FCC PART 90

TEST REPORT

For

Wallys Communications Technologies Co.,Ltd

Room 2723, Le Jia building, Jia Rui Xiang No.8, Suzhou Industrial Park, Suzhou, P.R 215000 China

FCC ID: 2AG7VDR900VX

Report Type:	**Product Type:**
Original Report	Dual Band 11AC wireless Module

Test Engineer:	Carry Cai
Report Number:	RKSA191022001-00C
Report Date:	2019-11-27
Reviewed By:	Oscar Ye EMC Manager
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)

Applicant:	Wallys Communications Technologies Co.,Ltd
Test Model	DR900VX
Series Model	DR900VX-4.9,DR600VX,DR600VX-4.9,DR900VX-MX,DR600VX-MX
Model Difference	Model name
Product Type:	Dual Band 11AC wireless Module
Power Supply:	DC 3.3V
RF Function:	2.4GHz; 5GHz
Operating Band/Frequency:	2.4GHz: 2412MHz ~ 2462MHz 5GHz: 4940~4990MHz、5150~5250MHz、5725~ 5850MHz
Channel Number:	2.4GHz: 11 5GHz: 4940~4990MHz: 7 5150~5250MHz: 7 5725~ 5850MHz: 8
Channel Separation:	2.4GHz: 5 MHz 5GHz: 4940~4990MHz: 5 MHz 5150~5250MHz/5725~ 5850MHz: 802.11a/802.11ac20/802.11n-HT20 :20 MHz, 802.11ac40/802.11n-HT40: 40 MHz, 802.11ac80:80 MHz

**All measurement and test data in this report was gathered from production sample serial number: 20191022001. (Assigned by the BACL). The EUT supplied by the applicant was received on 2019-10-22.*

Objective

This test report is prepared on behalf of Wallys Communications Technologies Co.,Ltd in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS and Part 15.407 NII submissions with FCC ID: 2AG7VDR900VX.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Part90 as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: KDB 971168 D01, ANSI C63.26-2016.

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
Radiated emission	30MHz~1GHz	5.91dB
	1GHz~6GHz	4.68dB
	6 GHz ~18 GHz	4.92dB
	18 GHz~40 GHz	5.21dB
Temperature		1.0℃
Humidity		6%

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

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.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

In **4940~4990 MHz** band, test channel list is as below, EUT was tested with channel 3, 6 and 9.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	4950	7	4970
4	4955	8	4975
5	4960	9	4980
6	4965	/	/

EUT Exercise Software

RF test tool: Cart.exe

Mode	Data rate	Power level
20M	6 Mbps	18

Special Accessories

No special accessory was used.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

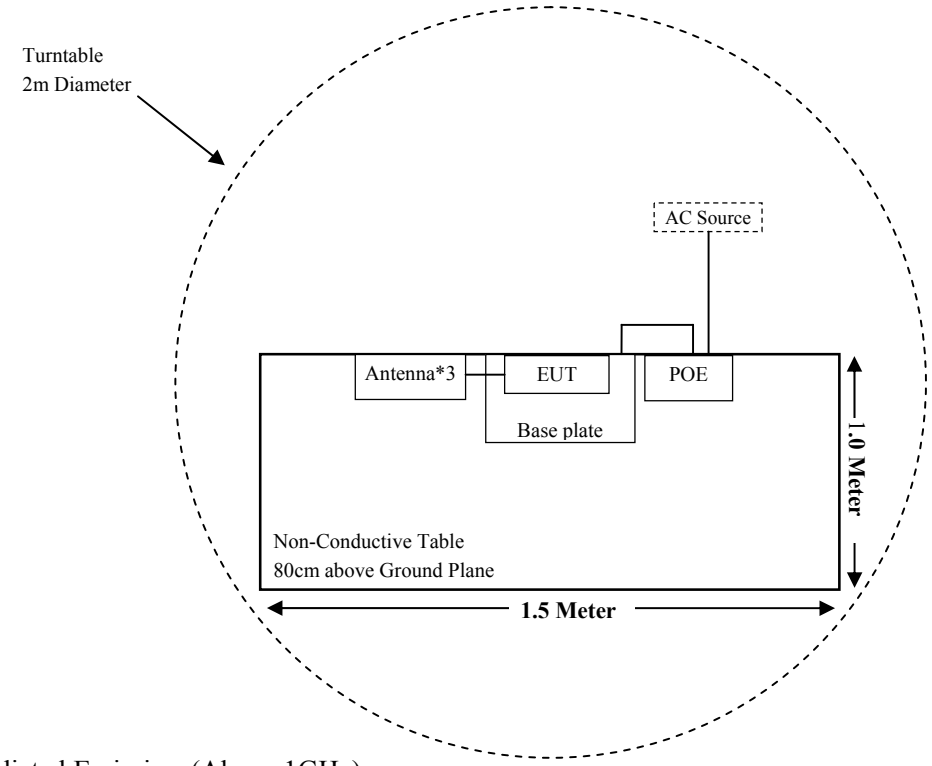
Manufacturer	Description	Model	Serial Number
Wallys	Base plate	DR344-NAS_Ver_MP3A	/
Wallys	POE	GRT-POE15-240100	/
Wallys	Antenna*3	/	/

