

FCC PART 27
MEASUREMENT AND TEST REPORT

For

Fujian Helios Technologies Co., Ltd.

Helios BLDG, No. 12 Xiangyue RD, Torch Hi-Tech Industrial Zone,
Xiang'an DIST, Xiamen, China

FCC ID: 2AEIKHETD26L

Report Type: Original Report	Product Type: TD-LTE Digital Repeater
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Report Number: <u>RXM150324050-00</u>	
Report Date: <u>2015-08-31</u>	
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FINAL

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Fujian Helios Technologies Co., Ltd.*'s product, model number: *HETD26L* (FCC ID: *2AEIKHETD26L*) or the "EUT" as referred to in this report is a *TD-LTE Digital Repeater*,

Radio System Type	Repeater
Network Type	TD-LTE
Frequency Bands	Uplink: 2570-2620 MHz Downlink: 2570-2620 MHz
Support Bandwidth	20MHz
Support Channels	2580MHz, 2610MHz
Max. Output Power	Uplink: 15dBm+/-2dB Downlink: 15dBm+/-2dB
Max. Gain	Uplink: 70+/-2dB Downlink: 70+/-2dB
Modulation Type	QPSK, 16QAM, 64QAM
Antenna Gain:	Uplink: 11dBi Down Link: 7dBi
Nominal Power Supply:	DC 12V from adapter
External Dimension	28.0 cm (L) x 11.5 cm (W) x 3.6 cm (H)
Temperature Range	0°C to 50°C

Accessory Equipment List and Details

Manufacturer	Description	Model	Serial Number	Details
GME TECHNOLOGY Co., Ltd.	Adapter	GFP361DA-1230-1	1310-0000064	Input: 100-240V~50/60Hz, 1.2A, Output: 12V, 3A

Note: The series product, model HETD26L, HETD18L, HETD19L, HETD20L, HETD23L, HETD25L are electrically identical, the difference between them is just the model name, we selected HETD26L for fully testing, the details was explained in the attached declaration letter.

**All measurement and test data in this report was gathered from production sample serial number: 150324050 (Assigned by BACL, Dongguan). The EUT supplied by applicant was received on 2015-03-24.*

Objective

This type approval report is prepared on behalf of *Fujian Helios Technologies Co., Ltd.* in accordance with Part 2, Part 27 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

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

Part 27 – Miscellaneous wireless communications services

Applicable Standards: TIA-1037, TIA/EIA 603-D.

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

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 06, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

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

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

Equipment Modifications

No modifications were made to the EUT.

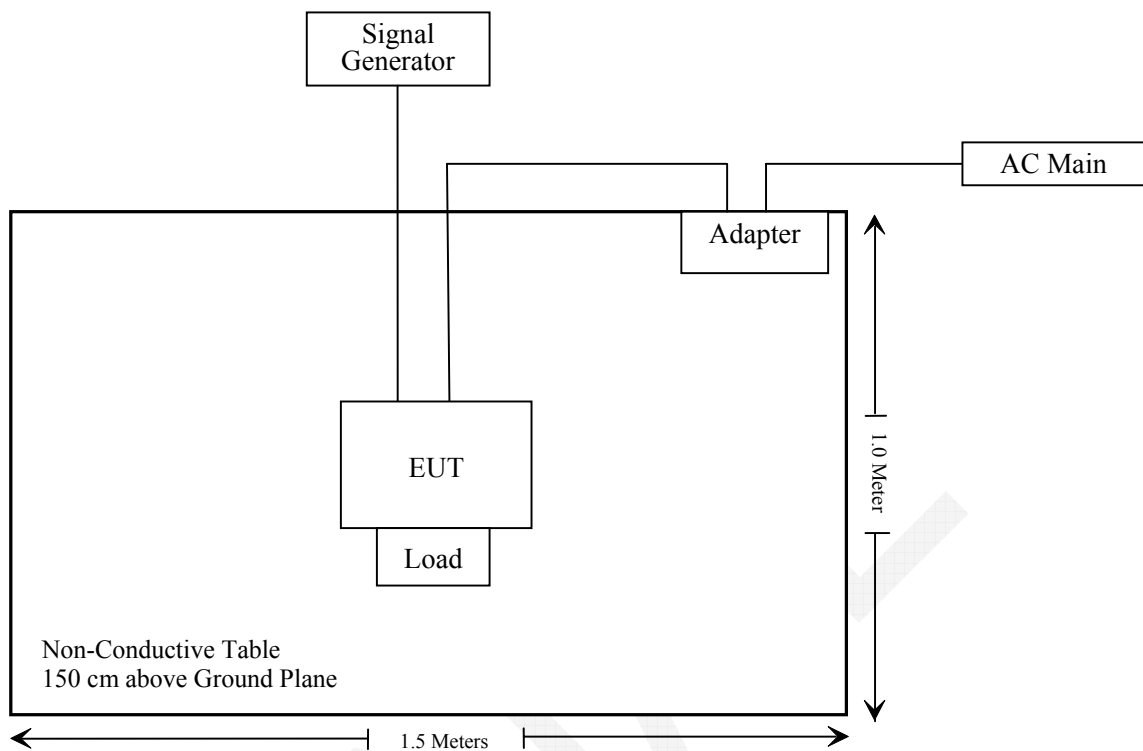
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Agilent	MXG Vector Signal Generator	N5182B	MY513502142
R & S	Wideband Radio Communication Tester	CMW500	114772

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Adapter Cable	no	no	1.0	Adapter	EUT
RF Cable	Yes	no	1.0	Signal generator	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 (b)(1), §2.1091, §27.52	Maximum Permissible Exposure	Compliance
§2.1046; §27.50	RF Output Power	Compliance
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; §27.53	Occupied Bandwidth	Compliance
§ 2.1051; §27.53	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053; §27.53	Spurious Radiated Emissions	Compliance
§27.53	Band Edge	Compliance
§ 2.1055; §27.54	Frequency stability	Compliance
§20.21	Out of band rejection	Compliance

FCC §1.1307(b) & §27.52 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency Band	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
Uplink	2580-2610MHz	11.00	12.59	17.00	50.12	20.00	0.13	1.0
Downlink	2580-2610MHz	7.00	5.01	17.00	50.12	20.00	0.05	1.0

Result: The device meet FCC MPE at 20 cm distance

FCC § 2.1046 & § 27.50 - RF OUTPUT POWER

Applicable Standard

FCC 47 §2.1046 and §27.50(h).

(h) The following power limits shall apply in the BRS and EBS:

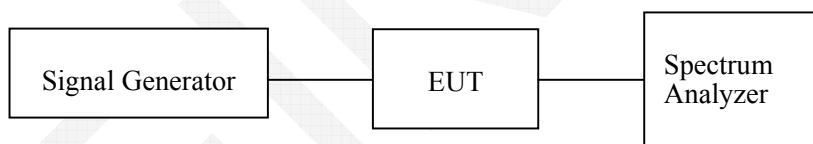
(1) *Main, booster and base stations.* (i) The maximum EIRP of a main, booster or base station shall not exceed $33 \text{ dBW} + 10\log(X/Y) \text{ dBW}$, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

(ii) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in dBW in a given direction shall be determined by the following formula: $\text{EIRP} = 33 \text{ dBW} + 10 \log(X/Y) \text{ dBW} + 10 \log(360/\text{beamwidth}) \text{ dBW}$, where X is the actual channel width in MHz, Y is either (i) 6 MHz if prior to transition or the station is in the MBS following transition or (ii) 5.5 MHz if the station is in the LBS and UBS following transition, and beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points.

Test Procedure

Conducted method:

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



- Connect a signal generator to the input of the EUT.
- Configure to generate the AWGN (broadband) test signal.
- The frequency of the signal generator shall be set to the frequency of (f_0) as determined from 3.3.
- Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.
- Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- Measure the output power of the EUT and record (see 3.5.3 or 3.5.4 for power measurement guidance).
- Remove the EUT from the measurement setup and using the same signal generator settings, repeat the power measurement on the input signal to the EUT and record as input power.
- Repeat the procedure with the narrowband test signal.
- Repeat the procedure for both test signals with input signal amplitude set to 3 dB above the AGC threshold level.
- Repeat for all frequency bands authorized for use by the EUT.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09
R & S	Wideband Radio Communication Tester	CMW500	114772	2014-11-15	2015-11-14

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

Test Data**Environmental Conditions**

Temperature:	25.2℃
Relative Humidity:	53%
ATM Pressure:	101.1 kPa

The testing was performed by Dean Liu on 2015-04-09.

AGC threshold level:

Test mode	Modulation	Frequency	Input power	Output Power	Gain	Results
		MHz	dBm	dBm	dB	
Downlink	QPSK	2580	-53.30	14.84	68.14	Compliant
		2610	-52.31	16.22	68.53	Compliant
	16QAM	2580	-53.25	14.90	68.15	Compliant
		2610	-52.09	16.15	68.24	Compliant
	64QAM	2580	-53.17	15.27	68.44	Compliant
		2610	-52.94	15.59	68.53	Compliant
Uplink	QPSK	2580	-53.09	15.76	68.85	Compliant
		2610	-52.46	15.56	68.02	Compliant
	16QAM	2580	-52.67	15.82	68.49	Compliant
		2610	-52.44	15.84	68.28	Compliant
	64QAM	2580	-53.01	15.97	68.98	Compliant
		2610	-52.48	15.74	68.22	Compliant

3dB above the AGC threshold Level

Test mode	Modulation	Frequency	Input power	Output Power	Results
		MHz	dBm	dBm	
Downlink	QPSK	2580	-50.3	14.88	Compliant
		2610	-49.31	16.29	Compliant
	16QAM	2580	-50.25	14.99	Compliant
		2610	-49.09	16.21	Compliant
	64QAM	2580	-50.17	15.45	Compliant
		2610	-49.94	15.79	Compliant
Uplink	QPSK	2580	-50.09	15.86	Compliant
		2610	-49.46	15.72	Compliant
	16QAM	2580	-49.67	16.03	Compliant
		2610	-49.44	15.96	Compliant
	64QAM	2580	-50.01	16.02	Compliant
		2610	-49.48	15.86	Compliant

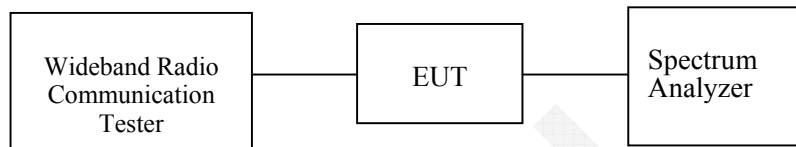
FCC §2.1049 & §27.53 - OCCUPIED BANDWIDTH

Applicable Standards

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.



A 26 dB bandwidth measurement shall be performed on the input signal and the output signal (alternatively, the 99% OBW can be measured and used) to demonstrate compliance to the technical requirements specified in §90.219(e)(4)(i) and (ii). See KDB Publication 971168 for more information regarding measuring the OBW.

- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to transmit the AWGN signal.
- c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.
- d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 times to 5 times the EBW or alternatively, the OBW.
- f) The nominal resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be $\geq 3 \times \text{RBW}$.
- g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than $[10 \log (\text{OBW} / \text{RBW})]$ below the reference level.

NOTE—Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

- h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.
- i) Set spectrum analyzer detection function to positive peak.
- j) Set the trace mode to max hold.
- k) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency as f_0 .
- l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the -26 dB down amplitude. The 2 dB emission bandwidth is the positive frequency difference between the two markers.

NOTE—The spectral envelope may cross the -26 dB down amplitude at multiple points. If so, the lowest or highest frequency shall be selected as the frequencies the furthest removed from the center frequency at which the spectral envelope crosses the -26 dB down amplitude point.

m) Repeat steps e) to l) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

n) Compare the spectral plot of the input signal (determined from step m) to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

o) Repeat steps a) to n) with the signal generator set to the narrowband signal.

p) Repeat the procedure for both test signals with the input signal amplitude set 3 dB above the AGC threshold.

q) Repeat for all frequency bands authorized for use by the EUT.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
R & S	Wideband Radio Communication Tester	CMW500	114772	2014-11-15	2015-11-14

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

Test Data

Environmental Conditions

Temperature:	24.1~25.2 °C
Relative Humidity:	53~54 %
ATM Pressure:	101.1~101.3 kPa

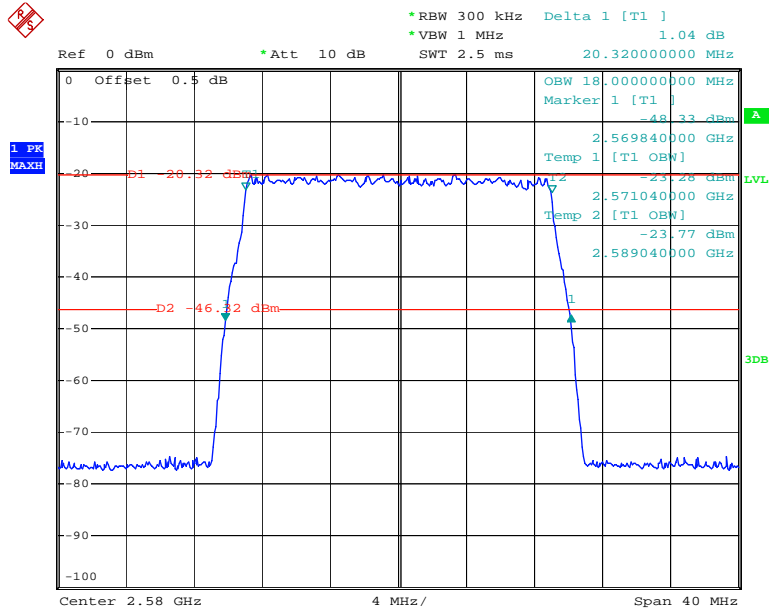
The testing was performed by Dean Liu from 2015-04-09 to 2015-08-29.

Input-versus-output signal comparison:

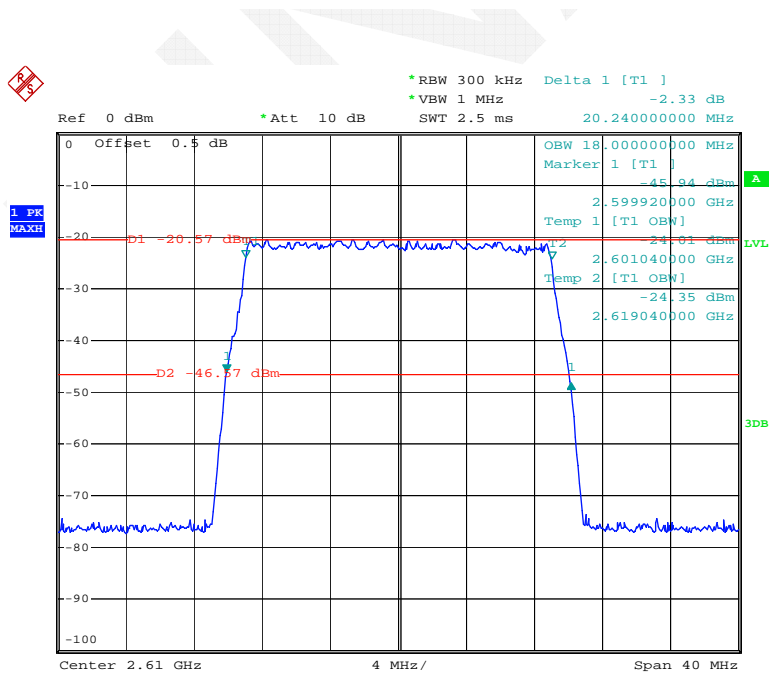
Test mode	Modulation	Frequency	Input		Output AGC threshold level		Output 3dB above the AGC threshold level	
			99% Occupied Bandwidth	26dB Emission Bandwidth	99% Occupied Bandwidth	26dB Emission Bandwidth	99% Occupied Bandwidth	26dB Emission Bandwidth
		MHz	MHz	MHz	MHz	MHz	MHz	MHz
Down link	QPSK	2580	18.00	20.32	17.96	19.56	18.00	19.69
		2610	18.00	20.24	17.86	19.56	17.92	19.52
	16QAM	2580	18.16	20.24	18.04	19.60	18.00	19.61
		2610	18.08	20.24	17.96	19.52	17.92	19.52
	64QAM	2580	18.08	20.16	17.96	19.64	18.00	19.69
		2610	18.08	20.24	17.96	19.53	17.92	19.52
Up link	QPSK	2580	18.00	20.32	18.04	19.64	18.08	19.68
		2610	18.00	20.24	17.96	20.02	18.08	19.60
	16QAM	2580	18.16	20.24	18.04	19.80	18.08	19.68
		2610	18.08	20.24	17.96	19.92	18.08	19.60
	64QAM	2580	18.08	20.16	18.04	19.60	18.16	19.60
		2610	18.08	20.24	18.04	20.17	18.08	19.52

Input Bandwidth:

QPSK

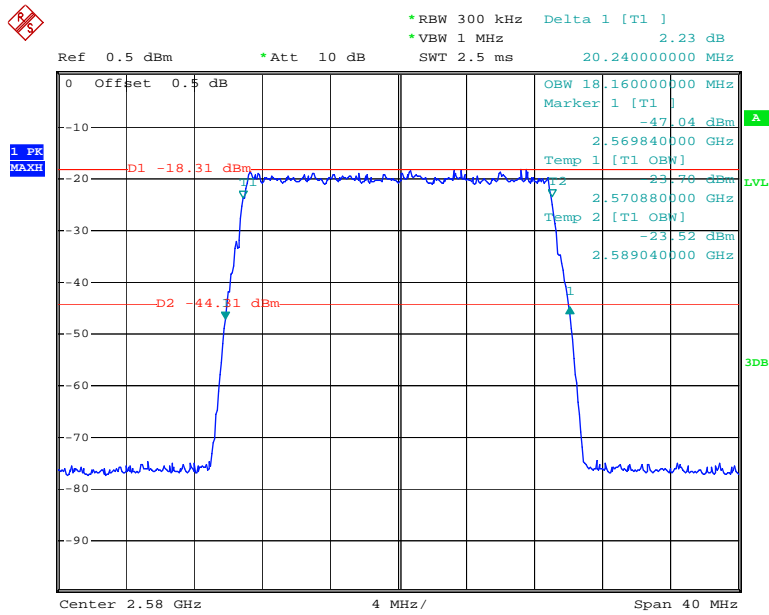


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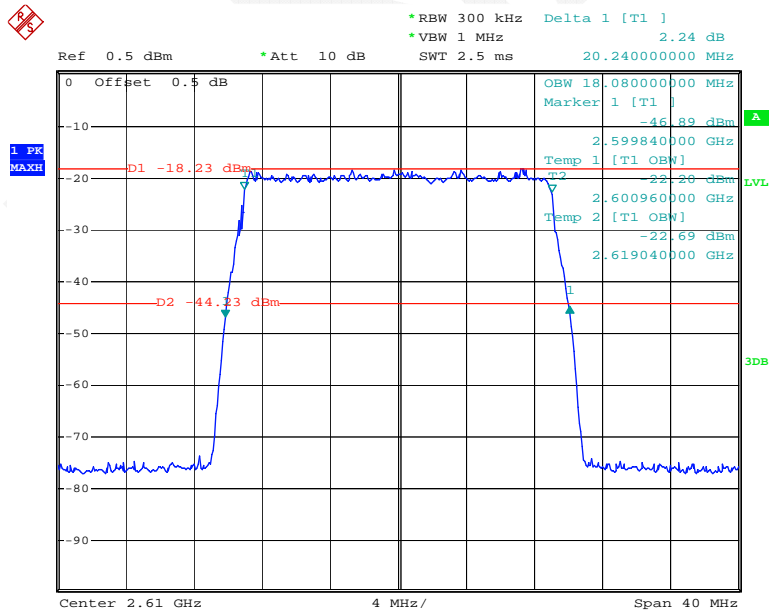


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16QAM

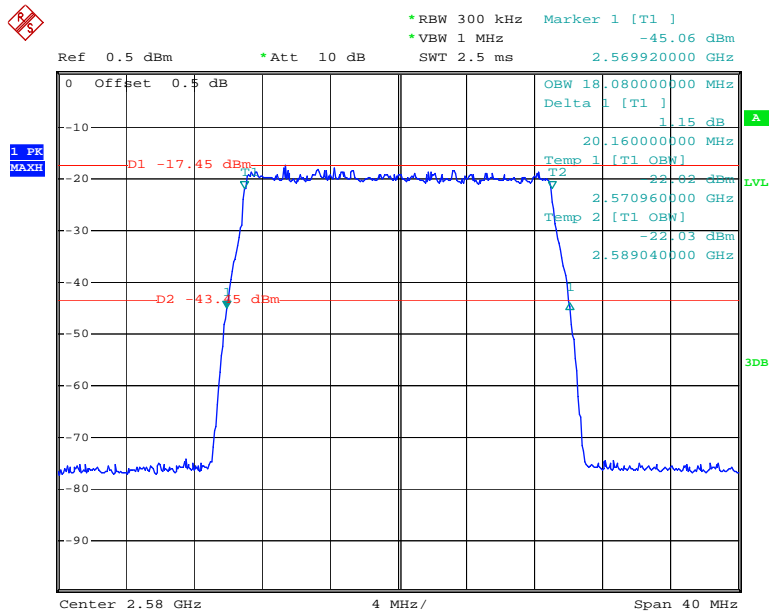


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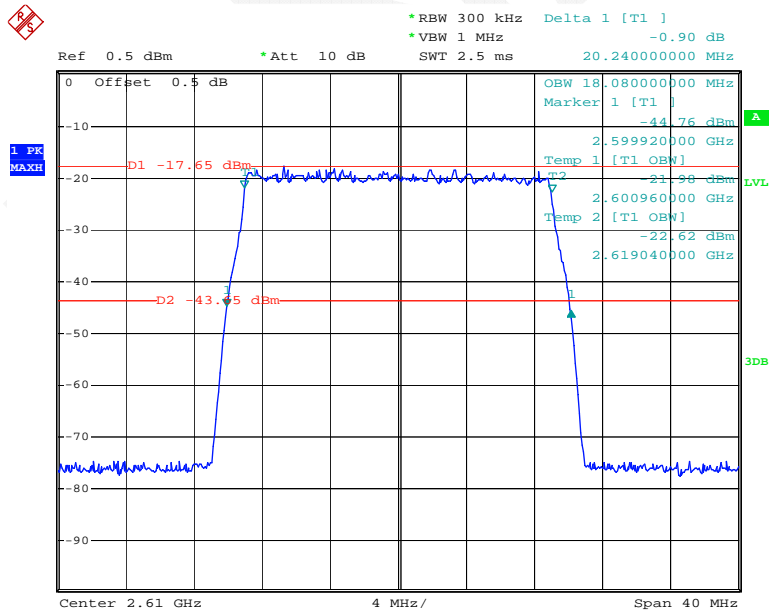


