FCC PART 15.249

TEST REPORT

For

Shenzhen Rakwireless Technology Co., Ltd.

RM1007,Hangsheng Technology Building,4th South Gaoxing Avenue,Science and Technology Park, Nanshan District,Shenzhen,China

FCC ID: 2AF6B-RAKSMR006

Report Type:	**Product Type:**
Original Report	LoRa Module

Report Number:	RSZ170330002-00
Report Date:	2017-05-03
Reviewed By:	Oscar Ye Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shenzhen Rakwireless Technology Co., Ltd.* 's product, model number: *RAK811(FCC ID: 2AF6B-RAKSMR006)* or the "EUT" in this report was an *LoRa Module* , which was measured approximately: 22.0 mm (L) * 14.0 mm (W) *1.7 mm (H), rated with input voltage: DC3.3V.

**All measurement and test data in this report was gathered from production sample serial number: 1700575. (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-03-30.*

Objective

This report is prepared on behalf of *Shenzhen Rakwireless Technology Co., Ltd.* in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209, 15.215 and 15.249 rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

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

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		±3.26 dB
RF conducted test with spectrum		±0.9dB
RF Output Power with Power meter		±0.5dB
Radiated emission	30MHz~1GHz	±5.91dB
	Above 1G	±4.92dB
Occupied Bandwidth		±0.5kHz
Temperature		±1.0℃
Humidity		±6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10-2013.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. 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 system was configured for testing in engineering mode.

EUT Exercise Software

No software was used.

Equipment Modifications

No modifications were made to the unit tested.

Support Equipment List and Details

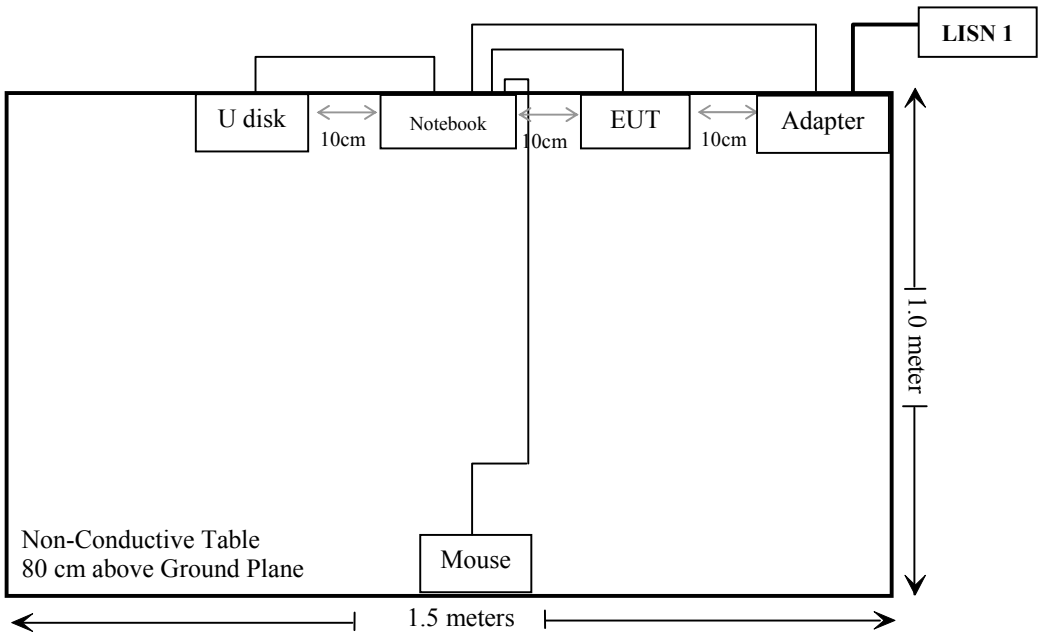
Manufacturer	Description	Model	Serial Number
DELL	Notebook	E6410	GYXJ3A00 JSD2
DELL	Mouse	MOC5UO	G1900NKD
DELL	Adapter	LA90PM130	CN-06C3W2-72438-6BT-194A-A03
Kingston	U disk	4 GB	N/A

External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-Shielding Detachable USB Cable	1.5	PC	U disk
Un-Shielding Detachable USB Cable	1.5	PC	Mouse
Un-shielding Detachable USB Cable	1.0	EUT	PC
Un-shielding Detachable AC Cable	0.9	Adapter	LISN 1
Un-shielding Un-detachable DC Cable	0.9	Adapter	PC

Block Diagram of Test Setup

For conducted emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conducted test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2016-11-25	2017-11-25
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-10
Rohde & Schwarz	Pulse limiter	ESH3-Z2	879940/0058	2016-06-18	2017-06-17
MICRO-COAX	Coaxial line	UFB-293B-1-0480-50X50	97F0173	2016-09-08	2017-09-08
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	NCR	NCR
Radiation test					
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-12
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
EMCO	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-25
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-12