External I/O Cable

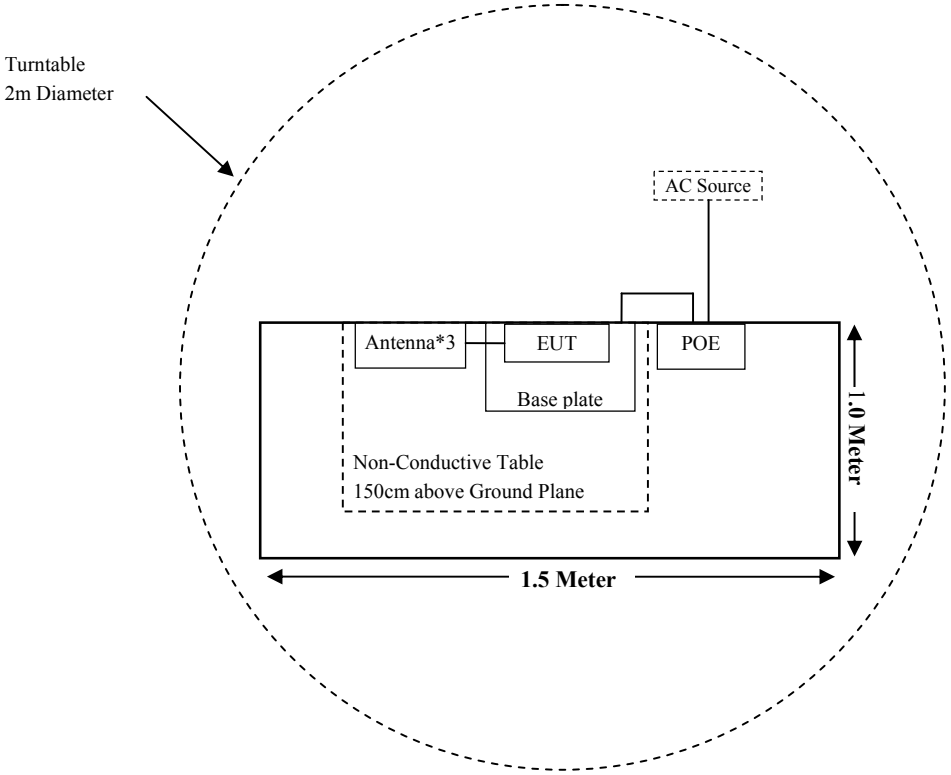
Cable Description	Length (m)	From Port	To
RJ45 Cable	1.0	Base plate	POE
Antenna Cable*3	0.3	EUT	Antenna

Block Diagram of Test Setup

For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307(b), §2.1091	Maximum Permissible Exposure (MPE)	Compliant
§2.1046, § 2.1046, 90.205(p), 90.1215(a)(1)	Power Output	Compliant
§2.1049, 90Y	Occupied Bandwidth	Compliant
§ 90.1215(a)(2)	Power Spectral Density	Compliant
§ 90.1215(e)	Peak Excursion	Compliant
§2.1051, § 90.210(m)	Conducted Spurious Emission at the Antenna Terminals	Compliant
§2.1053, § 90.210(m)	Radiated Spurious Emissions	Compliant
§ 2.1055, § 90.213	Frequency Stability	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2018-11-30	2019-11-29
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
HP	Signal Generator	HP 8341B	2624A00116	2018-11-30	2019-11-29
Sonoma Instrunent	Pre-amplifier	310N	171205	2019-08-14	2020-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2019-08-15	2020-08-14
Radiated Emission Test（Chamber 2#）					
HP	Signal Generator	HP 8341B	2624A00116	2018-11-30	2019-11-29
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2019-08-27	2020-08-26
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2017-07-15	2020-07-14
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-12-12	2019-12-11
A.H.Systems, inc	Amplifier	2641-1	491	2019-02-20	2020-02-19
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2019-08-15	2020-08-14
RF Conducted Test					
Rohde & Schwarz	EMI Test Receiver	ESIB26	100146	2018-11-30	2019-11-29
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2019-07-23	2020-07-22
Agilent	Power Meter	N1912A	MY5000492	2018-11-18	2019-11-17
Agilent	Power Sensor	N1921A	MY54210024	2018-11-18	2019-11-17
Narda	Attenuator	10dB	010	2019-08-15	2020-08-14
BACL	Temperature & Humidity Chamber	BTH-150	30023	2018-12-20	2019-12-20
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2019-10-10	2020-10-09
Wallys	RF Cable	Wallys C01	C01	Each Time	/