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64QAM

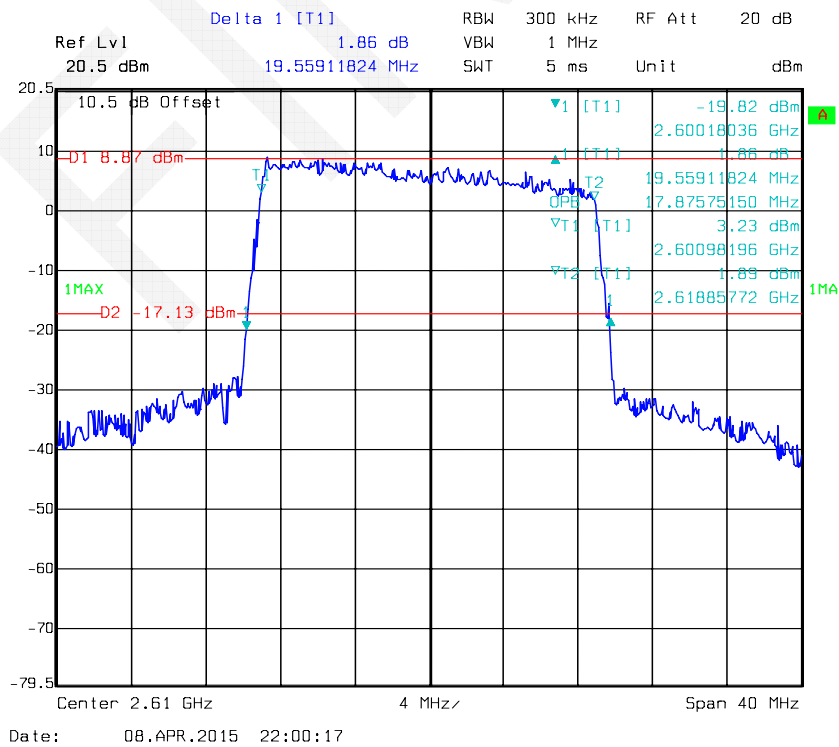
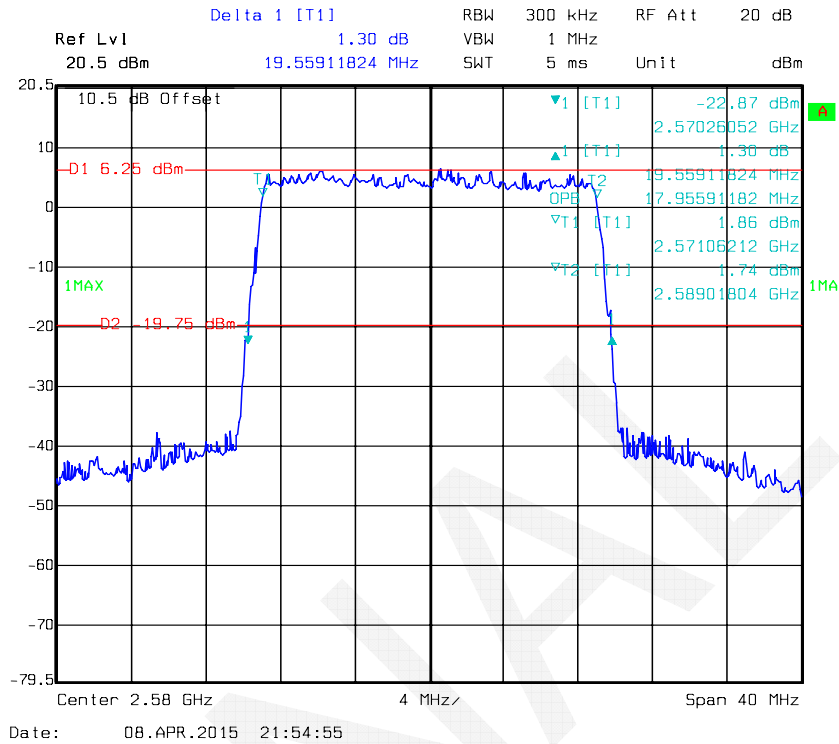


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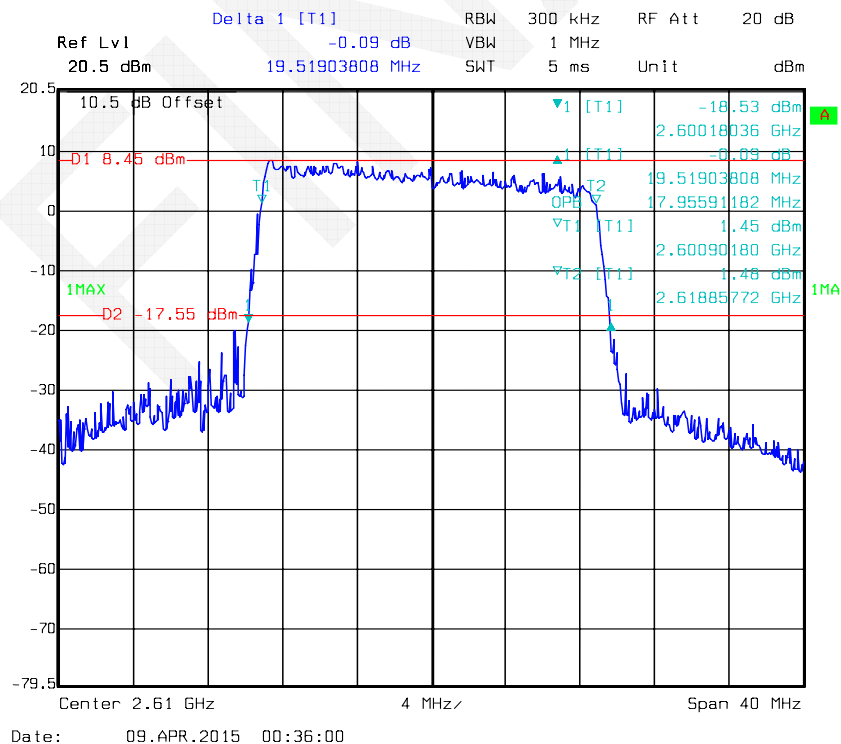
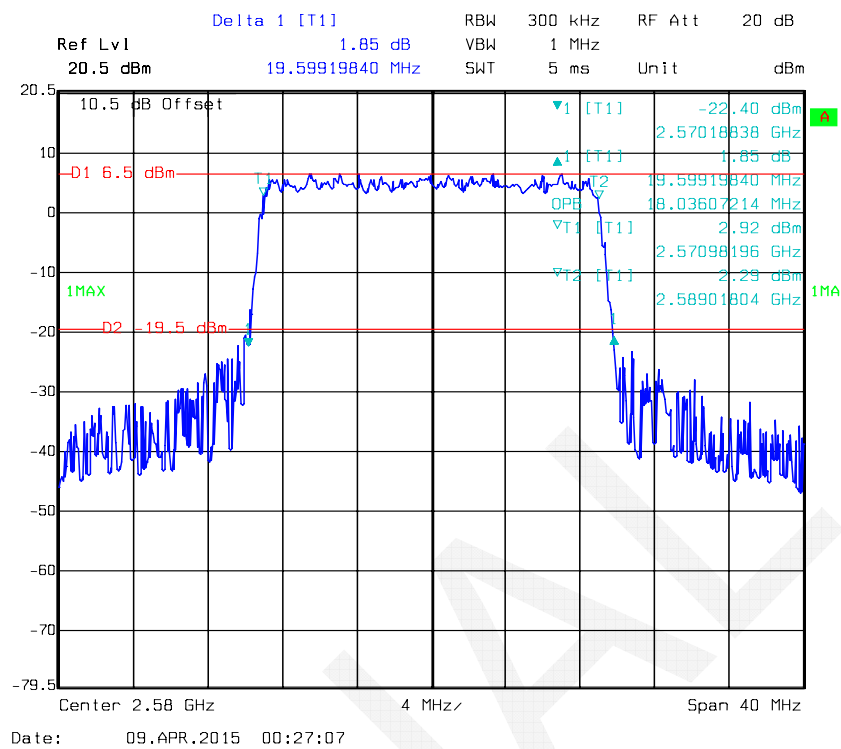


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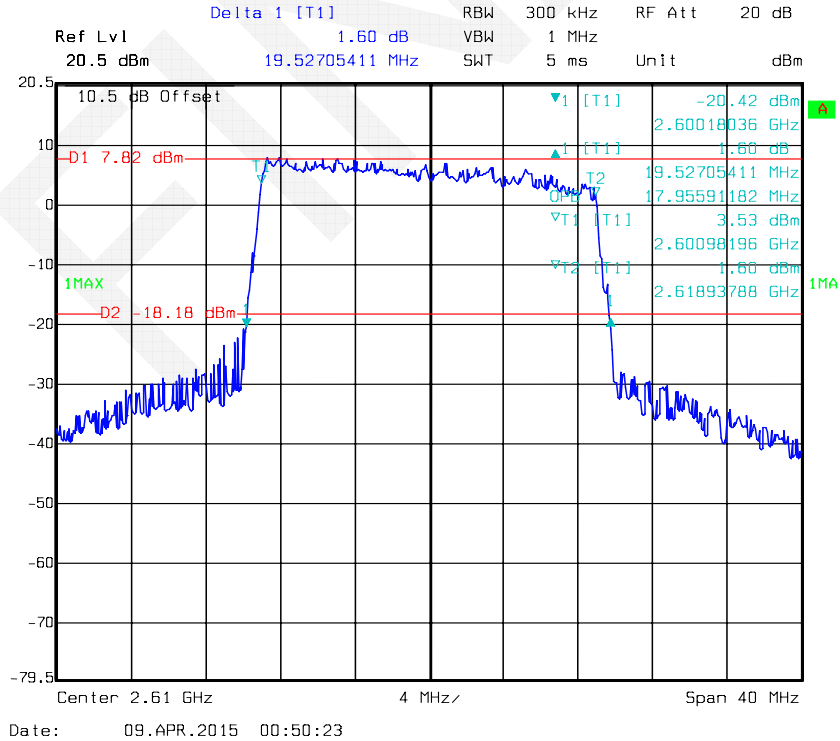
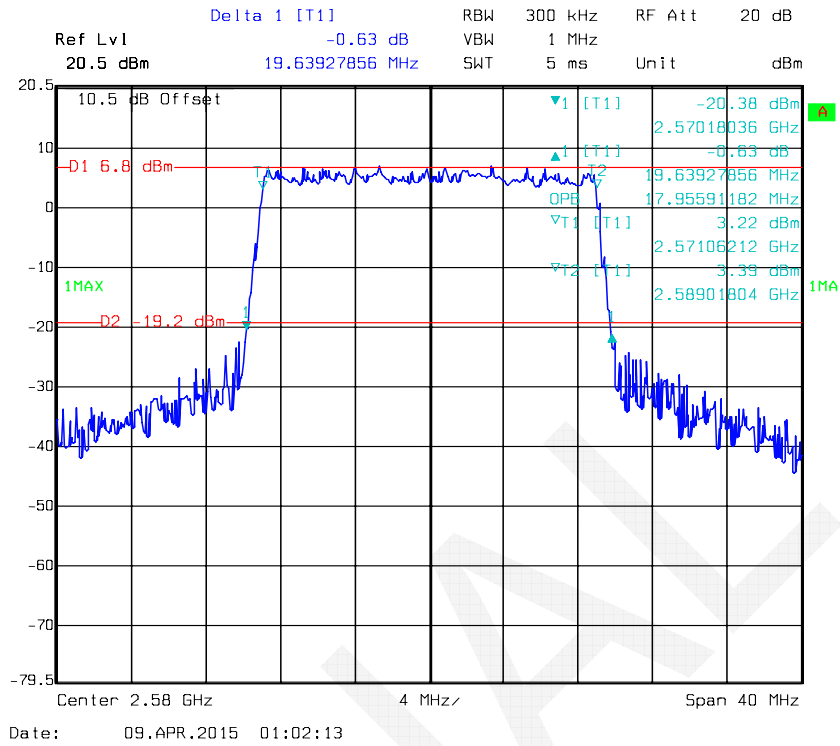
Output Bandwidth:
Downlink:

QPSK

16QAM

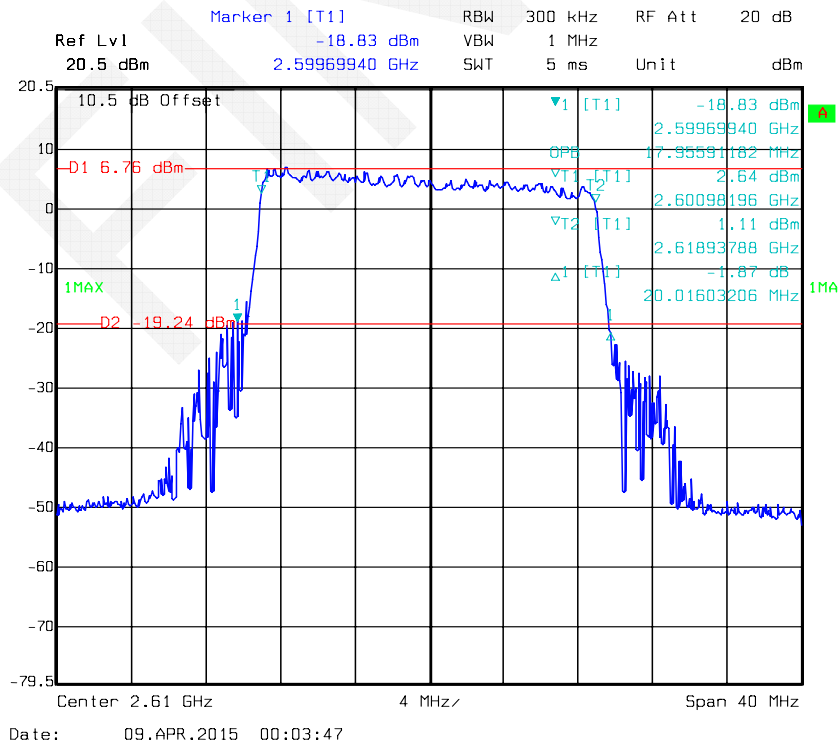
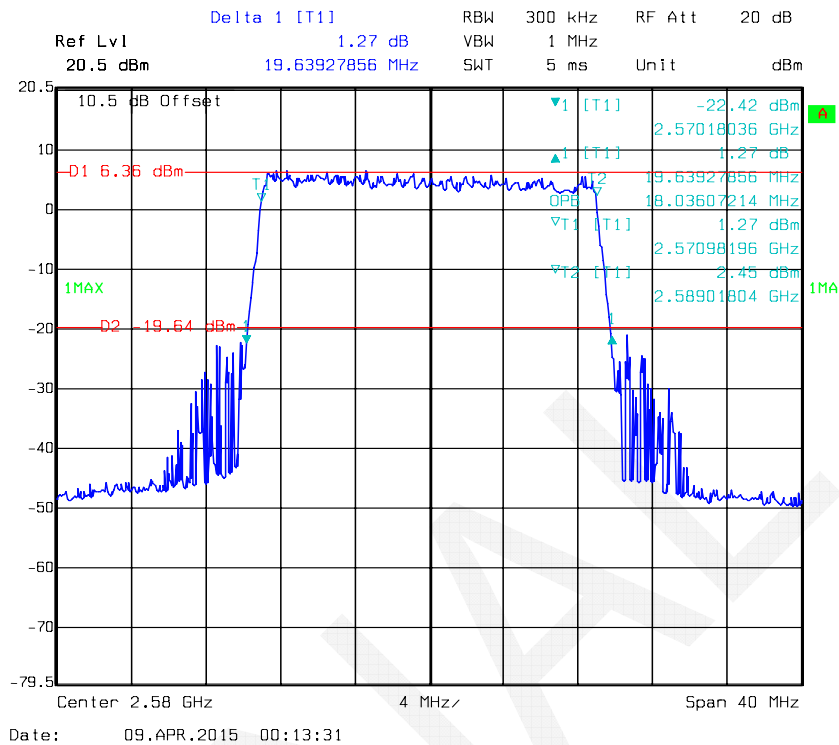


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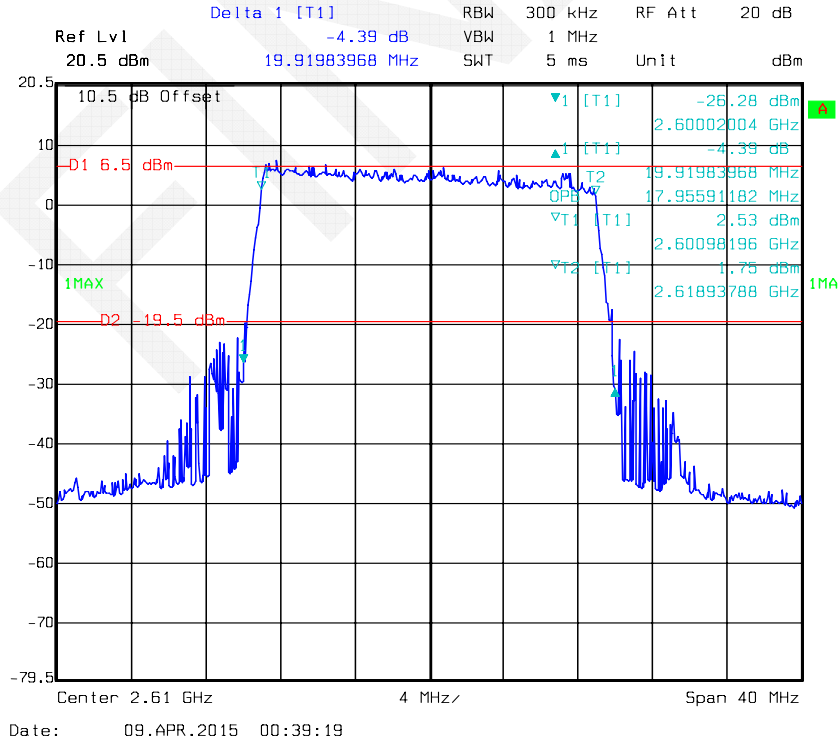
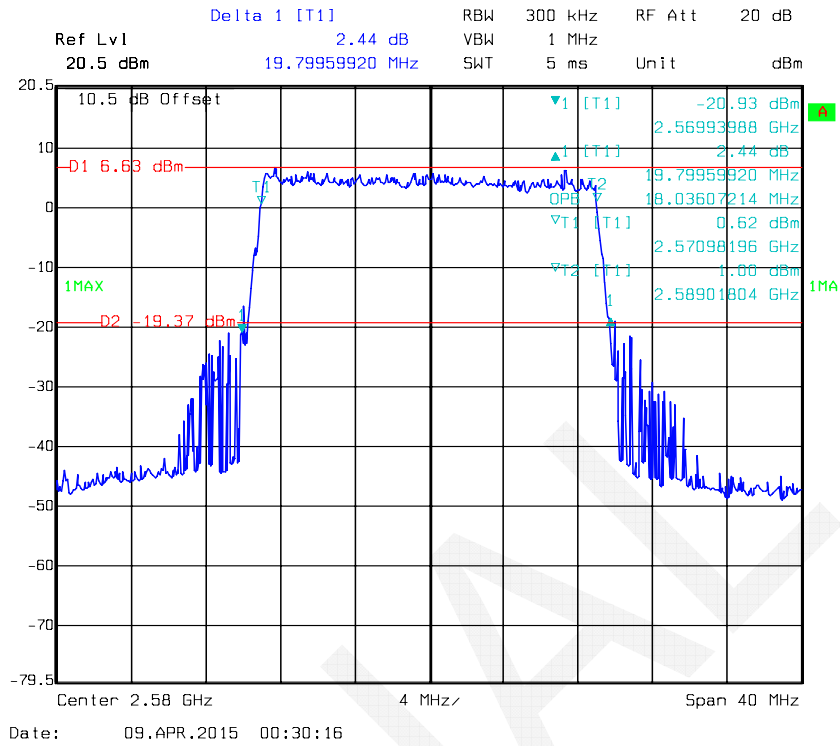


Uplink:

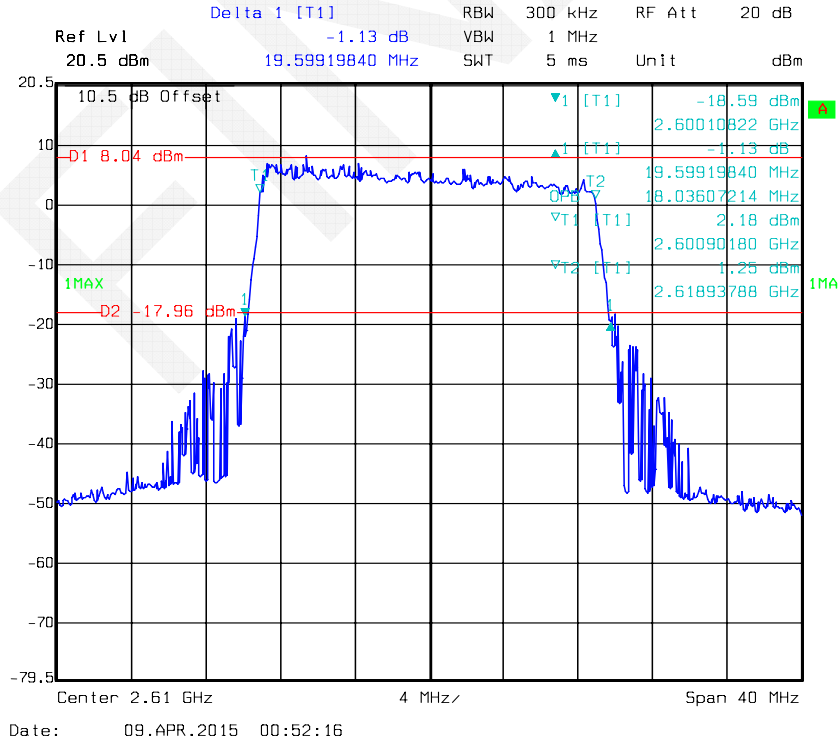
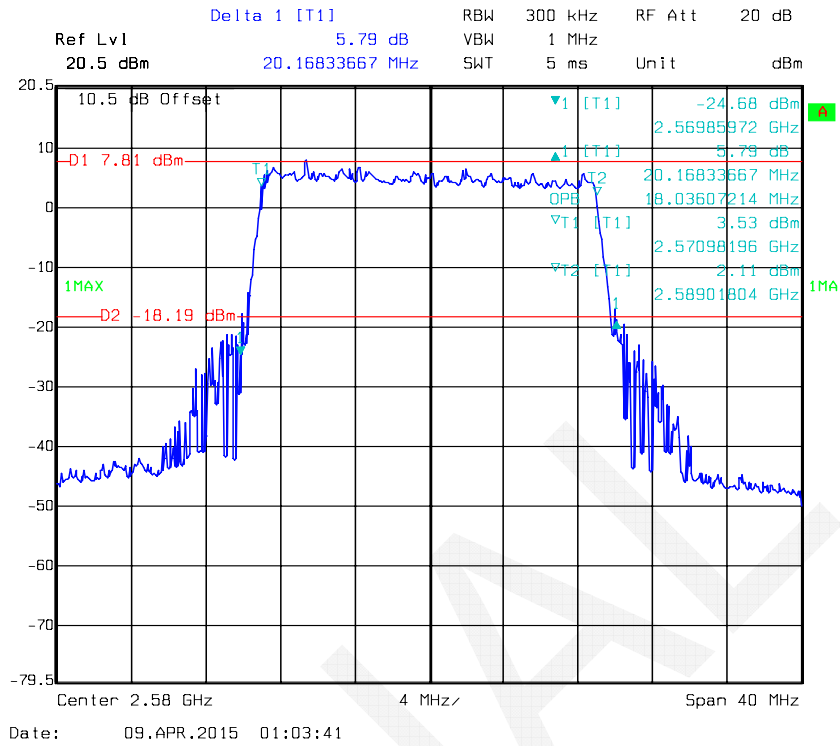
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16QAM

