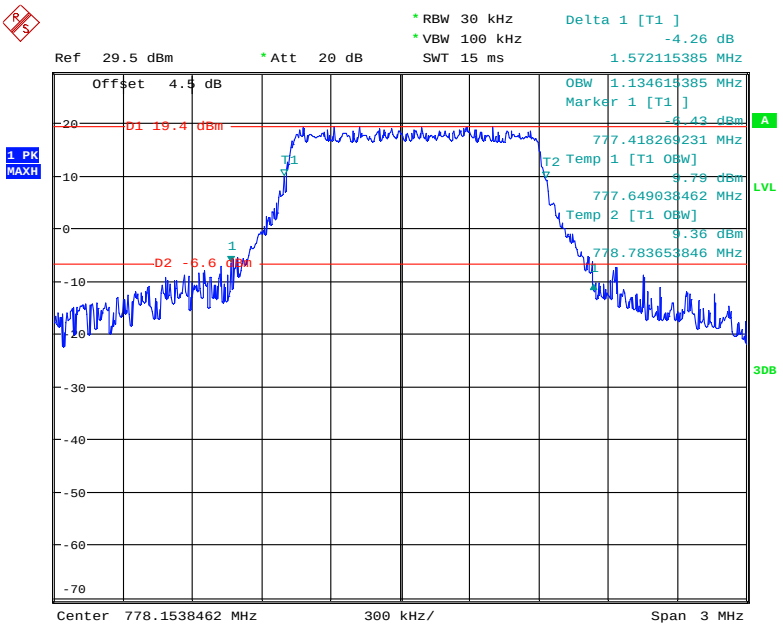
Date: 13.MAY.2018 19:53:09

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



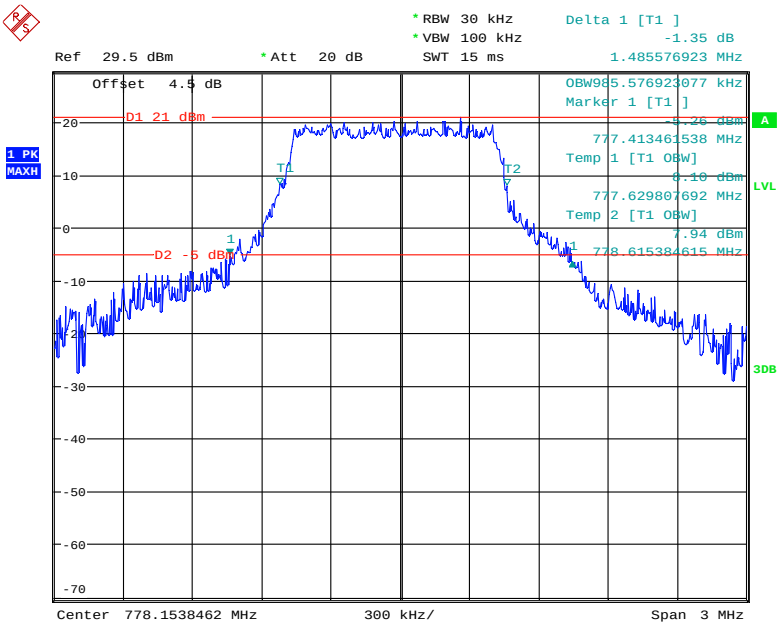
Date: 13.MAY.2018 19:55:24

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



Date: 14.MAY.2018 00:16:31

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



Date: 14.MAY.2018 00:17:46

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

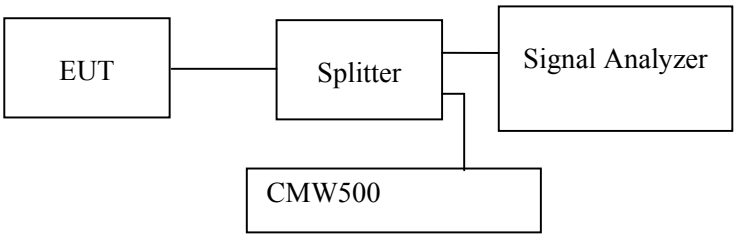
Applicable Standard

FCC §2.1051 and §27.53(c) (f) (g) (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 Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-12 and 2018-05-13.

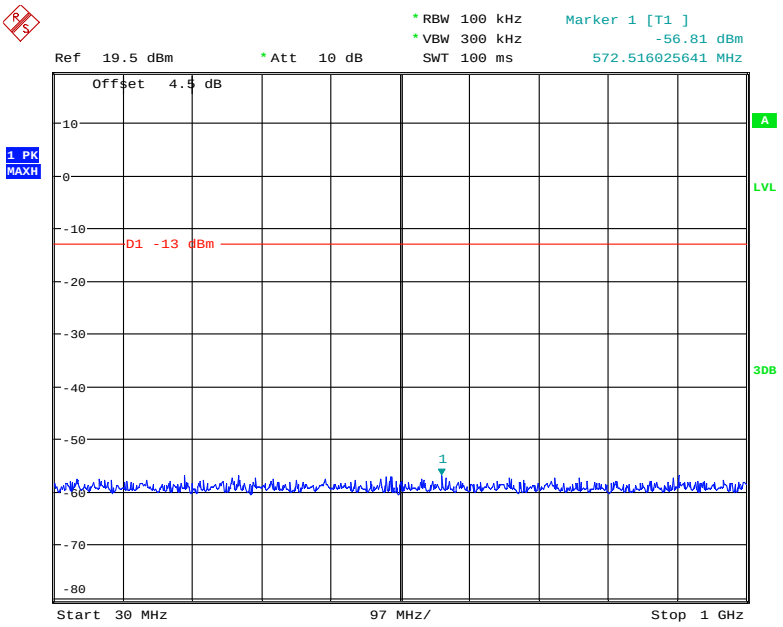
Test result: Compliance.

EUT operation mode: transmitting

Please refer to the following plots.

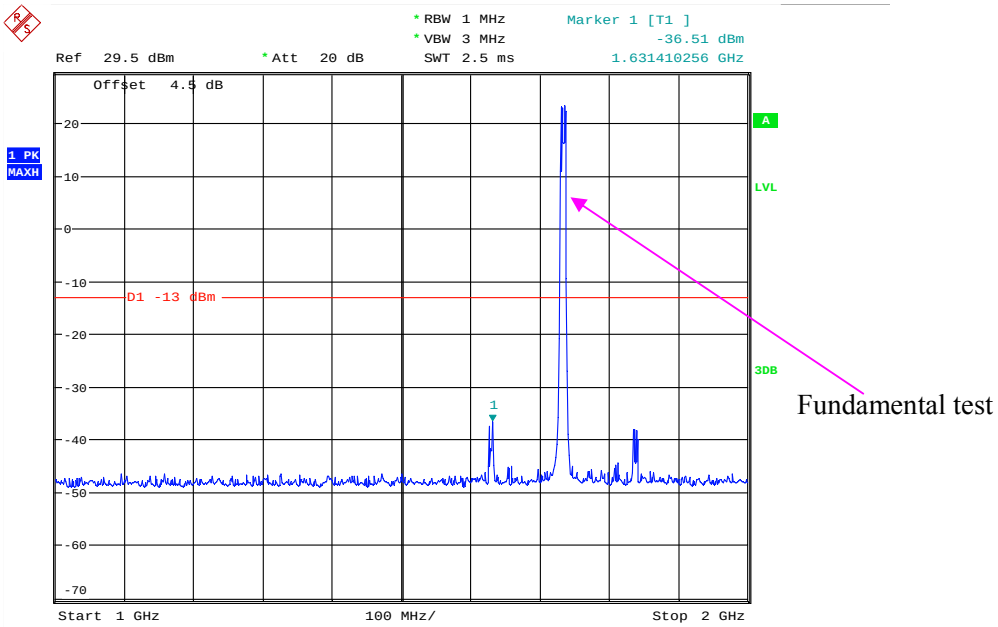
LTE Band 4:

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



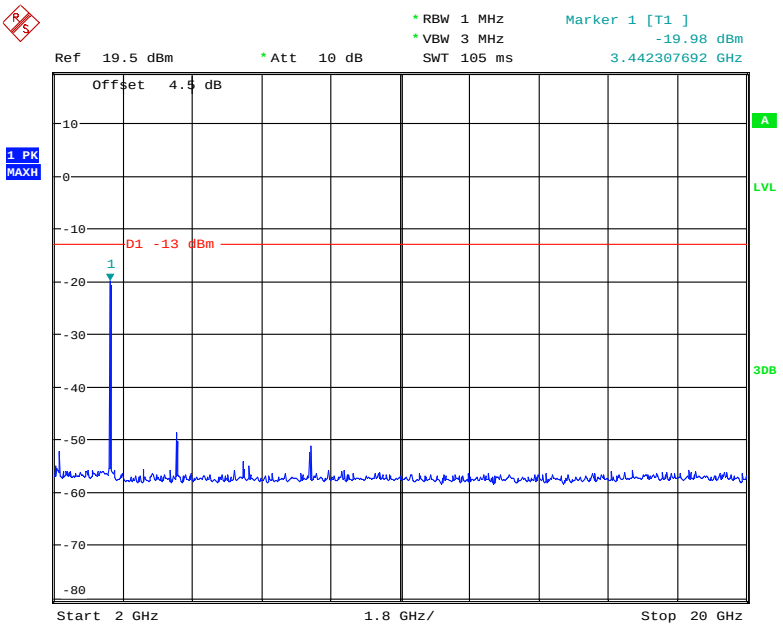
Date: 13.MAY.2018 10:19:53

1 GHz – 2 GHz (5.0 MHz, Middle Channel)



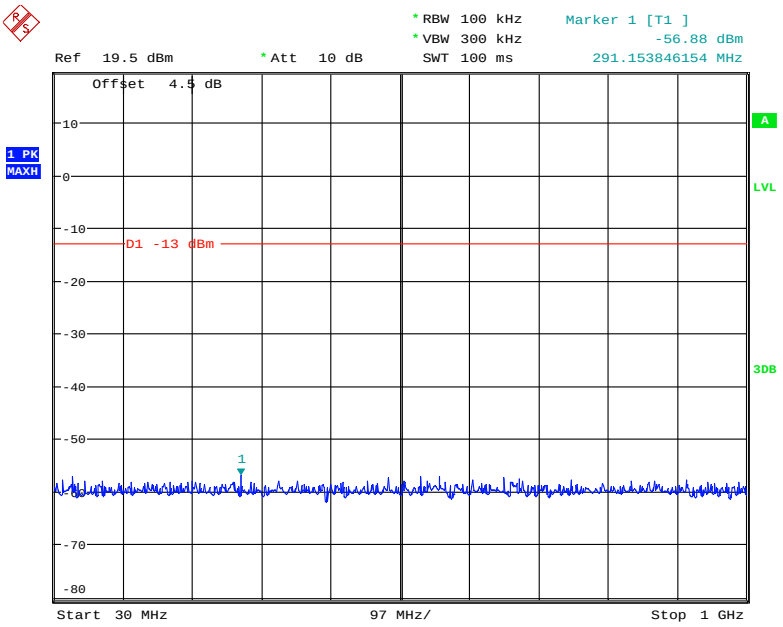
Date: 13.MAY.2018 10:20:53

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



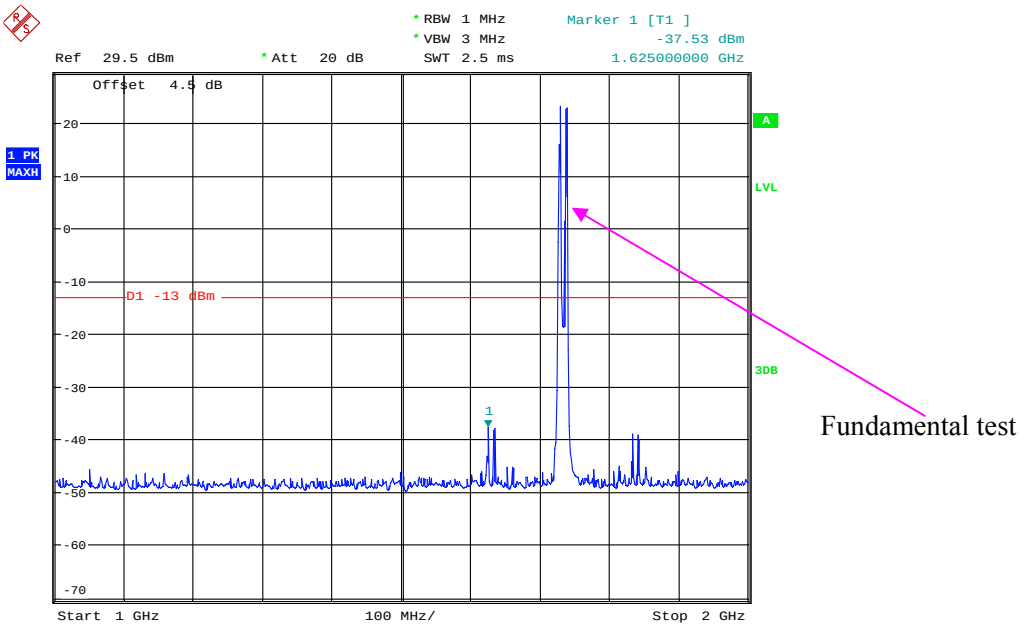
Date: 13.MAY.2018 10:22:57

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



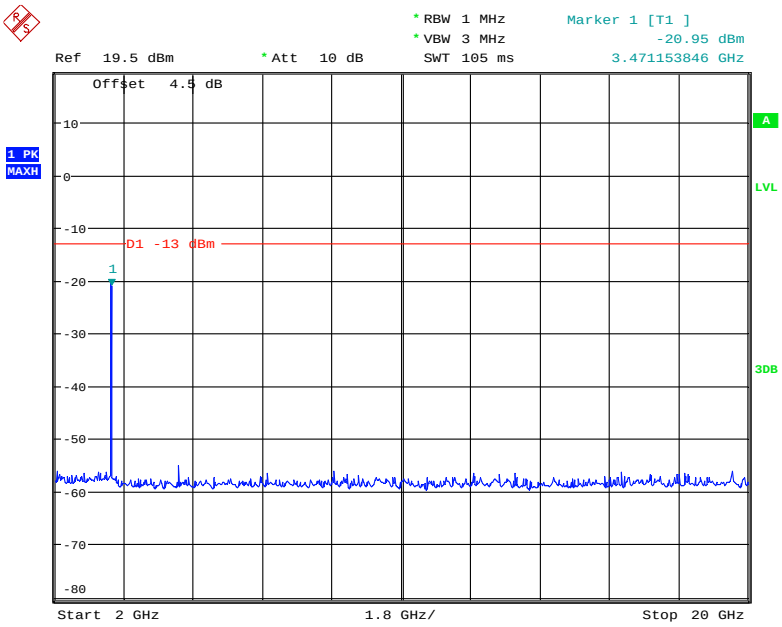
Date: 13.MAY.2018 10:26:24

1 GHz – 2 GHz (10.0 MHz, Middle Channel)



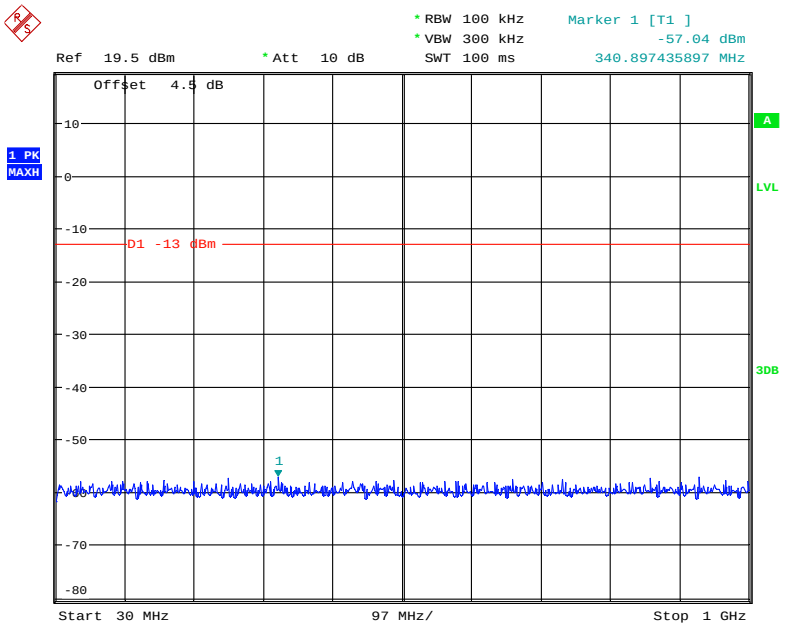
Date: 13.MAY.2018 10:25:03

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



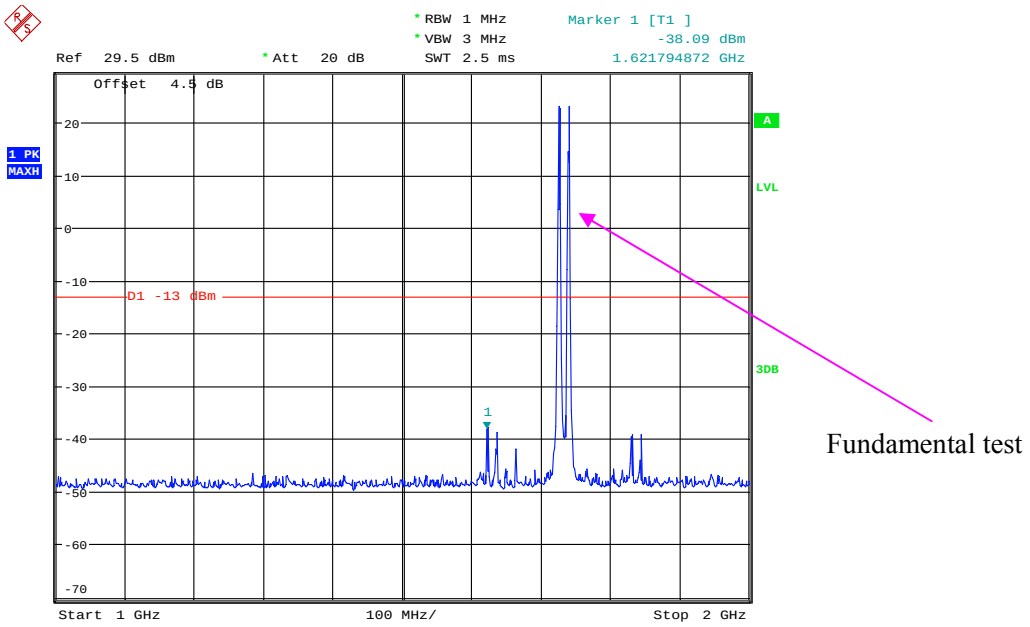
Date: 13.MAY.2018 10:24:33

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



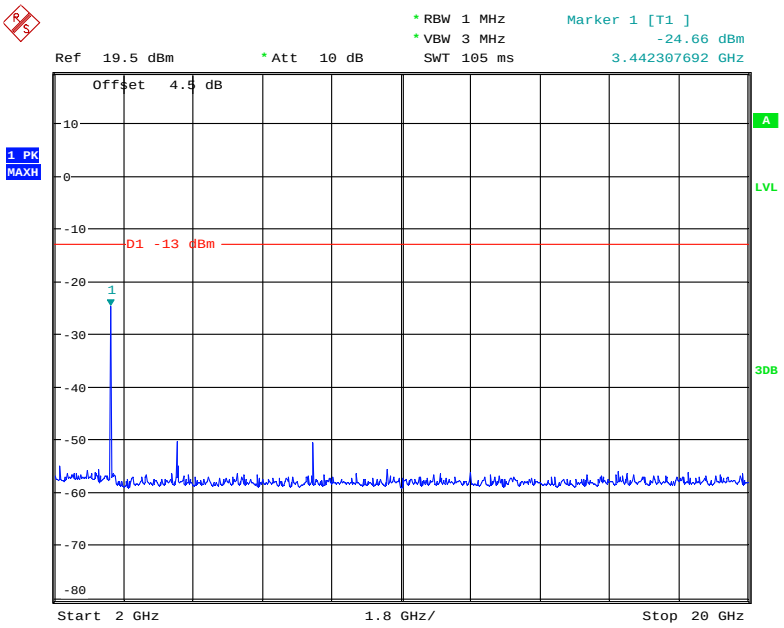
Date: 13.MAY.2018 10:27:58

1 GHz – 2 GHz (15.0 MHz, Middle Channel)



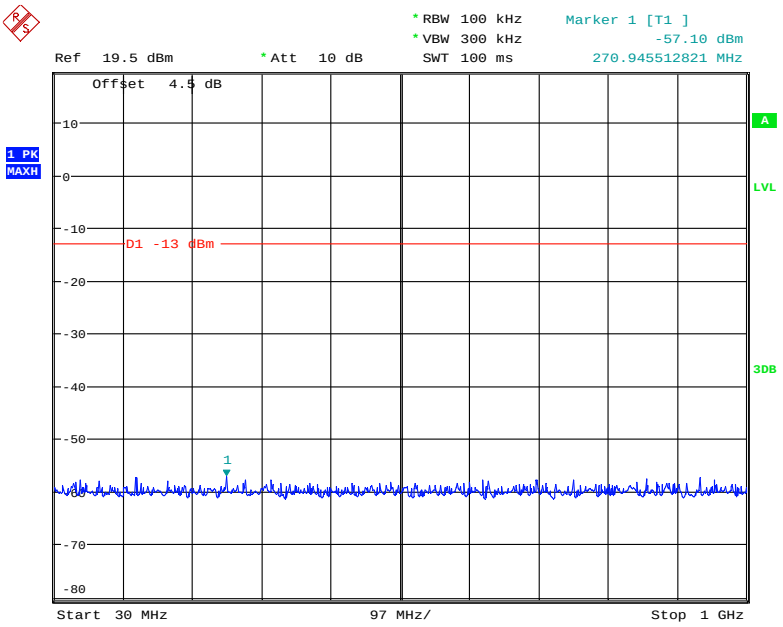
Date: 13.MAY.2018 10:28:32

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



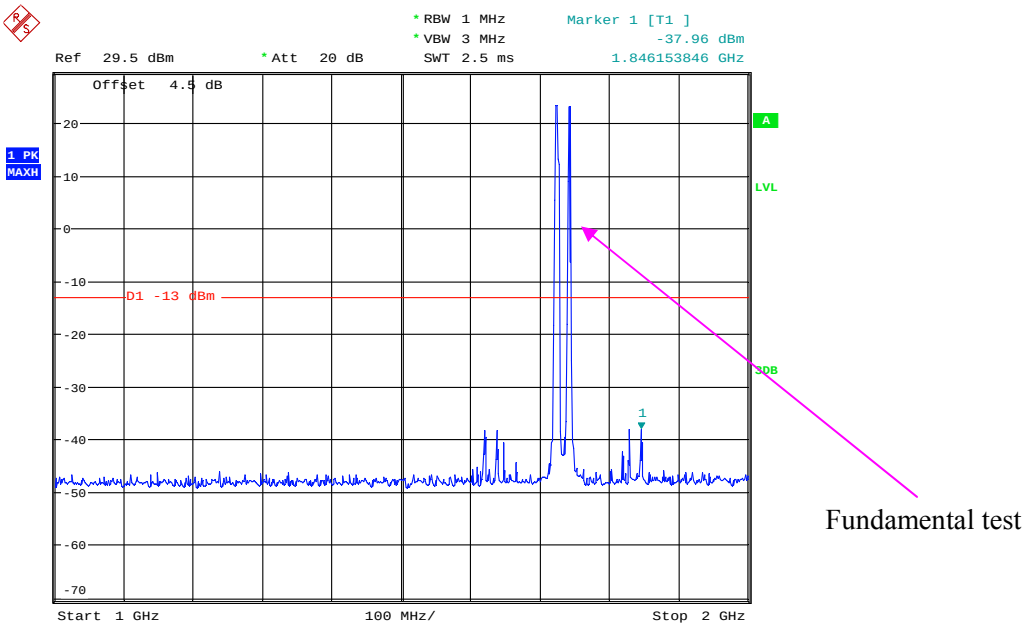
Date: 13.MAY.2018 10:29:38

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



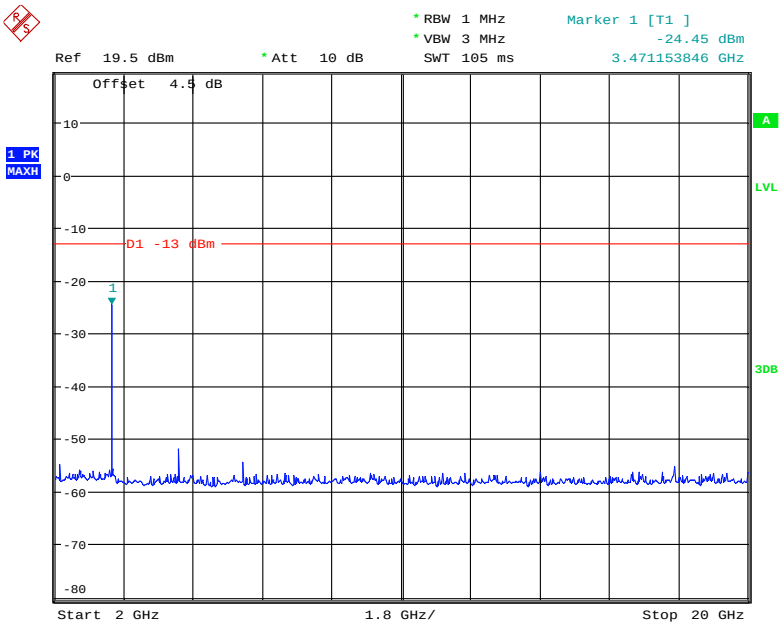