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

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

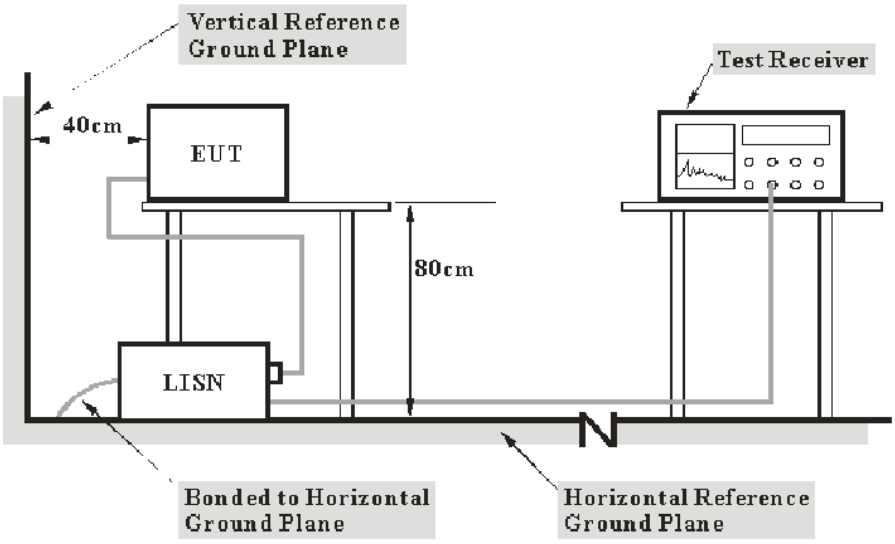
The EUT used a non-standard SMA jack antenna for test, the antenna gain is 2.0 dBi. For the end user, this module will be soldered on a PCB that has an internal antenna, and the max gain shell no exceed 2dBi.

FCC §15.207 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

According to FCC §15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with per ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207,

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL., $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

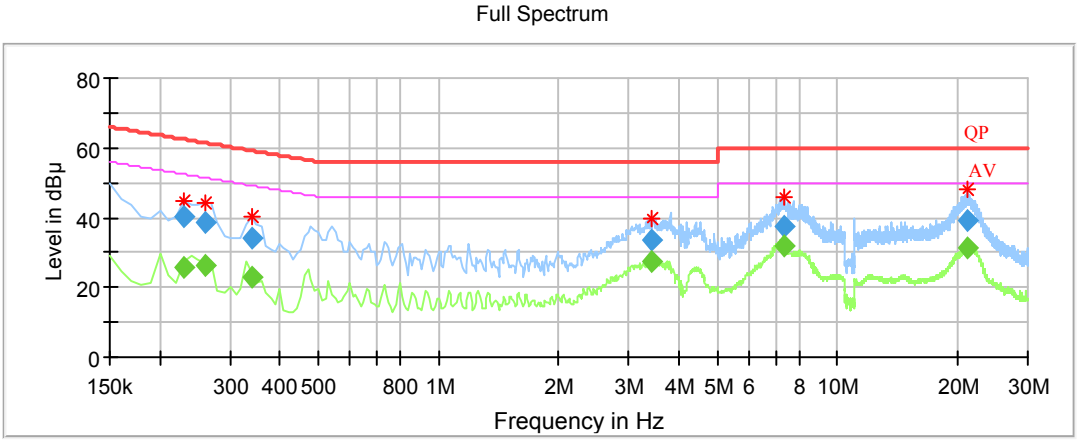
Test Data

Environmental Conditions

Temperature:	22 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

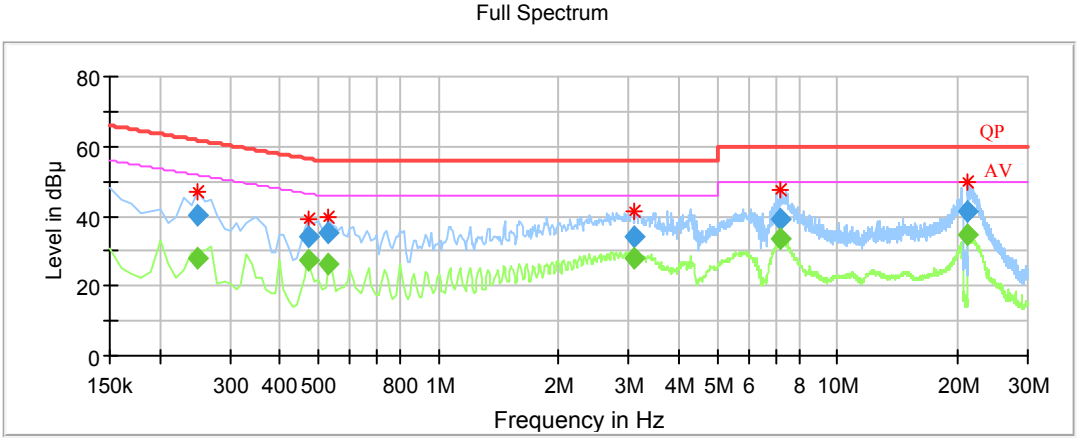
The testing was performed by Layne Li on 2017-04-14.