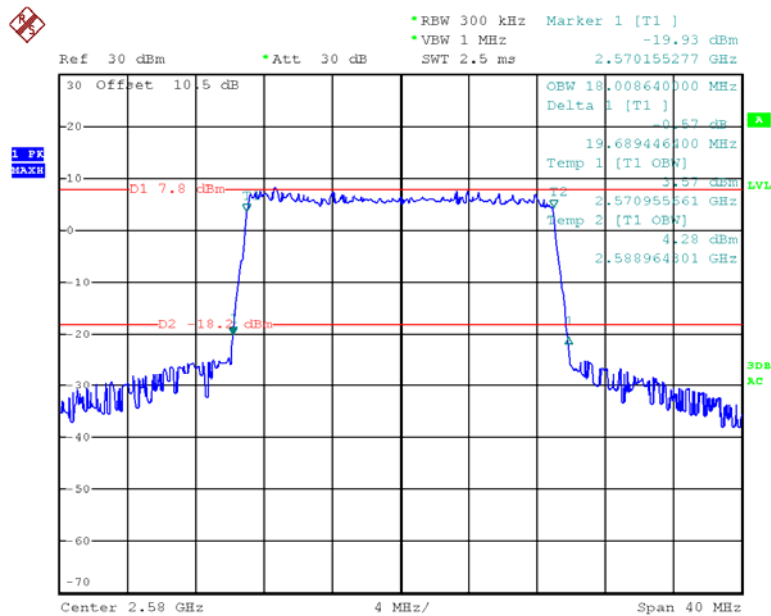


64QAM

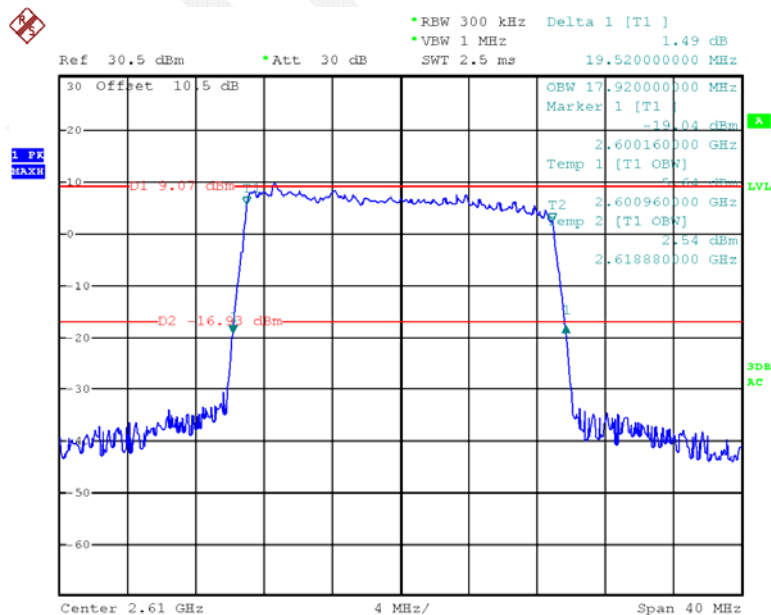


3dB above the AGC threshold Level

Downlink:

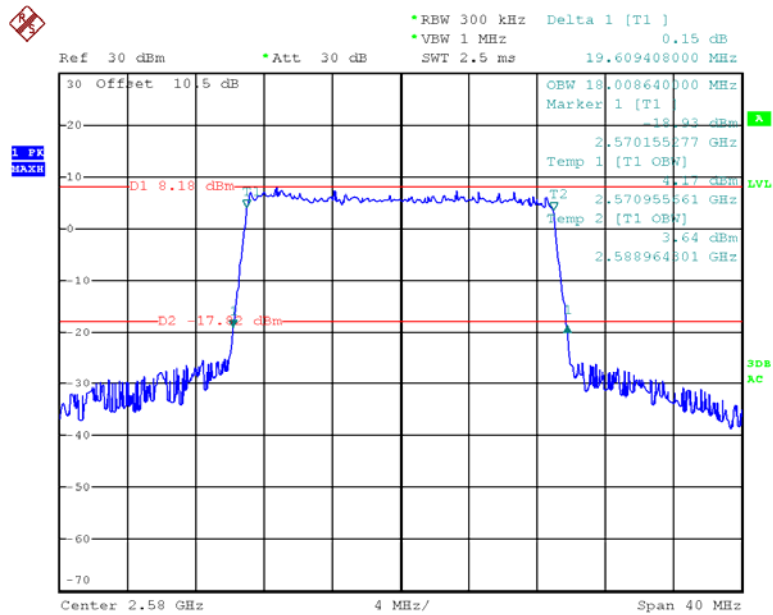
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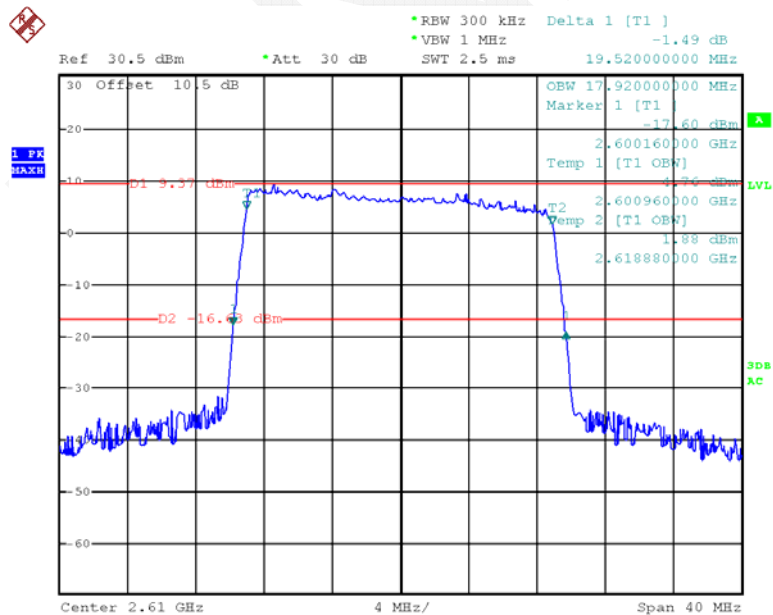


Date: 29.AUG.2015 13:28:34

16QAM

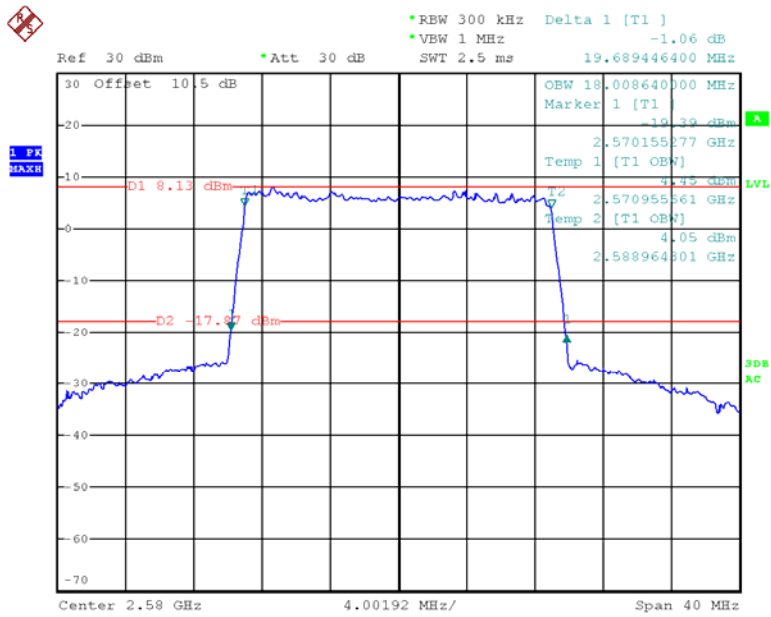


Date: 29.AUG.2015 03:03:08

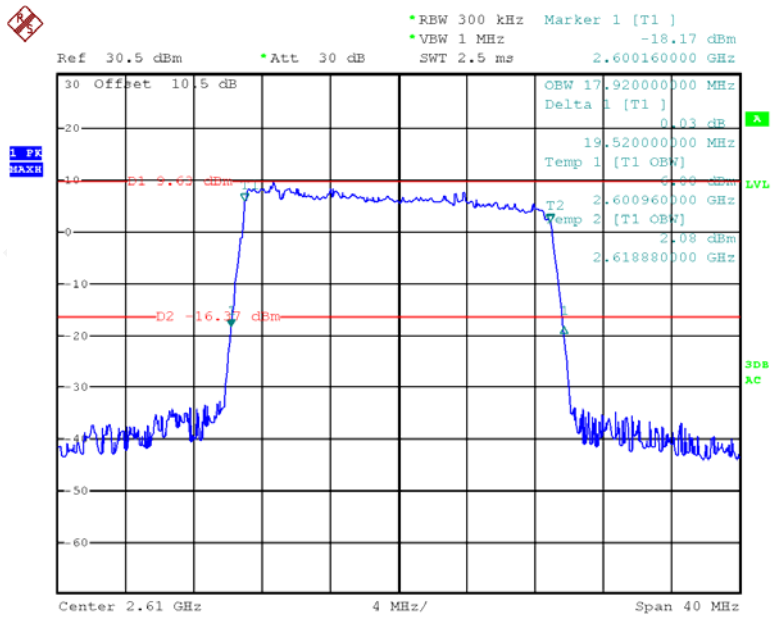


Date: 29.AUG.2015 13:29:39

64QAM



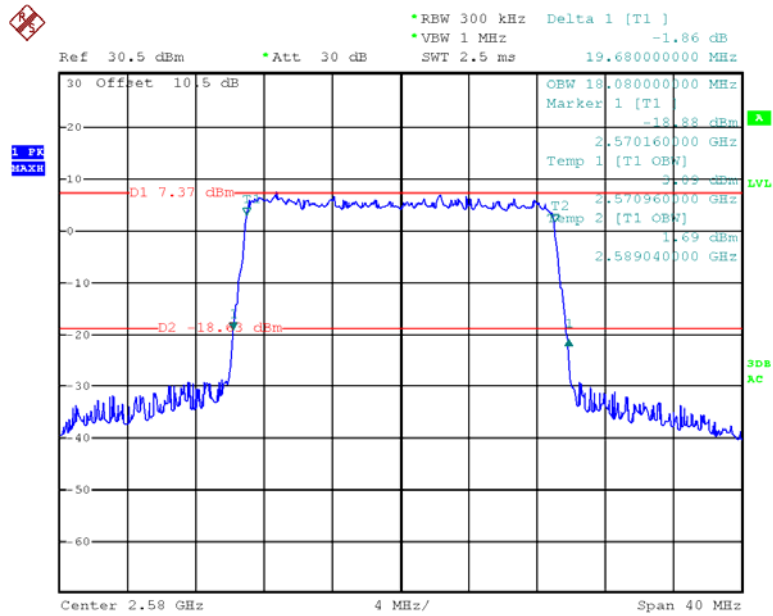
Date: 29.AUG.2015 03:08:12



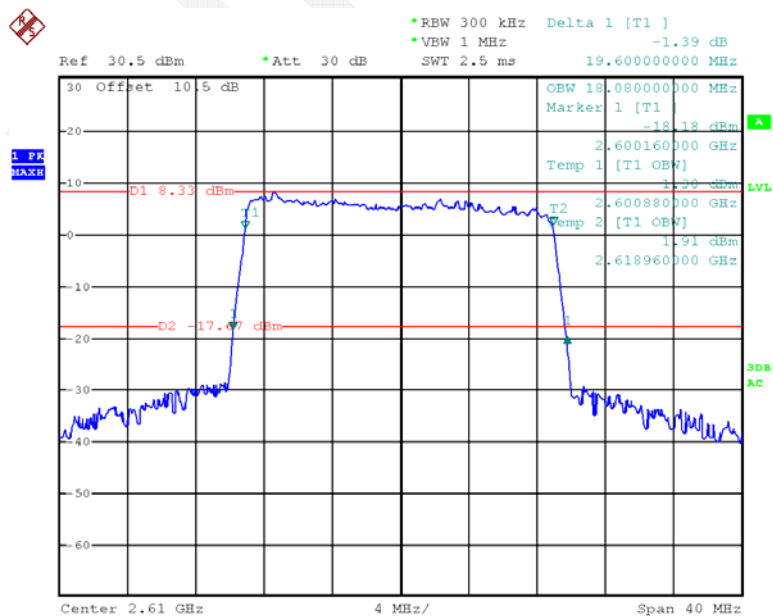
Date: 29.AUG.2015 13:30:27

Uplink

QPSK

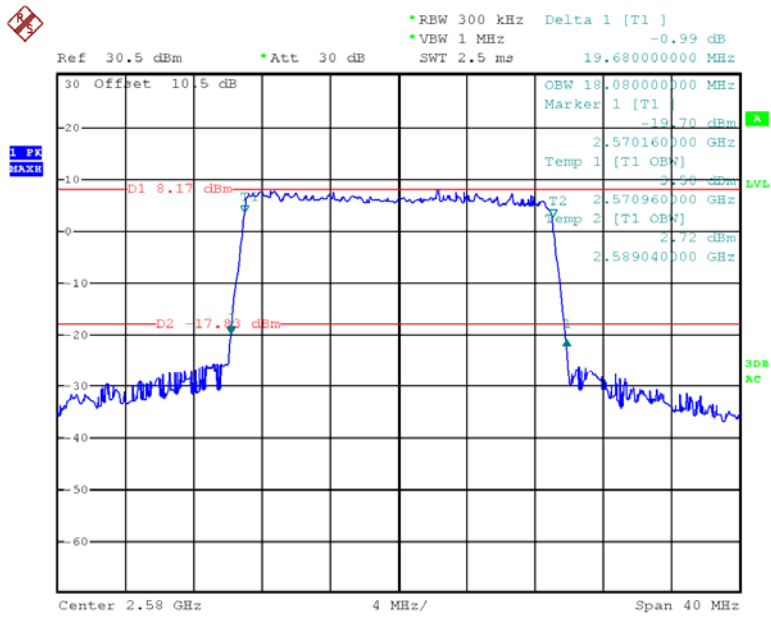


Date: 29.AUG.2015 13:37:22

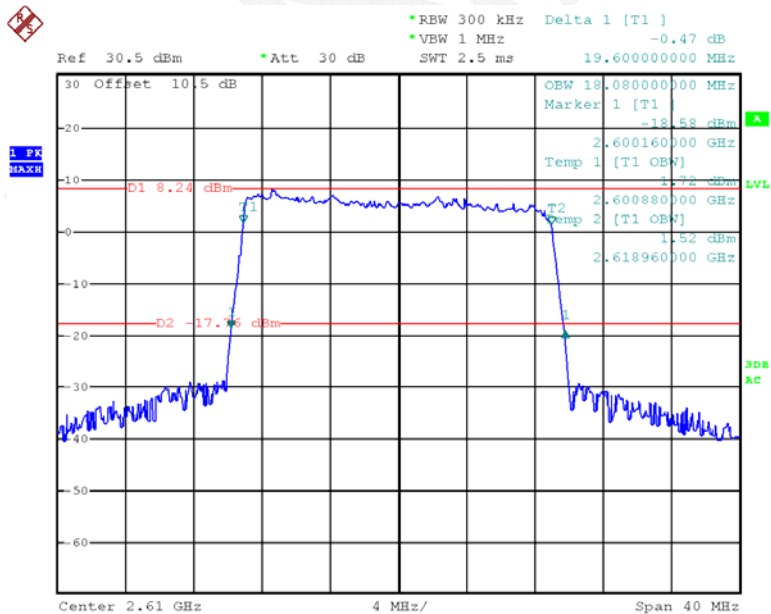


Date: 29.AUG.2015 13:42:22

16QAM

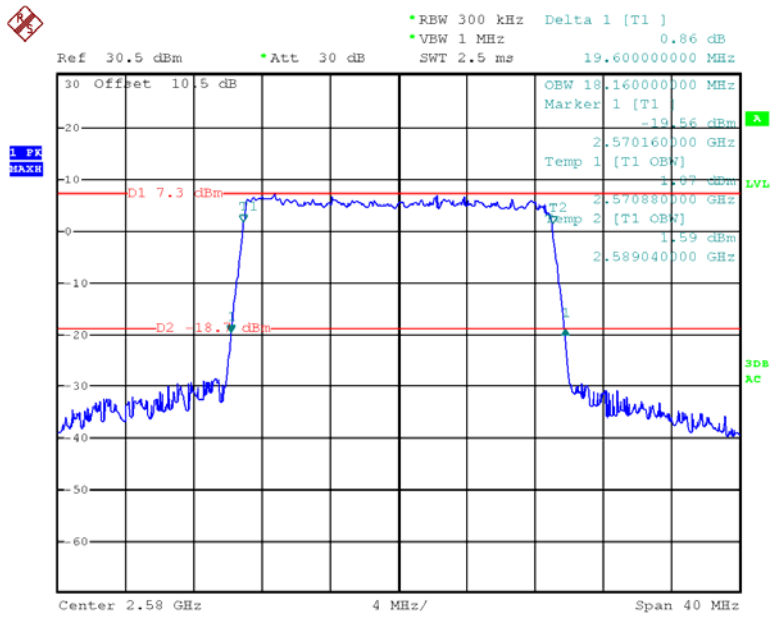


Date: 29.AUG.2015 13:38:42

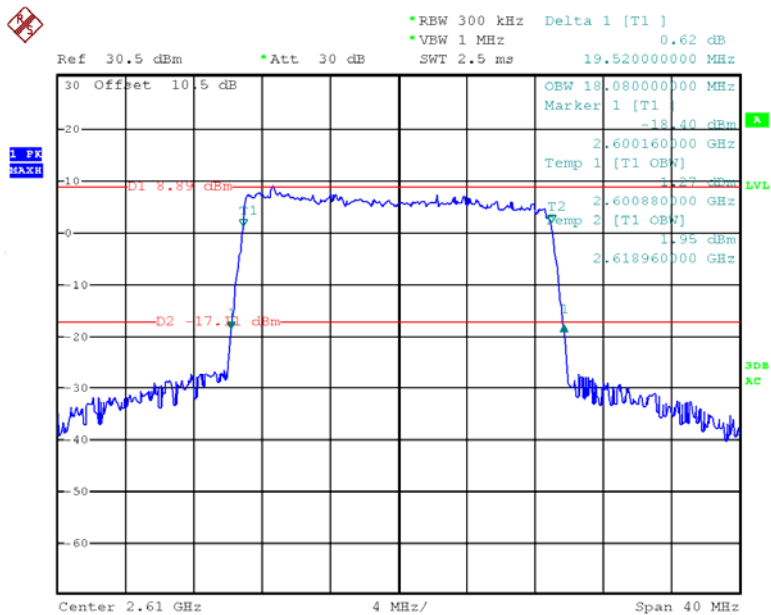


Date: 29.AUG.2015 13:43:19

64QAM



Date: 29.AUG.2015 13:39:49



Date: 29.AUG.2015 13:44:30

FCC §2.1051 & §27.53- SPURIOUS EMISSIONS AT ANTENNA TERMINALS

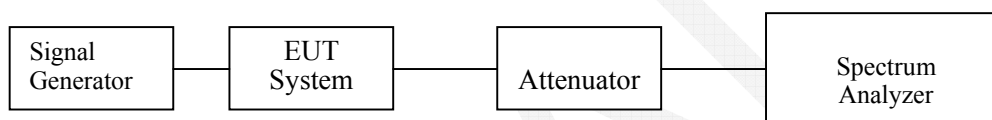
Applicable Standards

FCC §2.1051 and §27.53.

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 bandwidths of the spectrum analyzer were set at 100 kHz @ below 1GHz, 1MHz @ above 1GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
R & S	Wideband Radio Communication Tester	CMW500	114772	2014-11-15	2015-11-14
Agilent	MXG Vector Signal Generator	N5182B	MY513502142	2014-11-15	2015-11-14

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

Test Data

Environmental Conditions

Temperature:	25.2°C	26.1°C
Relative Humidity:	53 %	52 %
ATM Pressure:	101.4 kPa	101.3 kPa

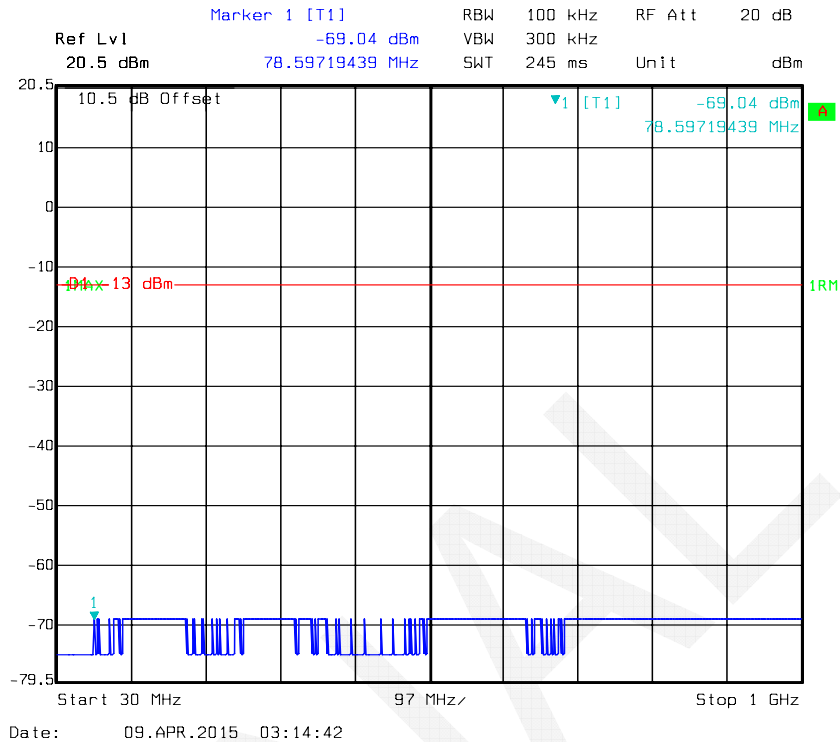
The testing was performed by Dean Liu on 2015-04-09 and 2015-08-16.