Date: 13.MAY.2018 10:33:23

1 GHz – 2 GHz (20.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:31:59

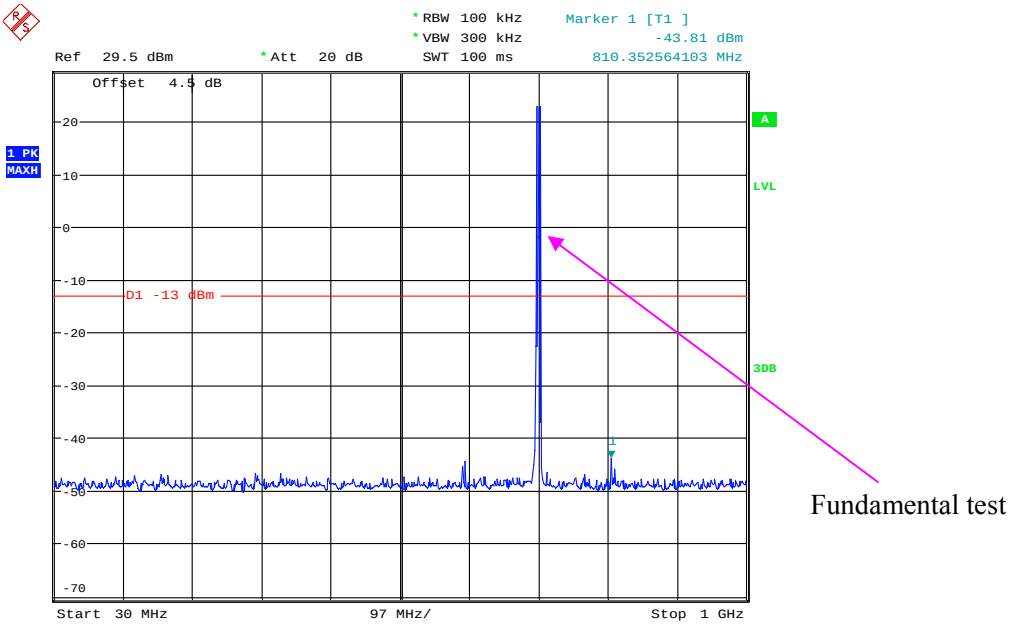
2 GHz – 20 GHz (20.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:31:24

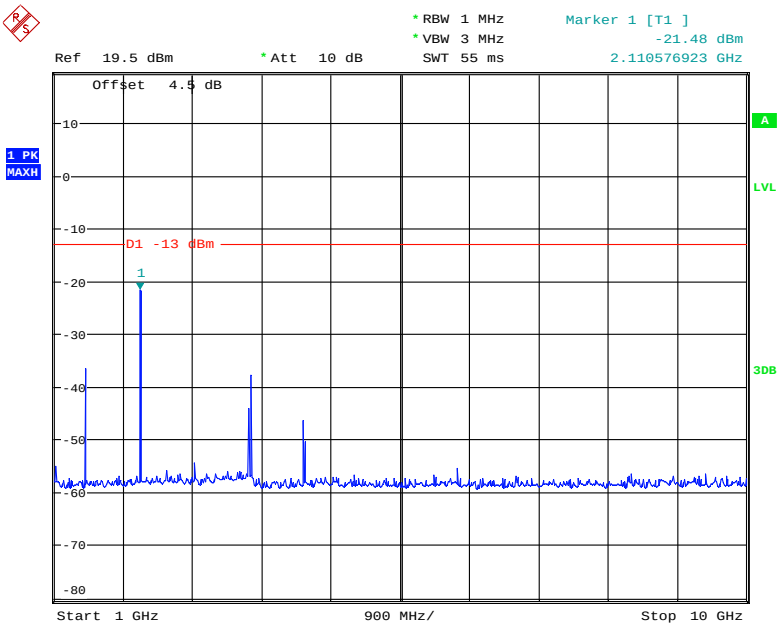
LTE Band 12:

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



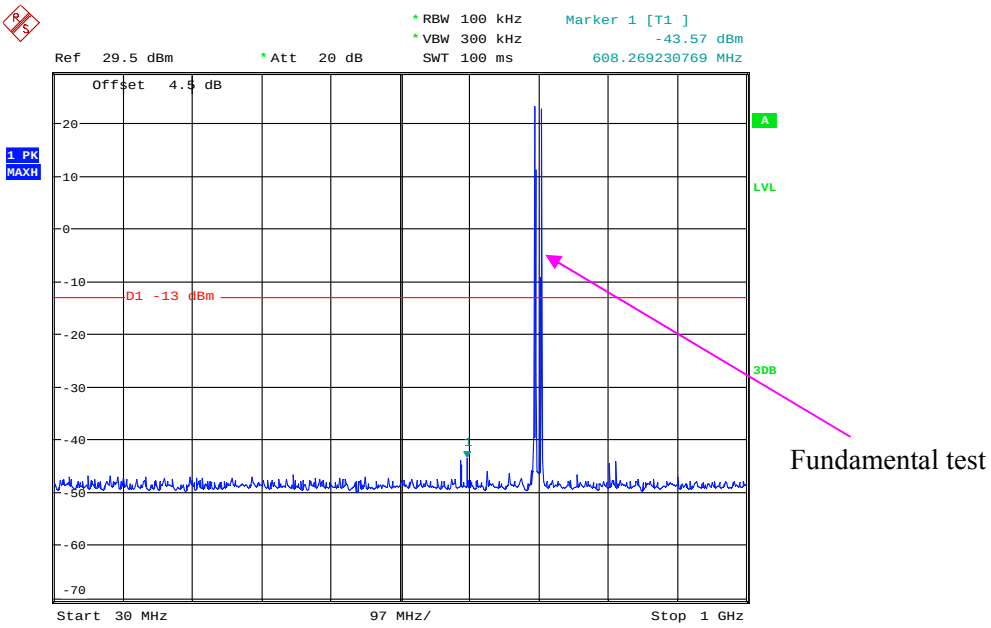
Date: 13.MAY.2018 10:42:38

1 GHz – 8GHz (5.0 MHz, Middle Channel)



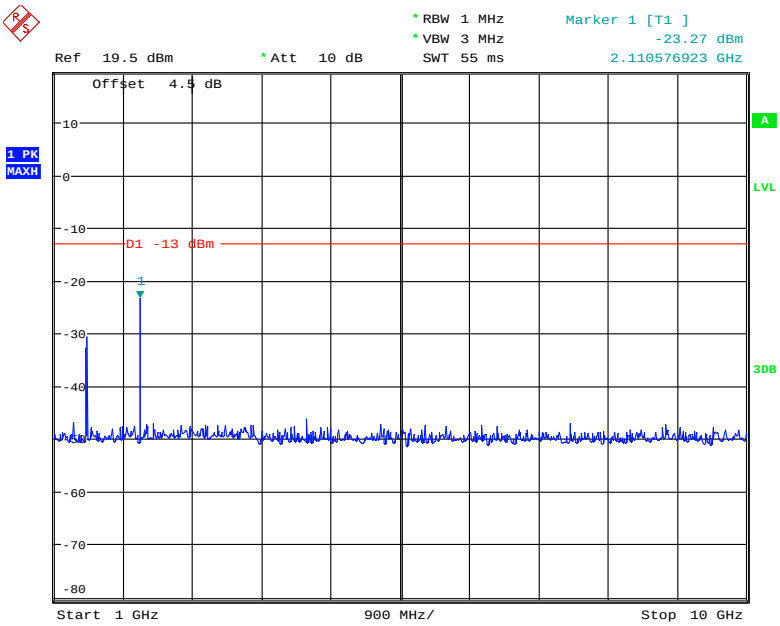
Date: 13.MAY.2018 10:41:58

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



Date: 13.MAY.2018 10:38:45

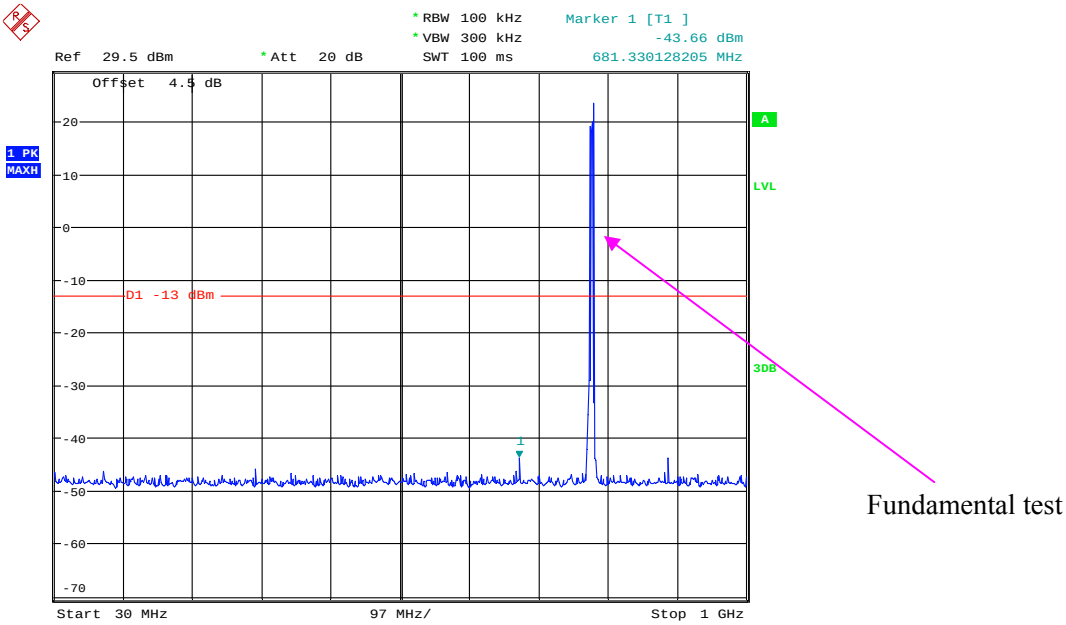
1 GHz – 8 GHz (10.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:39:16

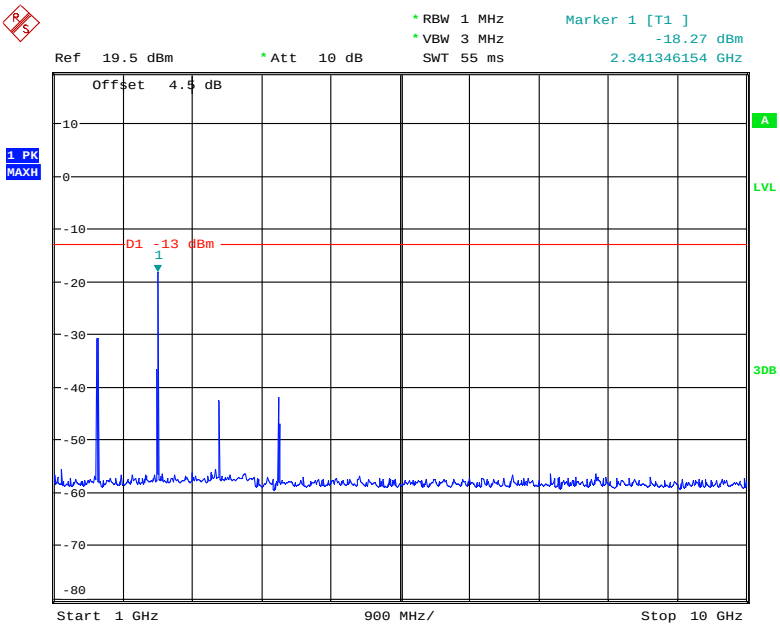
LTE Band 13:

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



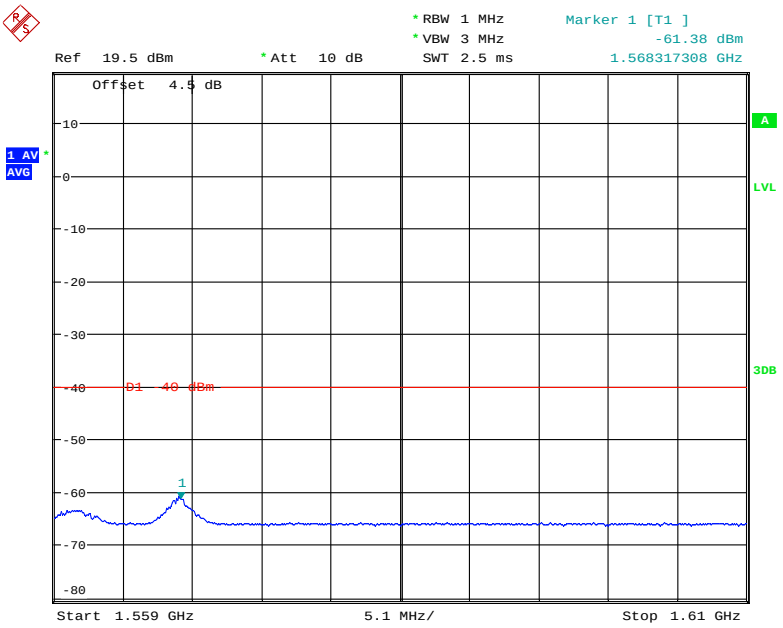
Date: 13.MAY.2018 10:46:25

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



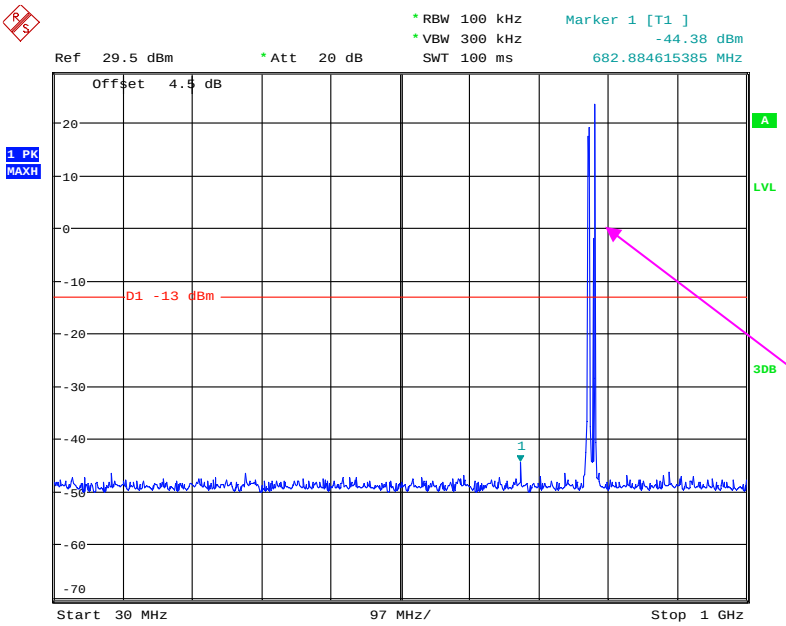
Date: 13.MAY.2018 10:48:42

1.559 GHz – 1.610 GHz (5.0 MHz, Middle Channel)



Date: 13.MAY.2018 11:00:06

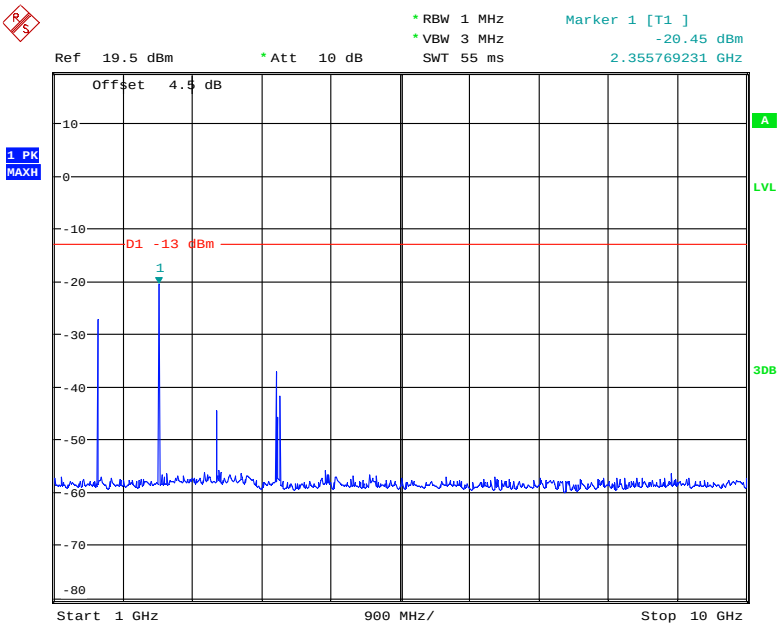
30 MHz – 1 GHz (10.0 MHz, Middle Channel)