*** 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 §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to §2.1091and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

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/cm^2);

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:

For worst case:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412~2462	2	1.58	25.00	316.23	20	0.0994	1.0
802.11g		2	1.58	23.50	223.87	20	0.0704	1.0
802.11 n-HT20		2	1.58	28.00	630.96	20	0.1983	1.0
802.11 n-HT40	2422~2452	2	1.58	24.50	281.84	20	0.0886	1.0
802.11a	5150~5250	2	1.58	17.50	56.23	20	0.0177	1.0
	5725~5850	2	1.58	20.50	112.20	20	0.0354	1.0
802.11ac20	5150~5250	2	1.58	21.00	125.89	20	0.0396	1.0
	5725~5850	2	1.58	24.00	251.19	20	0.0789	1.0
802.11n-HT20	5150~5250	2	1.58	21.00	125.89	20	0.0396	1.0
	5725~5850	2	1.58	24.00	251.19	20	0.0789	1.0
802.11ac40	5150~5250	2	1.58	17.00	50.12	20	0.0158	1.0
	5725~5850	2	1.58	23.00	199.53	20	0.0627	1.0
802.11n-HT40	5150~5250	2	1.58	17.00	50.12	20	0.0158	1.0
	5725~5850	2	1.58	23.00	199.53	20	0.0627	1.0
802.11ac80	5150~5250	2	1.58	15.00	31.62	20	0.0099	1.0
	5725~5850	2	1.58	23.00	199.53	20	0.0627	1.0
20MHz	4950-4980	2	1.58	22.50	117.83	20	0.0559	1.0

Note:
(1) The tune-up output power was declared by the manufacturer.
(2) 2.4G Wi-Fi ,4.9G,5G Wi-Fi can not transmit simultaneously.

Conclusion: The EUT meets exemption requirement - RF exposure evaluation greater than 20cm distance specified in § 2.1091. If the device built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by§ 2.1093.

FCC § 2.1049 - OCCUPIED BANDWIDTH

Applicable Standard

FCC Part 2.1049

Test Procedure

The following procedure shall be used for measuring (99 %) power bandwidth

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.
d) NOTE—Steps a) through c) may require iteration to adjust within the specified tolerances.
e) Set the detection mode to peak, and the trace mode to max hold..
f) Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.
g) If the instrument does not have a 99 % power bandwidth function, the trace data points are to be recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % power bandwidth is the difference between these two frequencies.
h) The OBW shall be reported by providing plot(s) of the measuring instrument display. The frequency and amplitude axes and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Carry Cai on 2019-11-11.

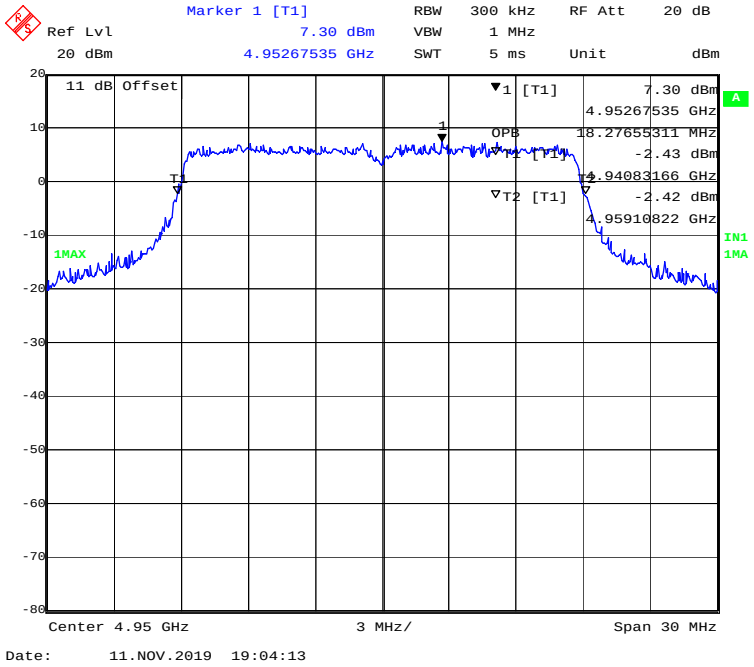
EUT Operation Mode: Transmitting

Test Result: Compliant.