EUT Operation Mode: Transmitting



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.230000	---	25.70	9.000	L1	10.0	26.75	52.45	Compliance
0.230000	40.15	---	9.000	L1	10.0	22.30	62.45	Compliance
0.260000	---	26.04	9.000	L1	10.0	25.39	51.43	Compliance
0.260000	38.82	---	9.000	L1	10.0	22.61	61.43	Compliance
0.340000	---	23.02	9.000	L1	10.0	26.18	49.20	Compliance
0.340000	34.18	---	9.000	L1	10.0	25.02	59.20	Compliance
3.440000	---	27.58	9.000	L1	9.9	18.42	46.00	Compliance
3.440000	33.46	---	9.000	L1	9.9	22.54	56.00	Compliance
7.390000	---	31.62	9.000	L1	10.0	18.38	50.00	Compliance
7.390000	37.24	---	9.000	L1	10.0	22.76	60.00	Compliance
21.180000	---	31.09	9.000	L1	10.4	18.91	50.00	Compliance
21.180000	39.41	---	9.000	L1	10.4	20.59	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.250000	---	28.04	9.000	N	10.1	23.72	51.76	Compliance
0.250000	40.38	---	9.000	N	10.1	21.38	61.76	Compliance
0.470000	---	27.51	9.000	N	10.1	19.00	46.51	Compliance
0.470000	33.93	---	9.000	N	10.1	22.58	56.51	Compliance
0.530000	---	26.28	9.000	N	10.1	19.72	46.00	Compliance
0.530000	34.98	---	9.000	N	10.1	21.02	56.00	Compliance
3.080000	---	27.78	9.000	N	9.9	18.22	46.00	Compliance
3.080000	34.13	---	9.000	N	9.9	21.87	56.00	Compliance
7.170000	---	33.71	9.000	N	9.9	16.29	50.00	Compliance
7.170000	39.19	---	9.000	N	9.9	20.81	60.00	Compliance
21.210000	---	34.55	9.000	N	10.2	15.45	50.00	Compliance
21.210000	41.51	---	9.000	N	10.2	18.49	60.00	Compliance

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
The corrected factor has been input into the transducer of the test software.
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

FCC§15.205, §15.209 & §15.249 - RADIATED EMISSIONS

Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

Test Equipment Setup

The spectrum analyzer or receiver is set as:

Below 1000MHz:

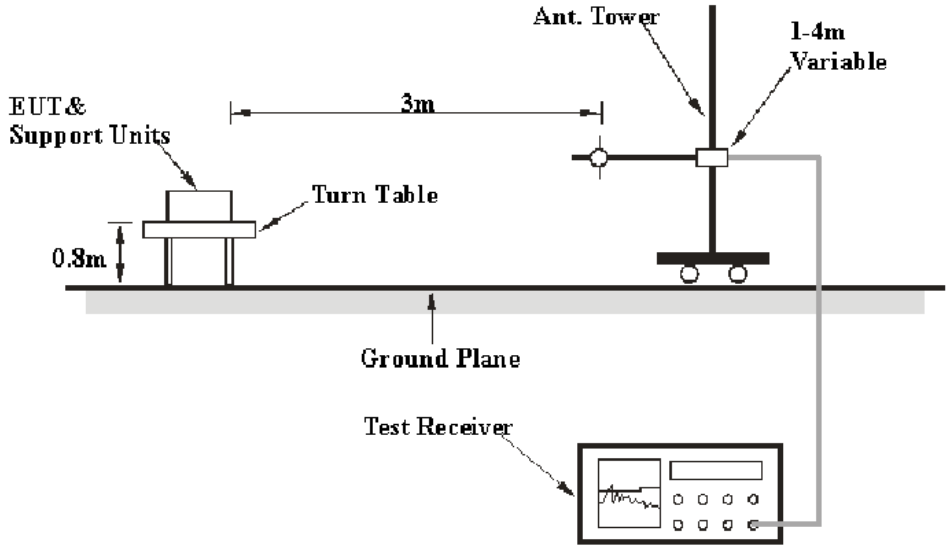
RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

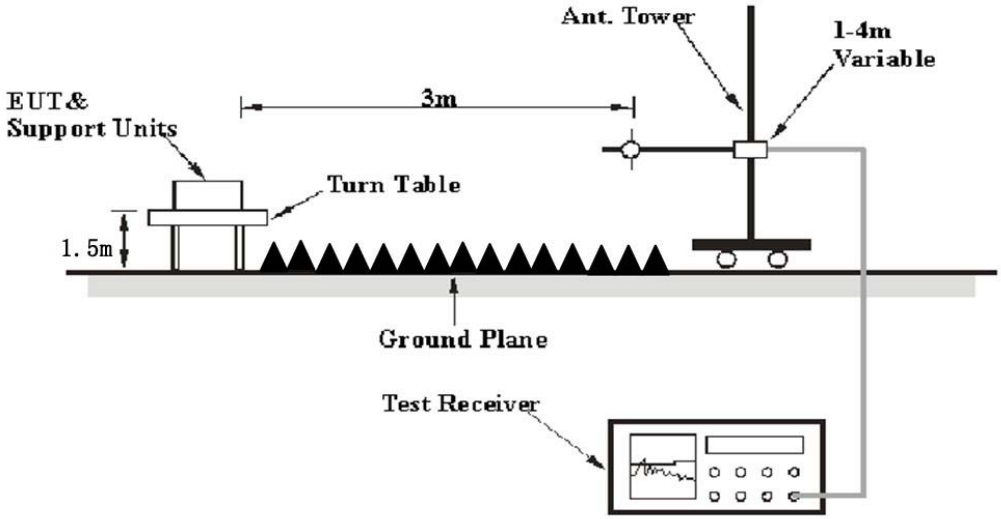
Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

EUT Setup

Below 1G:



Above 1GHz:



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC part 15.209, 15.205 and FCC part 15.249 limits.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane for below 1GHz and 1.5 meter above ground plane for above 1GHz, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.205, 15.209 & §15.249

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	22 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Layne Li on 2017-05-02.