Fundamental test

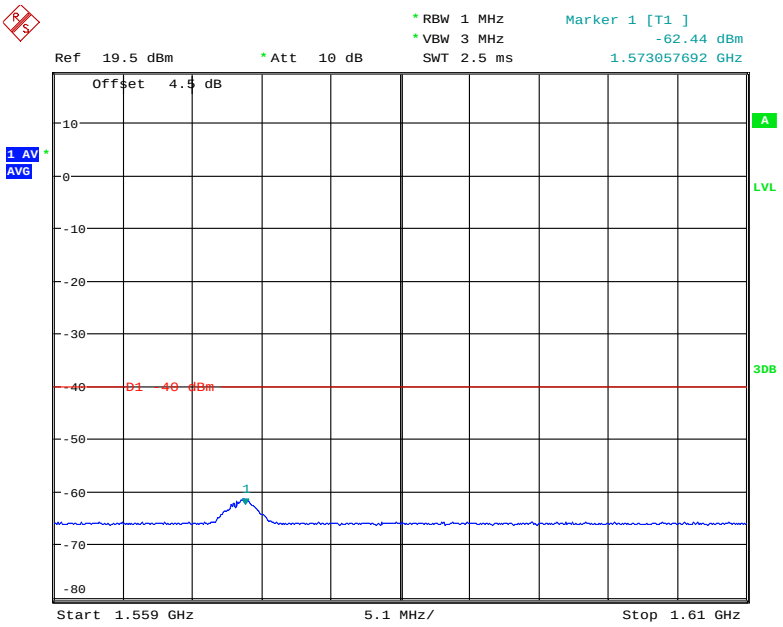
Date: 13.MAY.2018 10:52:23

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



Date: 13.MAY.2018 10:50:10

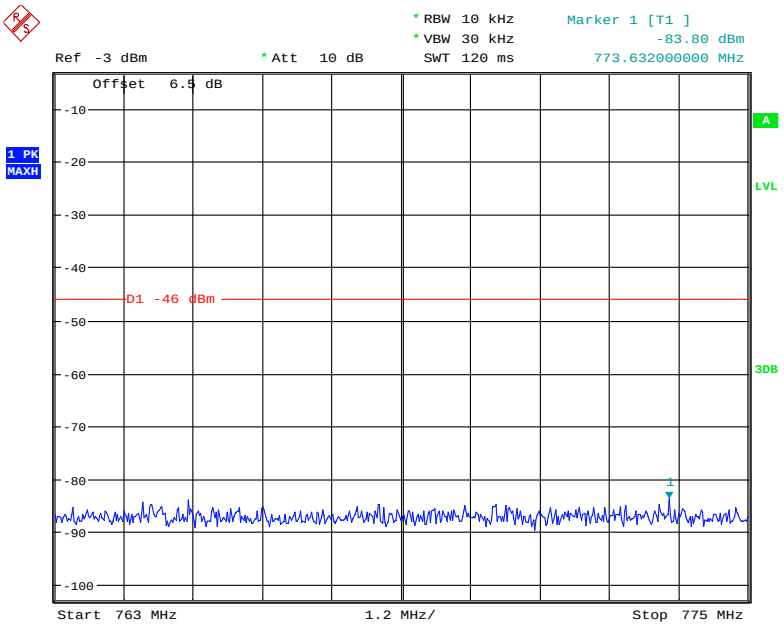
1.559 GHz – 1.610 GHz (10.0 MHz, Middle Channel)



Date: 13.MAY.2018 10:57:15

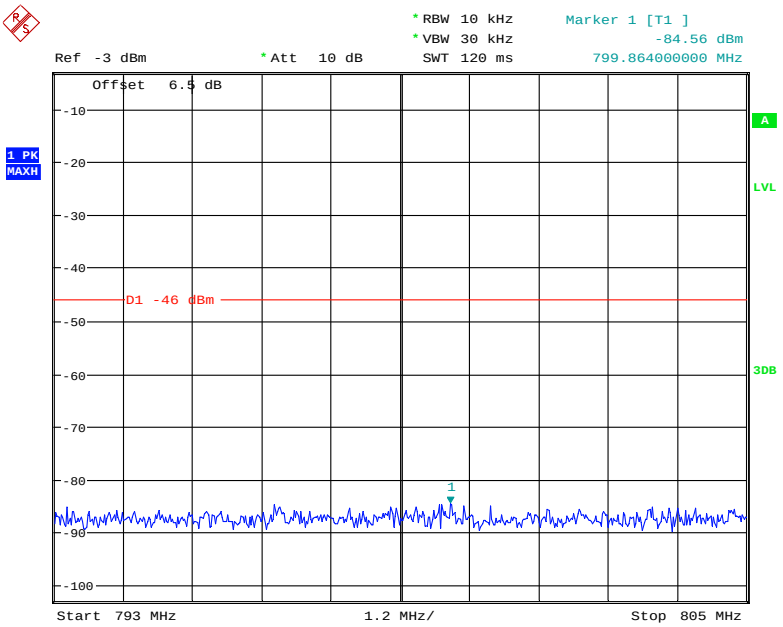
Additional Conducted Spurious Emissions Evaluations in accordance with FCC §27.53 (c)
Note: because of RBW 6.25kHz convert to 10kHz, 10lg(10/6.25)=2, offset added with more 2dB.

763 MHz – 775 MHz, 5MHz



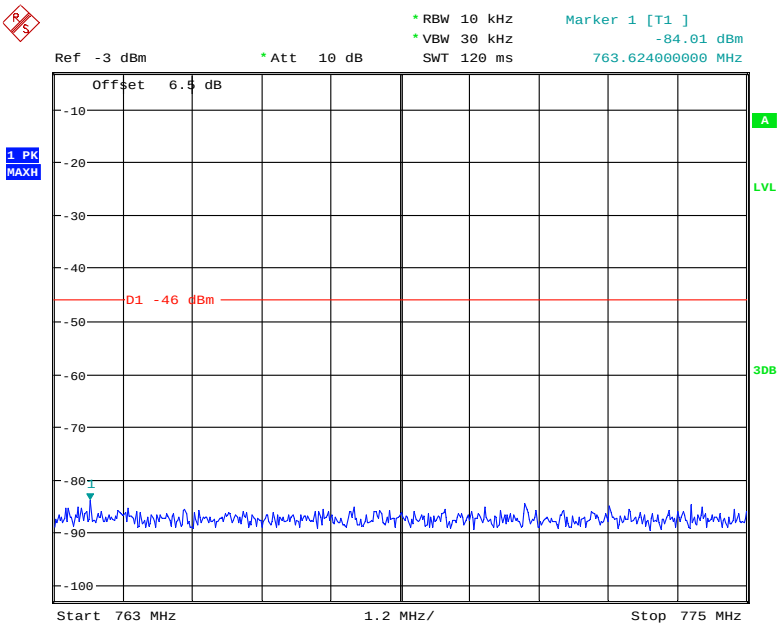
Date: 12.MAY.2018 13:32:49

793 MHz – 805 MHz, 5MHz



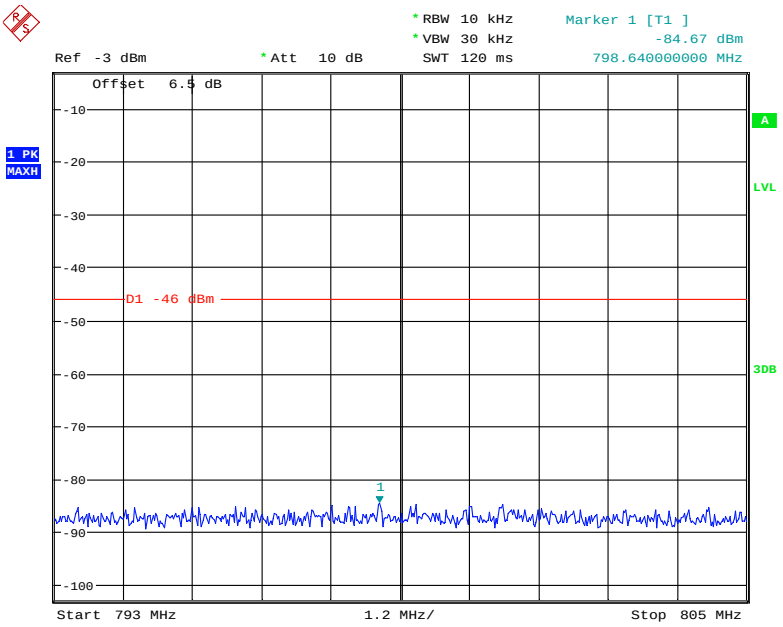
Date: 12.MAY.2018 13:33:15

763 MHz – 775 MHz, 10MHz



Date: 12.MAY.2018 13:35:57

793 MHz – 805 MHz, 10MHz



Date: 12.MAY.2018 13:35:39

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

Applicable Standard

FCC § 2.1053 and § 27.53(c) (g)(h)

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 receiving 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.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-13.

EUT operation mode: Transmitting

Pre-scan with Low, Middle and High channel, the worst case as below:

LTE Band: *(Pre-scan with all the bandwidth, and worse case as below)*

Frequency	Receiver	Turntable	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
(MHz)	Reading (dBμV)	Angle Degree	Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBi)			
Band 4										
Test frequency range:30 MHz ~ 18 GHz										
386.20	33.05	294	2.5	H	-63.9	0.42	0	-64.32	-13	51.32
386.20	34.55	265	2.3	V	-62.4	0.26	0	-62.66	-13	49.66
3465.00	55.28	36	2.1	H	-45.1	1.50	12.00	-34.60	-13	21.60
3465.00	53.52	279	1.4	V	-47.6	1.50	12.00	-37.10	-13	24.10
5197.50	46.51	345	1.1	H	-52.1	1.60	12.10	-41.60	-13	28.60
5197.50	48.91	280	1.8	V	-49.2	1.60	12.10	-38.70	-13	25.70
6930.00	44.21	249	2.3	H	-51.3	1.80	11.30	-41.80	-13	28.80
6930.00	48.47	134	2.4	V	-47.1	1.80	11.30	-37.60	-13	24.60
Band 12										
Test frequency range: 30 MHz ~ 10GHz										
386.20	33.74	229	1.5	H	-63.3	0.42	0	-63.72	-13	50.72
386.20	34.68	315	1.4	V	-62.3	0.26	0	-62.56	-13	49.56
1415.00	47.1	6	1.5	H	-60.7	1.60	7.90	-54.40	-13	41.40
1415.00	49.21	250	1.9	V	-58.9	1.60	7.90	-52.60	-13	39.60
2122.50	69.09	62	2.0	H	-33.0	1.30	9.70	-24.60	-13	11.60
2122.50	71.61	269	1.7	V	-31.3	1.30	9.70	-22.90	-13	9.90
2830.00	44.05	154	1.9	H	-59.7	1.80	10.50	-51.00	-13	38.00
2830.00	43.67	119	1.8	V	-59.8	1.80	10.50	-51.10	-13	38.10
Band 13										
Test frequency range: 30 MHz ~ 10GHz										
386.20	34.97	28	1.8	H	-62.0	0.42	0	-62.42	-13	49.42
386.20	34.13	208	1.4	V	-62.9	0.26	0	-63.16	-13	50.16
1564.00	71.84	60	2.5	H	-36.2	1.40	8.70	-28.90	-13	15.90
1564.00	74.93	135	2.0	V	-32.9	1.40	8.70	-25.60	-13	12.60
2346.00	73.14	347	1.9	H	-31.4	1.30	10.00	-22.70	-13	9.70
2346.00	69.97	340	1.1	V	-34.4	1.30	10.00	-25.70	-13	12.70
3128.00	44.81	296	1.1	H	-56.5	1.70	11.30	-46.90	-13	33.90
3128.00	45.06	175	1.8	V	-56.1	1.70	11.30	-46.50	-13	33.50

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

§27.53 (c) (g)(h) - BAND EDGES

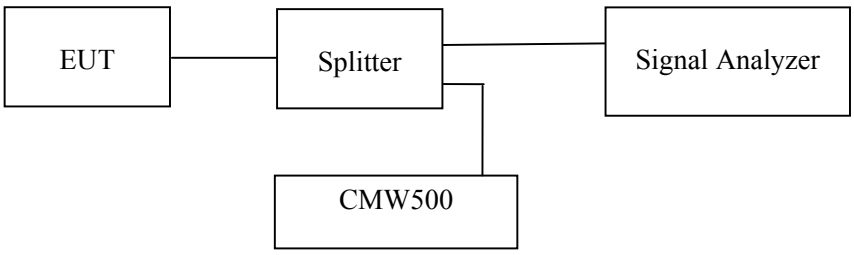
Applicable Standard

According to FCC §27.53(c) (g)(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.

Test Procedure

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

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



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

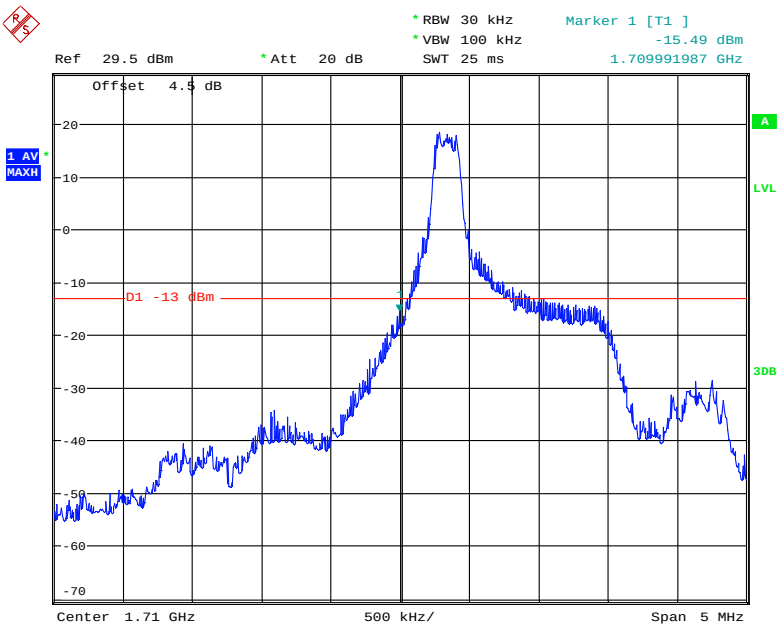
The testing was performed by Jacob Kong on 2018-05-13 and 2018-05-14.

EUT operation mode: Transmitting

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

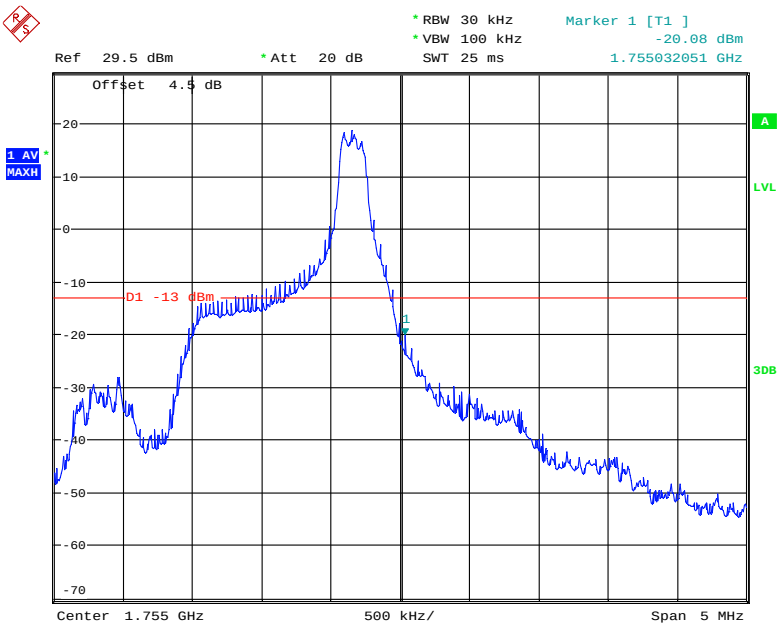
Band 4:

QPSK (5.0 MHz, RB0) - Left Band Edge



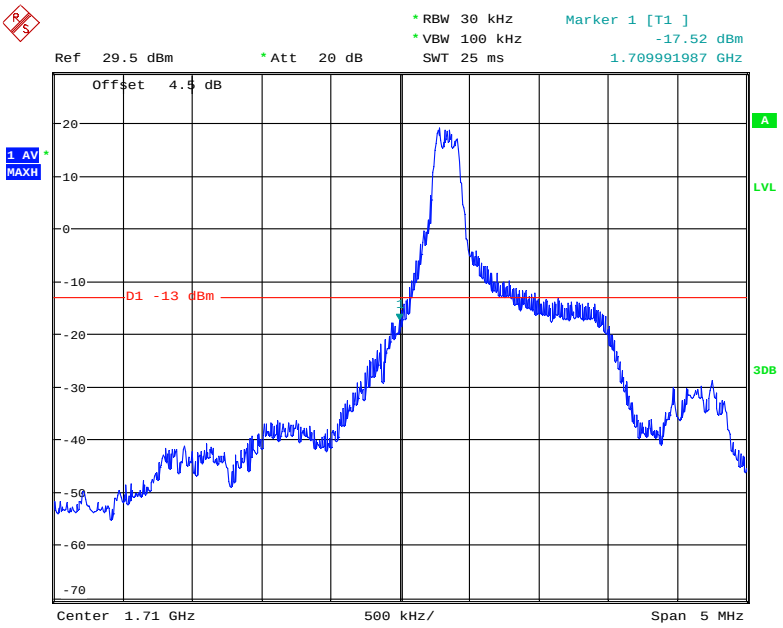
Date: 13.MAY.2018 21:17:20

QPSK (5.0 MHz, RB0) - Right Band Edge



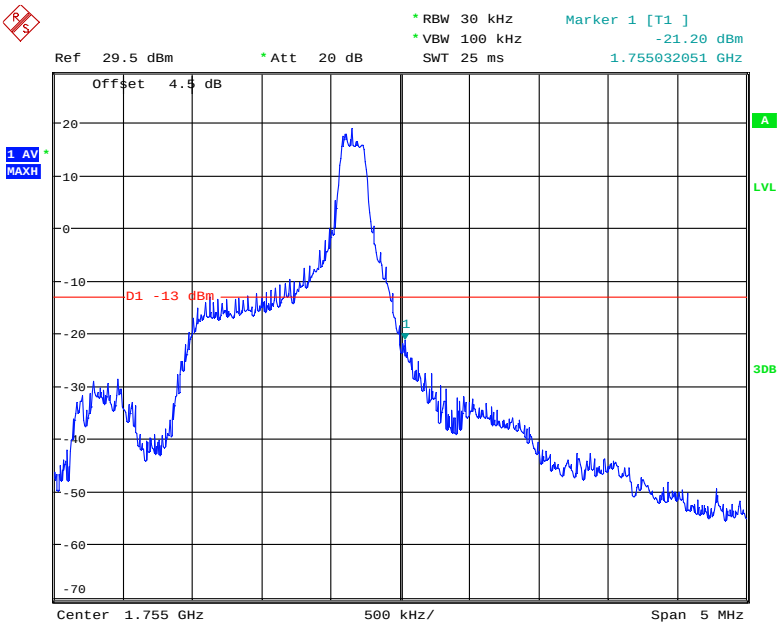
Date: 13.MAY.2018 21:29:47

16-QAM (5.0 MHz, RB0) - Left Band Edge



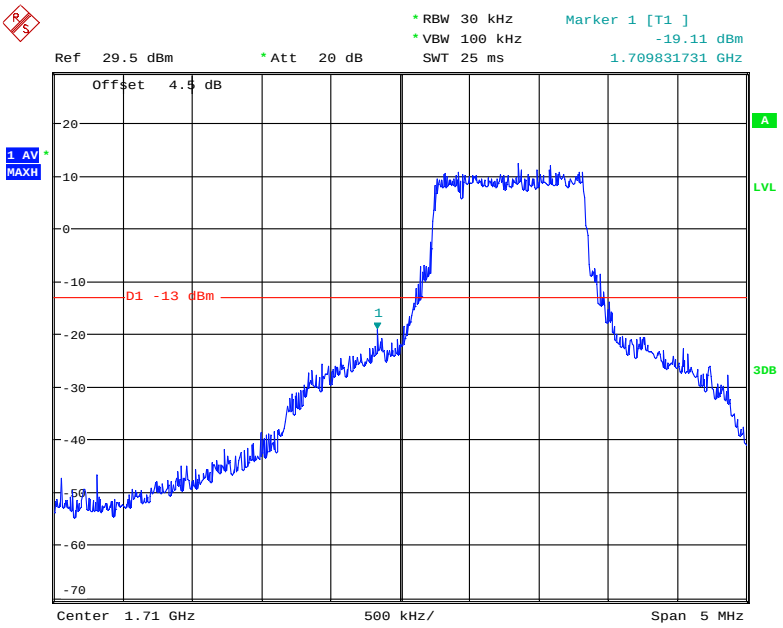
Date: 13.MAY.2018 21:20:17

16-QAM (5.0 MHz, RB0) - Right Band Edge



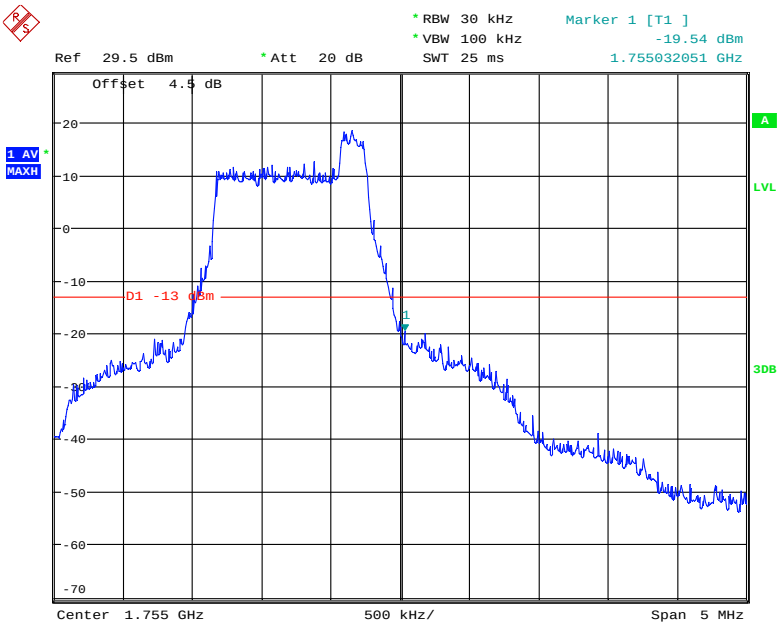
Date: 13.MAY.2018 21:30:53

QPSK (5.0 MHz, RB6) - Left Band Edge



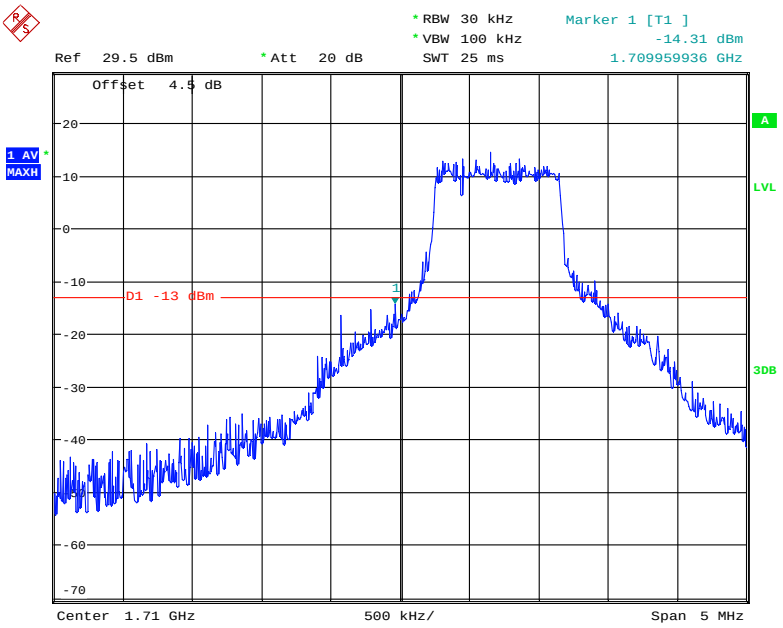
Date: 13.MAY.2018 21:14:56

QPSK (5.0 MHz, RB6) - Right Band Edge



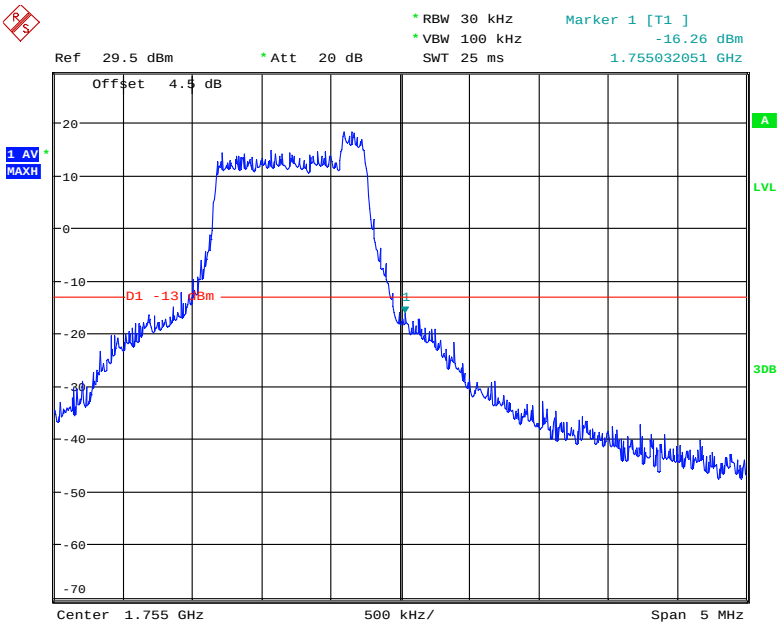
Date: 13.MAY.2018 21:27:27

16-QAM (5.0 MHz, RB5) - Left Band Edge



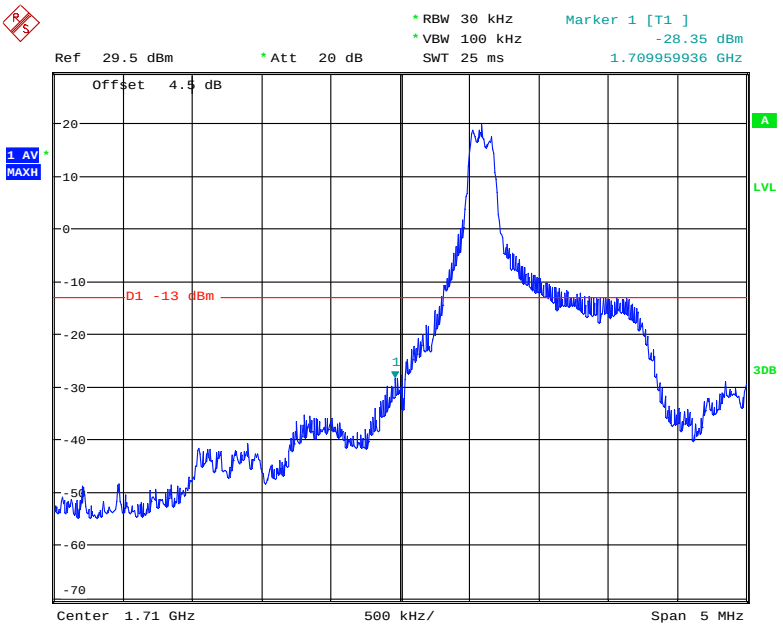
Date: 13.MAY.2018 21:23:01

16-QAM (5.0 MHz, RB5) - Right Band Edge



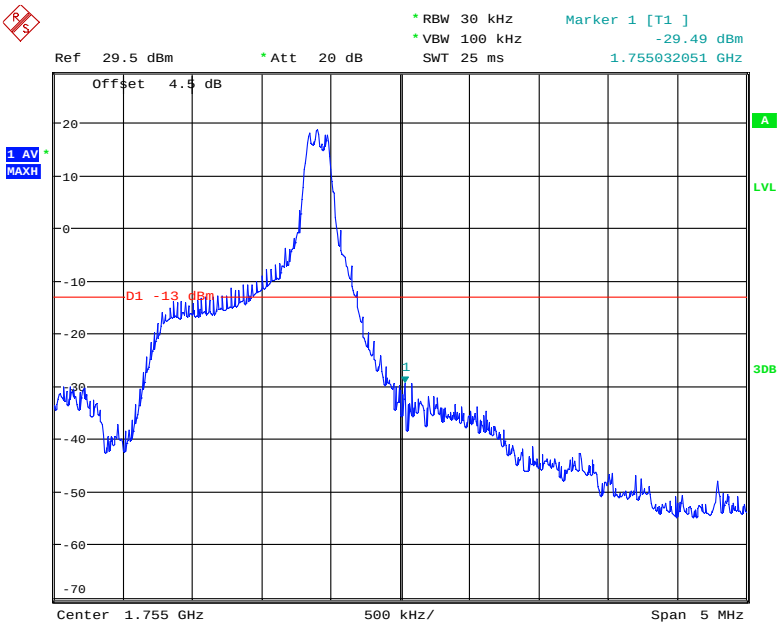
Date: 13.MAY.2018 21:32:42

QPSK (10.0 MHz, RB0) - Left Band Edge



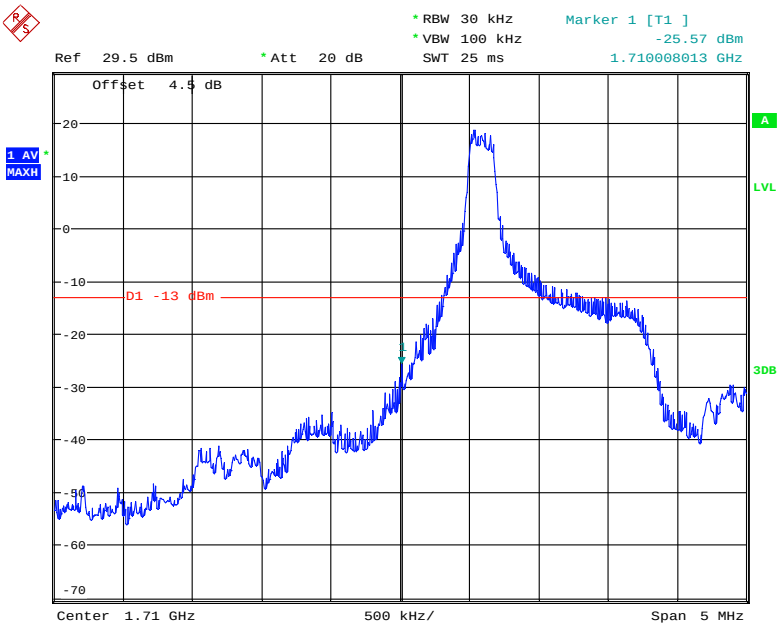
Date: 13.MAY.2018 22:50:35

QPSK (10.0 MHz, RB0) - Right Band Edge



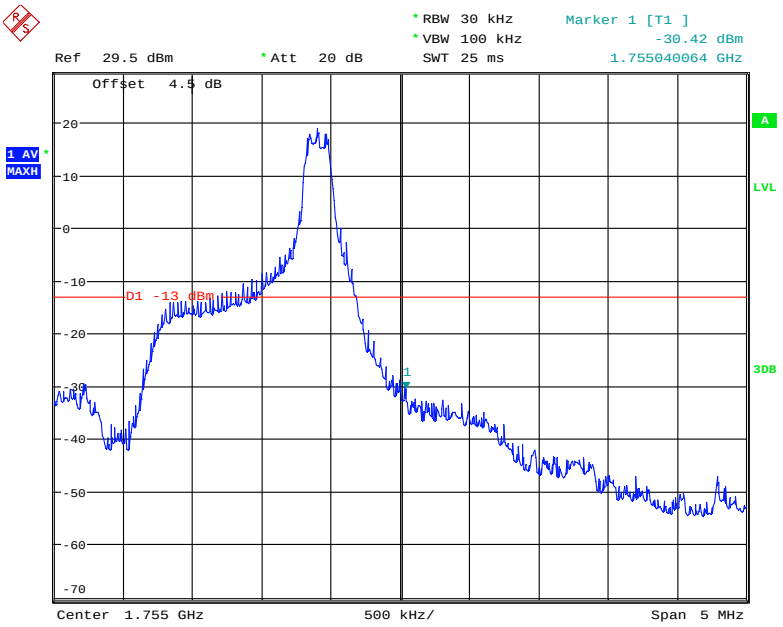
Date: 13.MAY.2018 21:36:55

16-QAM (10.0 MHz, RB0) - Left Band Edge



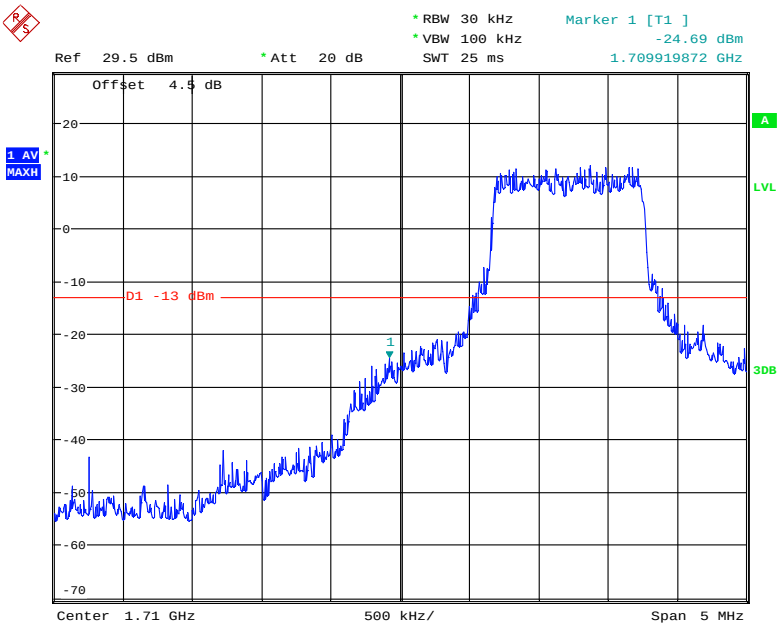
Date: 13.MAY.2018 22:52:10

16-QAM (10.0 MHz, RB0) - Right Band Edge



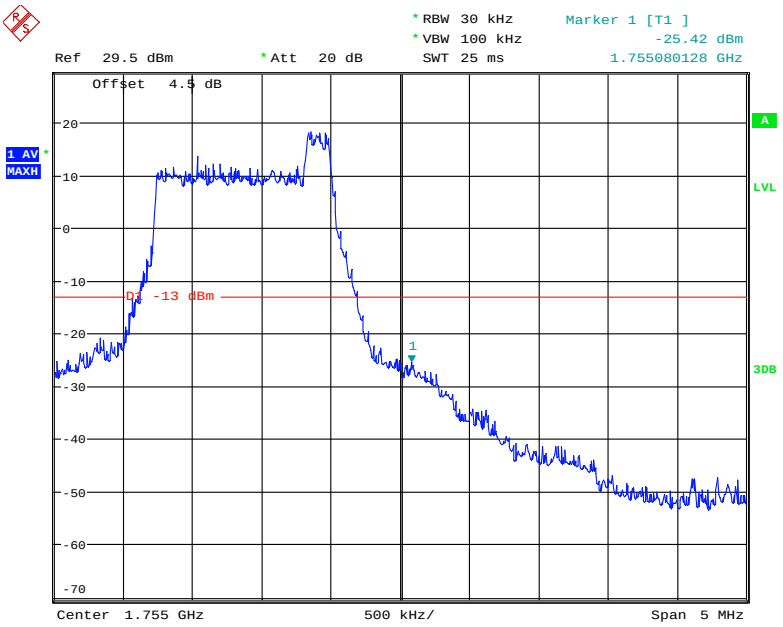
Date: 13.MAY.2018 22:45:04

QPSK (10.0 MHz, RB6) - Left Band Edge



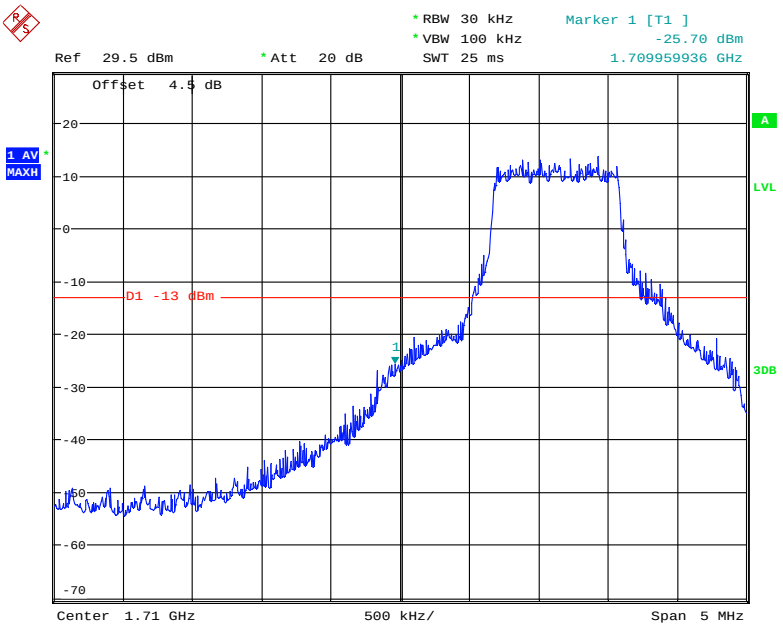
Date: 13.MAY.2018 22:48:31

QPSK (10.0 MHz, RB6) - Right Band Edge



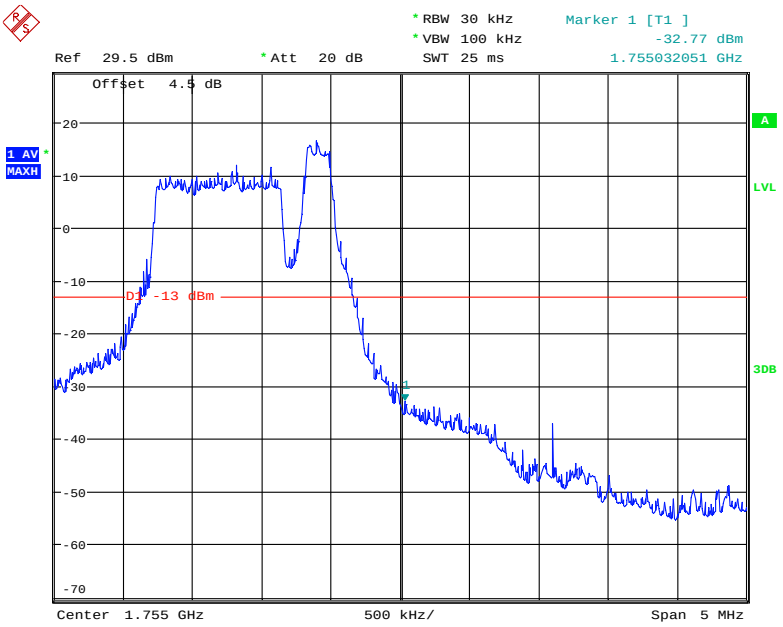
Date: 13.MAY.2018 21:35:07

16-QAM (10.0 MHz, RB5) - Left Band Edge



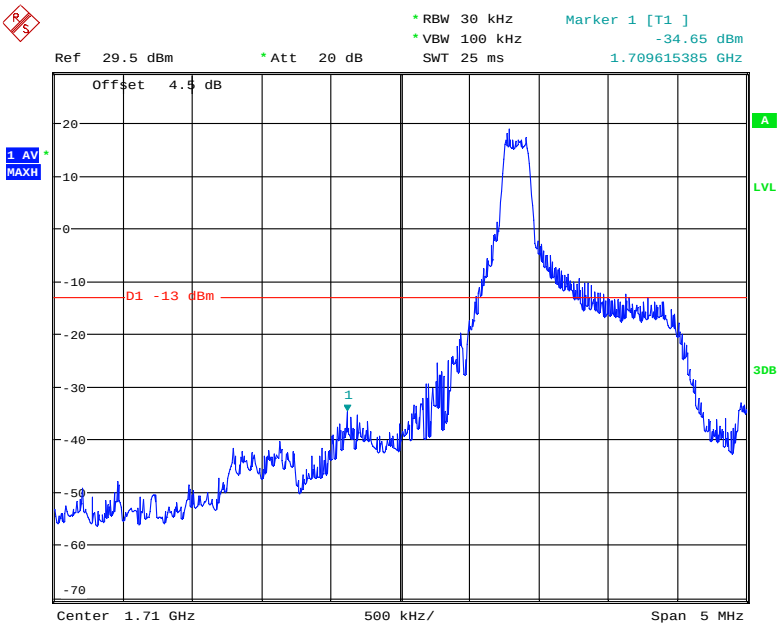
Date: 13.MAY.2018 22:53:37

16-QAM (10.0 MHz, RB5) - Right Band Edge



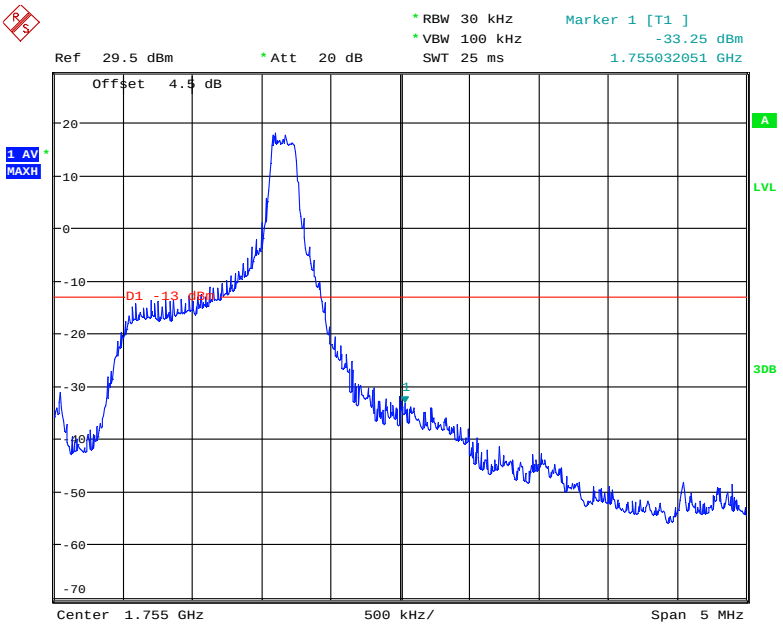
Date: 13.MAY.2018 22:46:20