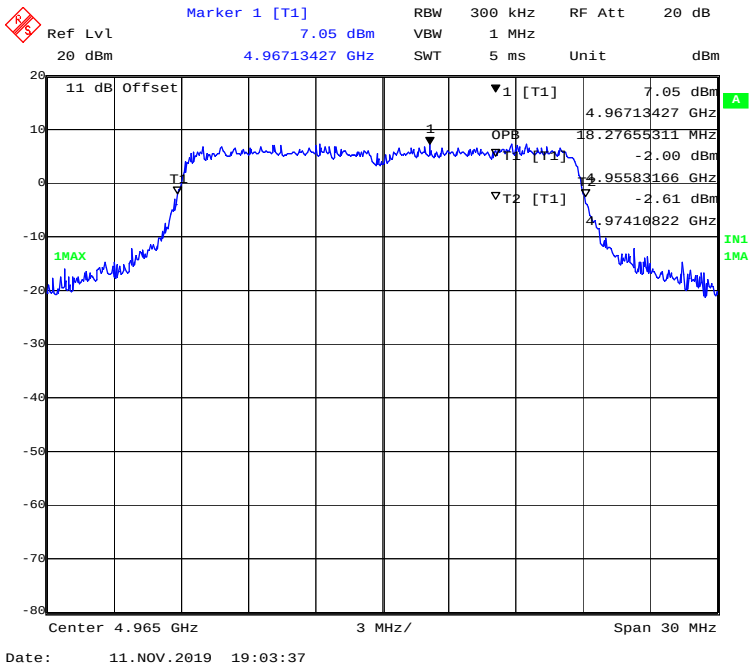
Declared Channel Bandwidth (MHz)	Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)		
			ANT 1	ANT 2	ANT 3
20	Low	4950	18.28	18.10	18.16
	Middle	4965	18.28	18.04	18.16
	High	4980	18.40	18.04	18.16

ANT 1

Low Channel



Middle Channel



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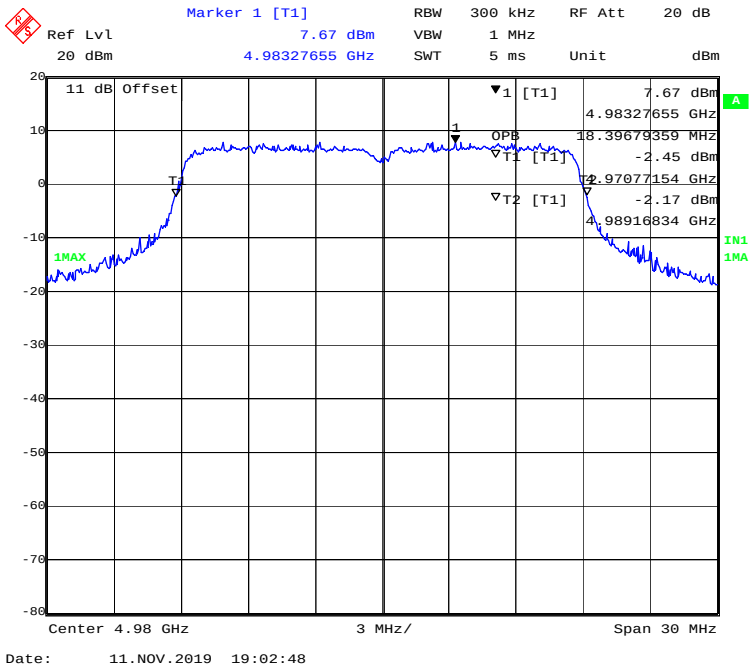
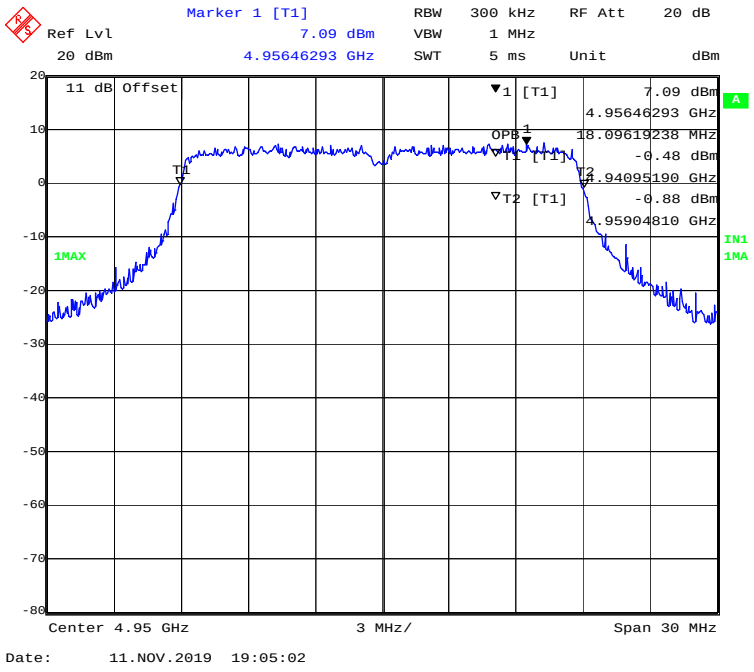
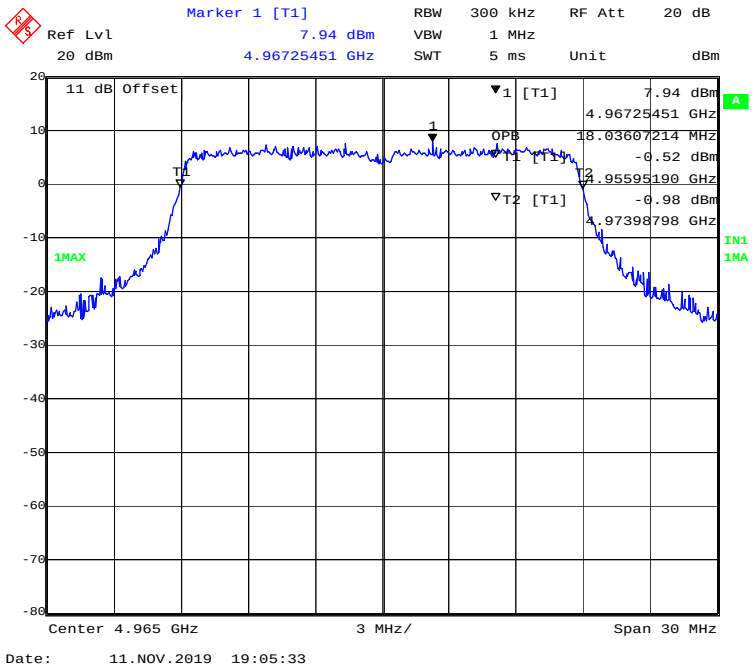