Please refer to the following plots.

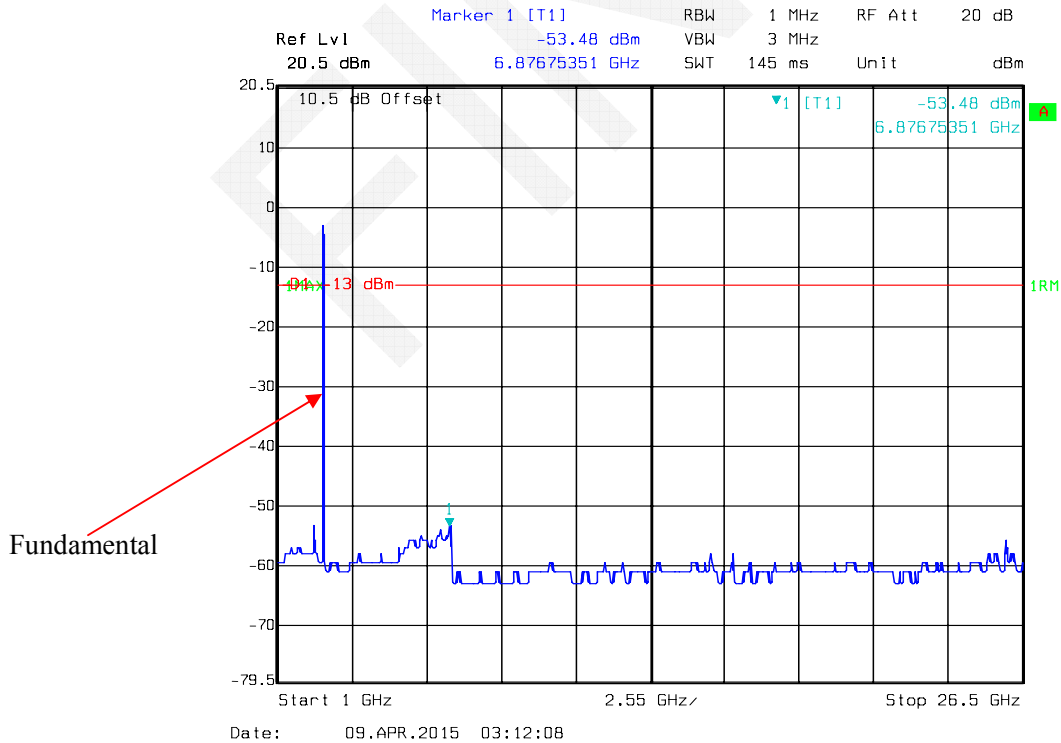
Note: This is a single channel booster, intermodulation does not need test.

Downlink:

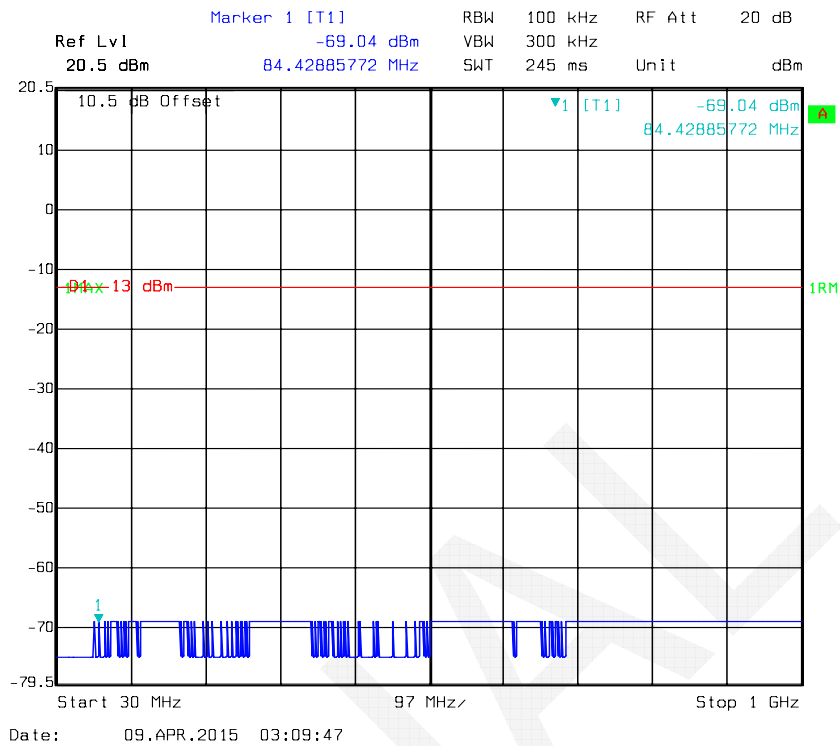
QPSK, 20MHz, Low Channel, 30MHz – 1GHz



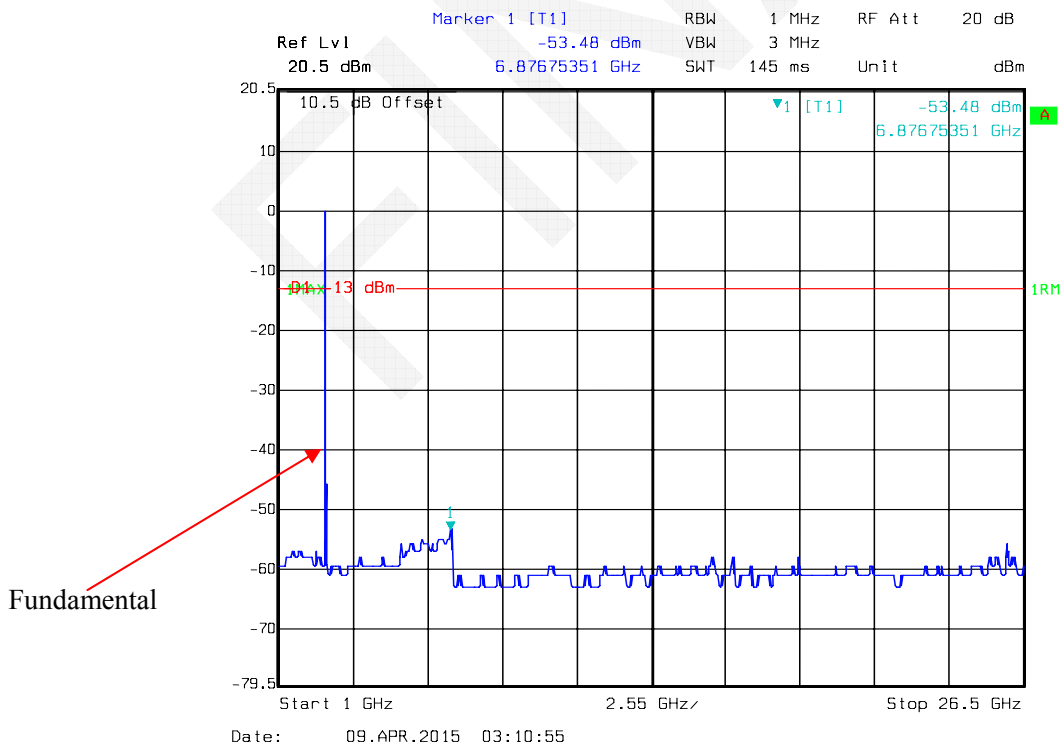
QPSK, 20MHz, Low Channel, 1GHz – 26.5GHz



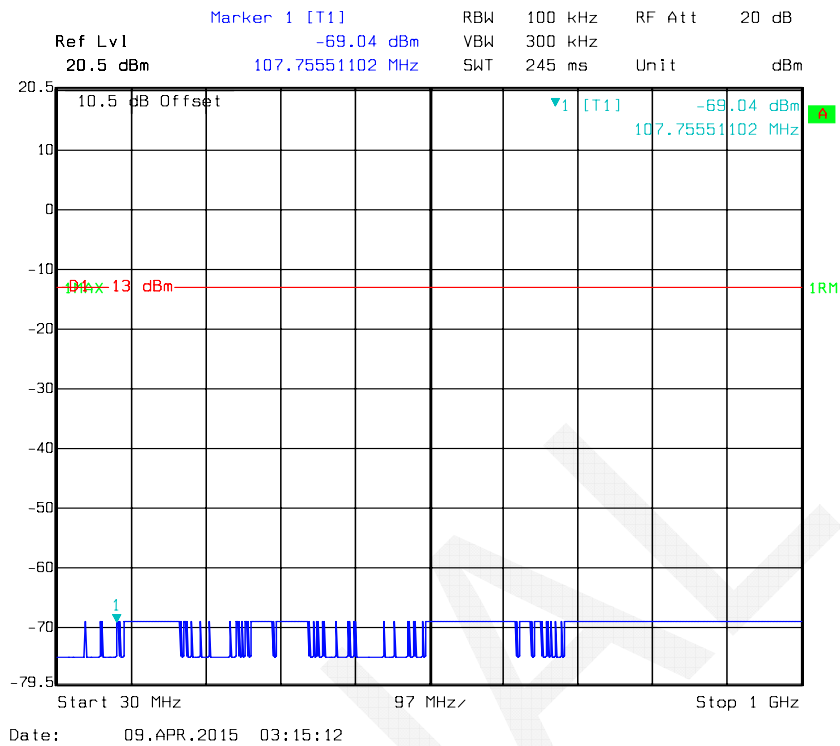
QPSK, 20MHz, High Channel, 30MHz – 1GHz



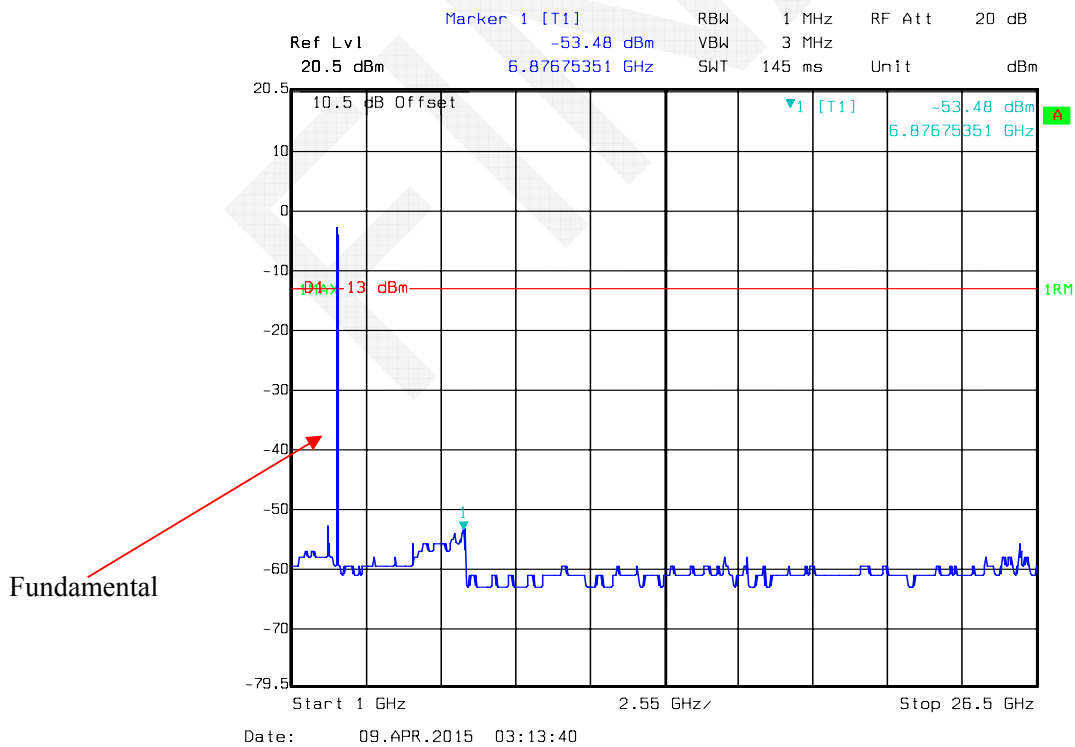
QPSK, 20MHz, High Channel, 1GHz – 26.5GHz



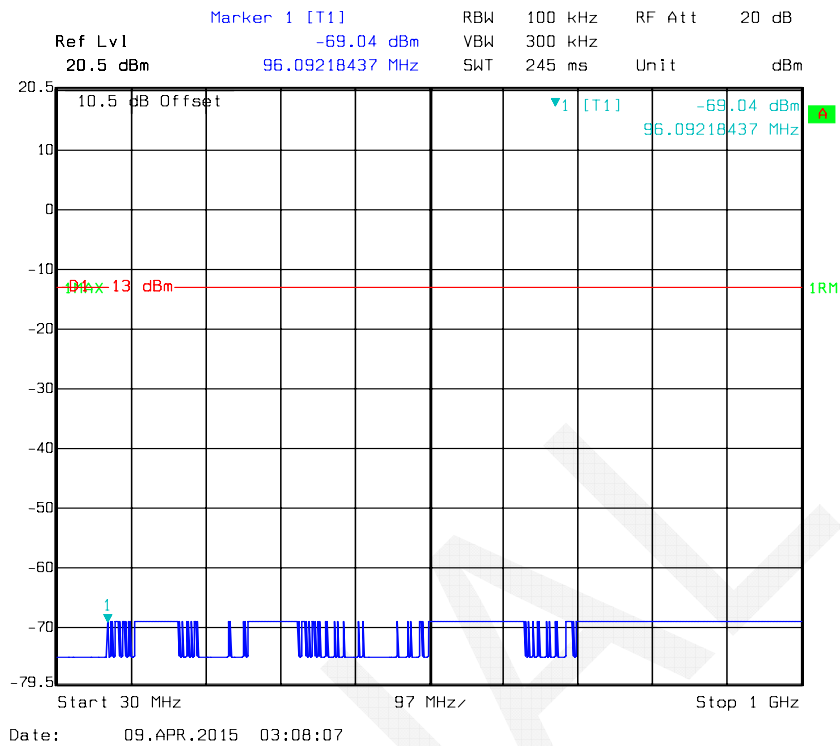
16QAM, 20MHz, Low Channel, 30MHz – 1GHz



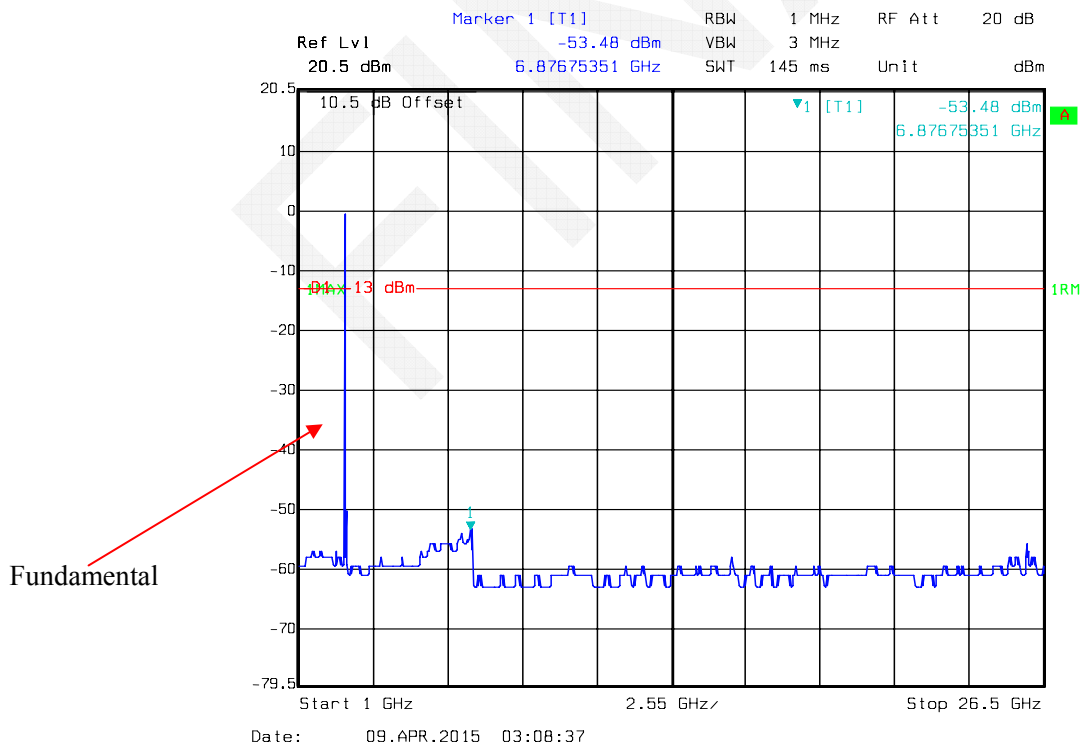
16QAM, 20MHz, Low Channel, 1GHz – 26.5GHz



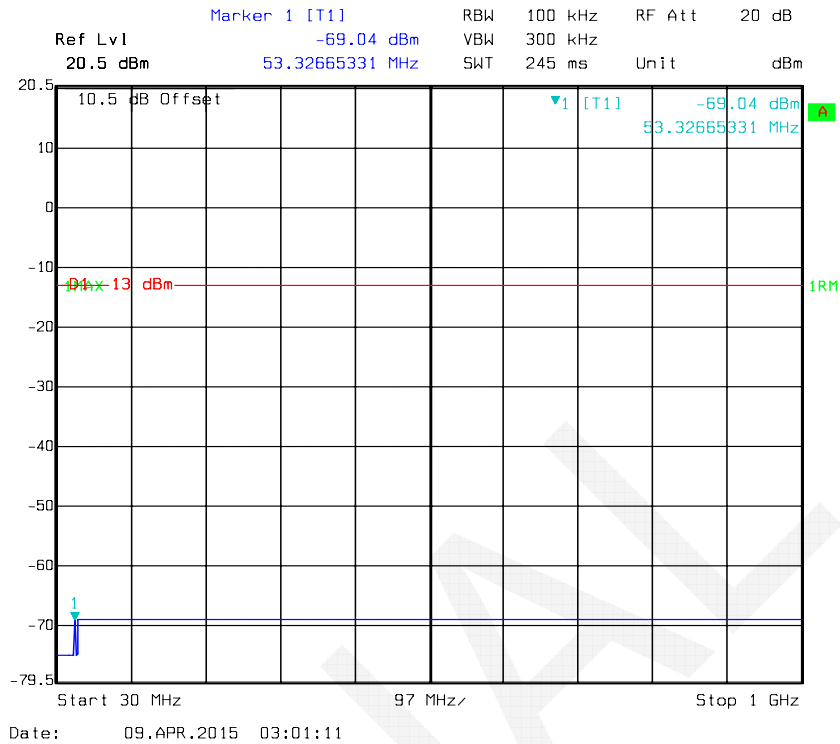
16QAM, 20MHz, High Channel, 30MHz – 1GHz



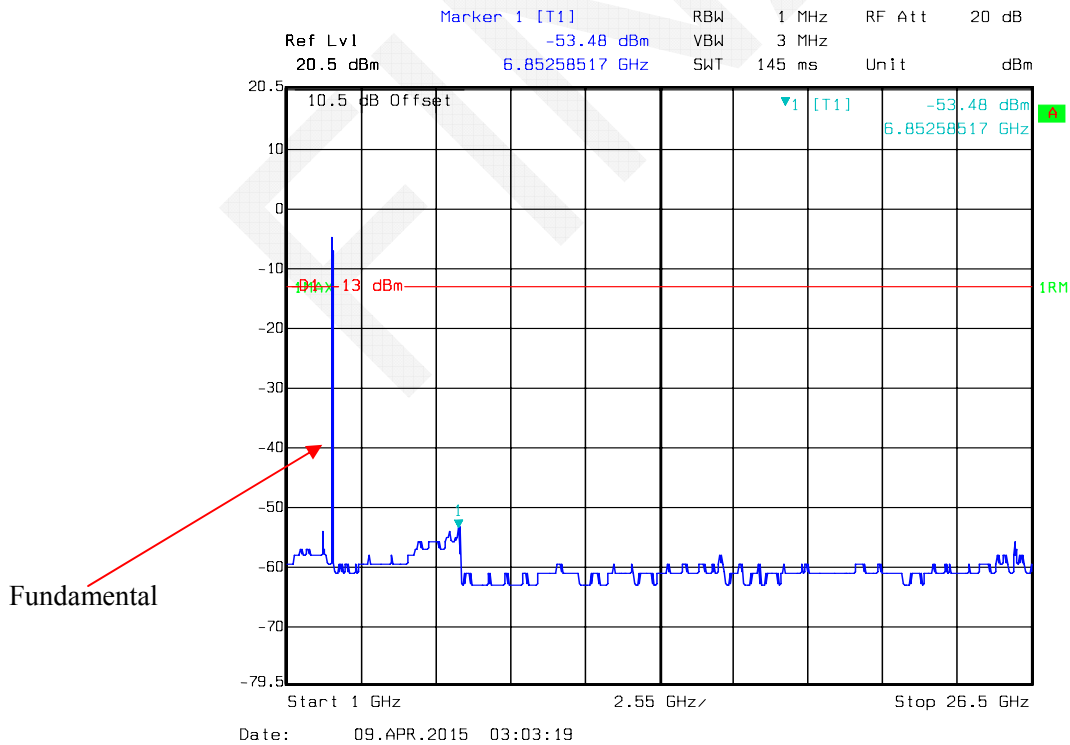
16QAM, 20MHz, High Channel, 1GHz – 26.5GHz