QPSK (15.0 MHz, RB0) - Left Band Edge



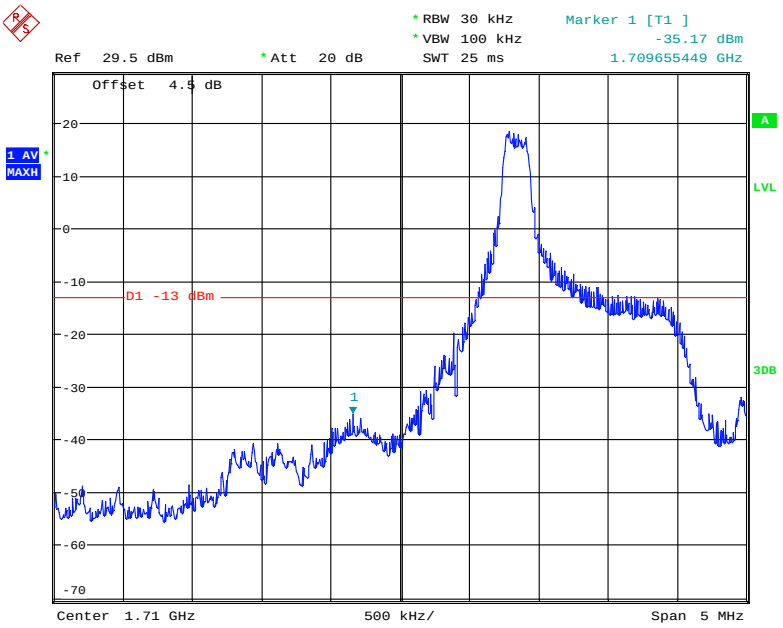
Date: 13.MAY.2018 22:57:23

QPSK (15.0 MHz, RB0) - Right Band Edge



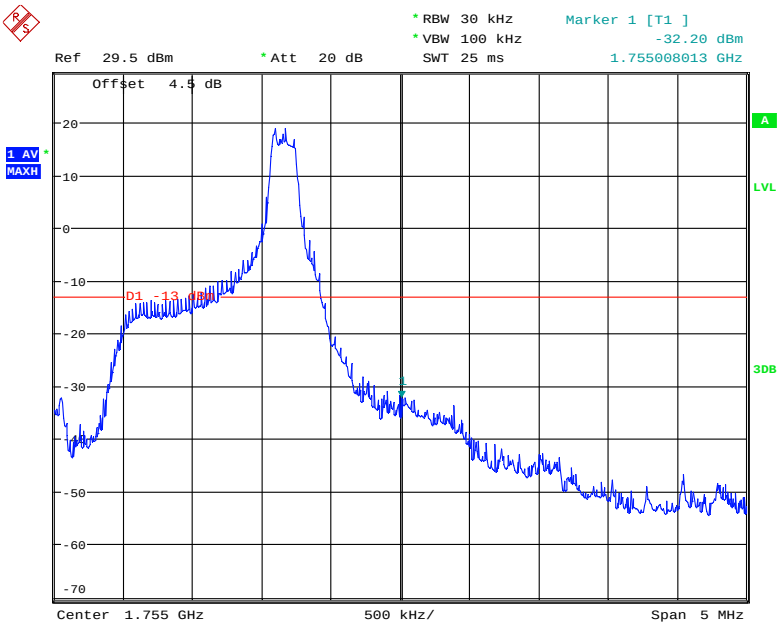
Date: 13.MAY.2018 23:03:29

16-QAM (15.0 MHz, RB0) - Left Band Edge



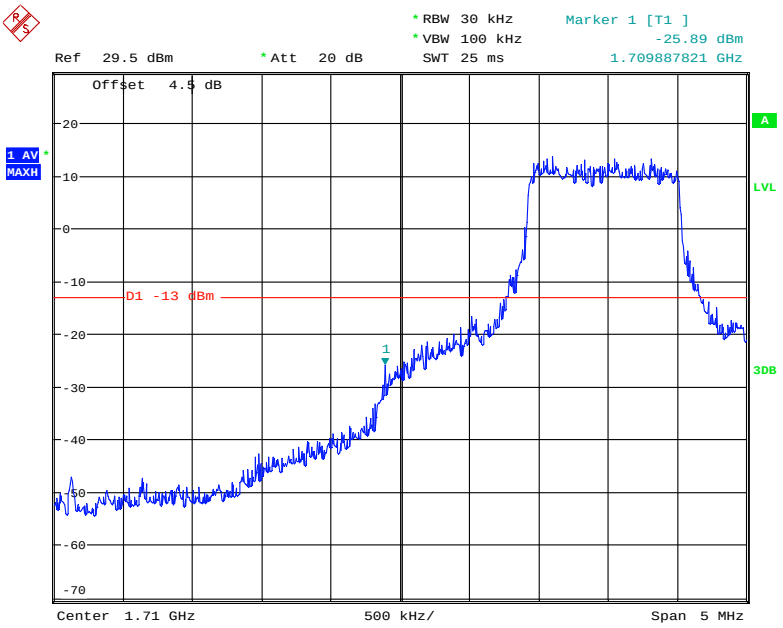
Date: 13.MAY.2018 22:58:44

16-QAM (15.0 MHz, RB0) - Right Band Edge



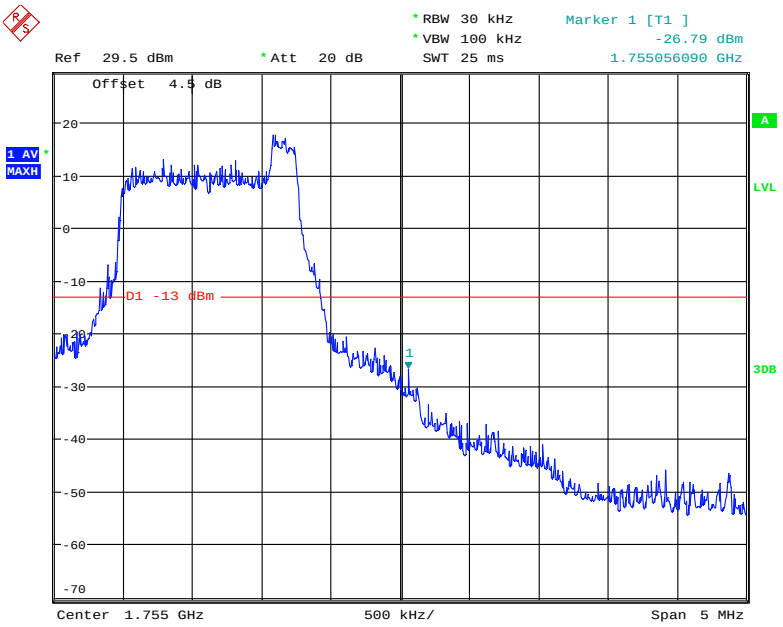
Date: 13.MAY.2018 23:05:31

QPSK (15.0 MHz, RB6) - Left Band Edge



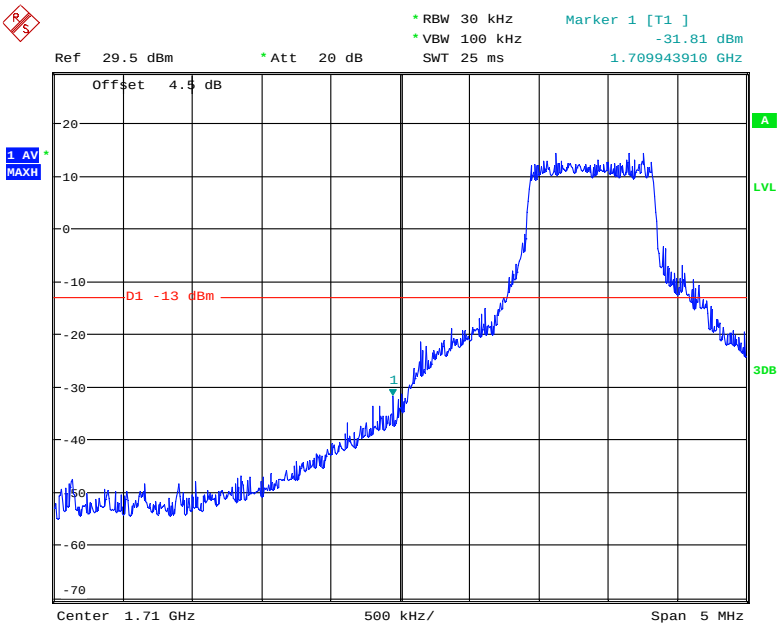
Date: 13.MAY.2018 22:56:03

QPSK (15.0 MHz, RB6) - Right Band Edge



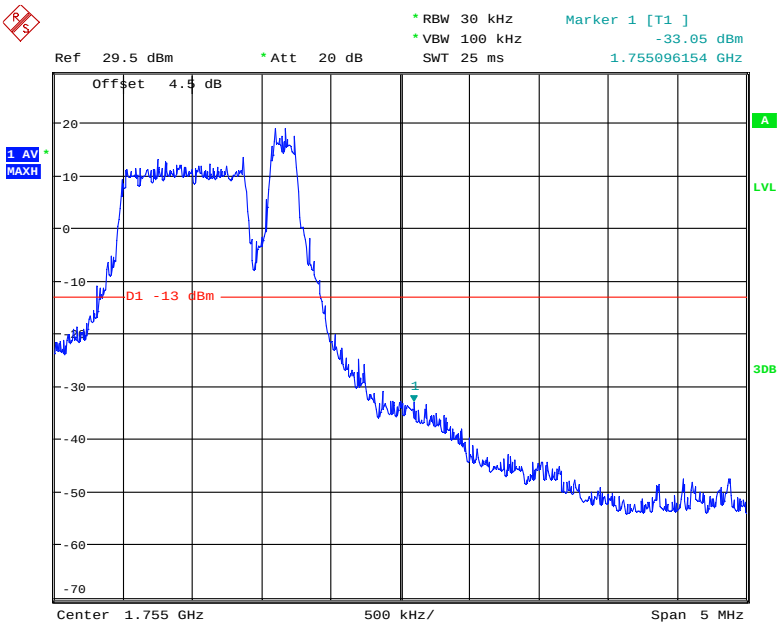
Date: 13.MAY.2018 23:01:56

16-QAM (15.0 MHz, RB5) - Left Band Edge



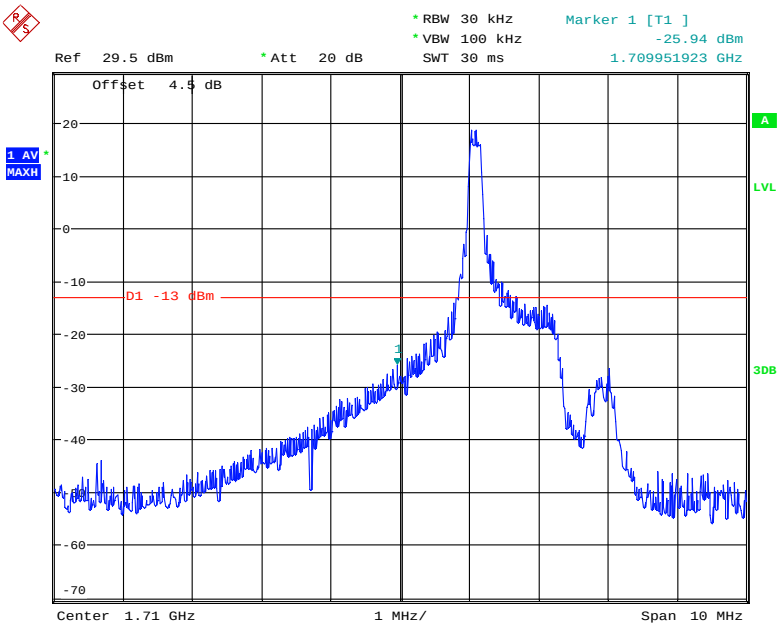
Date: 13.MAY.2018 22:59:51

16-QAM (15.0 MHz, RB5) - Right Band Edge



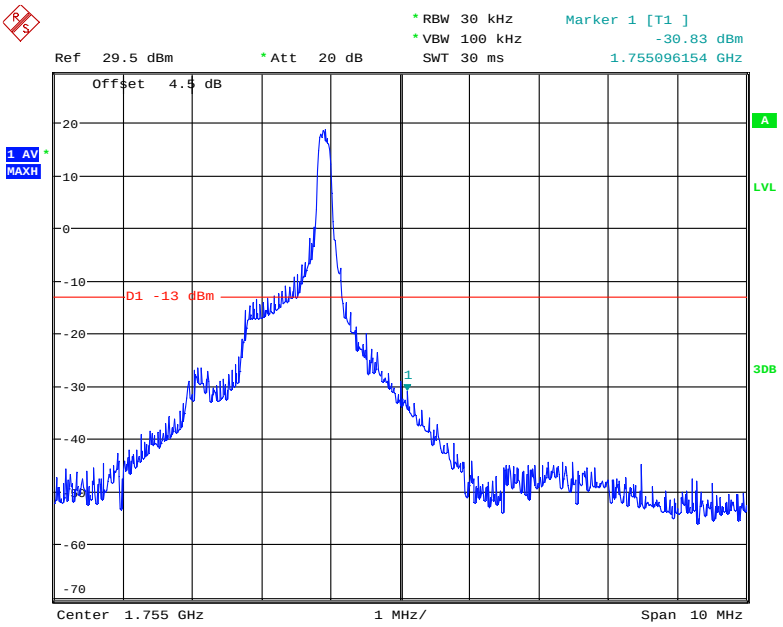
Date: 13.MAY.2018 23:07:49

QPSK (20.0 MHz, RB0) - Left Band Edge



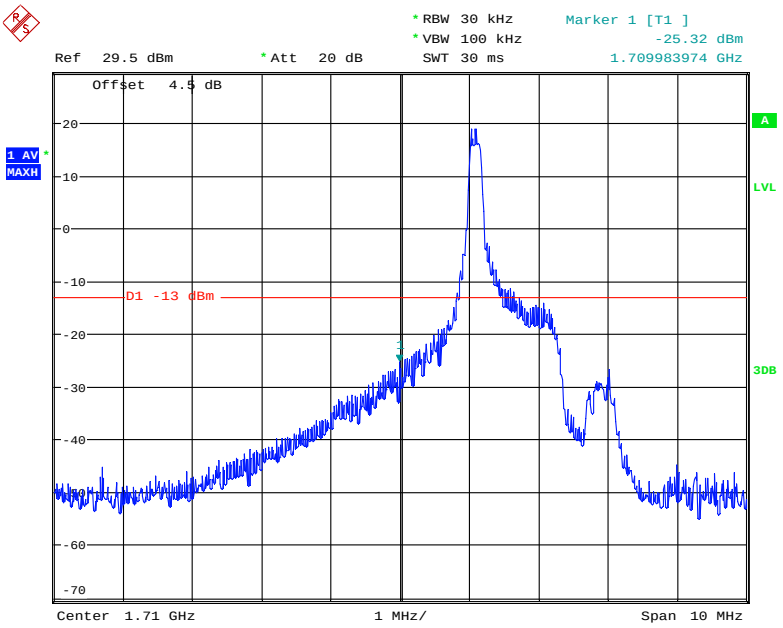
Date: 13.MAY.2018 23:27:14

QPSK (20.0 MHz, RB0) - Right Band Edge



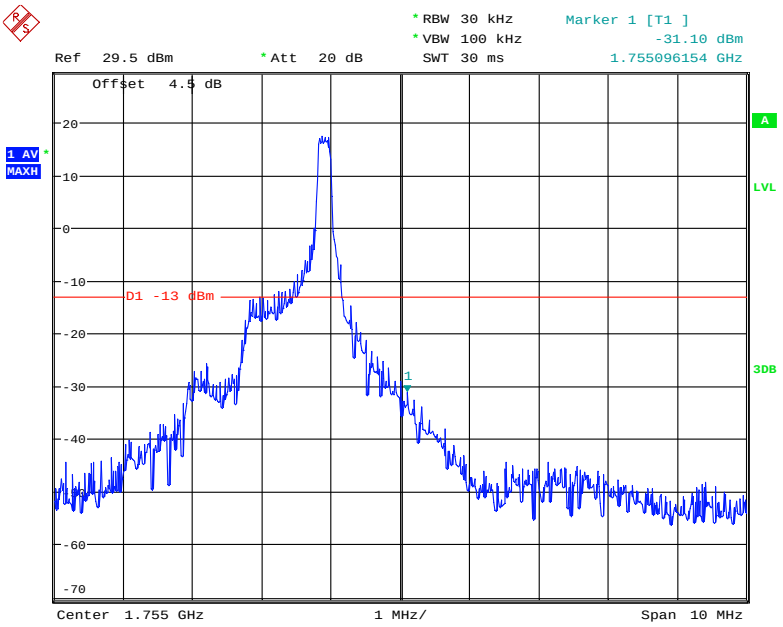
Date: 13.MAY.2018 23:17:50

16-QAM (20.0 MHz, RB0) - Left Band Edge



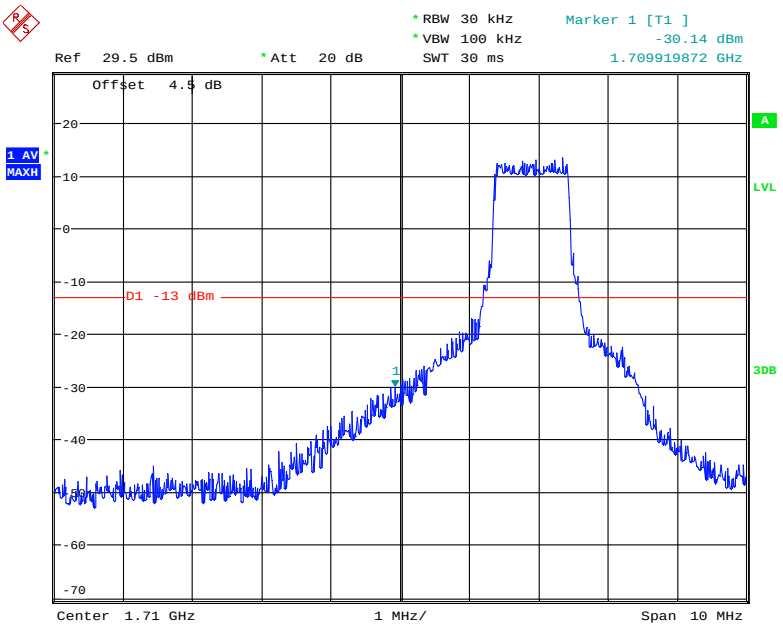
Date: 13.MAY.2018 23:30:15

16-QAM (20.0 MHz, RB0) - Right Band Edge



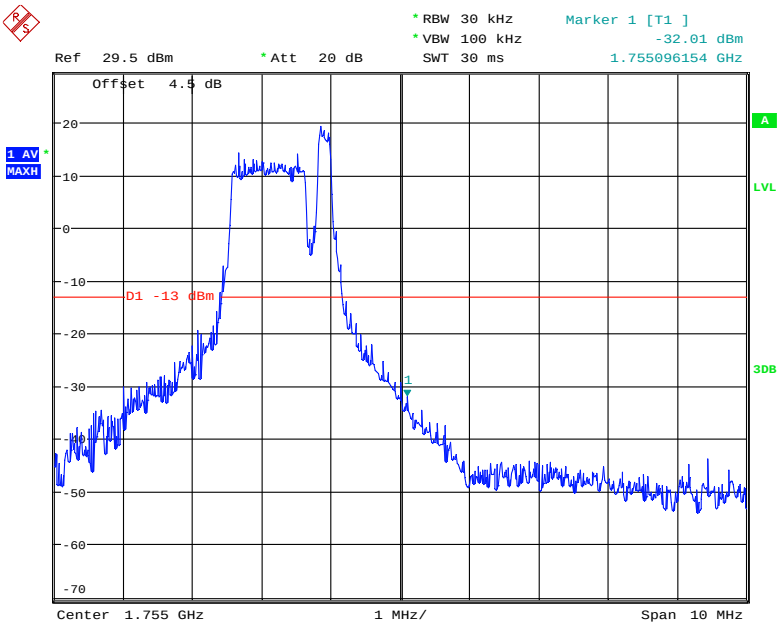
Date: 13.MAY.2018 23:19:24

QPSK (20.0 MHz, RB6) - Left Band Edge



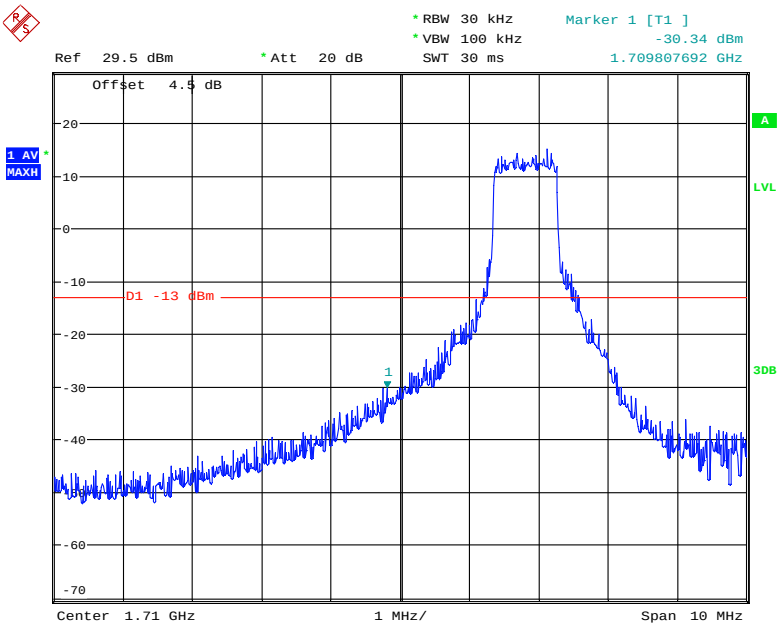
Date: 13.MAY.2018 23:24:36

QPSK (20.0 MHz, RB6) - Right Band Edge



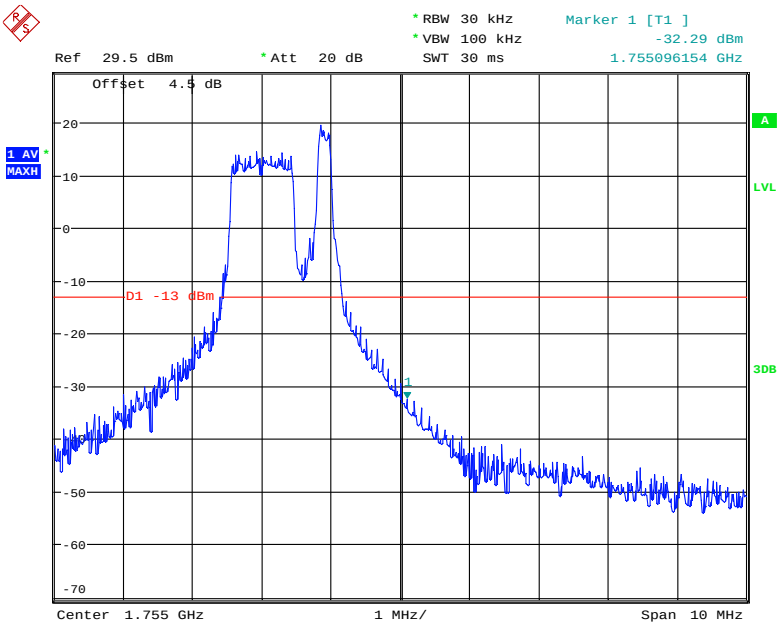
Date: 13.MAY.2018 23:14:36

16-QAM (20.0 MHz, RB5) - Left Band Edge



Date: 13.MAY.2018 23:33:39

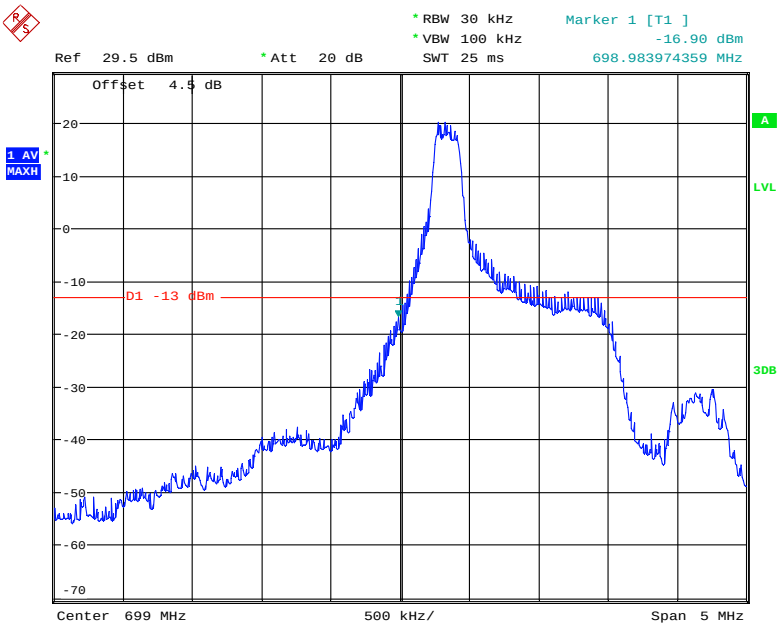
16-QAM (20.0 MHz, RB5) - Right Band Edge



Date: 13.MAY.2018 23:21:15

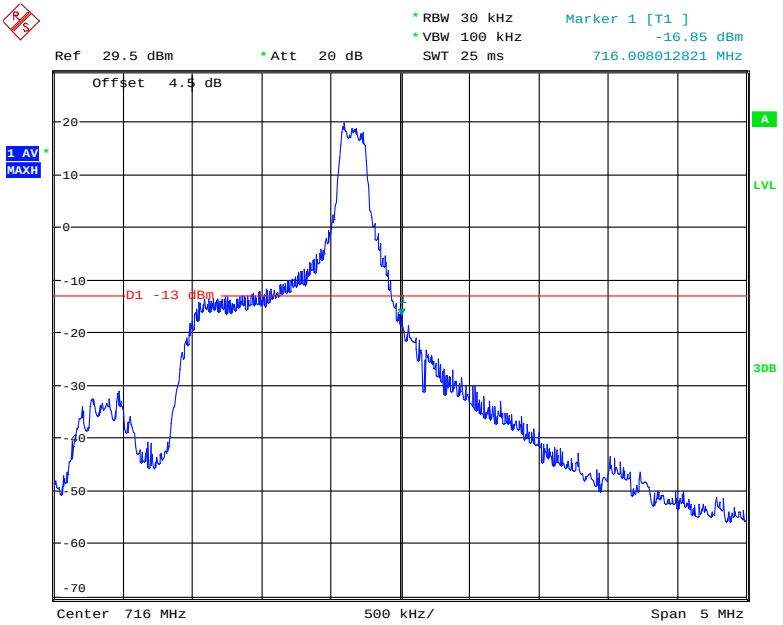
Band 12:

QPSK (5.0 MHz, RB0) - Left Band Edge



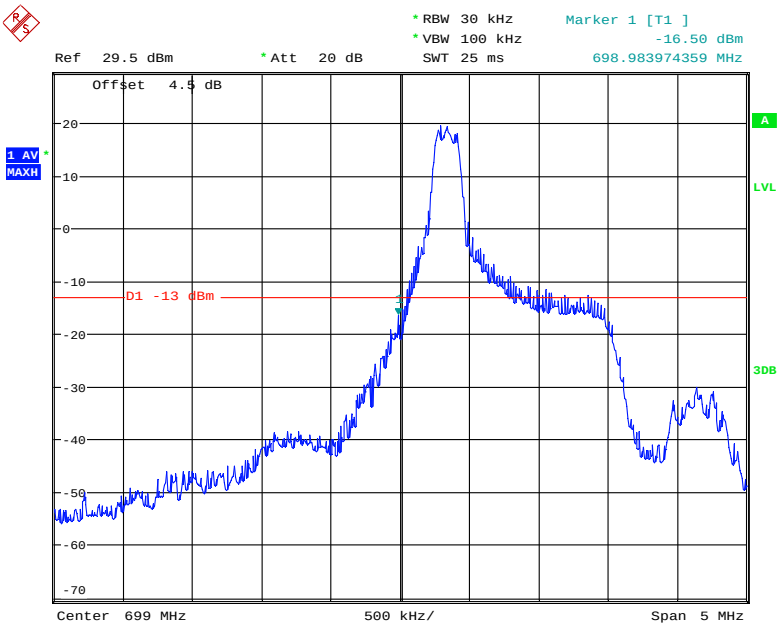
Date: 13.MAY.2018 20:28:46

QPSK (5.0 MHz, RB0) - Right Band Edge



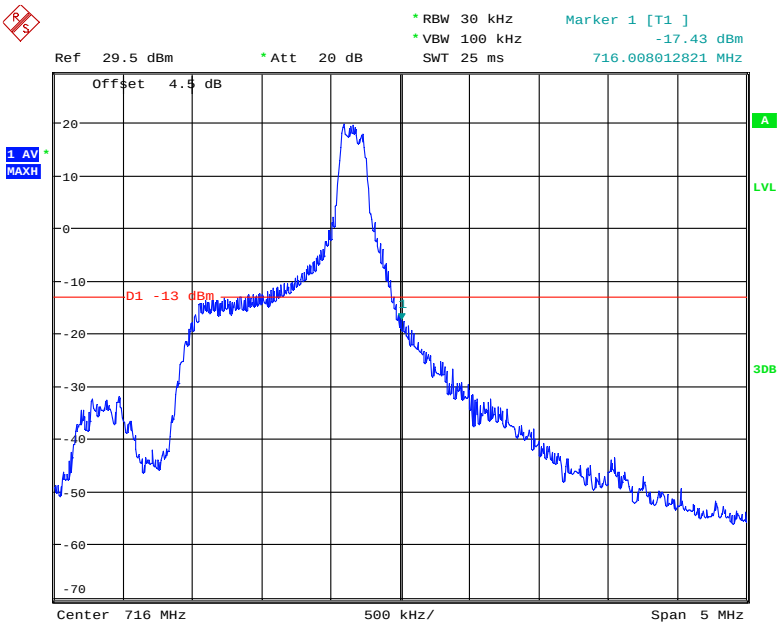
Date: 13.MAY.2018 20:37:58

16-QAM (5.0 MHz, RB0) - Left Band Edge



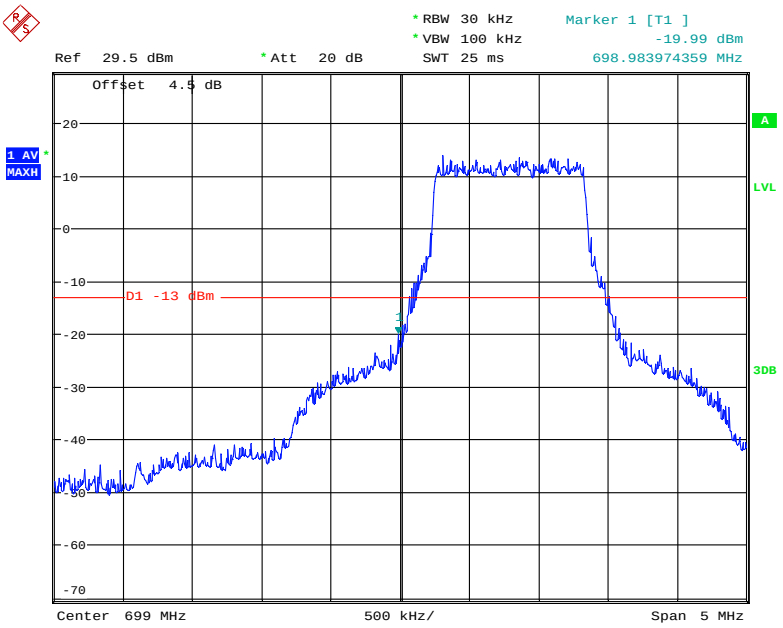
Date: 13.MAY.2018 20:30:20

16-QAM (5.0 MHz, RB0) - Right Band Edge



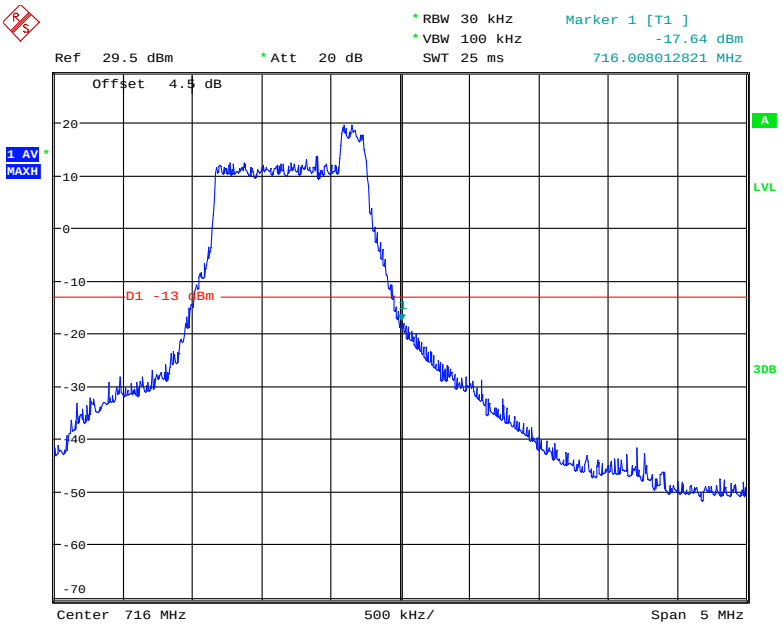
Date: 13.MAY.2018 20:39:36

QPSK (5.0 MHz, RB6) - Left Band Edge



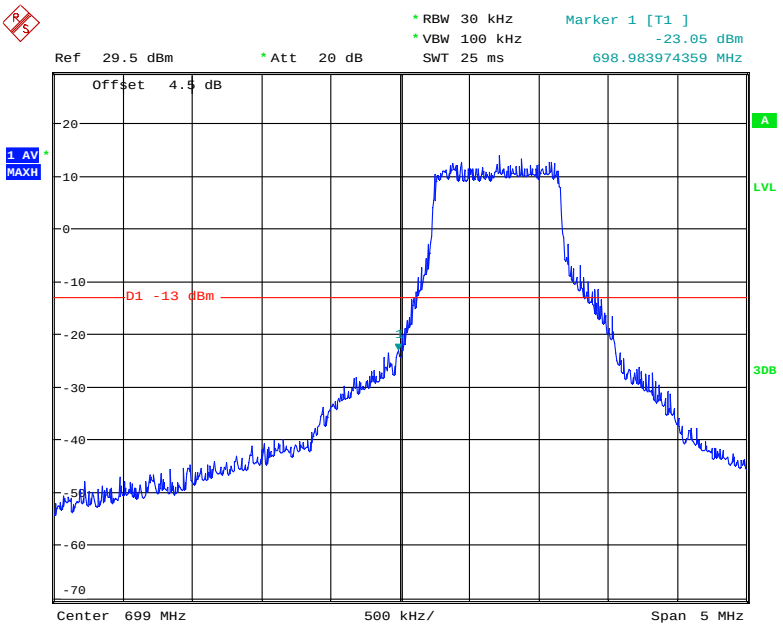
Date: 13.MAY.2018 20:26:14

QPSK (5.0 MHz, RB6) - Right Band Edge



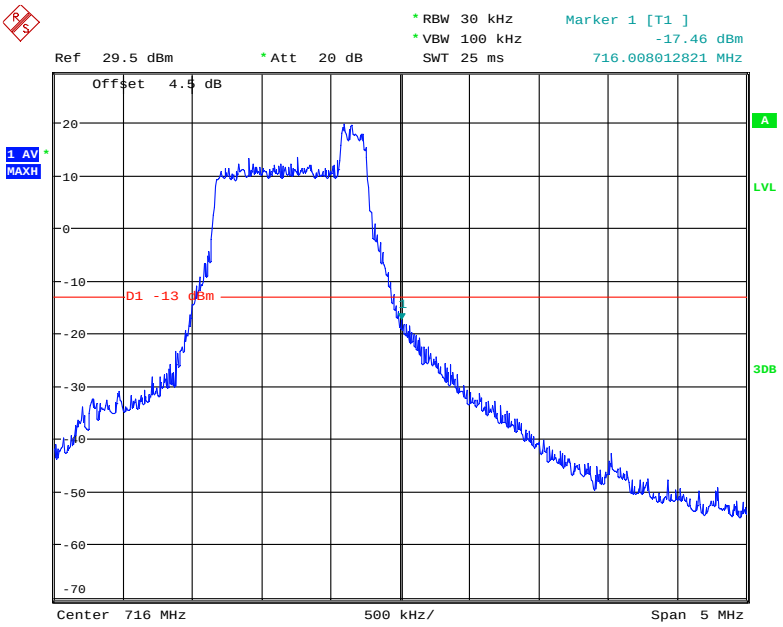
Date: 13.MAY.2018 20:36:06

16-QAM (5.0 MHz, RB5) - Left Band Edge



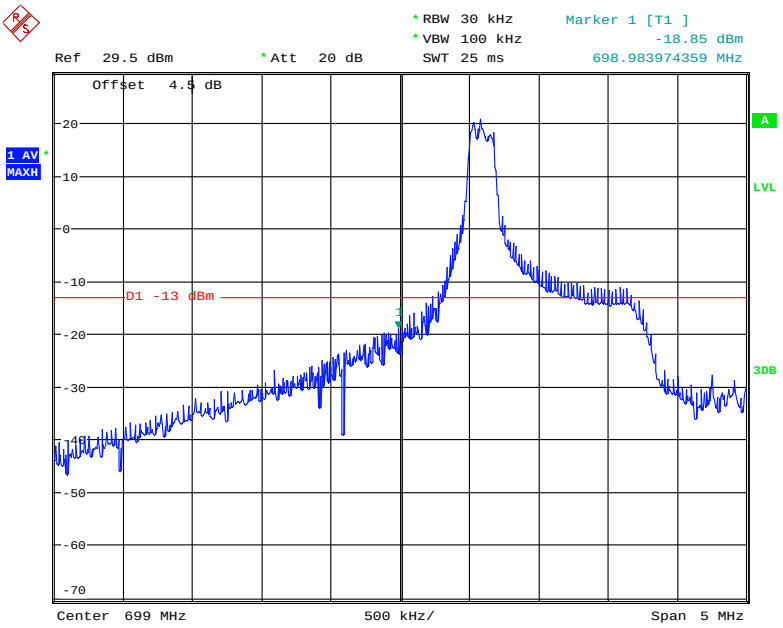
Date: 13.MAY.2018 20:31:49

16-QAM (5.0 MHz, RB5) - Right Band Edge



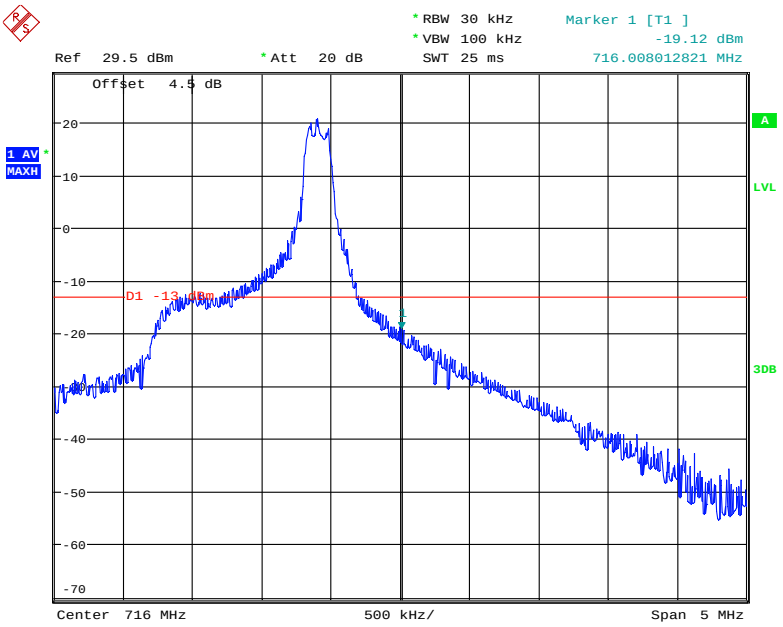
Date: 13.MAY.2018 20:41:24

QPSK (10.0 MHz, RB0) - Left Band Edge



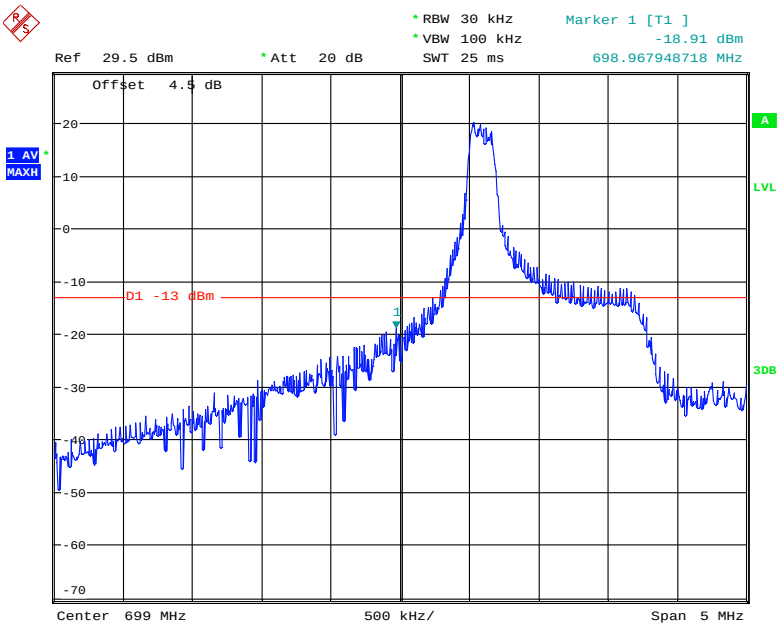
Date: 13.MAY.2018 23:41:37

QPSK (10.0 MHz, RB0) - Right Band Edge



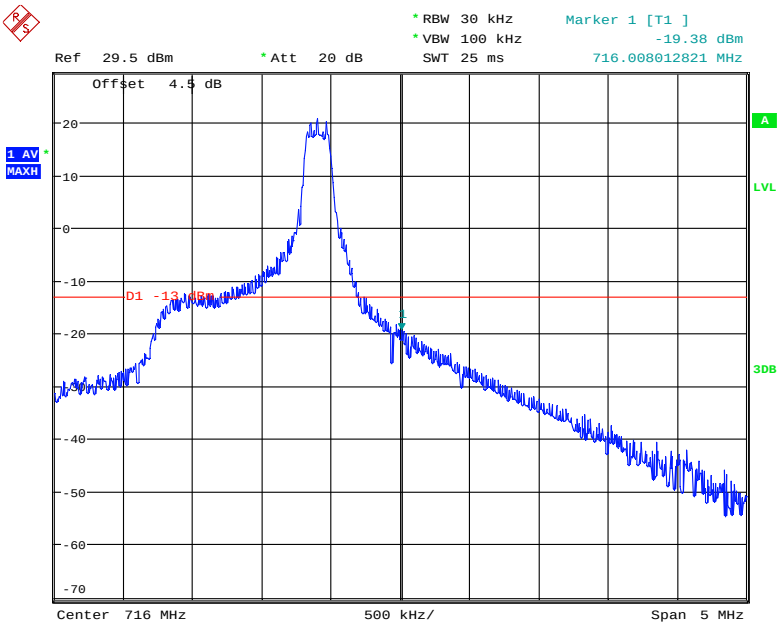
Date: 13.MAY.2018 23:50:47

16-QAM (10.0 MHz, RB0) - Left Band Edge



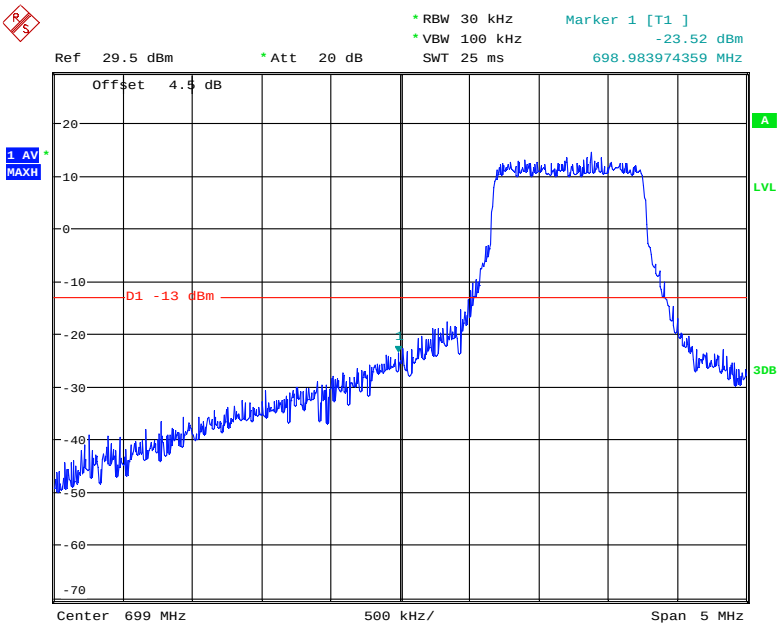
Date: 13.MAY.2018 23:43:02

16-QAM (10.0 MHz, RB0) - Right Band Edge



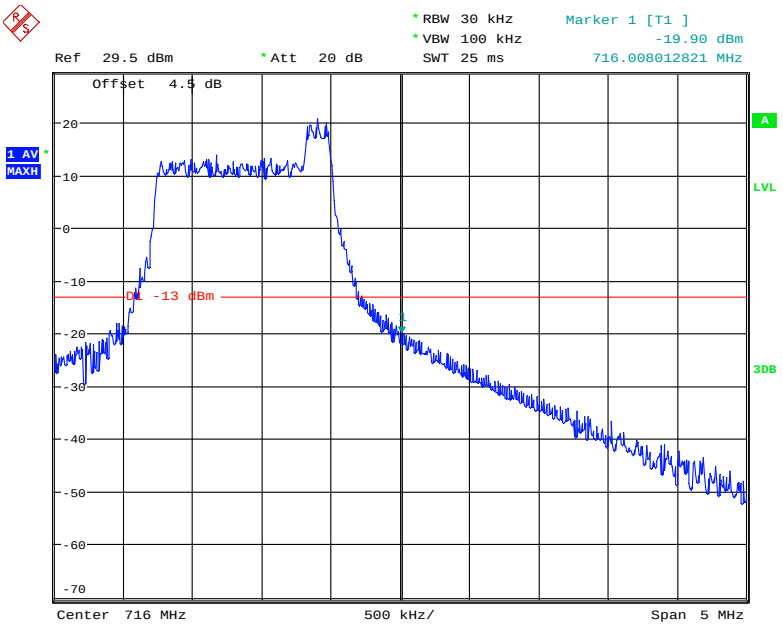
Date: 13.MAY.2018 23:52:48

QPSK (10.0 MHz, RB6) - Left Band Edge



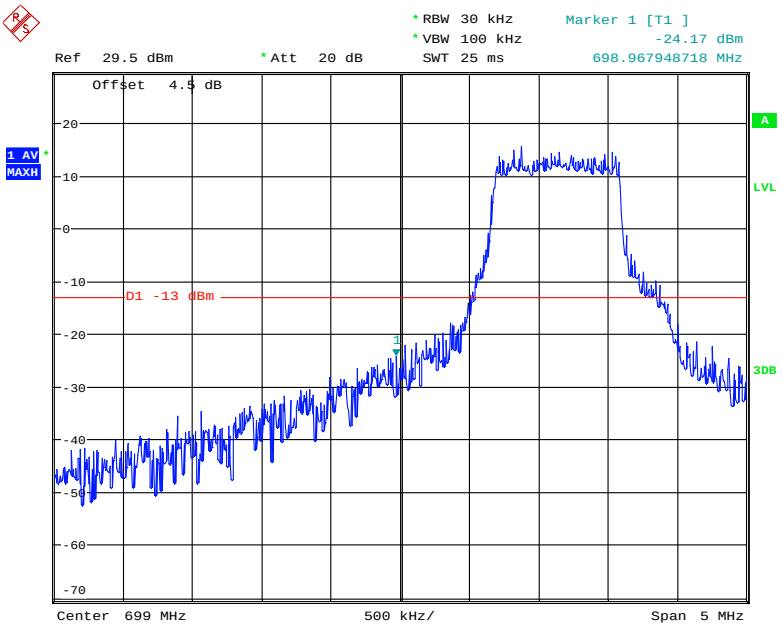
Date: 13.MAY.2018 23:39:05

QPSK (10.0 MHz, RB6) - Right Band Edge



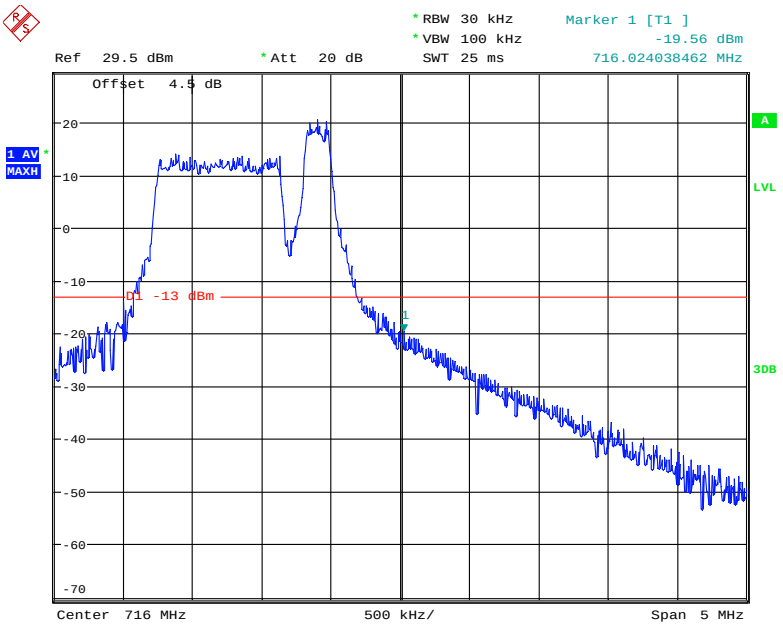
Date: 13.MAY.2018 23:48:34

16-QAM (10.0 MHz, RB5) - Left Band Edge



Date: 13.MAY.2018 23:44:05

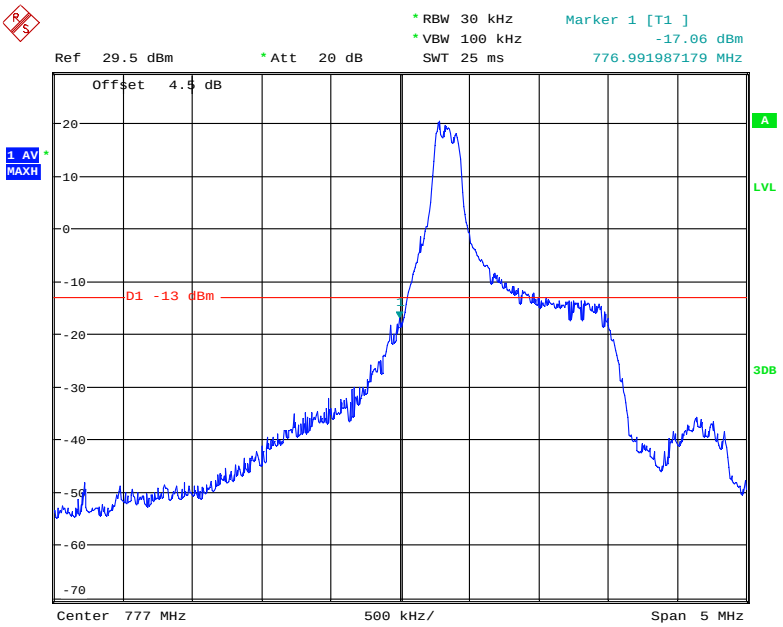
16-QAM (10.0 MHz, RB5) - Right Band Edge



Date: 13.MAY.2018 23:54:02

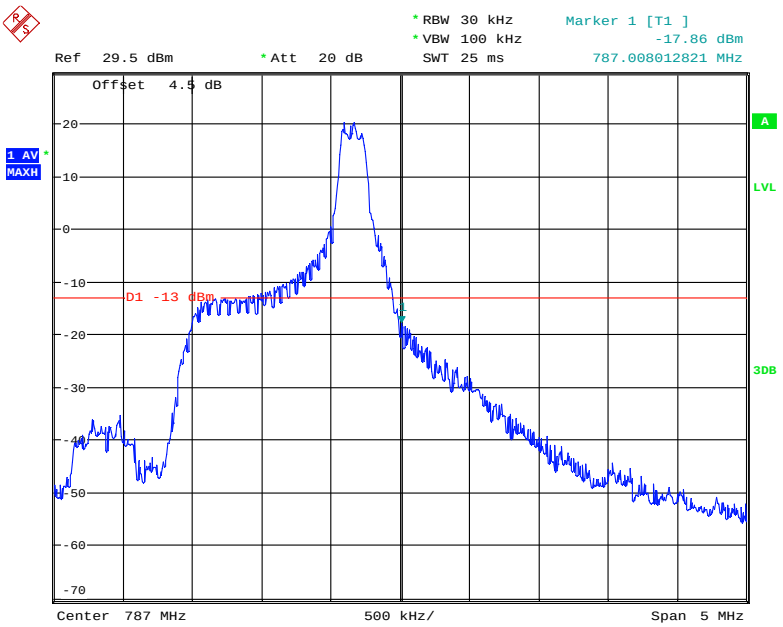
Band 13:

QPSK (5.0 MHz, RB0) - Left Band Edge



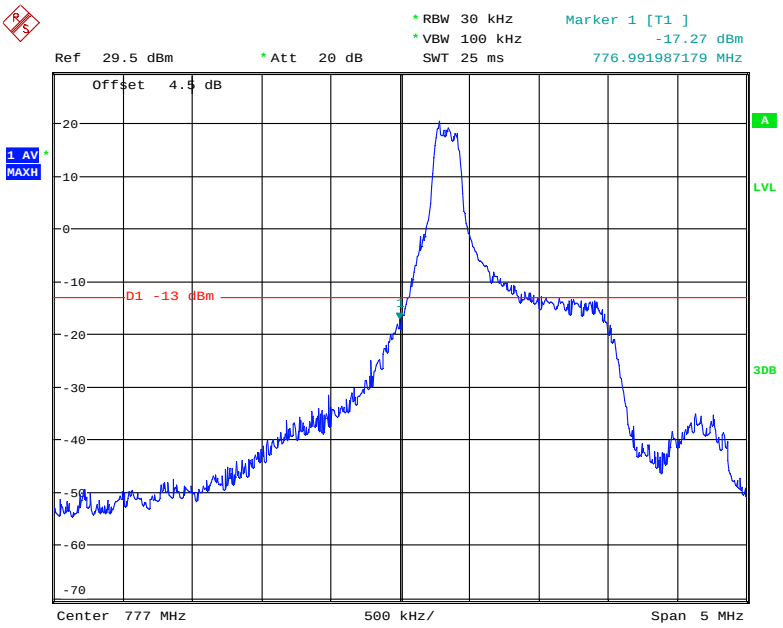
Date: 13.MAY.2018 20:05:32

QPSK (5.0 MHz, RB0) - Right Band Edge



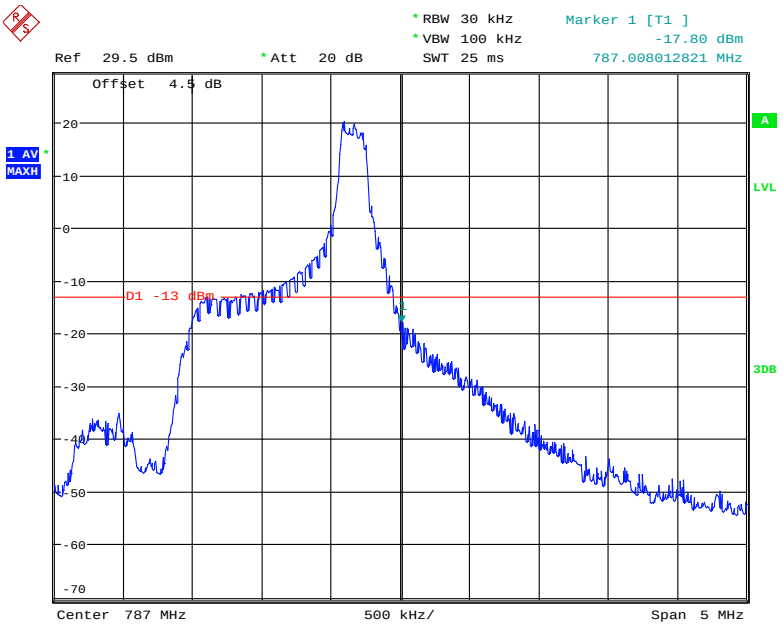
Date: 13.MAY.2018 20:17:40

16-QAM (5.0 MHz, RB0) - Left Band Edge



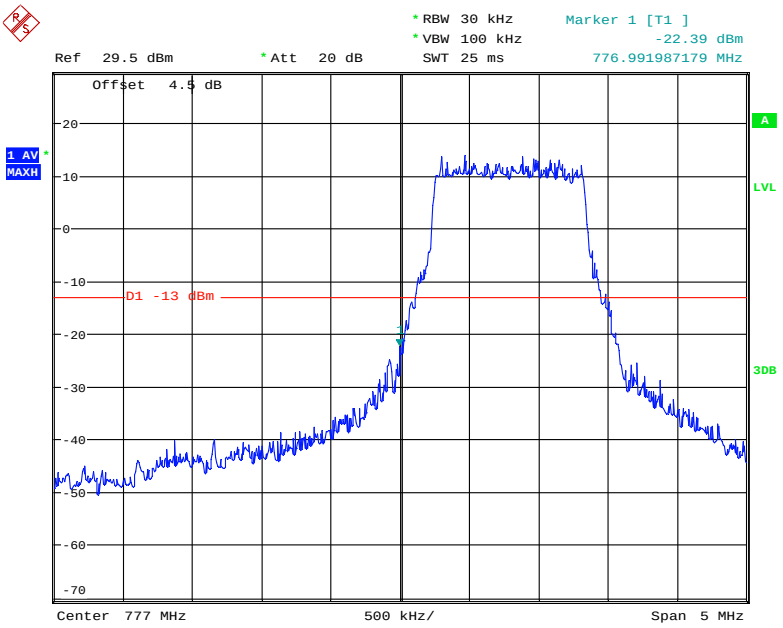
Date: 13.MAY.2018 20:11:23

16-QAM (5.0 MHz, RB0) - Right Band Edge



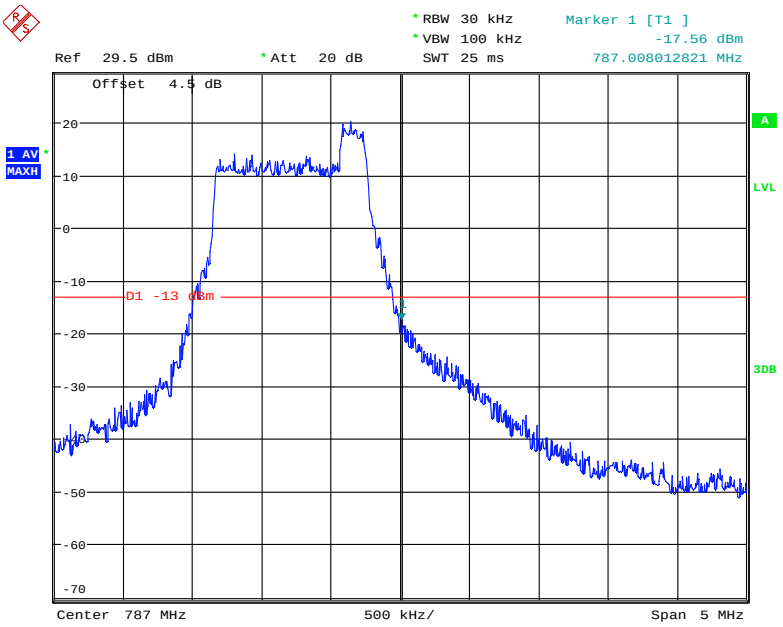
Date: 13.MAY.2018 20:20:36

QPSK (5.0 MHz, RB6) - Left Band Edge



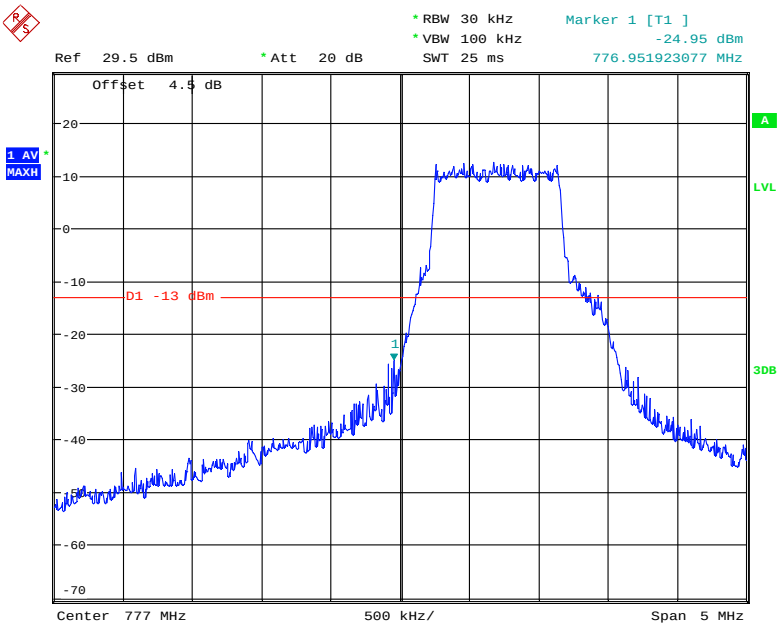
Date: 13.MAY.2018 20:03:16

QPSK (5.0 MHz, RB6) - Right Band Edge



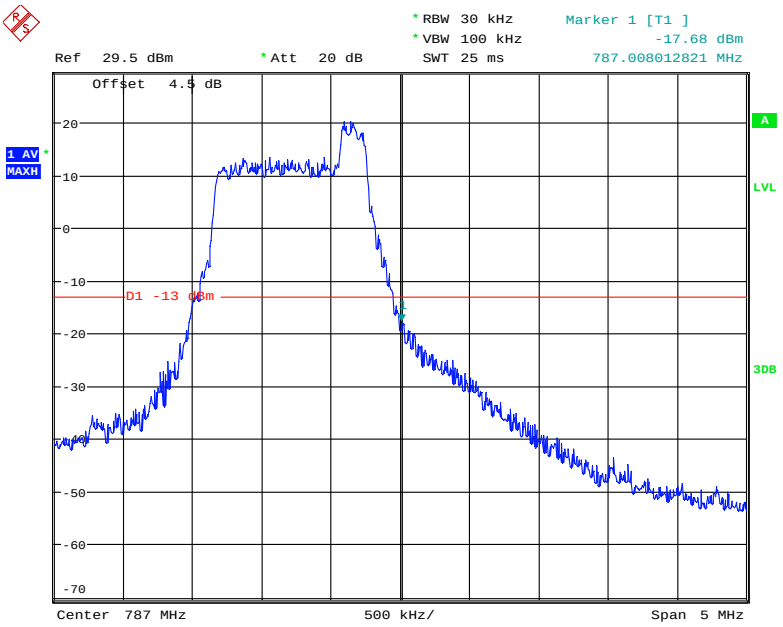
Date: 13.MAY.2018 20:15:32

16-QAM (5.0 MHz, RB5) - Left Band Edge



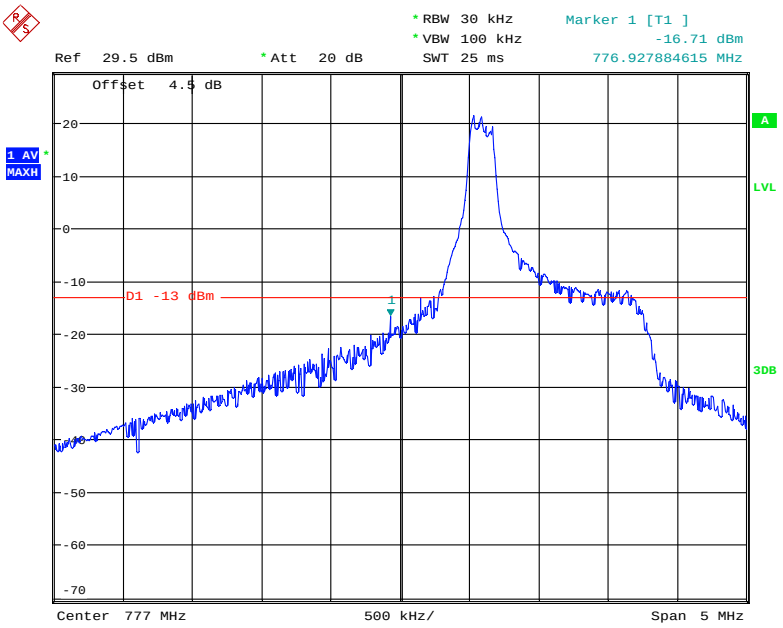
Date: 13.MAY.2018 20:12:26

16-QAM (5.0 MHz, RB5) - Right Band Edge



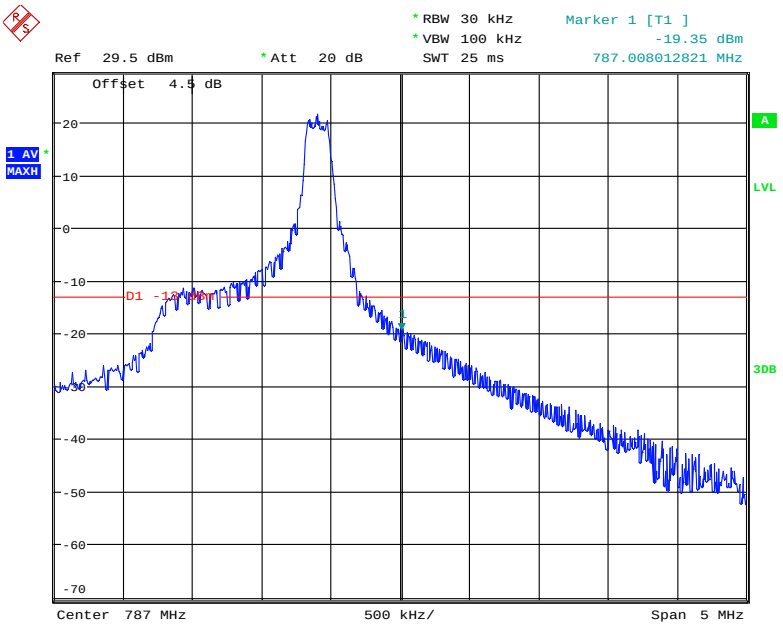
Date: 13.MAY.2018 20:23:02

QPSK (10.0 MHz, RB0) - Left Band Edge



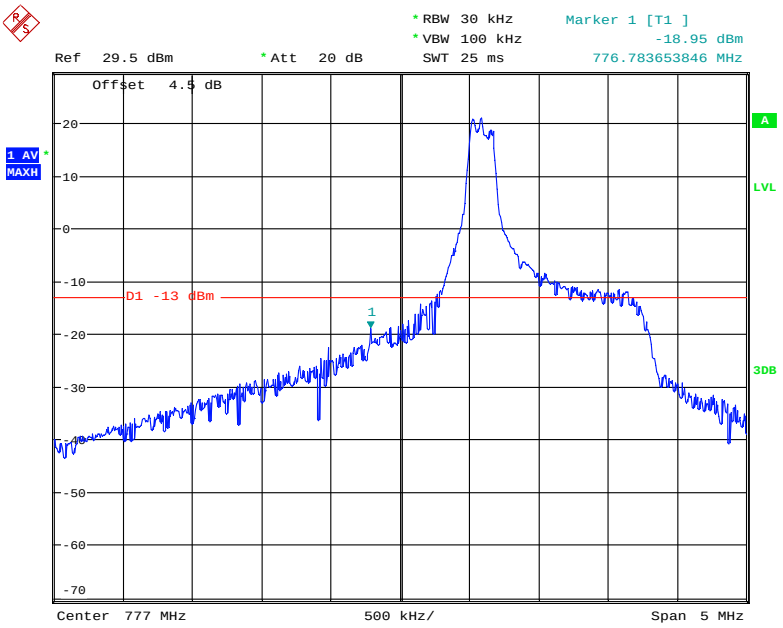
Date: 14.MAY.2018 00:03:37

QPSK (10.0 MHz, RB0) - Right Band Edge



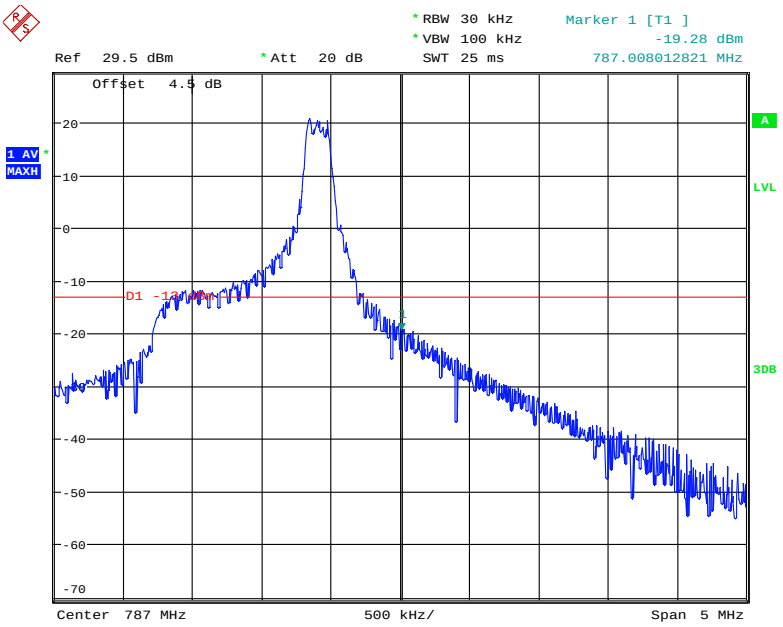
Date: 14.MAY.2018 00:10:44

16-QAM (10.0 MHz, RB0) - Left Band Edge



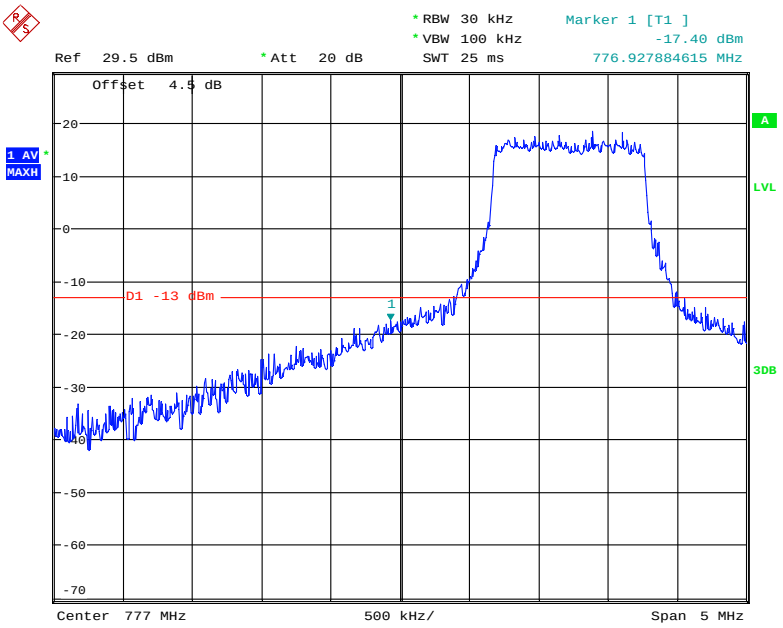
Date: 14.MAY.2018 00:05:18

16-QAM (10.0 MHz, RB0) - Right Band Edge



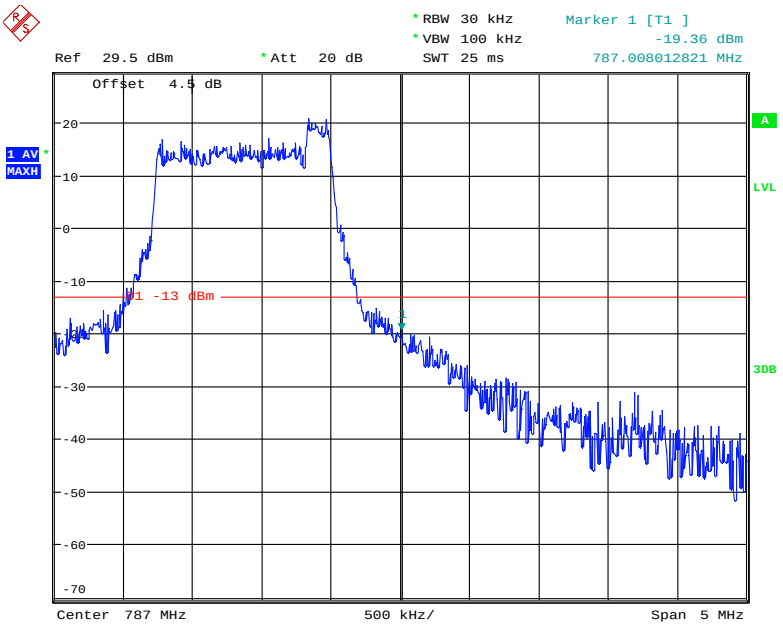
Date: 14.MAY.2018 00:13:02

QPSK (10.0 MHz, RB6) - Left Band Edge



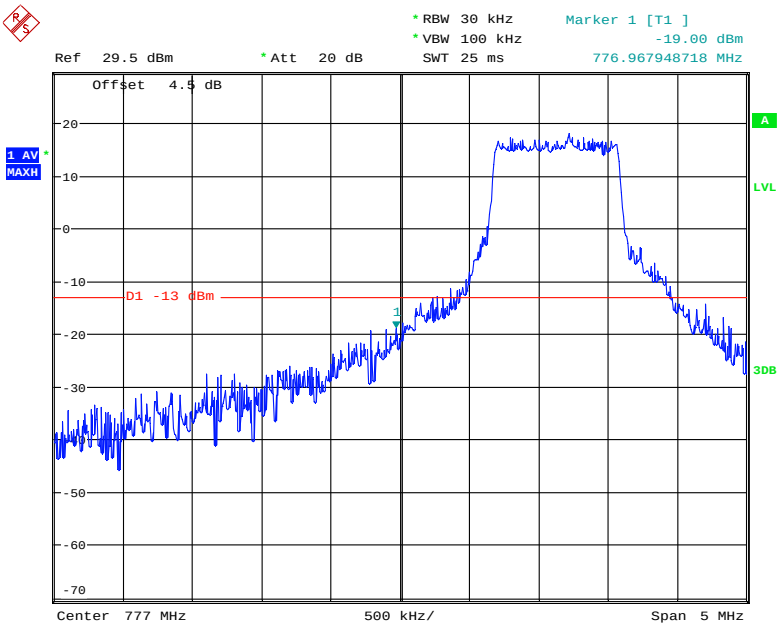
Date: 13.MAY.2018 23:59:58

QPSK (10.0 MHz, RB6) - Right Band Edge



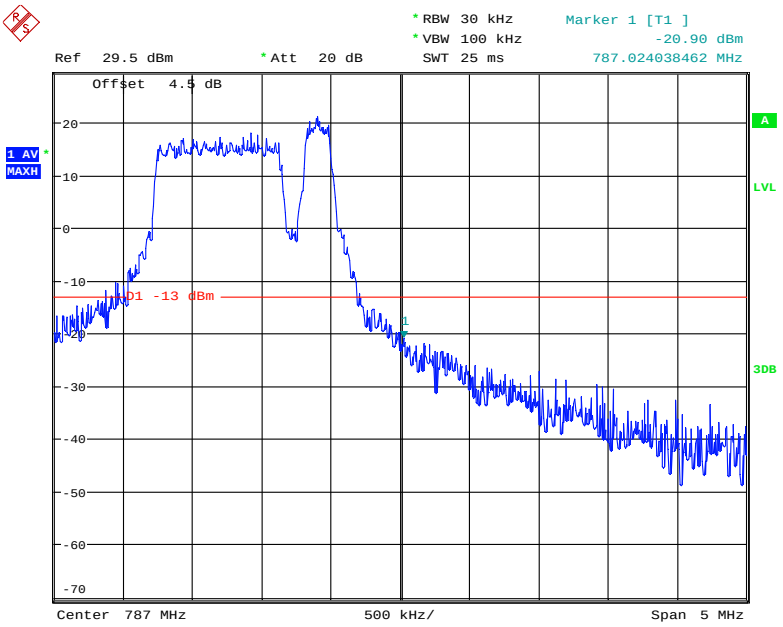
Date: 14.MAY.2018 00:08:01

16-QAM (10.0 MHz, RB5) - Left Band Edge



Date: 14.MAY.2018 00:06:42

16-QAM (10.0 MHz, RB5) - Right Band Edge



Date: 14.MAY.2018 00:14:14

FCC § 2.1055; §27.54 - FREQUENCY STABILITY

Applicable Standard

FCC § 2.1055 and & §27.54.

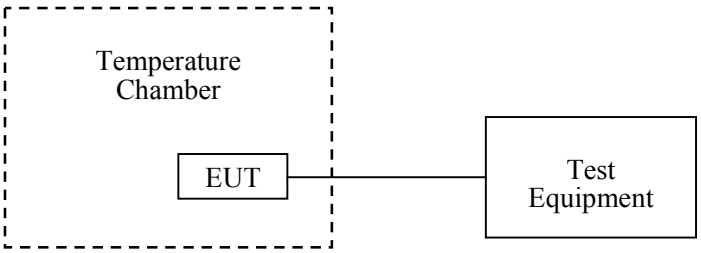
According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

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 Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-10.

EUT operation mode: Transmitting

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

QPSK:

Band 4:

Temperature (℃)	Voltage Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	5	1710.213751	1754.786324	1710	1755
-20		1710.213624	1754.786256	1710	1755
-10		1710.213703	1754.786103	1710	1755
0		1710.213674	1754.786078	1710	1755
10		1710.213609	1754.786127	1710	1755
20		1710.213701	1754.786221	1710	1755
30		1710.213666	1754.786158	1710	1755
40		1710.213789	1754.786128	1710	1755
50		1710.213821	1754.786217	1710	1755
20	4.25	1710.213819	1754.786215	1710	1755
20	5.75	1710.213823	1754.786219	1710	1755

Band 12:

Temperature (℃)	Voltage Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	5	699.223152	715.782365	699	716
-20		699.223247	715.782457	699	716
-10		699.223051	715.782614	699	716
0		699.223162	715.782315	699	716
10		699.221582	715.782765	699	716
20		699.223068	715.782651	699	716
30		699.2227968	715.782462	699	716
40		699.221983	715.782365	699	716
50		699.224571	715.783214	699	716
20	4.25	699.224573	715.783211	699	716
20	5.75	699.224568	715.783209	699	716

Band 13:

Temperature (℃)	Voltage Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	5	777.22102	786.786863	777	787
-20		777.222152	786.787521	777	787
-10		777.221025	786.787102	777	787
0		777.220321	786.786352	777	787
10		777.221021	786.786245	777	787
20		777.219862	786.786242	777	787
30		777.219872	786.785698	777	787
40		777.220163	786.785320	777	787
50		777.219863	786.787154	777	787
20	4.25	777.219861	786.787153	777	787
20	5.75	777.219859	786.787149	777	787

16QAM:

Band 4:

Temperature (℃)	Voltage Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	5	1710.213789	1754.785761	1710	1755
-20		1710.213715	1754.785763	1710	1755
-10		1710.213762	1754.785719	1710	1755
0		1710.213780	1754.785638	1710	1755
10		1710.213745	1754.785498	1710	1755
20		1710.213709	1754.785627	1710	1755
30		1710.213766	1754.785446	1710	1755
40		1710.213698	1754.785784	1710	1755
50		1710.213697	1754.785639	1710	1755
20	4.25	1710.213693	1754.785636	1710	1755
20	5.75	1710.213699	1754.785638	1710	1755

Band 12:

Temperature (℃)	Voltage Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	5	699.222362	715.78362	699	716
-20		699.221853	715.78372	699	716
-10		699.222157	715.78396	699	716
0		699.222351	715.782463	699	716
10		699.222150	715.78312	699	716
20		699.221986	715.783110	699	716
30		699.222060	715.782983	699	716
40		699.221586	715.782896	699	716
50		699.222145	715.782587	699	716
20	4.25	699.222143	715.782583	699	716
20	5.75	699.222148	715.782589	699	716

Band 13:

Temperature (℃)	Voltage Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	5	777.221010	786.785520	777	787
-20		777.220965	786.785325	777	787
-10		777.221452	786.785412	777	787
0		777.220362	786.784214	777	787
10		777.219985	786.786325	777	787
20		777.220145	786.786010	777	787
30		777.219652	786.7854125	777	787
40		777.219352	786.783525	777	787
50		777.220021	786.7873214	777	787
20	4.25	777.220023	786.7863206	777	787
20	5.75	777.220019	786.784639	777	787

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