ANT 2

Low Channel



Middle Channel



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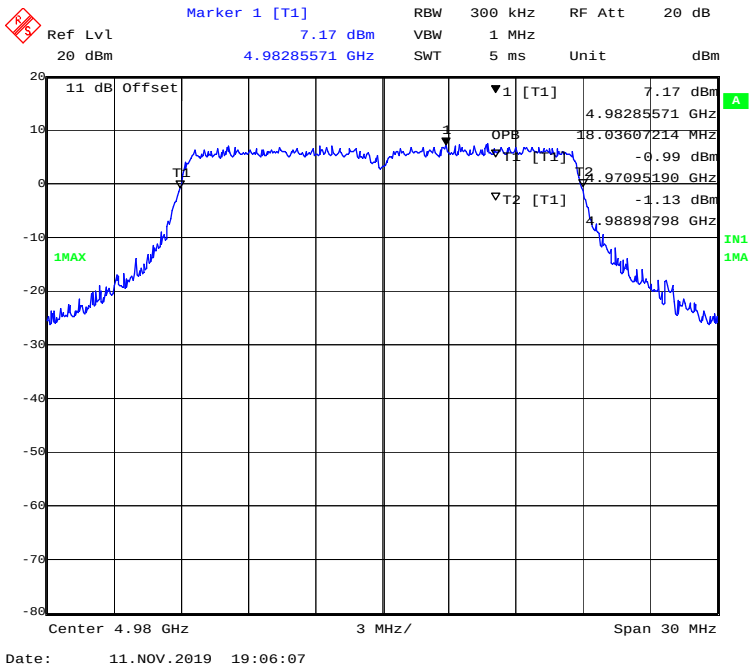
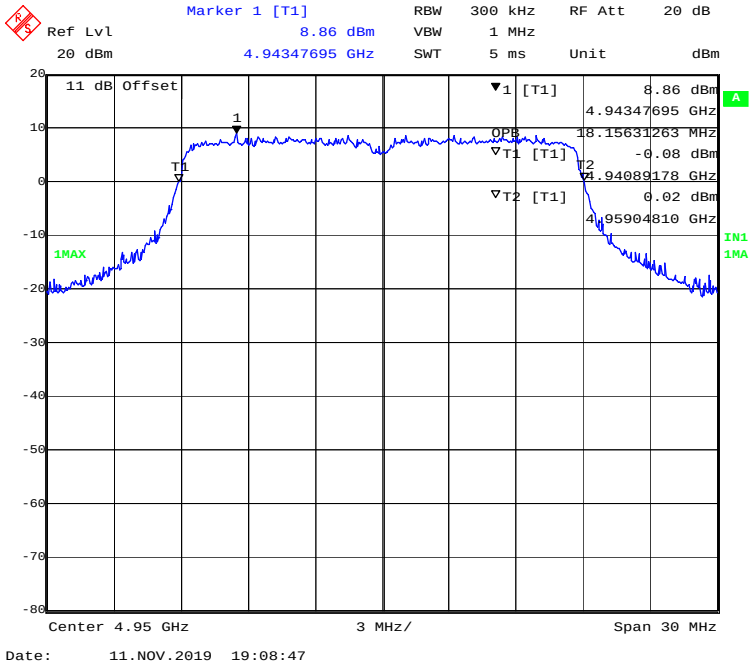