30 MHz to 10 GHz:

125 kHz

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel									
436.53	34.75	QP	188	2.4	H	-8.34	26.41	46	19.59
903.00	81.40	QP	259	1.1	V	-0.86	80.54	94	13.46
901.76	27.89	QP	353	1.3	V	-0.86	27.03	46	18.97
928.15	27.54	QP	284	1.1	V	-0.86	26.68	46	19.32
1806.00	63.56	PK	4	1.3	H	-8.04	55.52	74	18.48
1806.00	55.74	Ave.	4	1.3	H	-8.04	47.70	54	6.30
2709.00	62.94	PK	250	1.7	H	-4.88	58.06	74	15.94
2709.00	53.50	Ave.	250	1.7	H	-4.88	48.62	54	5.38
3612.00	59.47	PK	239	1.6	V	-1.61	57.86	74	16.14
3612.00	48.40	Ave.	239	1.6	V	-1.61	46.79	54	7.21
4515.00	58.26	PK	295	1.2	V	0.92	59.18	74	14.82
4515.00	46.14	Ave.	295	1.2	V	0.92	47.06	54	6.94
Middle Channel									
436.53	35.70	QP	181	2.3	H	-8.34	27.36	46	18.64
915.00	85.15	QP	172	1.1	V	-0.86	84.29	94	9.71
901.83	28.30	QP	54	1.9	V	-0.86	27.44	46	18.56
928.61	28.16	QP	62	1.3	V	-0.86	27.30	46	18.70
1830.00	62.54	PK	347	2.4	H	-8.04	54.50	74	19.50
1830.00	53.63	Ave.	347	2.4	H	-8.04	45.59	54	8.41
2745.00	62.92	PK	328	2.2	H	-4.88	58.04	74	15.96
2745.00	52.19	Ave.	328	2.2	H	-4.88	47.31	54	6.69
3660.00	58.68	PK	69	1.6	V	-1.28	57.40	74	16.60
3660.00	48.59	Ave.	69	1.6	V	-1.28	47.31	54	6.69
4575.00	54.58	PK	345	1.7	V	1.15	55.73	74	18.27
4575.00	46.32	Ave.	345	1.7	V	1.15	47.47	54	6.53

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel									
436.53	35.17	QP	100	2.4	H	-8.34	26.83	46	19.17
927.00	86.03	QP	204	2.6	V	-0.86	85.17	94	8.83
901.68	28.80	QP	241	1.4	V	-0.86	27.94	46	18.06
928.14	27.95	QP	239	1.7	V	-0.86	27.09	46	18.91
1854.00	64.42	PK	202	1.5	H	-7.56	56.86	74	17.14
1854.00	55.47	Ave.	202	1.5	H	-7.56	47.91	54	6.09
2781.00	62.15	PK	232	2.3	H	-4.33	57.82	74	16.18
2781.00	50.76	Ave.	232	2.3	H	-4.33	46.43	54	7.57
3708.00	59.74	PK	47	1.0	V	-1.28	58.46	74	15.54
3708.00	49.29	Ave.	47	1.0	V	-1.28	48.01	54	5.99
4635.00	56.08	PK	79	1.0	V	1.15	57.23	74	16.77
4635.00	44.9	Ave.	79	1.0	V	1.15	46.05	54	7.95

250 kHz

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel									
436.53	38.13	QP	181	2.0	H	-8.34	29.79	46	16.21
903.00	83.60	QP	259	1.1	V	-0.86	82.74	94	11.26
901.84	27.55	QP	56	1.4	V	-0.86	26.69	46	19.31
928.22	31.14	QP	284	1.1	V	-0.86	30.28	46	15.72
1806.00	60.18	PK	154	1.3	H	-8.04	52.14	74	21.86
1806.00	53.4	Ave.	154	1.3	H	-8.04	45.36	54	8.64
2709.00	58.98	PK	338	1.2	H	-4.88	54.10	74	19.90
2709.00	48.85	Ave.	338	1.2	H	-4.88	43.97	54	10.03
3612.00	48.73	PK	164	1.0	V	-1.61	47.12	74	26.88
3612.00	39.78	Ave.	164	1.0	V	-1.61	38.17	54	15.83
Middle Channel									
436.53	35.91	QP	71	1.1	H	-8.34	27.57	46	18.43
915.00	84.28	QP	177	1.1	V	-0.86	83.42	94	10.58
901.67	28.73	QP	231	2.7	V	-0.86	27.87	46	18.13
928.23	30.23	QP	121	2.8	V	-0.86	29.37	46	16.63
1830.00	61.04	PK	93	2.3	H	-8.04	53.00	74	21
1830.00	54.52	Ave.	93	2.3	H	-8.04	46.48	54	7.52
2745.00	59.99	PK	183	2.3	H	-4.88	55.11	74	18.89
2745.00	48.66	Ave.	183	2.3	H	-4.88	43.78	54	10.22
3660.00	50.31	PK	170	1.8	V	-1.28	49.03	74	24.97
3660.00	41.24	Ave.	170	1.8	V	-1.28	39.96	54	14.04

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel									
436.53	36.06	QP	274	2.0	H	-8.34	27.72	46	18.28
927.00	83.69	QP	185	3.1	V	-0.86	82.83	94	11.17
901.49	28.10	QP	226	1.9	V	-0.86	27.24	46	18.76
928.11	30.33	QP	198	2.5	V	-0.86	29.47	46	16.53
1854.00	63.36	PK	281	1.4	H	-7.56	55.80	74	18.2
1854.00	53.63	Ave.	281	1.4	H	-7.56	46.07	54	7.93
2781.00	58.4	PK	193	1.4	H	-4.33	54.07	74	19.93
2781.00	47.29	Ave.	193	1.4	H	-4.33	42.96	54	11.04
3708.00	51.03	PK	75	1.2	V	-1.28	49.75	74	24.25
3708.00	41.93	Ave.	75	1.2	V	-1.28	40.65	54	13.35