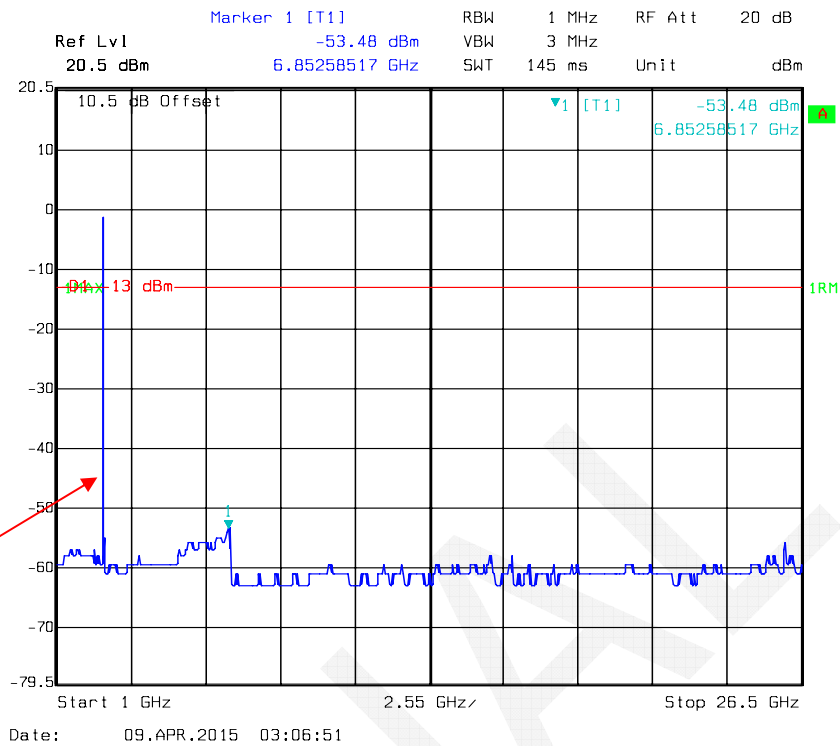
64QAM, 20MHz, Low Channel, 30MHz – 1GHz



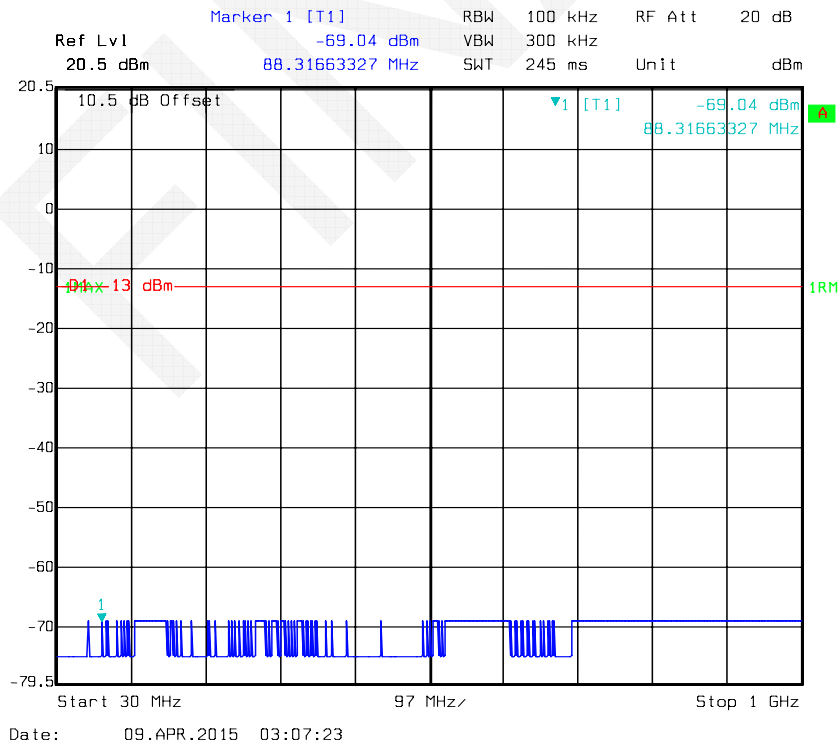
64QAM, 20MHz, Low Channel, 1GHz – 26.5GHz



64QAM, 20MHz, High Channel, 1GHz – 26.5GHz

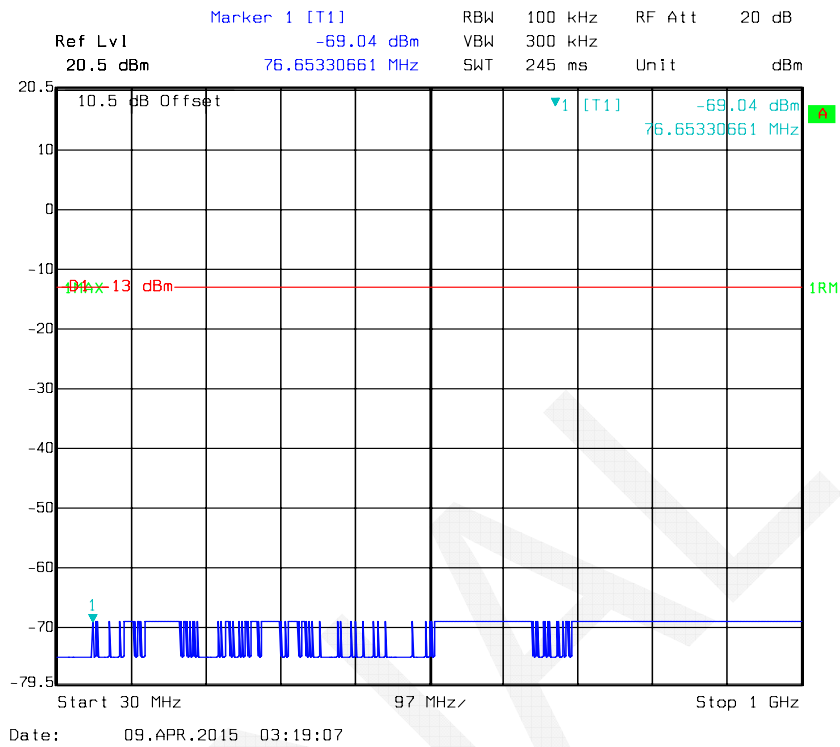


64QAM, 20MHz, High Channel, 1GHz – 26.5GHz

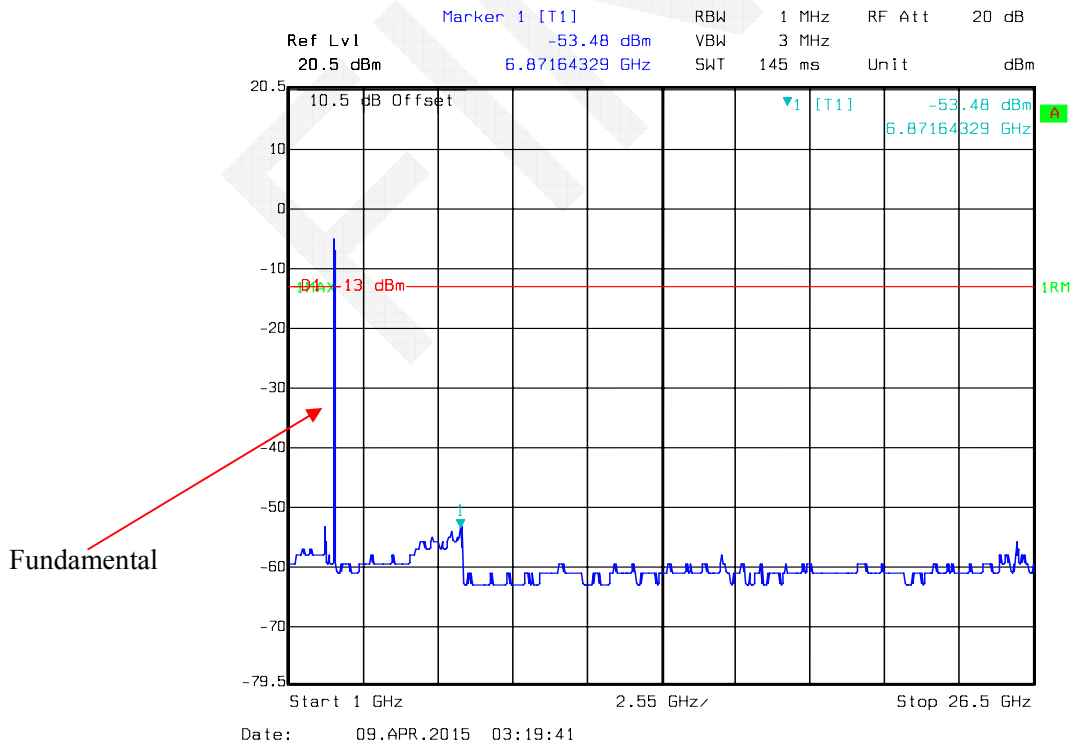


Uplink:

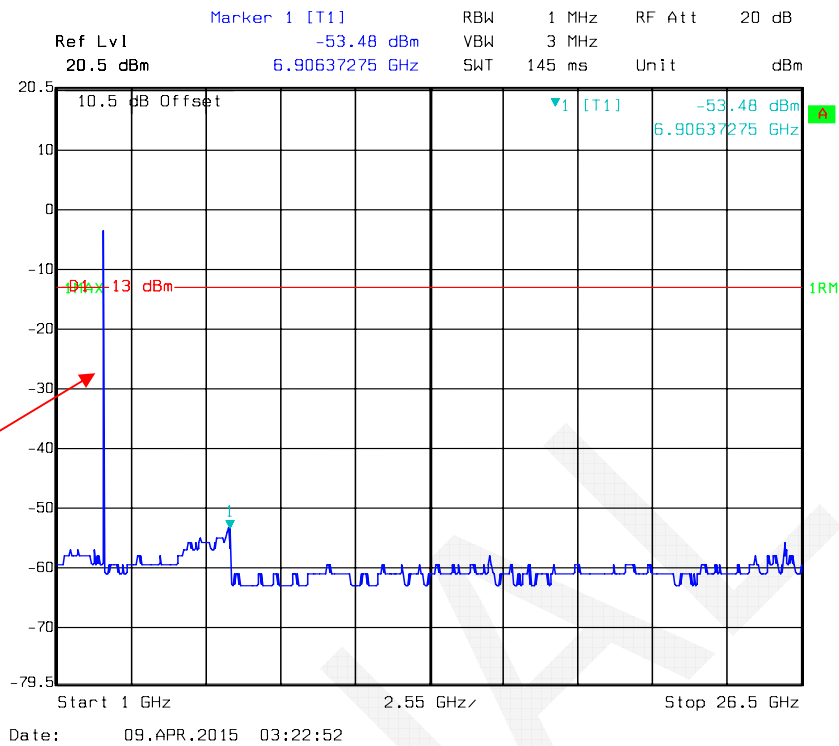
QPSK, 20MHz, Low Channel, 30MHz – 1GHz



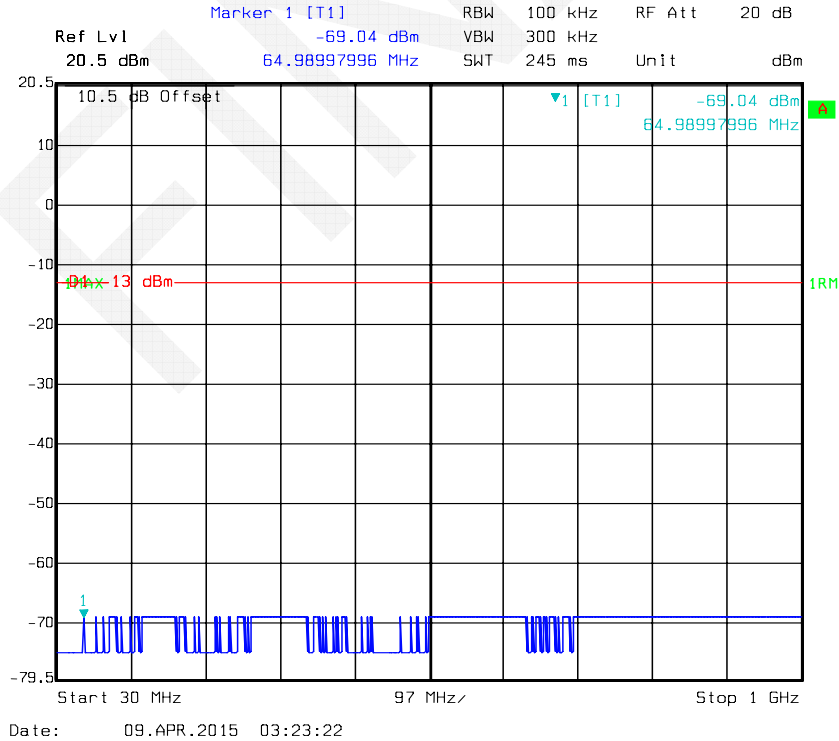
QPSK, 20MHz, Low Channel, 1GHz – 26.5GHz



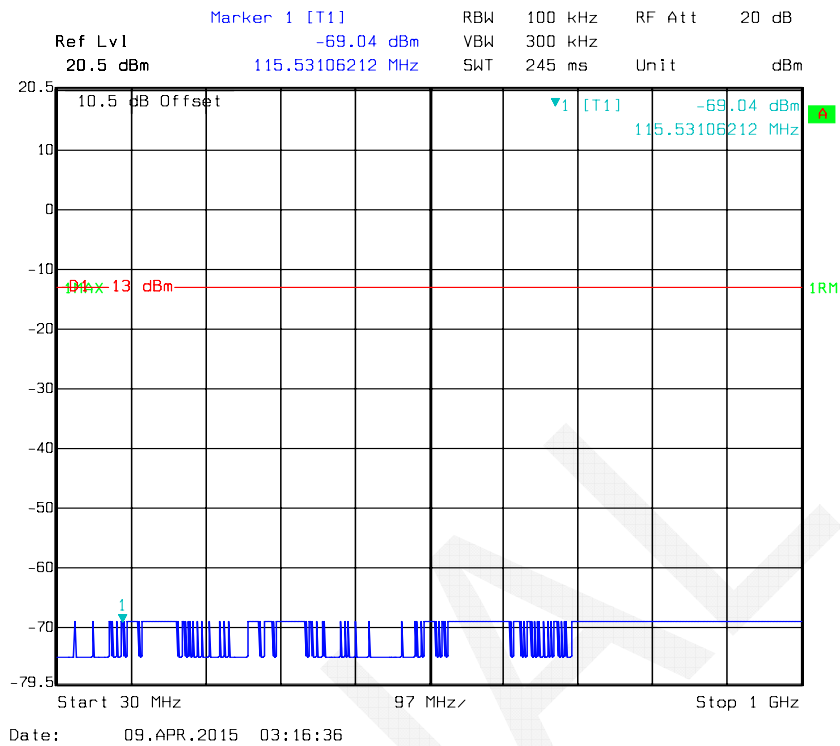
QPSK, 20MHz, High Channel, 30MHz – 1GHz



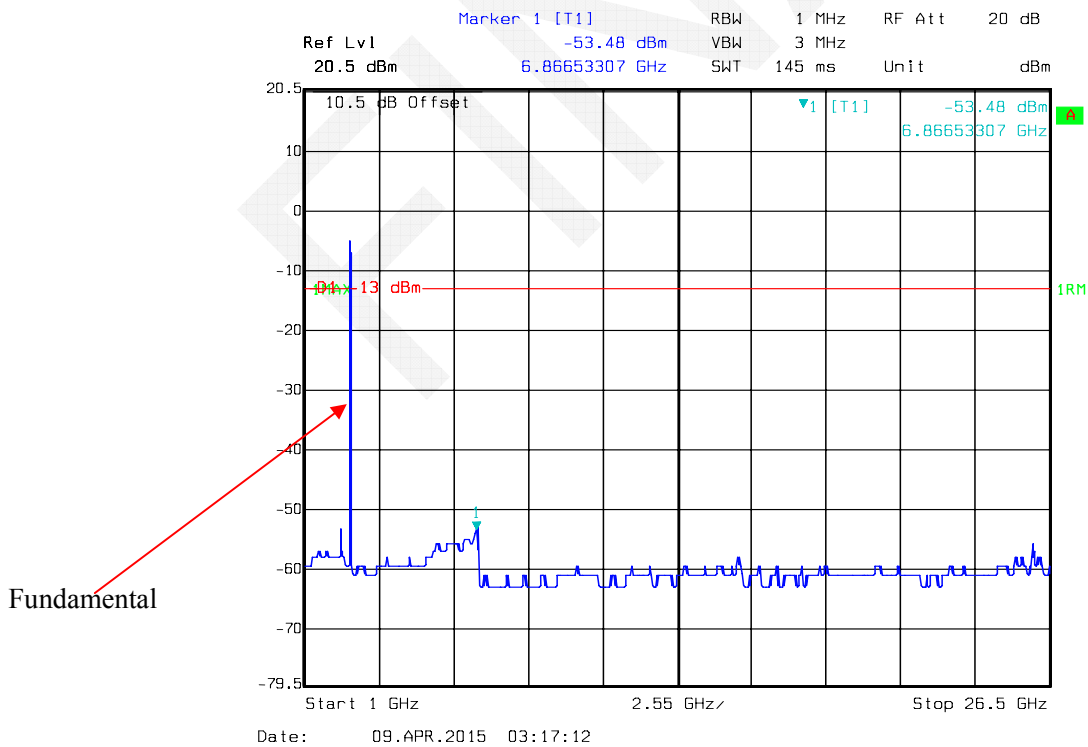
QPSK, 20MHz, High Channel, 1GHz – 26.5GHz



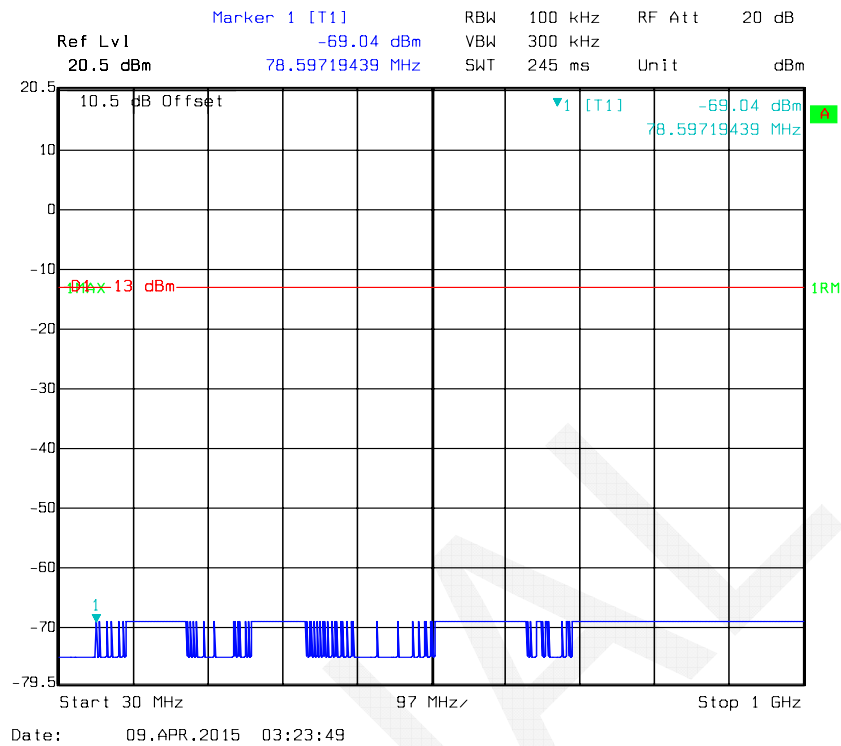
16QAM, 20MHz, Low Channel, 30MHz – 1GHz



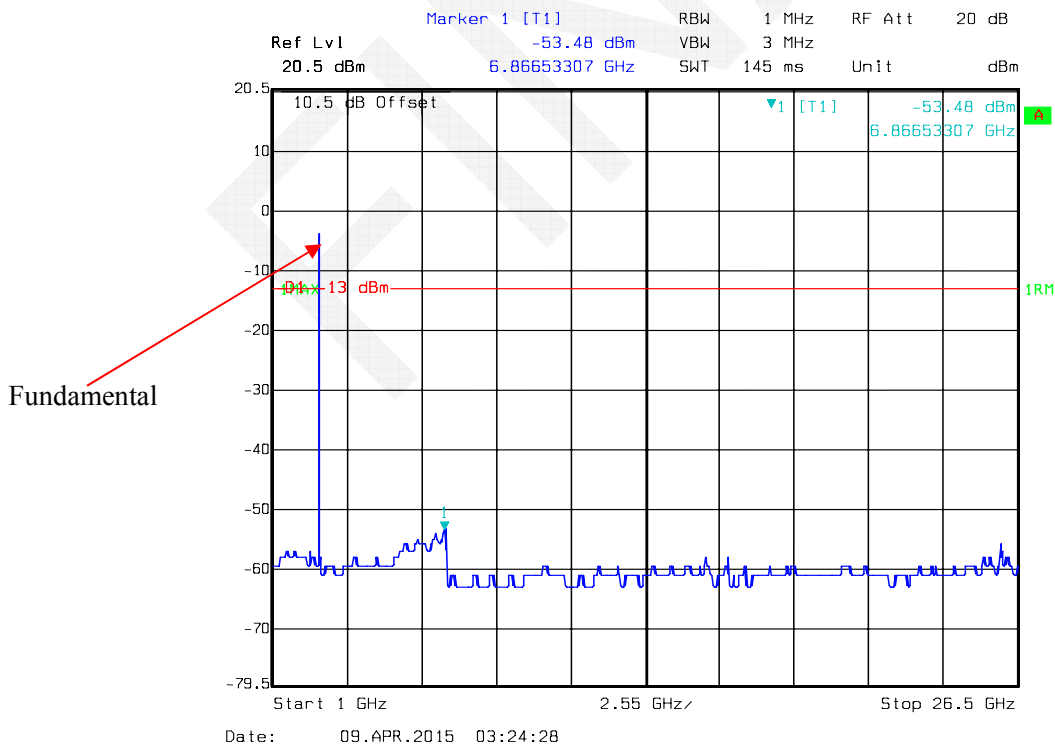
16QAM, 20MHz, Low Channel, 1GHz – 26.5GHz