ANT 3

Low Channel



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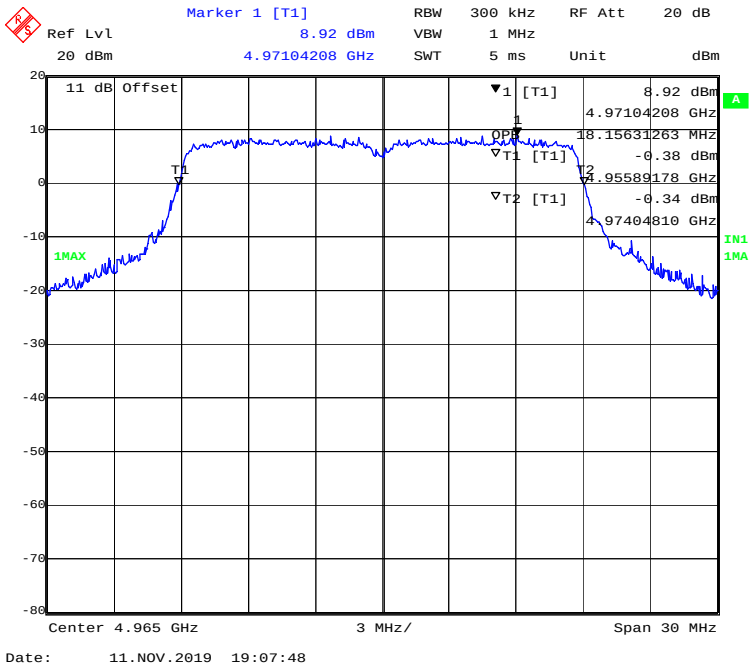

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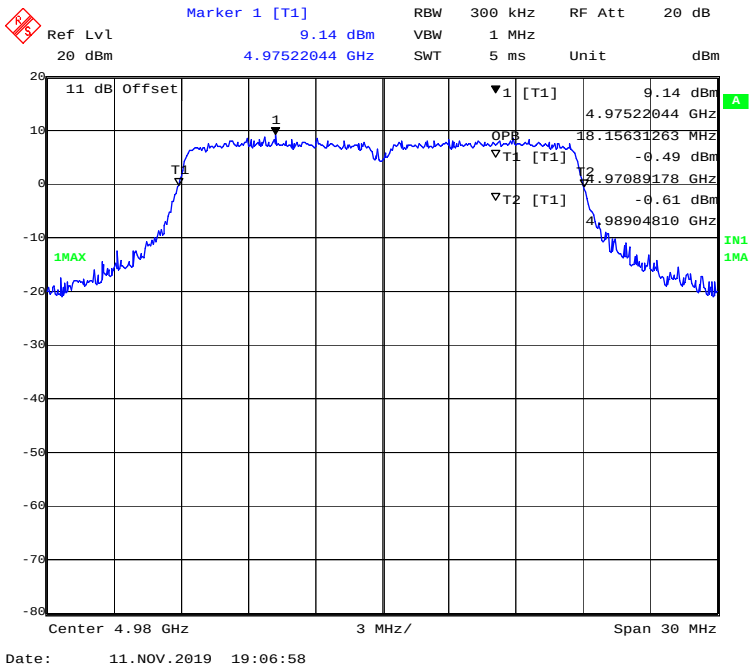


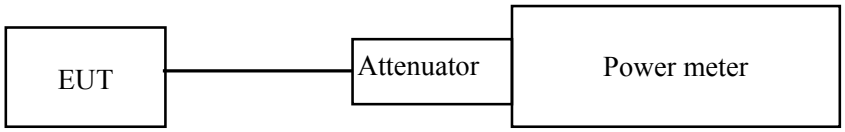
FCC § 2.1046, § 90.205(p), § 90.1215(a)(1) - POWER OUTPUT

Applicable Standard

FCC Part 2.1046, 90.205(p), & 90.1215(a)(1)
(1) The maximum conducted output power should not exceed 33 dBm
(2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Carry Cai on 2019-11-11.

EUT Operation Mode: Transmitting

Test Result: Compliant.

