FCC PART 15.249

TEST REPORT

For

Changsha SunSky Electronic Design & Development Co., Ltd.

Room1024, Building A, Biaozhi Business Center No. 198 Xiang Fu Road, Changsha, China

FCC ID: WSVSUNVOTEKEYM5S

Report Type:	**Product Type:**
Original Report	Voting Keypad

Test Engineer:	Matt Yao
Report Number:	RKS160712001-00G
Report Date:	2016-07-18
Reviewed By:	Jesse Huang EMC Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Kunshan) Chenghu Road,Kunshan Development Zone No.248,Kunshan, Jiangsu, 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 Changsha SunSky Electronic Design & Development Co., Ltd.' s product, model number: M52Plus (FCC ID: WSVSUNVOTEKEYM5S) (the "EUT") in this report was a Voting Keypad , was measured approximately: 92mm (L) x54mm (W) x 8mm (H), rated input voltage:2 pieces button batteries(CR2032) 3.0V .

All measurement and test data in this report was gathered from production sample serial number: 20160627003.

(Assigned by BACL, Kunshan). The EUT was received on 2016-06-27.

Objective

This type approval report is prepared on behalf of Changsha SunSky Electronic Design & Development Co., Ltd. in accordance with Part 2-Subpart J, and Part 15-Subparts A, B 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 and 15.249 rules.

Related Submittal(s)/Grant(s)

N/A.

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

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the Chenghu Road,Kunshan Development Zone No.248,Kunshan, Jiangsu, 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 December 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4.

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 in testing mode which was provided by manufacturer.

EUT was tested with Channel 2404MHz, 2432MHz and 2466MHz.

EUT Exercise Software

No software was used during the test.

Block Diagram of Test Setup

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Not Applicable*
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.249(d)	Out of Band Emission	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

Not Applicable*: The EUT is battery operated equipment.

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

For intentional device, 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.

Antenna Connector Construction

The EUT has one integral antenna arrangement and antenna gain is -3.4dBi, which was permanently attached ,fulfill the requirement of this section, please refer to the EUT photos.

Result: Compliant.

FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS& OUT OF BAND EMISSION

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.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

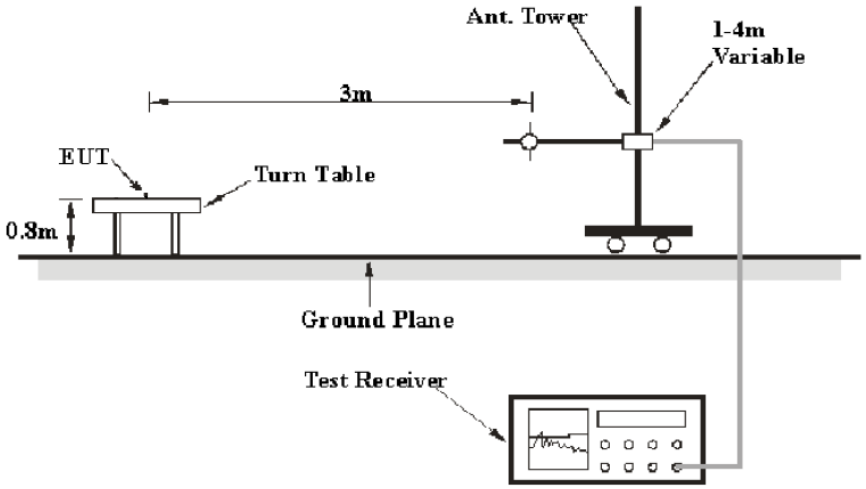
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Kunshan) is:
30MHz-1GHz: 5.91 dB
Above 1GHz: 4.92 dB

Table 1 – Values of U_{cispr}

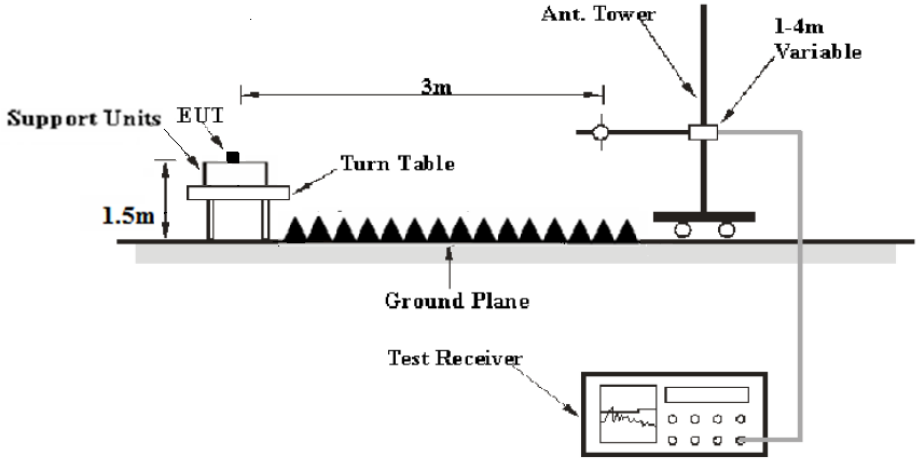
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1 GHz:



Above 1 GHz:



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 15.209/15.205 and FCC 15.249 limits.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

Test Equipment Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrunent	Amplifier	330	171377	2015-09-16	2016-09-16
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2015-11-12	2016-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2015-11-07	2016-11-06
ETS	Horn Antenna	3115	6229	2015-11-07	2016-11-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2015-11-12	2016-11-11
Mini	Pre-amplifier	ZVA-183-S+	857001418	2015-09-16	2016-09-16
R&S	Auto test Software	EMC32	V 09.10.0	-	-
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 &15.205 & 15.249, with the worst margin reading of:

9.77dB at **7398 MHz** in the **Horizontal** polarization for High Channel

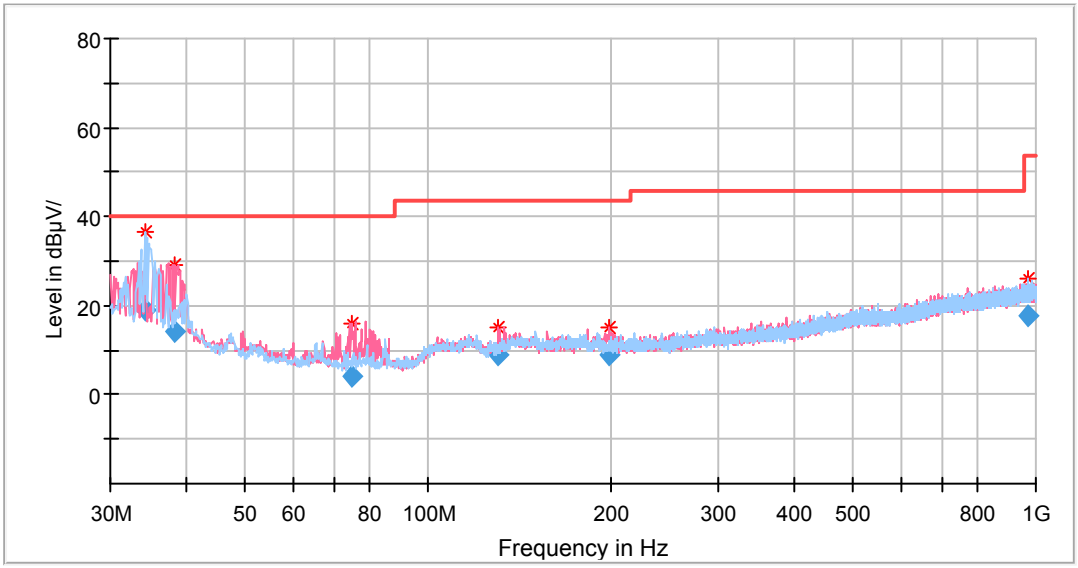
Test Data

Environmental Conditions

Temperature:	25.6°C
Relative Humidity:	52%
ATM Pressure:	101.2 kPa

The testing was performed by Matt Yao on 2016-07-15.

30MHz-1GHz:



Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.249/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µ V/m)	Margin (dB)
34.243750	26.50	QP	194.0	101.0	H	-7.4	19.10	40.00	20.90
38.245000	23.48	QP	195.0	199.0	V	-9.4	14.08	40.00	25.92
74.741250	21.07	QP	236.0	101.0	V	-17.1	3.97	40.00	36.03
130.031250	22.38	QP	330.0	101.0	V	-13.4	8.98	43.50	34.52
198.658750	21.49	QP	236.0	101.0	V	-12.5	8.99	43.50	34.51
974.052500	17.69	QP	100.0	101.0	H	0.1	17.79	53.90	36.11