500 kHz

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel									
436.53	34.87	QP	84	1.2	H	-8.34	26.53	46	19.47
903.00	82.10	QP	196	3.7	V	-0.86	81.24	94	12.76
901.64	28.67	QP	190	2.2	V	-0.86	27.81	46	18.19
928.07	31.53	QP	143	1.2	V	-0.86	30.67	46	15.33
1806.00	63.56	PK	4	1.3	H	-8.04	55.52	74	18.48
1806.00	55.74	Ave.	4	1.3	H	-8.04	47.70	54	6.30
2709.00	62.94	PK	250	1.7	H	-4.88	58.06	74	15.94
2709.00	53.5	Ave.	250	1.7	H	-4.88	48.62	54	5.38
3612.00	59.47	PK	239	1.6	V	-1.61	57.86	74	16.14
3612.00	48.4	Ave.	239	1.6	V	-1.61	46.79	54	7.21
4515.00	58.26	PK	295	1.2	V	0.92	59.18	74	14.82
4515.00	46.14	Ave.	295	1.2	V	0.92	47.06	54	6.94
Middle Channel									
436.53	34.41	QP	258	1.8	H	-8.34	26.07	46	19.93
915.00	83.42	QP	134	1.5	V	-0.86	82.56	94	11.44
900.07	28.70	QP	190	1.2	V	-0.86	27.84	46	18.16
931.34	31.99	QP	175	3.5	V	-0.86	31.13	46	14.87
1830.00	62.54	PK	347	2.4	H	-8.04	54.50	74	19.50
1830.00	53.63	Ave.	347	2.4	H	-8.04	45.59	54	8.41
2745.00	62.92	PK	328	2.2	H	-4.88	58.04	74	15.96
2745.00	52.19	Ave.	328	2.2	H	-4.88	47.31	54	6.69
3660.00	58.68	PK	69	1.6	V	-1.28	57.40	74	16.60
3660.00	48.59	Ave.	69	1.6	V	-1.28	47.31	54	6.69
4575.00	54.58	PK	345	1.7	V	1.15	55.73	74	18.27
4575.00	46.32	Ave.	345	1.7	V	1.15	47.47	54	6.53

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel									
436.53	35.92	QP	168	1.6	H	-8.34	27.58	46	18.42
927.00	84.65	QP	104	2.6	V	-0.86	83.79	94	10.21
898.32	28.44	QP	204	3.6	V	-1.23	27.21	46	18.79
932.81	33.36	QP	239	2.1	V	-0.86	32.5	46	13.5
1854.00	64.42	PK	202	1.5	H	-7.56	56.86	74	17.14
1854.00	55.47	Ave.	202	1.5	H	-7.56	47.91	54	6.09
2781.00	62.15	PK	232	2.3	H	-4.33	57.82	74	16.18
2781.00	50.76	Ave.	232	2.3	H	-4.33	46.43	54	7.57
3708.00	59.74	PK	47	1.0	V	-1.28	58.46	74	15.54
3708.00	49.29	Ave.	47	1.0	V	-1.28	48.01	54	5.99
4635.00	56.08	PK	79	1.0	V	1.15	57.23	74	16.77
4635.00	44.9	Ave.	79	1.0	V	1.15	46.05	54	7.95

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude

FCC§15.215(c) - 20dB EMISSION BANDWIDTH

Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

3. Measure the frequency difference of two frequencies that indicated 20dB bandwidth.

4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Phil Zhu on 2017-05-01.

Please refer to the following table and plots.

Test Mode: Transmitting

125 kHz

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low Channel	903	0.139
Middle Channel	915	0.139
High Channel	927	0.138

250 kHz

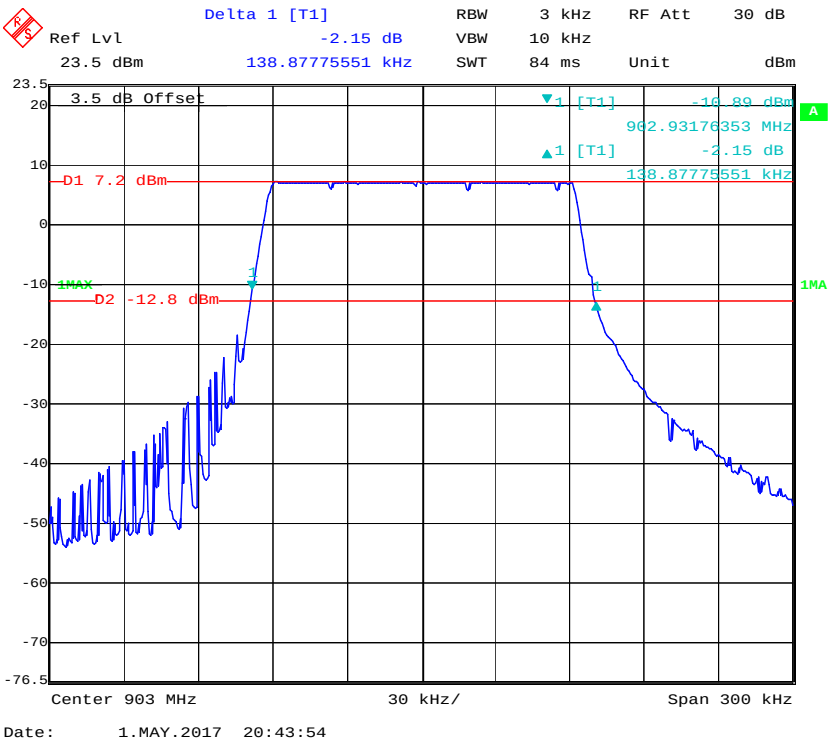
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low Channel	903	0.303
Middle Channel	915	0.301
High Channel	927	0.301