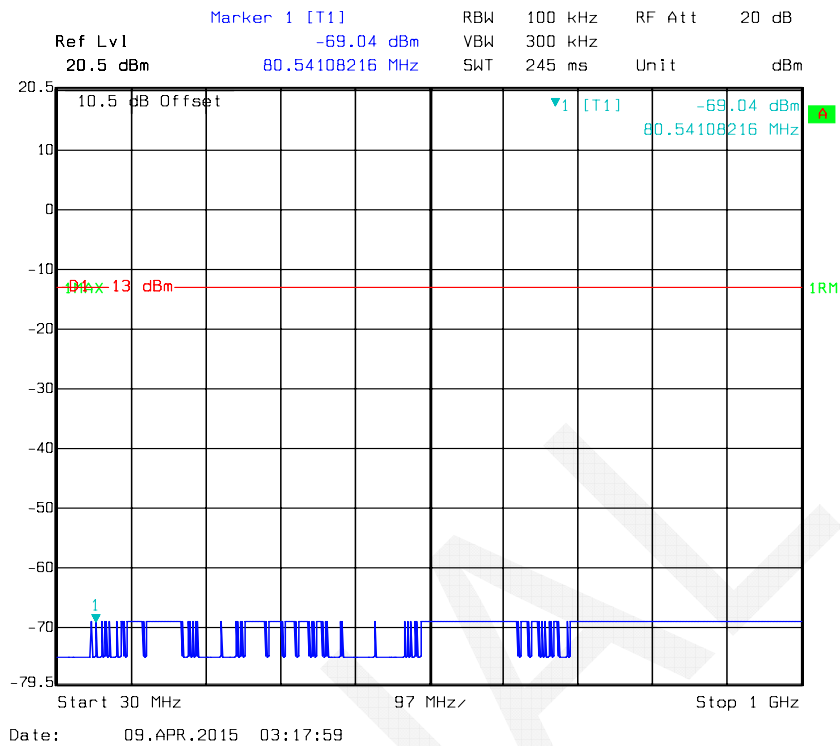
16QAM, 20MHz, High Channel, 30MHz – 1GHz



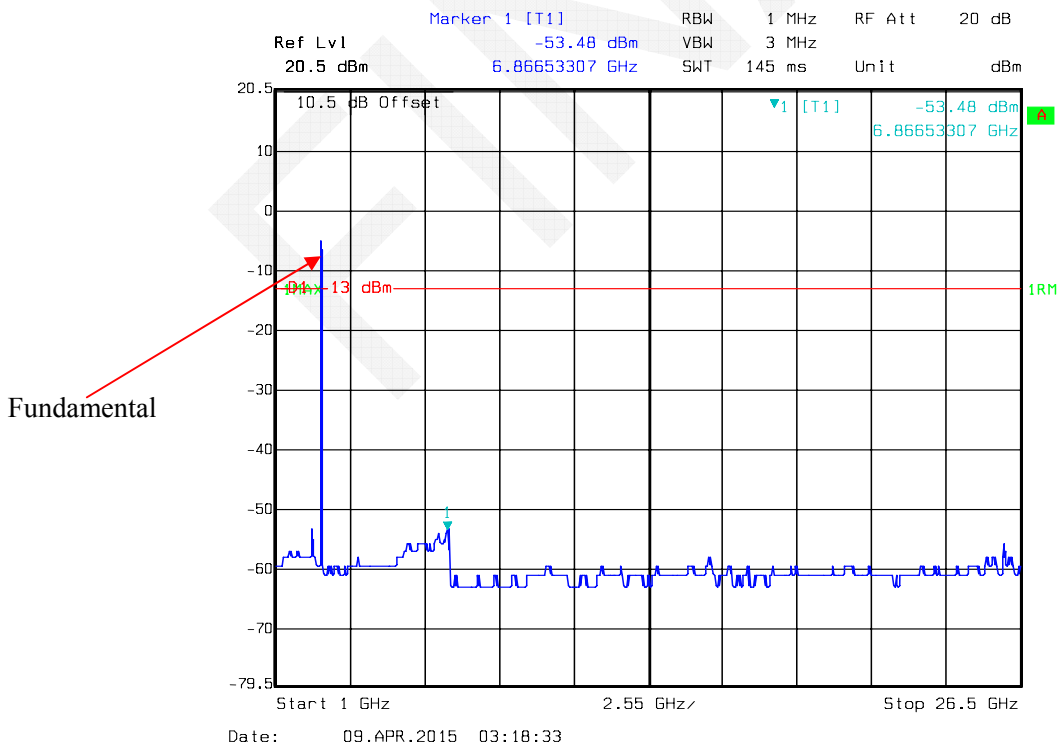
16QAM, 20MHz, High Channel, 1GHz – 26.5GHz



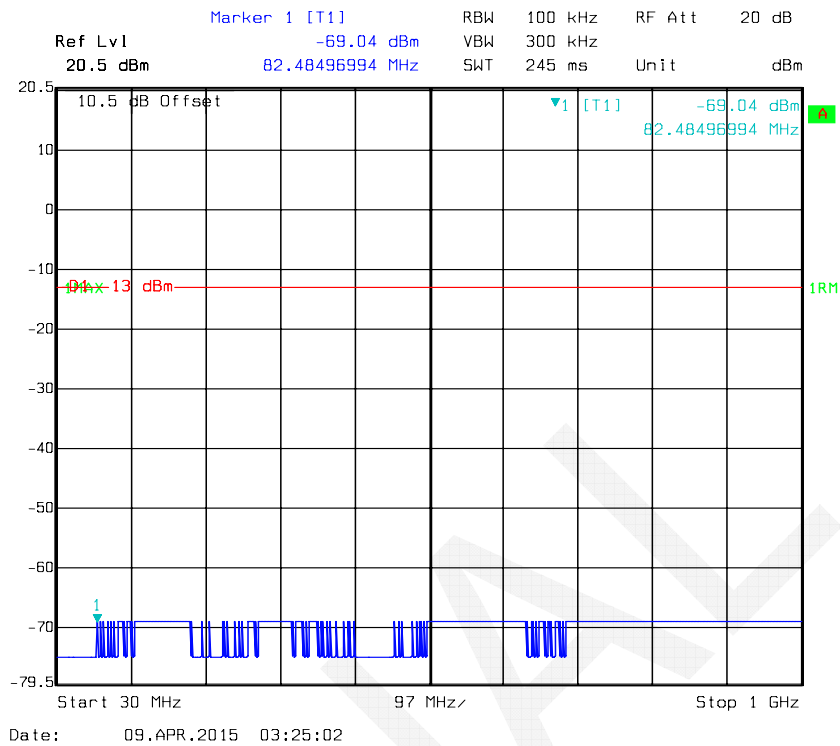
64QAM, 20MHz, Low Channel, 30MHz – 1GHz



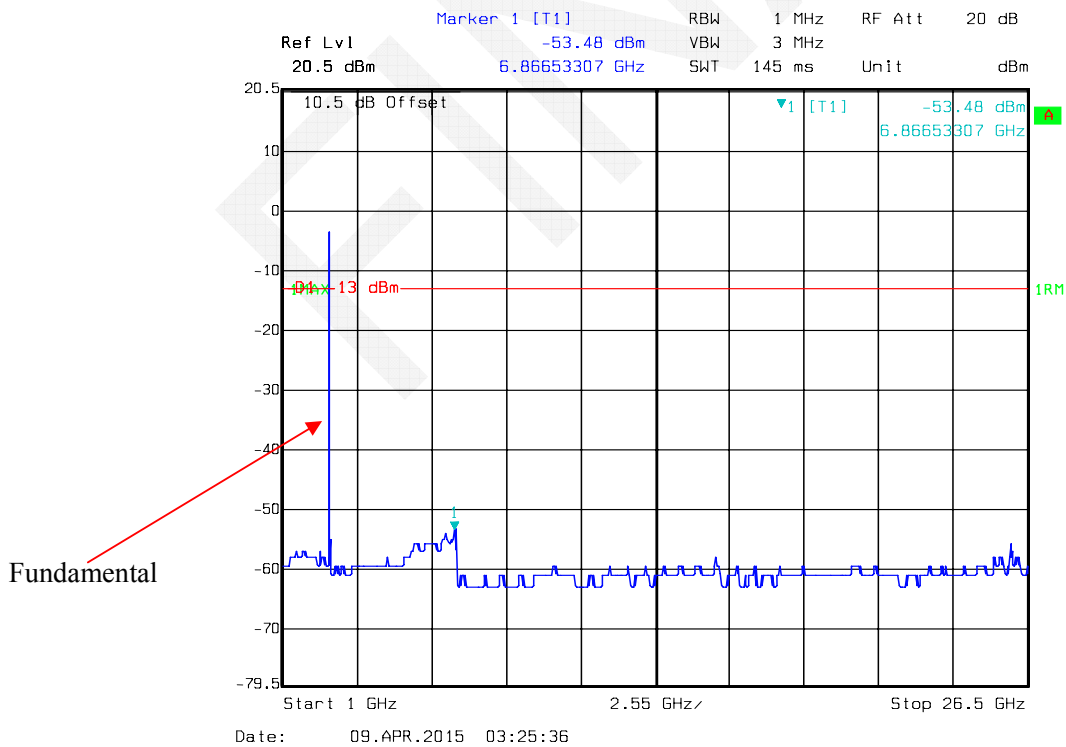
64QAM, 20MHz, Low Channel, 1GHz – 26.5GHz



64QAM, 20MHz, High Channel, 1GHz – 26.5GHz



64QAM, 20MHz, High Channel, 1GHz – 26.5GHz



FCC §2.1053 & §27.53 - SPURIOUS RADIATED EMISSIONS**Applicable Standards**

FCC § 2.1053 and § 27.53.

Test Procedure

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

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

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Signal Generator	8648A	3426A00831	2014-11-06	2015-11-06
Sunol Sciences	Antenna	JB3	A060611-3	2014-11-06	2017-11-05
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
HP	Amplifier	8447E	2434A02181	2014-09-01	2015-09-01
R&S	EMI Test Receiver	ESCI	100224	2014-05-09	2015-05-09
Giga	Signal Generator	1026	320408	2014-05-09	2015-05-08
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2015-02-19	2016-02-18
TDK RF	Horn Antenna	HRN-0118	130 084	2012-09-06	2015-09-05
ETS LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-05
R&S	Spectrum Analyzer	E4440A	SG43360054	2014-12-04	2015-12-04

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

Test Data**Environmental Conditions**

Temperature:	24.1 °C
Relative Humidity:	69 %
ATM Pressure:	101.1 kPa

The testing was performed by Dean Liu on 2015-04-09.

Test mode: Transmitting

2580MHz-2610MHz:

Downlink:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK Middle Channel (2580MHz)								
5160.000	H	35.54	-55.5	13.9	2.6	-44.2	-13.0	31.2
5160.000	V	36.12	-56.3	13.9	2.6	-45.0	-13.0	32.0
7740.000	H	31.85	-55.4	13.3	3	-45.1	-13.0	32.1
7740.000	V	33.10	-54.5	13.3	3	-44.2	-13.0	31.2
292.000	H	29.61	-74.9	0.0	0.5	-75.4	-13.0	62.4
292.000	V	28.79	-77.4	0.0	0.5	-77.9	-13.0	64.9
16-QAM Middle Channel (2610MHz)								
5220.000	H	34.61	-56.6	14.0	2.6	-45.2	-13.0	32.2
5220.000	V	35.25	-57.3	14.0	2.6	-45.9	-13.0	32.9
7830.000	H	31.45	-55.7	13.3	2.9	-45.3	-13.0	32.3
7830.000	V	33.42	-54.2	13.3	2.9	-43.8	-13.0	30.8
292.000	H	30.43	-74.1	0.0	0.5	-74.6	-13.0	61.6
292.000	V	29.05	-77.2	0.0	0.5	-77.7	-13.0	64.7

Uplink:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK Middle Channel (2580MHz)								
5160.000	H	35.71	-55.3	13.9	2.6	-44.0	-13.0	31.0
5160.000	V	36.24	-56.1	13.9	2.6	-44.8	-13.0	31.8
7740.000	H	31.97	-55.3	13.3	3	-45.0	-13.0	32.0
7740.000	V	33.27	-54.3	13.3	3	-44.0	-13.0	31.0
292.000	H	29.73	-74.8	0.0	0.5	-75.3	-13.0	62.3
292.000	V	29.00	-77.2	0.0	0.5	-77.7	-13.0	64.7
16-QAM Middle Channel (2610MHz)								
5220.000	H	34.74	-56.5	14.0	2.6	-45.1	-13.0	32.1
5220.000	V	35.42	-57.2	14.0	2.6	-45.8	-13.0	32.8
7830.000	H	31.69	-55.5	13.3	2.9	-45.1	-13.0	32.1
7830.000	V	33.61	-54	13.3	2.9	-43.6	-13.0	30.6
292.000	H	30.54	-74	0.0	0.5	-74.5	-13.0	61.5
292.000	V	29.25	-77	0.0	0.5	-77.5	-13.0	64.5

Note:

- 1) Absolute Level = SG Level - Cable loss + Antenna Gain
- 2) Margin = Limit- Absolute Level
- 3) No emission was detected in the range below 1GHz.

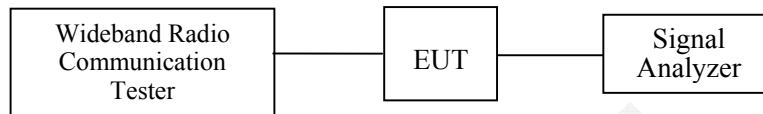
FCC §27.53 - BAND EDGES

Applicable Standards

FCC § 2.1053 and § 27.53.

Test Procedure

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



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
R & S	Wideband Radio Communication Tester	CMW500	114772	2014-11-15	2015-11-14

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

Test Data

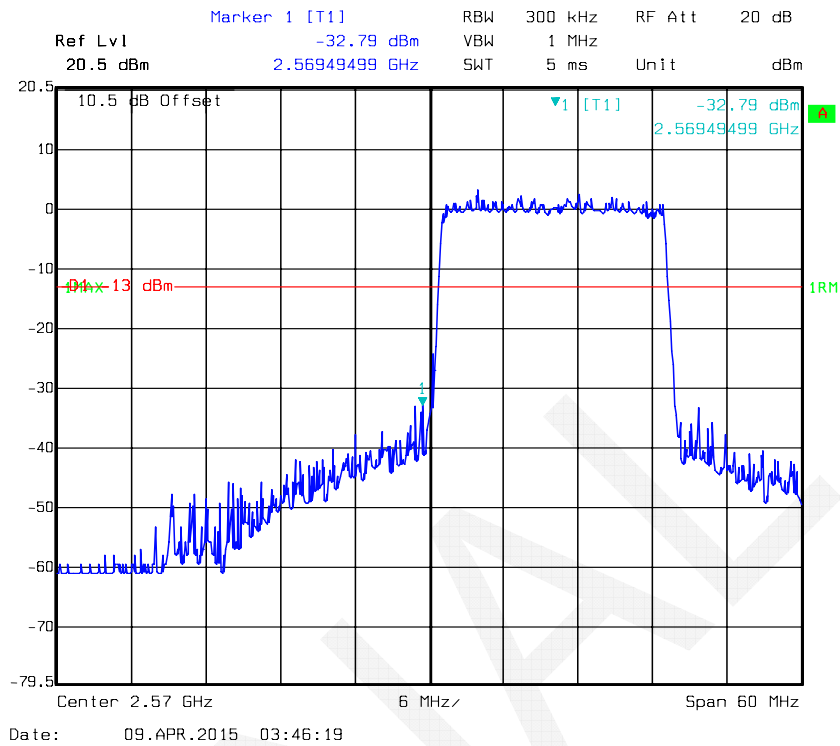
Environmental Conditions

Temperature:	25.2-27.3 °C
Relative Humidity:	53-57 %
ATM Pressure:	101.1-100.2 kPa

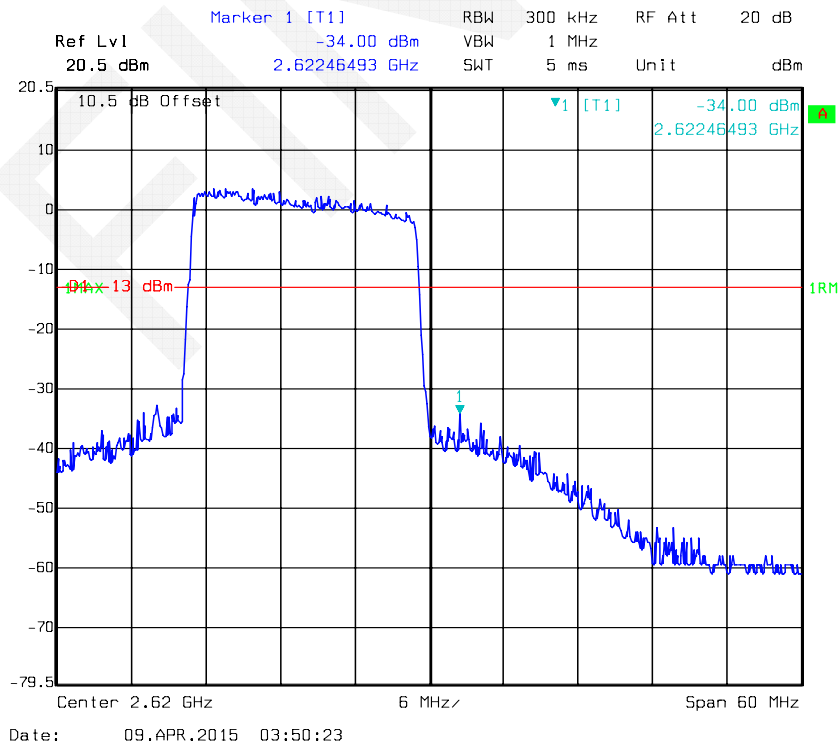
The testing was performed by Dean Liu on 2015-04-09 and 2015-08-31.

Downlink:

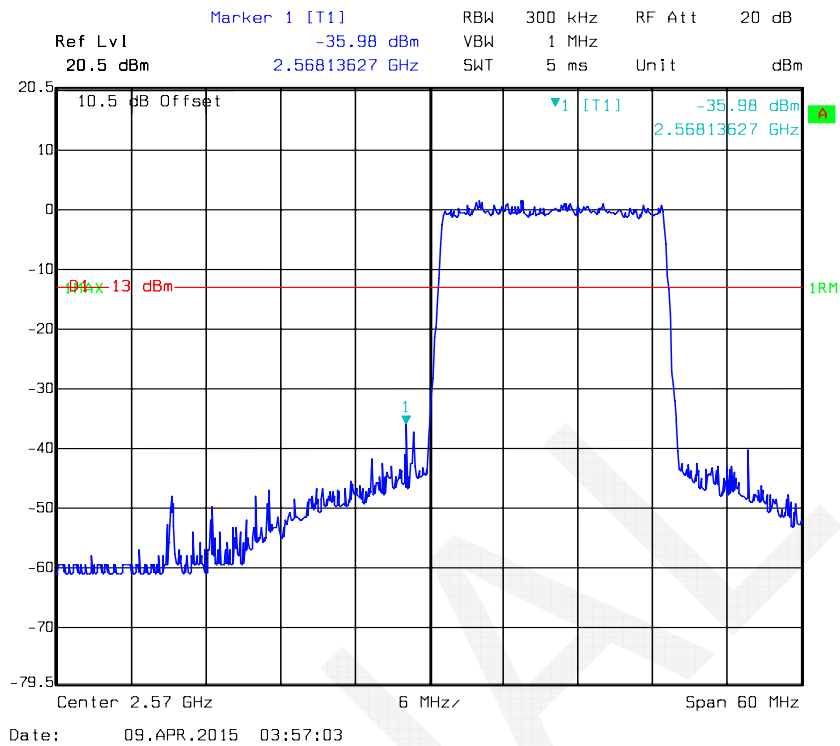
QPSK, 20MHz, Low Channel



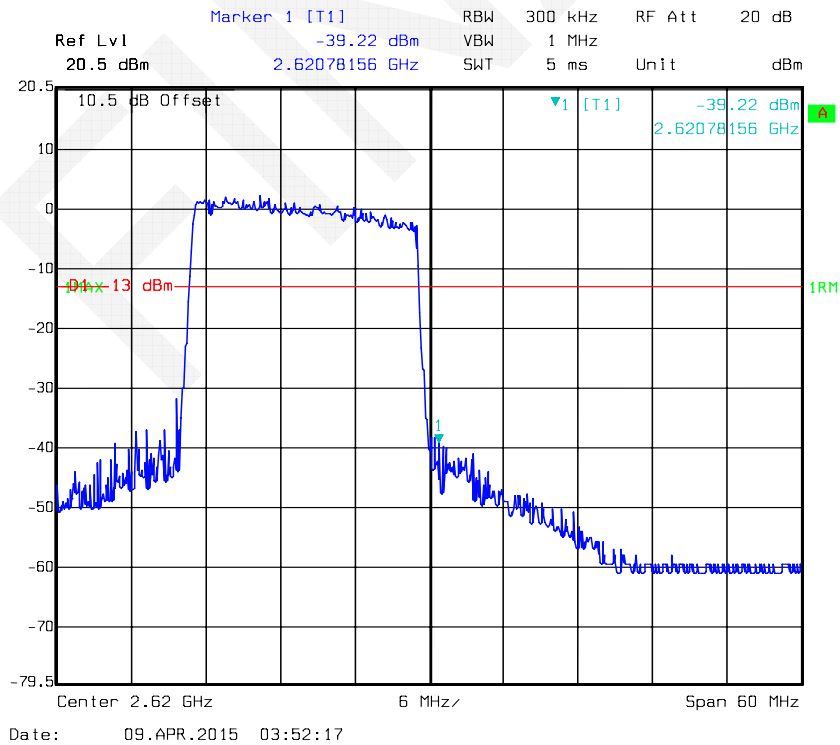
QPSK, 20MHz, High Channel



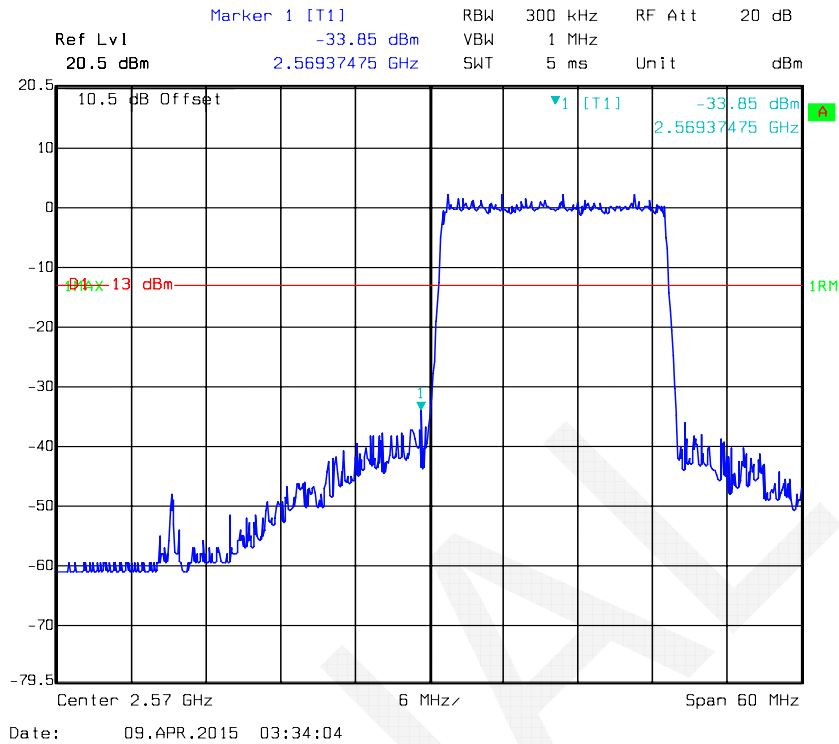
16QAM, 20MHz, Low Channel



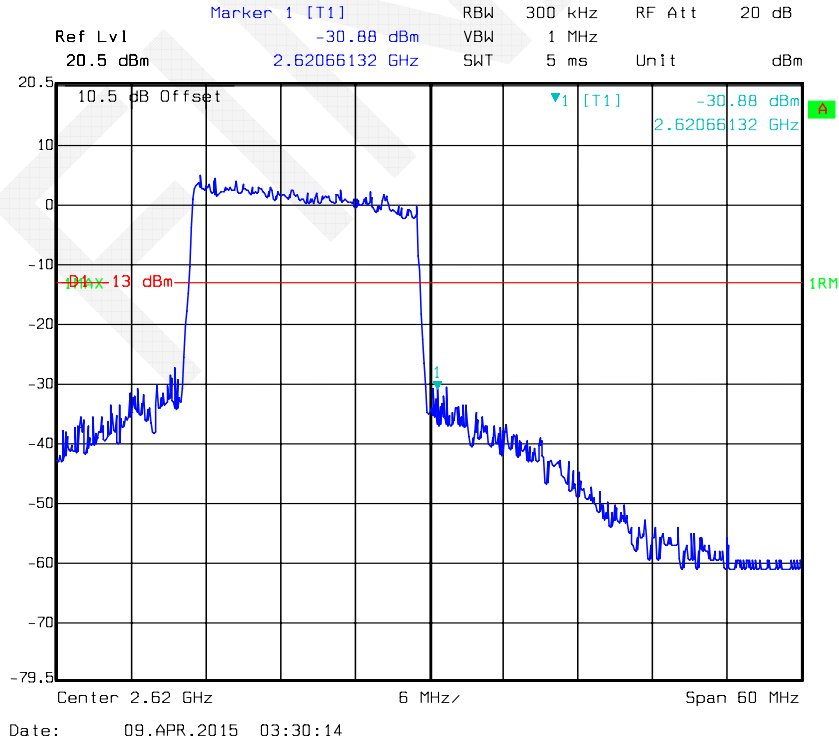
16QAM, 20MHz, High Channel



64QAM, 20MHz, Low Channel

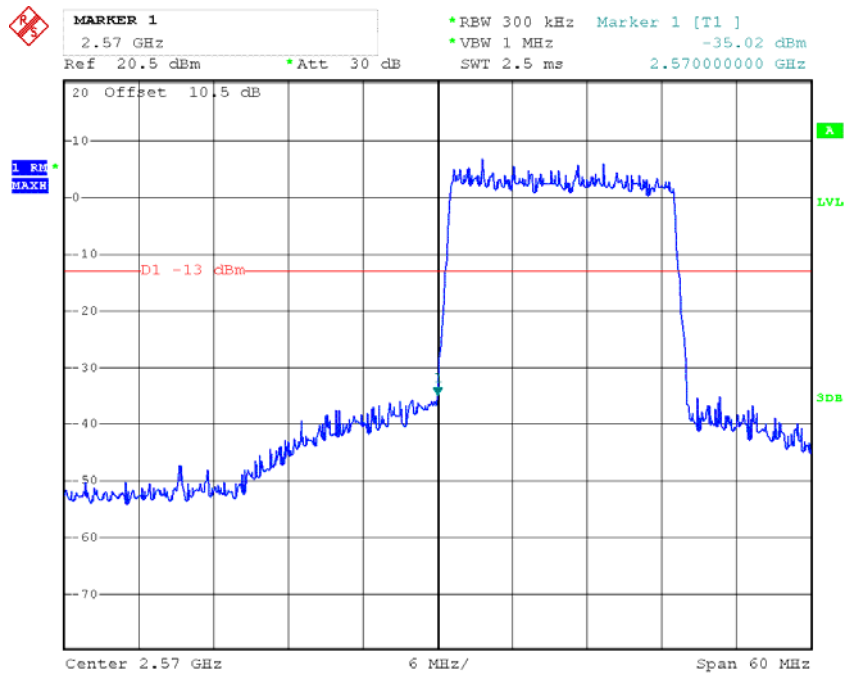


64QAM, 20MHz, High Channel



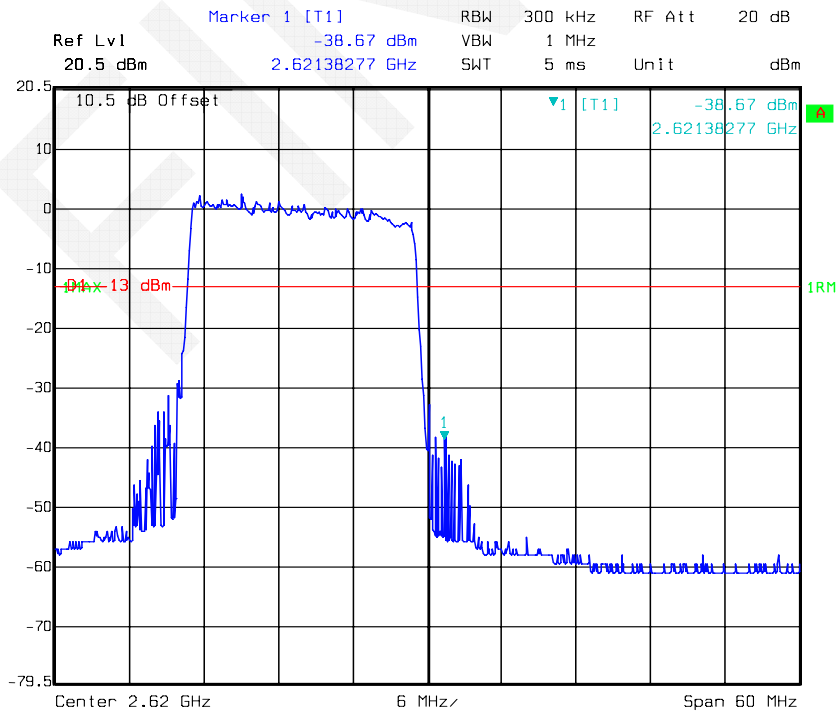
Uplink:

QPSK, 20MHz, Low Channel



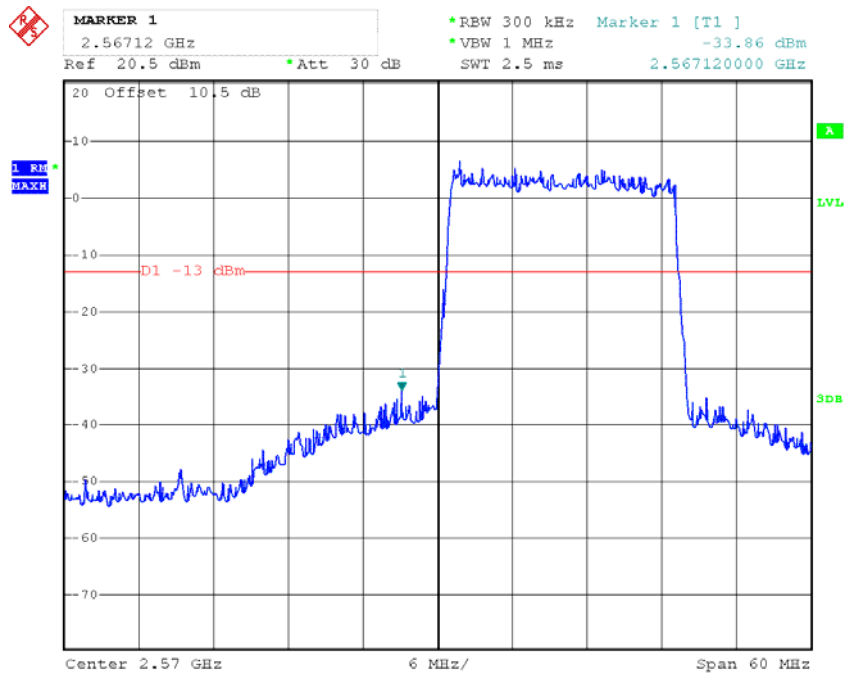
Date: 31.AUG.2015 21:35:08

QPSK, 20MHz, High Channel



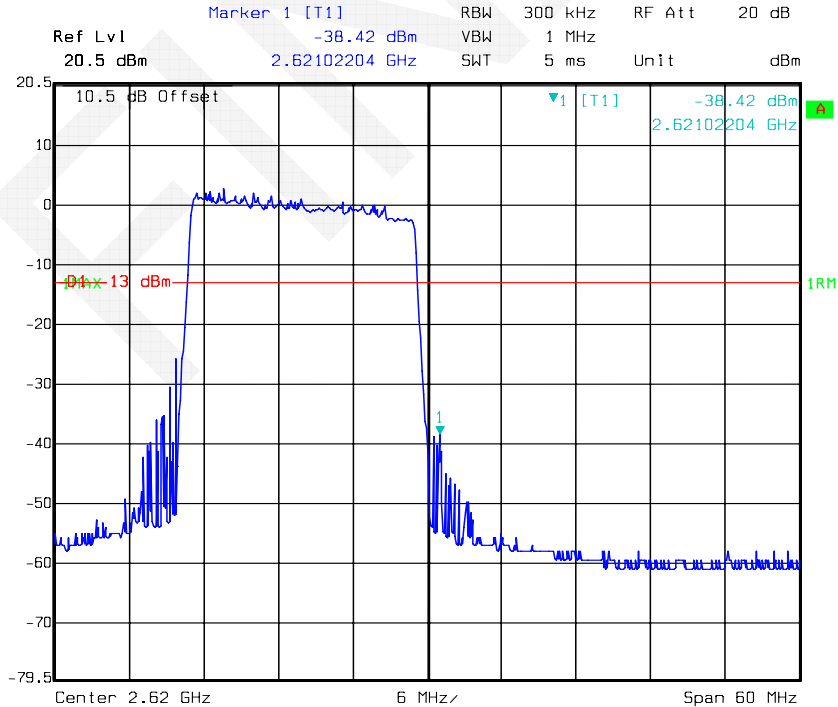
Date: 09.APR.2015 03:53:39

16QAM, 20MHz, Low Channel



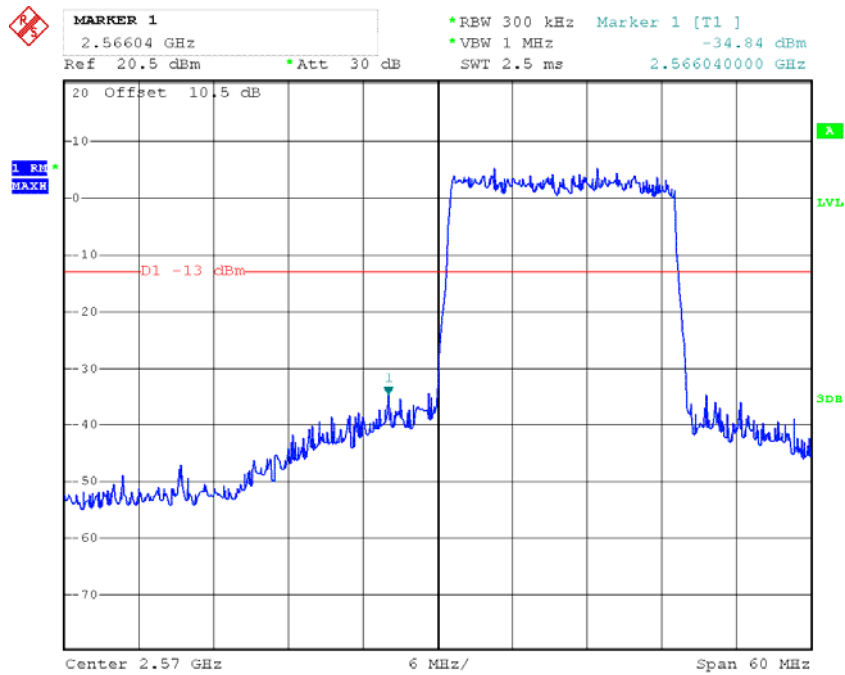
Date: 31.AUG.2015 21:36:38

16QAM, 20MHz, High Channel



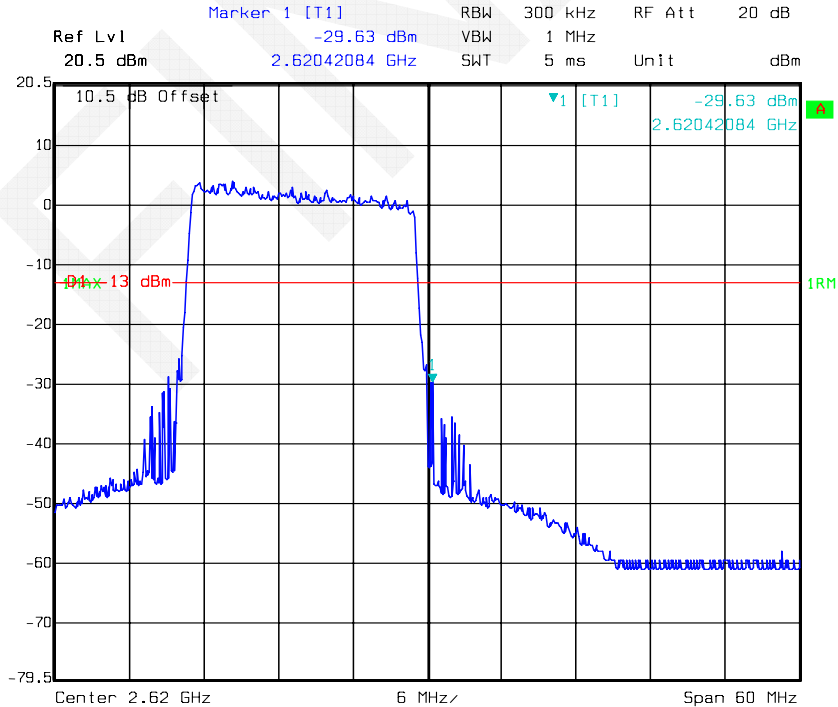
Date: 09.APR.2015 03:54:47

64QAM, 20MHz, Low Channel



Date: 31.AUG.2015 21:37:19

64QAM, 20MHz, High Channel

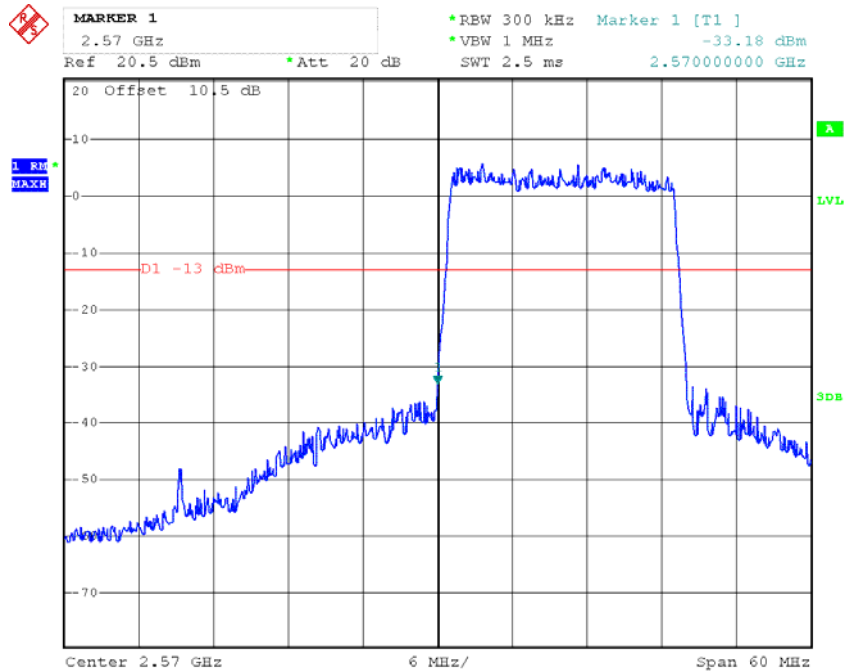


Date: 09.APR.2015 03:32:14

3 dB above the AGC threshold level

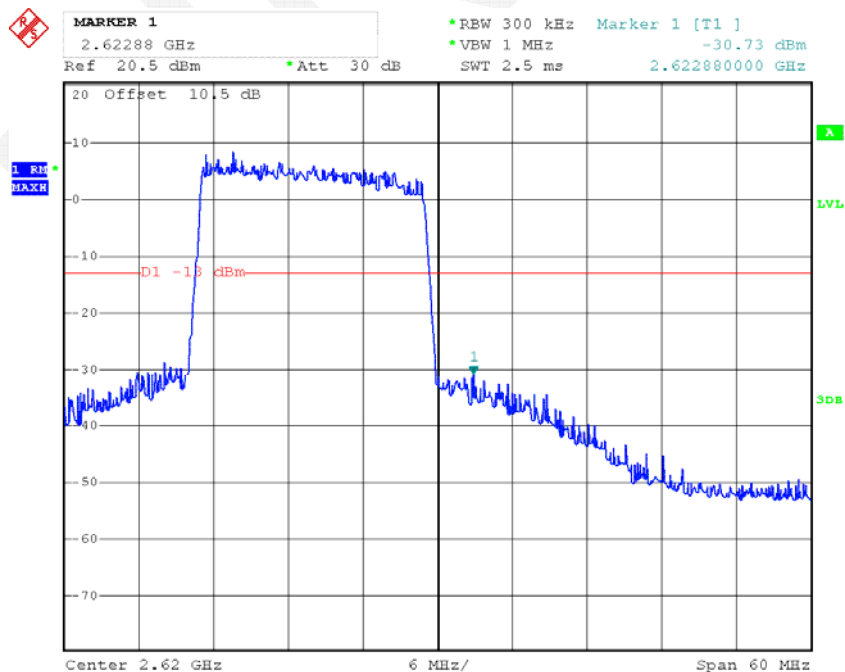
Downlink:

QPSK, 20MHz, Low Channel



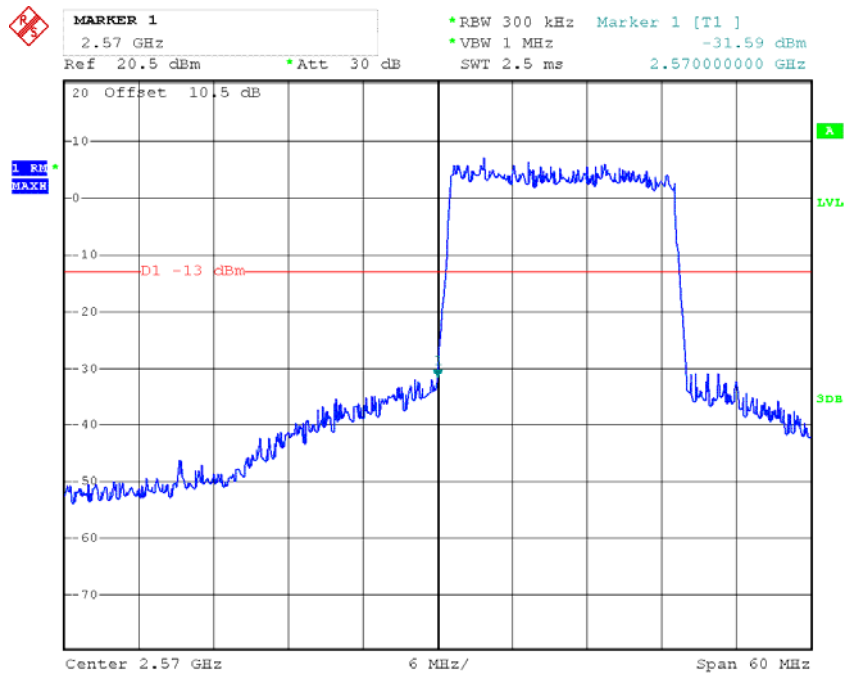
Date: 31.AUG.2015 21:22:21

QPSK, 20MHz, High Channel



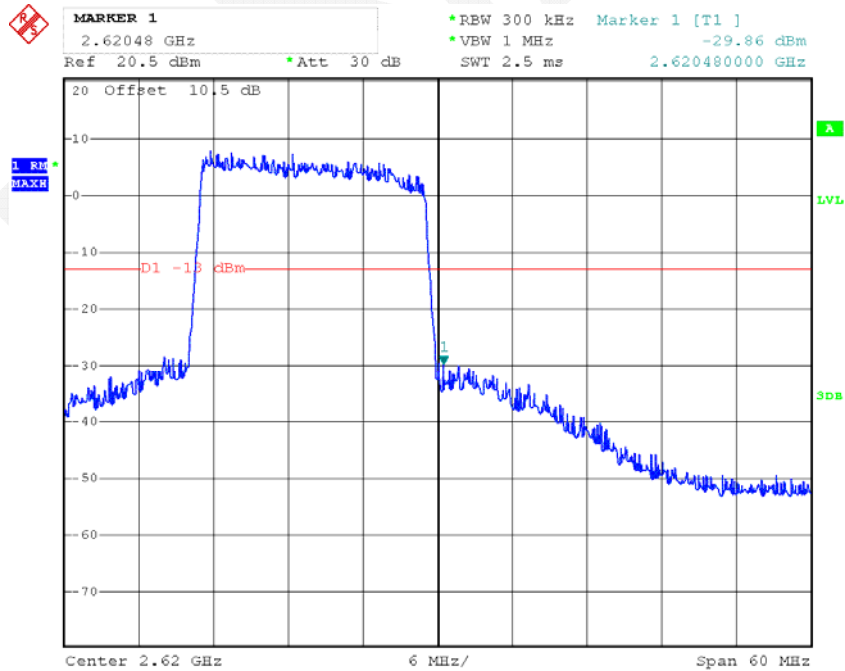
Date: 31.AUG.2015 21:27:55

16QAM, 20MHz, Low Channel



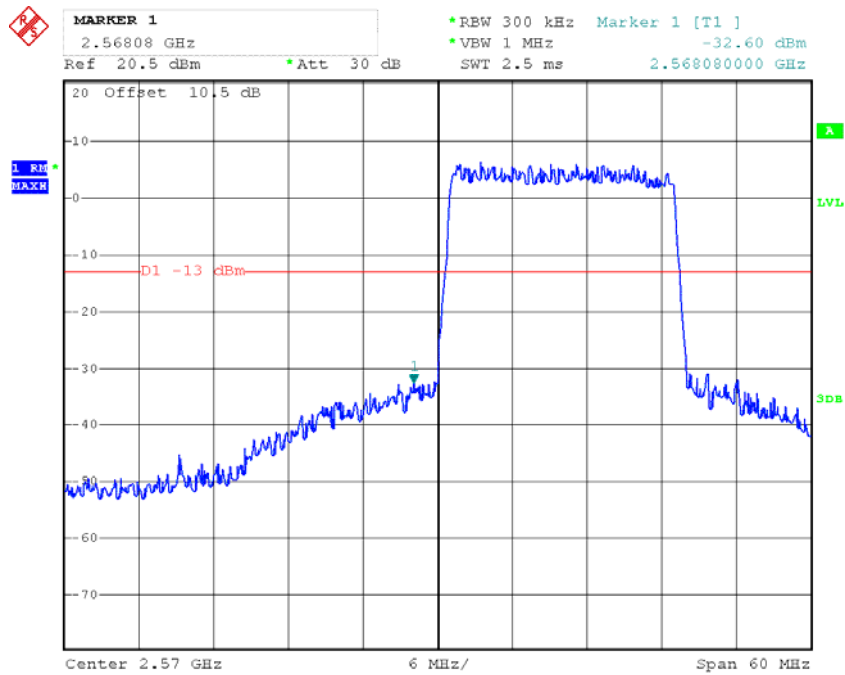
Date: 31.AUG.2015 21:23:37

16QAM, 20MHz, High Channel



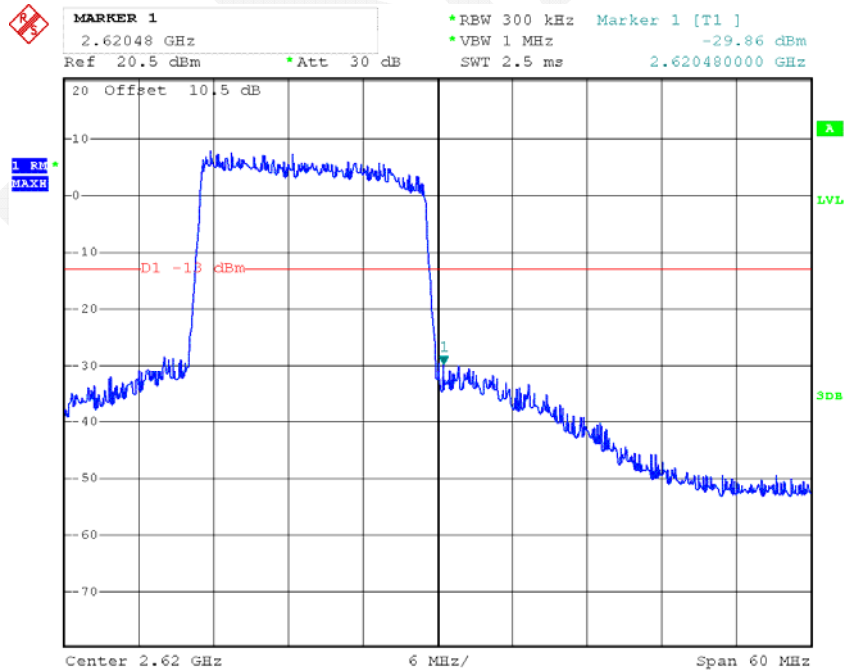
Date: 31.AUG.2015 21:28:53

64QAM, 20MHz, Low Channel



Date: 31.AUG.2015 21:25:16

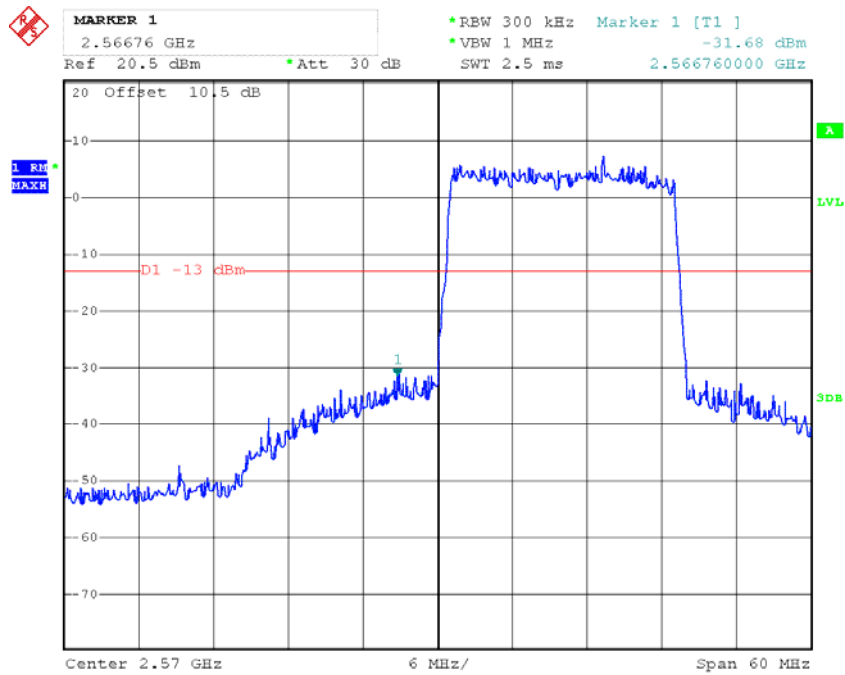
64QAM, 20MHz, High Channel



Date: 31.AUG.2015 21:28:53

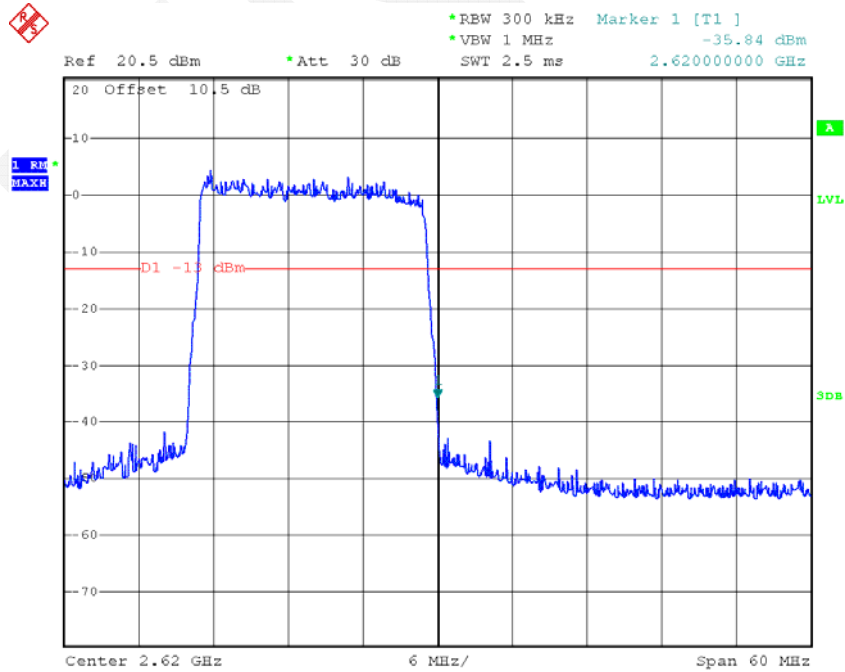
Uplink:

QPSK, 20MHz, Low Channel



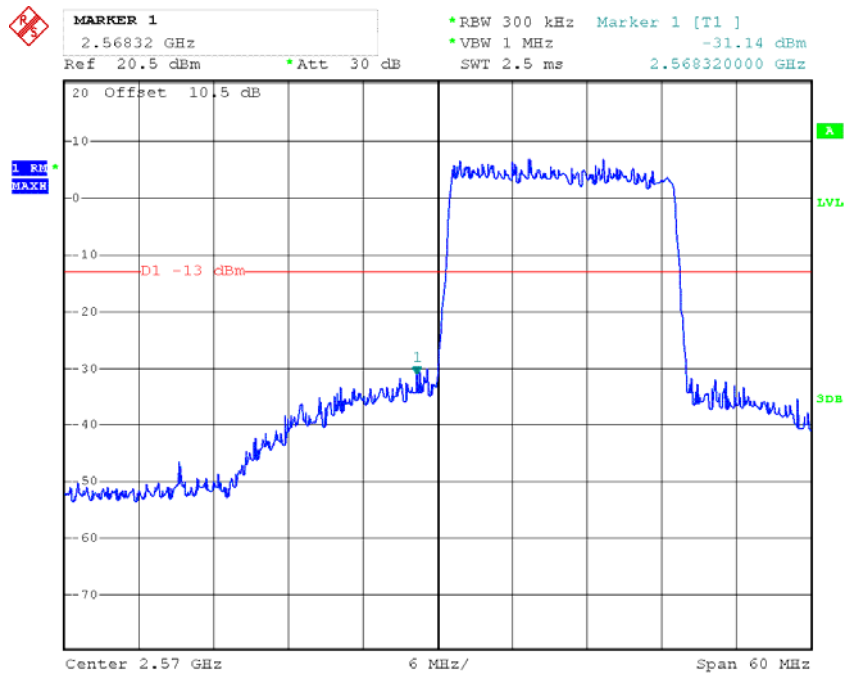
Date: 31.AUG.2015 21:41:04

QPSK, 20MHz, High Channel



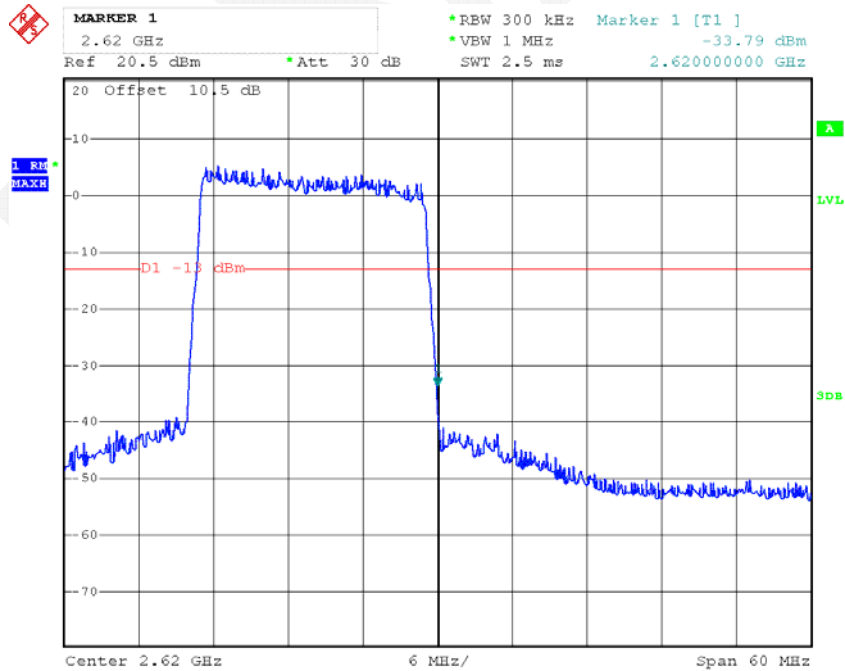
Date: 31.AUG.2015 21:31:26

16QAM, 20MHz, Low Channel



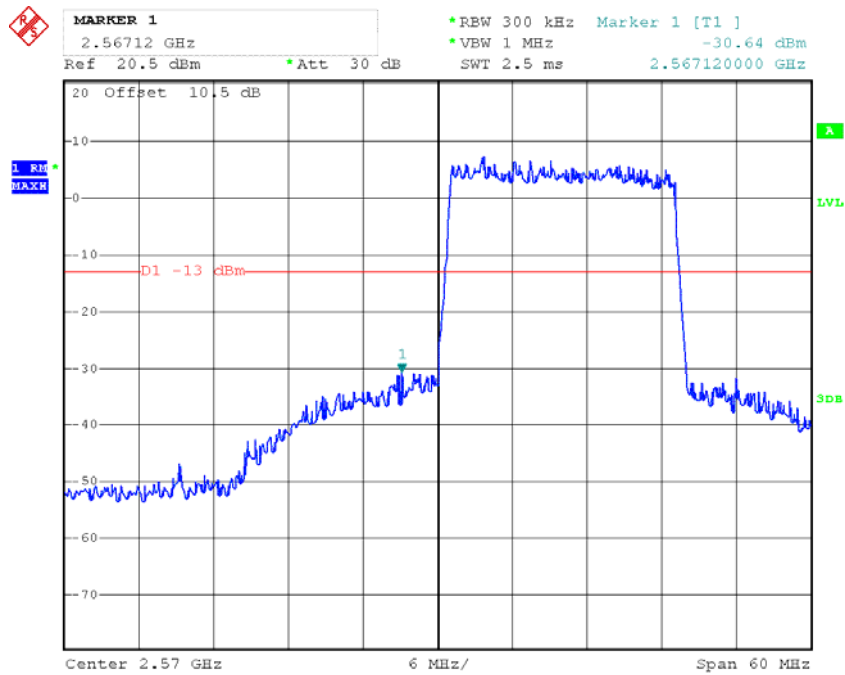
Date: 31.AUG.2015 21:40:43

16QAM, 20MHz, High Channel



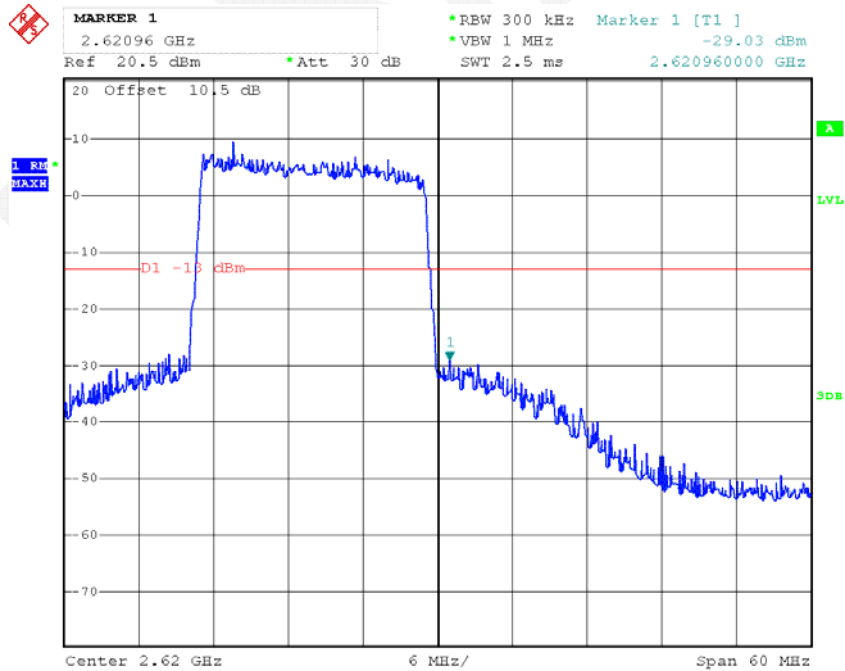
Date: 31.AUG.2015 21:34:06

64QAM, 20MHz, Low Channel



Date: 31.AUG.2015 21:39:56

64QAM, 20MHz, High Channel



Date: 31.AUG.2015 21:33:23

FCC §2.1055 & §27.54 - FREQUENCY STABILITY**Applicable Standards**

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

The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from - 30 °C to + 50 °C using an environmental chamber.
b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R & S	Wideband Radio Communication Tester	CMW500	114772	2014-11-15	2015-11-14
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-4	2014-08-11	2015-08-11
Agilent	MXG Vector Signal Generator	N5182B	MY51350214 2	2014-11-15	2015-11-14

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

Test Data**Environmental Conditions**

Temperature:	25.2 °C
Relative Humidity:	53 %
ATM Pressure:	101.1 kPa

The testing was performed by Dean Liu on 2015-04-09.

Downlink:

Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	Vac	Hz	ppm	
-30	120	93	0.036	Pass
-20	120	85	0.033	Pass
-10	120	93	0.036	Pass
0	120	72	0.028	Pass
10	120	94	0.036	Pass
20	120	80	0.031	Pass
30	120	81	0.031	Pass
40	120	93	0.036	Pass
50	120	96	0.037	Pass
25	102	90	0.035	Pass
25	138	94	0.036	Pass

Uplink:

Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	Vac	Hz	ppm	
-30	120	91	0.035	Pass
-20	120	97	0.038	Pass
-10	120	95	0.037	Pass
0	120	92	0.036	Pass
10	120	91	0.035	Pass
20	120	80	0.031	Pass
30	120	83	0.032	Pass
40	120	87	0.034	Pass
50	120	74	0.029	Pass
25	102	91	0.035	Pass
25	138	92	0.036	Pass

FCC§20.21 - OUT OF BAND REJECTION

Applicable Standards

FCC§20.21

Test Procedure

Adjust the internal gain control of the equipment under test to the maximum gain for which equipment certification is sought.

- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
 - 1) Frequency range = ± 250 % of the passband from the center of the passband.
 - 2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.
 - 3) Dwell time = approx. 10 ms.
 - 4) Number of points = $\text{SPAN}/(\text{RBW}/2)$.
- c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.
- e) Set the resolution bandwidth of the spectrum analyzer to be 1 % to 5 % of the passband and the video bandwidth shall be set to $\geq 3 \times \text{RBW}$.
- f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer's spectral display to fill.
- g) Place a marker to the peak of the frequency response and record this frequency as f_0 .
- h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the -20 dB down amplitude to determine the 20 dB bandwidth. Capture the frequency response of the EUT.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
Agilent	MXG Vector Signal Generator	N5182B	MY513502142	2014-11-15	2015-11-14

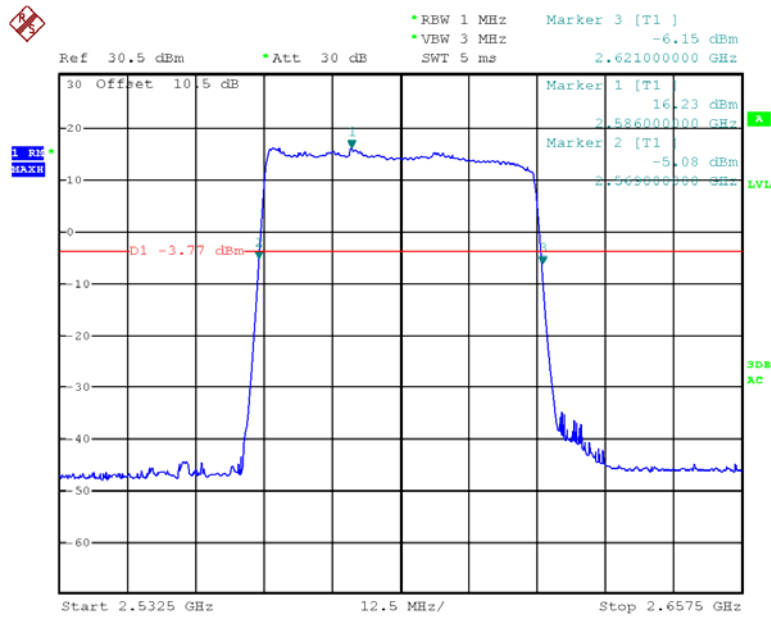
* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

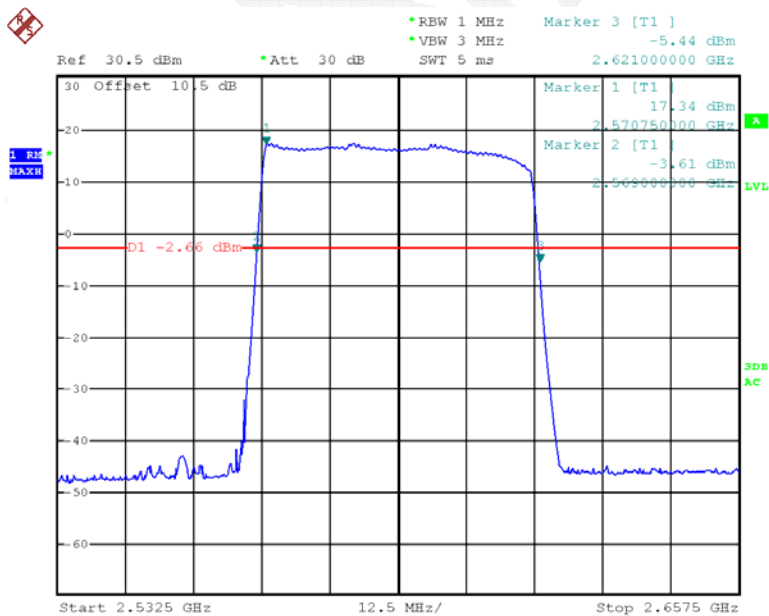
Environmental Conditions

Temperature:	25.2 °C
Relative Humidity:	53 %
ATM Pressure:	101.1 kPa

The testing was performed by Dean Liu on 2015-08-29.

Downlink, Output

Date: 29.AUG.2015 14:27:07

Uplink, Output

Date: 29.AUG.2015 14:31:58

DECLARATION LETTER



Fujian Helios Technologies Co., Ltd.

Add: Helios BLDG, No. 12 Xiangyue RD, Torch Hi-Tech Industrial Zone, Xiang'an DIST, Xiamen, China

Tel: 86-592-5785219

Fax: 86-592-5785239

DECLARATION OF SIMILARITY

Date: 2015-04-13

To Whom It May Concern,

We, Fujian Helios Technologies Co., Ltd., hereby declare that our product: TD-LTE Digital Repeater, Model Number: HETD18L, HETD19L, HETD20L, HETD23L, HETD25L, HEDB26L is electrically identical with the same electromagnetic emissions and electromagnetic compatibility characteristics as model name: HETD26L that was tested by BACL, the results of which are featured in BACL project. The difference among these models is model name.

Please contact me should there be need for any additional clarification or information.

Best Regards,

Signature:

Link kang

Manager

A handwritten signature in black ink, appearing to read "Link kang", written over the printed name.

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