Test Mode: Transmitting （Scan with X, Y, Z axis, the worst case is X axis ）

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/205/209	
	Reading (dBμV)	Detector (PK/QP/ Ave.)		Height (cm)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
Low Channel (2404MHz)									
2404	80.47	PK	12.0	150.0	V	4.9	85.37	114	28.63
2404	79.22	Ave	12.0	150.0	V	4.9	84.12	94	9.88
2404	79.35	PK	18.0	150.0	H	4.9	84.25	114	29.75
2404	78.82	Ave	18.0	150.0	H	4.9	83.72	94	10.28
2326	22.04	Ave	0.0	150.0	H	4.8	26.84	54	27.16
2326	35.37	PK	0.0	150.0	H	4.8	40.17	74	33.83
2390	33.35	PK	347.0	150.0	H	4.9	38.25	74	35.75
2390	19.99	Ave	347.0	150.0	H	4.9	24.89	54	29.11
3034	20.04	Ave	293.0	150.0	V	6.9	26.94	54	27.06
3034	33.12	PK	293.0	150.0	V	6.9	40.02	74	33.98
4808	30.89	PK	198.0	150.0	H	13.3	44.19	74	29.81
4808	17.35	Ave	198.0	150.0	H	13.3	30.65	54	23.35
7212	30.96	PK	314.0	200.0	H	19.7	50.66	74	23.34
7212	17.33	Ave	314.0	200.0	H	19.7	37.03	54	16.97

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Middle Channel (2432MHz)									
2432	79.87	PK	330.0	150.0	V	4.9	84.77	114	29.23
2432	78.61	Ave	330.0	150.0	V	4.9	83.51	94	10.49
2432	78.85	PK	218.0	200.0	H	4.9	83.75	114	30.25
2432	77.73	Ave	218.0	200.0	H	4.9	82.63	94	11.37
2234	32.20	PK	173.0	150.0	H	4.7	36.90	74	37.10
2234	19.03	Ave	173.0	150.0	H	4.7	23.73	54	30.27
3764	19.07	Ave	299.0	150.0	H	9.1	28.17	54	25.83
3764	32.52	PK	299.0	150.0	H	9.1	41.62	74	32.38
4864	30.48	PK	26.0	150.0	H	13.5	43.98	74	30.02
4864	17.36	Ave	26.0	150.0	H	13.5	30.86	54	23.14
5068	30.81	PK	17.0	150.0	H	14.2	45.01	74	28.99
5068	17.32	Ave	17.0	150.0	H	14.2	31.52	54	22.48
7296	31.72	PK	154.0	150.0	H	19.9	51.62	74	22.38
7296	16.75	Ave	154.0	150.0	H	19.9	36.65	54	17.35
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2466MHz)									
2466	78.86	PK	123.0	150.0	V	5.0	83.86	114	30.14
2466	77.83	Ave	123.0	150.0	V	5.0	82.83	94	11.17
2466	78.48	PK	161.0	150.0	H	5.0	83.48	114	30.52
2466	77.96	Ave	161.0	150.0	H	5.0	82.96	94	11.04
2483.5	20.00	Ave	49.0	150.0	H	5.0	25.00	54	29.00
2483.5	33.47	PK	49.0	150.0	H	5.0	38.47	74	35.53
2513	33.77	PK	341.0	150.0	V	5.1	38.87	74	35.13
2513	19.97	Ave	341.0	150.0	V	5.1	25.07	54	28.93
2248	20.01	Ave	14.0	200.0	H	4.7	24.71	54	29.29
2248	33.12	PK	14.0	200.0	H	4.7	37.82	74	36.18
4932	16.73	Ave	32.0	150.0	H	13.8	30.53	54	23.47
4932	30.33	PK	32.0	150.0	H	13.8	44.13	74	29.87
7398	24.03	Ave	126.0	150.0	H	20.2	44.23	54	9.77
7398	35.83	PK	126.0	150.0	H	20.2	56.03	74	17.97

FCC §15.215(c) – 20 dB BANDWIDTH TESTING

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 on the test table without connection to measurement instrument. Turn on the EUT. 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 were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2015-11-12	2016-11-11
Dressler	Attenuator	ATT 6/75	510020010004	2015-11-12	2016-11-12