500 kHz

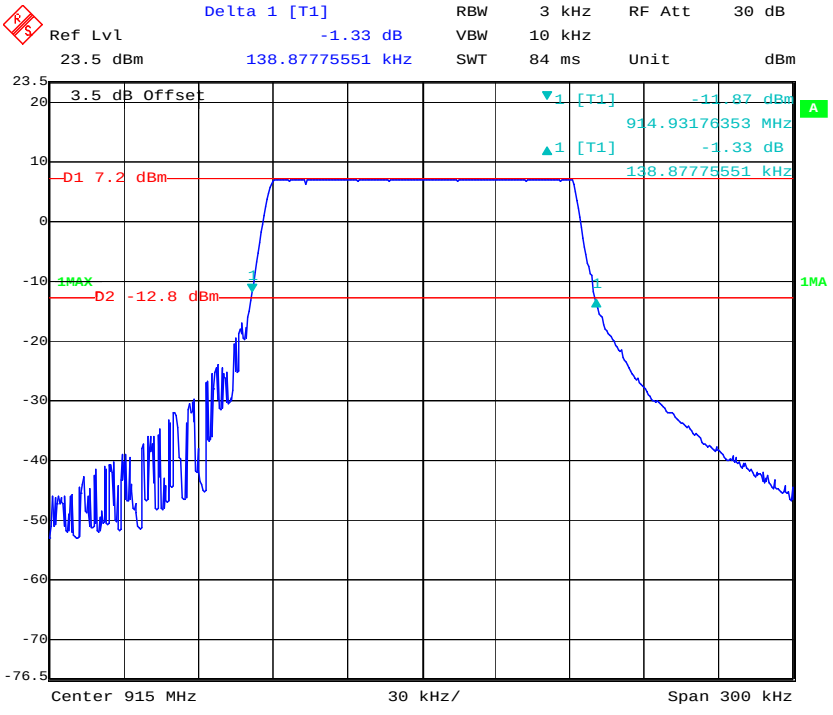
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low Channel	903	0.774
Middle Channel	915	0.754
High Channel	927	0.725