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

Test Data

Environmental Conditions

Temperature:	25.6°C
Relative Humidity:	51 %
ATM Pressure:	101.2kPa

** The testing was performed by Matt Yao on 2016-07-15.*

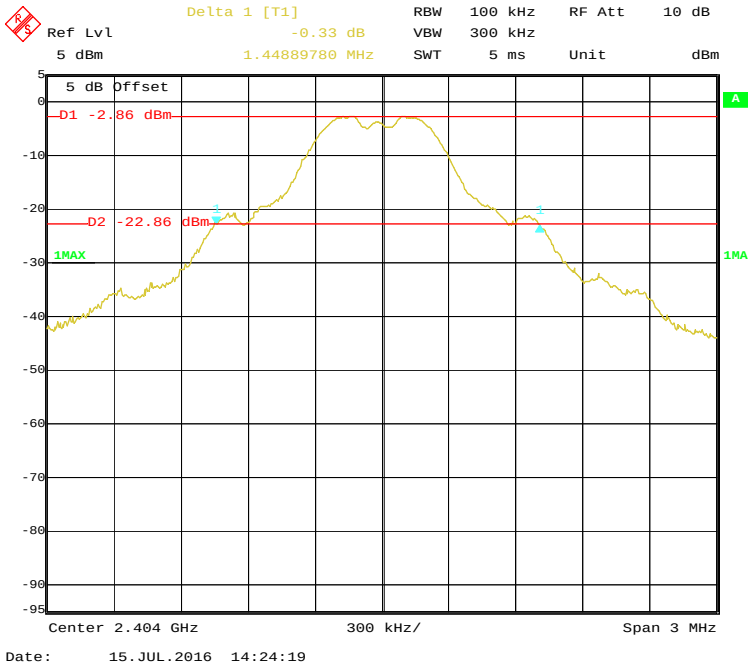
Test Result: Compliant.

Please refer to following tables and plots

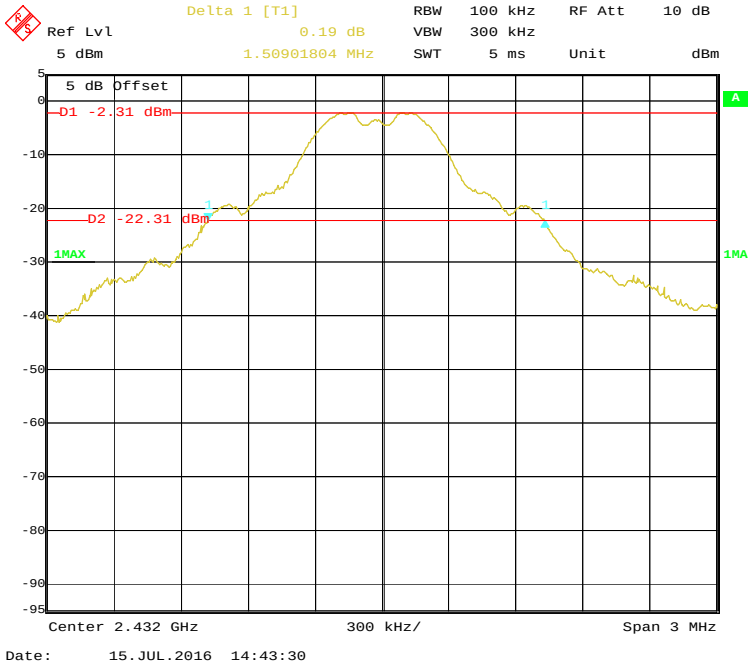
Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2404	1.45
Middle	2432	1.51
High	2466	1.50

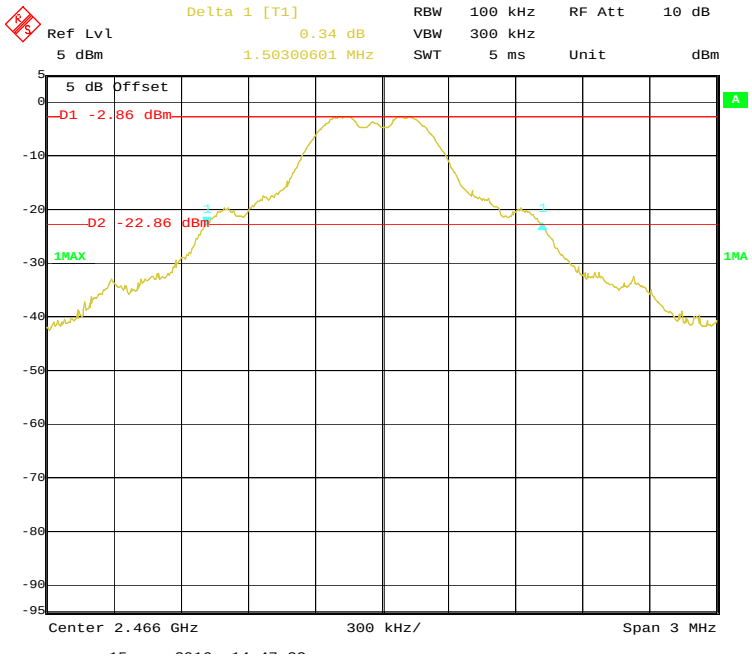
Low Channel



Middle Channel



High Channel



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