125 kHz

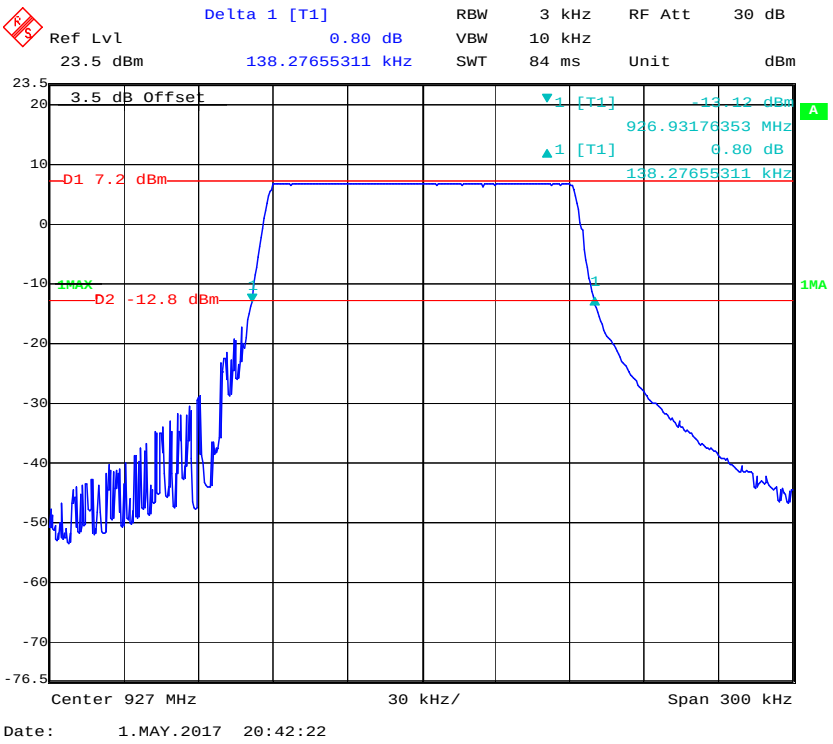
Low Channel



Middle Channel

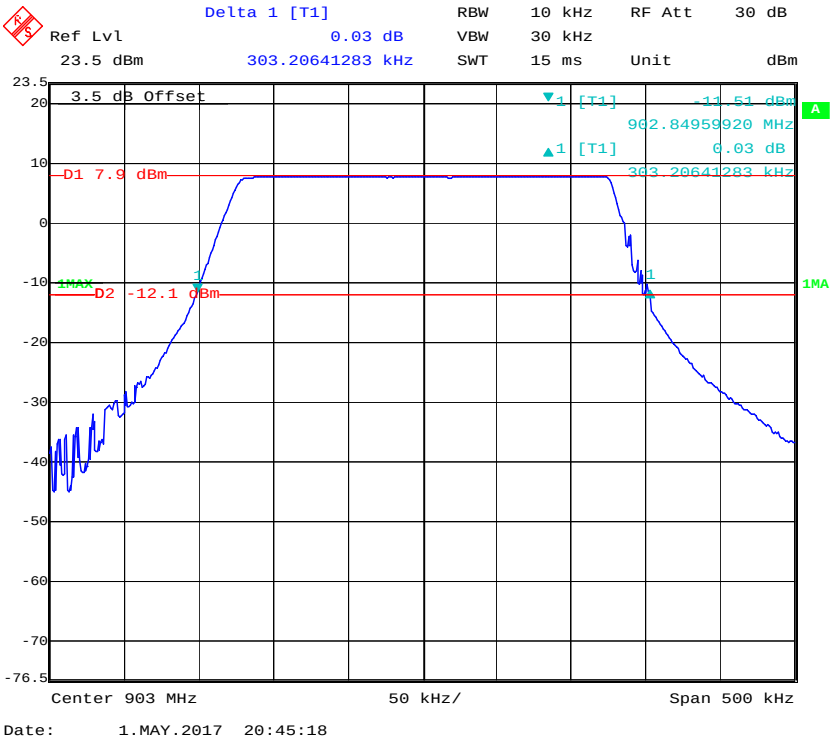


High Channel

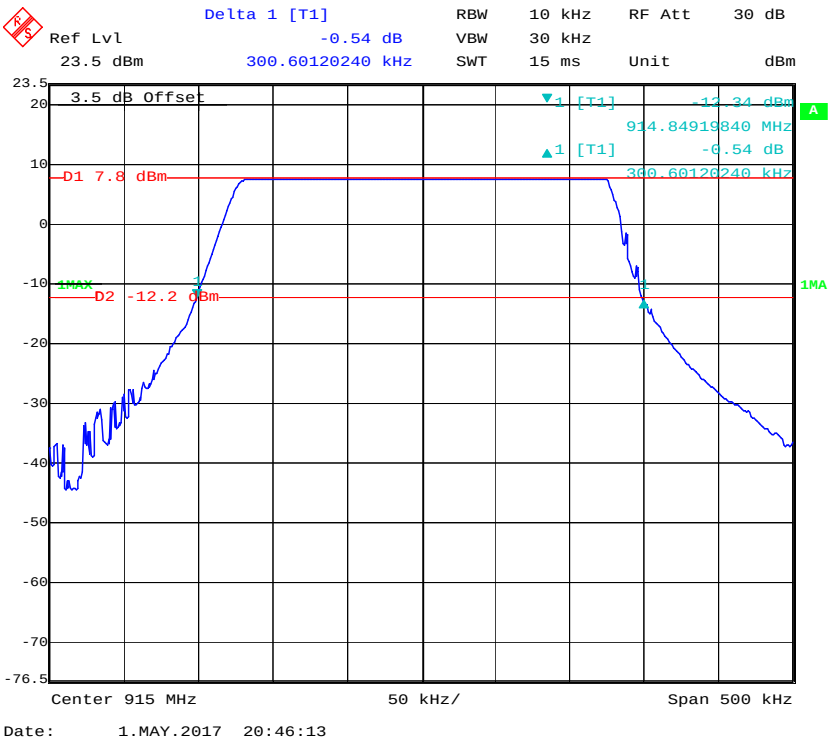


250 kHz

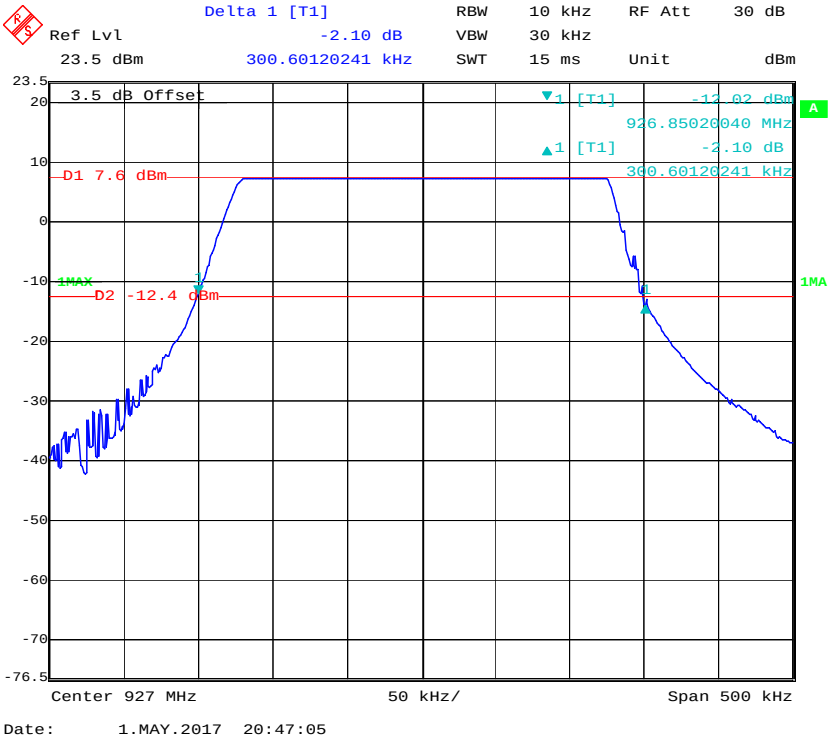
Low Channel



Middle Channel

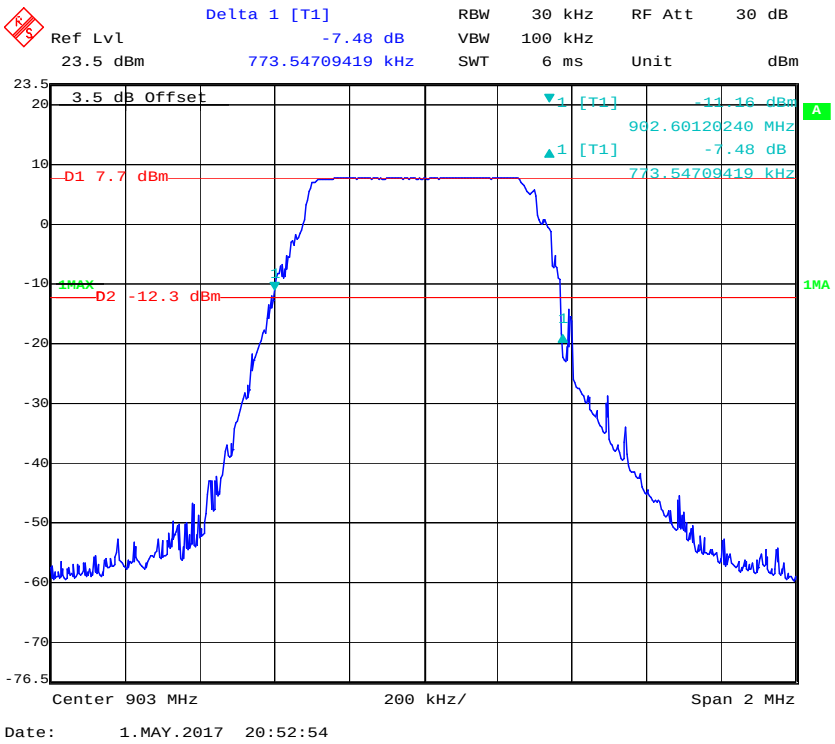


High Channel

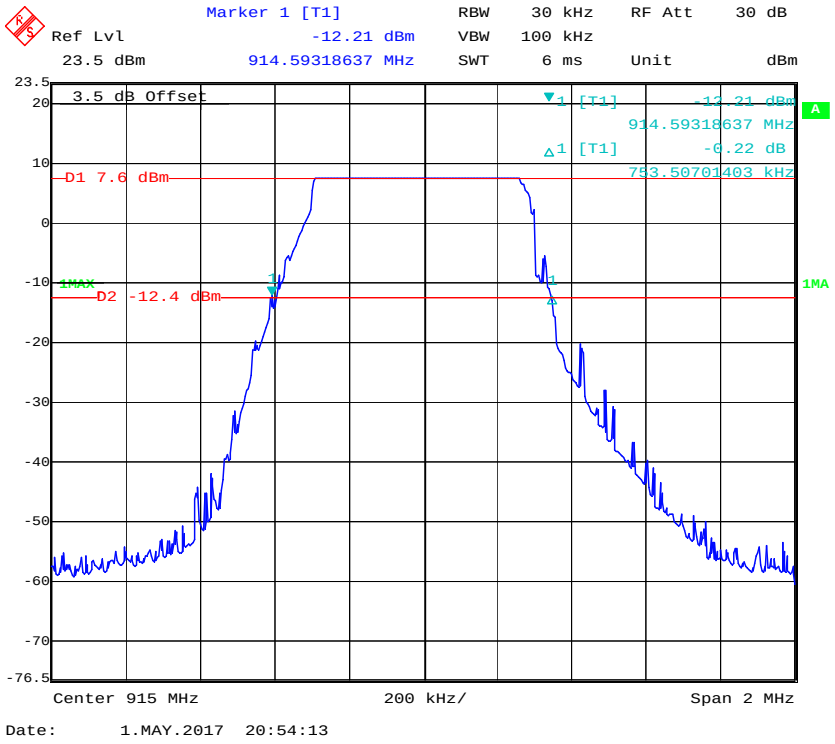


500 kHz

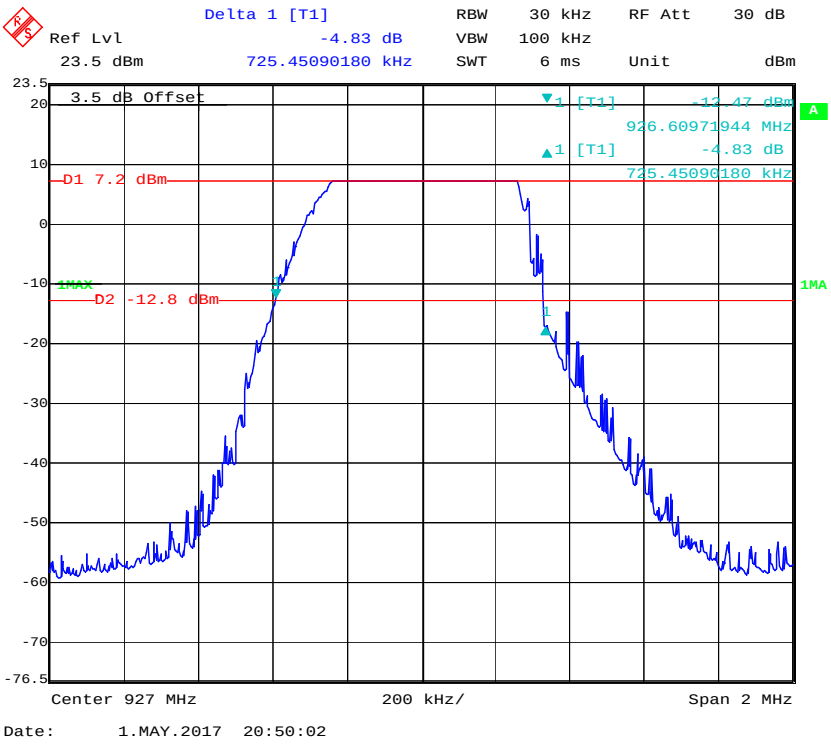
Low Channel



Middle Channel



High Channel



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