Decleared Channel Bandwidth (MHz)	Channel	Frequency (MHz)	Maximum Conducted Output Power (dBm)				Limit (dBm)
			ANT 1	ANT 2	ANT 3	Total	
20	Low	4950	17.56	16.83	18.30	22.38	33
	Middle	4965	17.43	16.97	18.26	22.36	33
	High	4980	17.43	16.95	18.15	22.31	33

Note:

*1: The total output power=10*Log10(10^(ANT 1/10)+10^(ANT 2/10)+10^(ANT 3/10))*
2: The antenna gain is 2 dBi

FCC § 2.1046 , § 90.205(p), § 90.1215(a)(2) - POWER SPECTRAL DENSITY

Applicable Standard

FCC Part 2.1046, 90.205(p), & 90.1215(a)(2)

Test Procedure

Procedure for use when EUT can be configured to transmit continuously or when sweep triggering/signal gating can be properly implemented

The EUT is considered to transmit continuously if it can be configured to transmit at a burst duty cycle of greater than or equal to 98% throughout the duration of the measurement. If this condition can be achieved, then the following procedure can be used to measure the average PSD.

This procedure can also be used when the EUT cannot be configured to transmit continuously, provided that the measurement instrument can be configured to trigger a sweep at the beginning of each full-power transmission burst, and the sweep time is less than or equal to the minimum transmission time during each burst (i.e., no burst off-time is to be included in the measurement).

a) Set the analyzer center frequency to the OBW center frequency.
b) Set the span to 1.5 times the OBW bandwidth.
c) Set the RBW to the specified reference bandwidth (often 1 MHz).
d) Set the VBW ≥ 3 × RBW.
e) Set the number of points in sweep ≥ span / RBW.
Note: This requirement is applicable only to final measurement. It can be violated for preliminary (pre-scan) measurements when necessary for wide span measurements.
f) Detector = peak.
g) Sweep time = auto couple.
h) Trace mode = max hold.
i) Allow trace to fully stabilize.
j) Use the peak marker function to determine the maximum amplitude level within the specified reference bandwidth (PSD)

Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Carry Cai on 2019-11-11.

EUT Operation Mode: Transmitting

Test Result: Compliant.

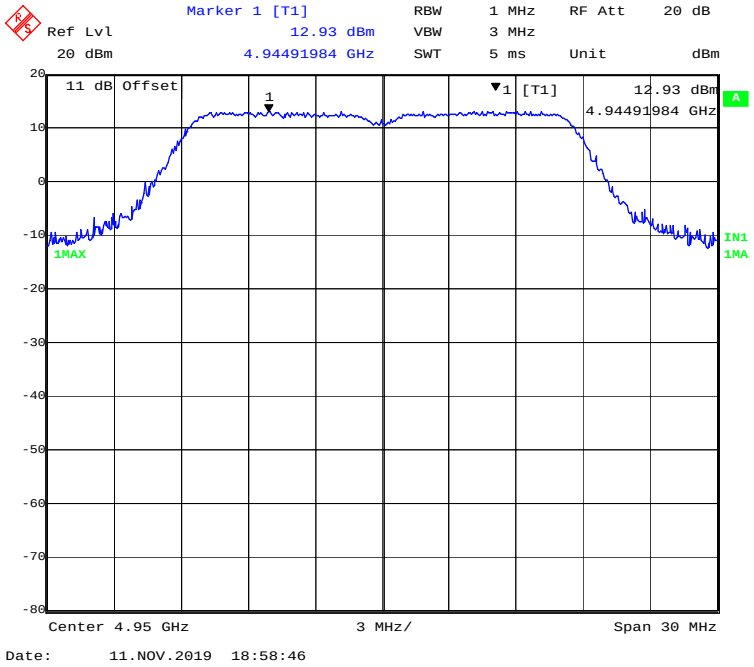
Decleared Channel Bandwidth (MHz)	Channel	Frequency (MHz)	PSD (dBm/MHz)				Limit (dBm/MHz)
			ANT 1	ANT 2	ANT 3	Total	
20	Low	4950	12.93	12.74	14.46	18.22	21
	Middle	4965	12.87	13.01	14.16	18.16	21
	High	4980	12.81	13.18	14.30	18.25	21

Note:

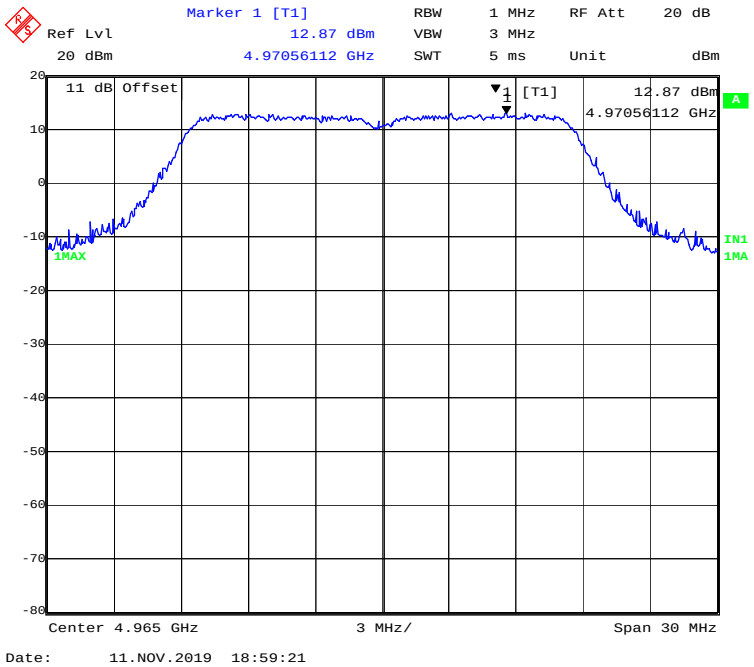
*1: The total PSD=10*Log10(10^(ANT 1/10)+10^(ANT 2/10)+10^(ANT 3/10))*
2: The antenna gain is 2 dBi.

ANT 1

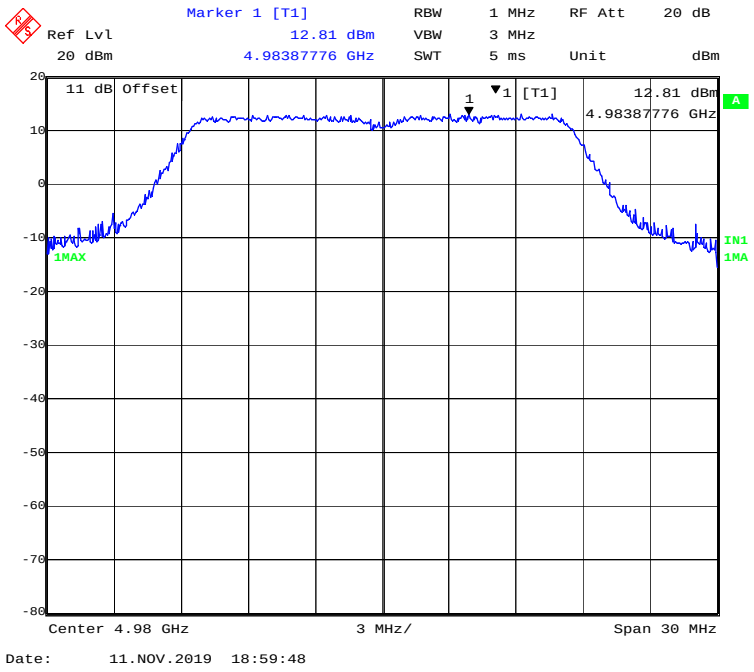
Low Channel



Middle Channel

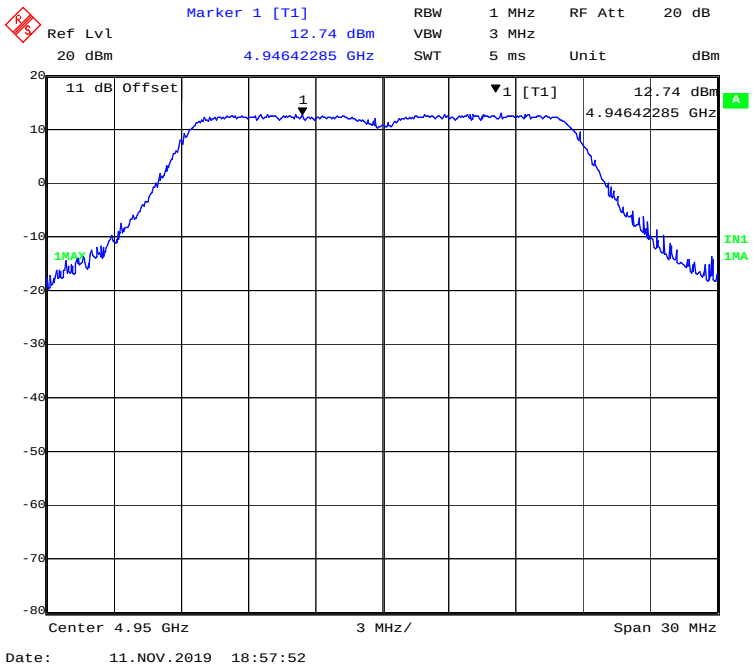


High Channel



ANT 2

Low Channel



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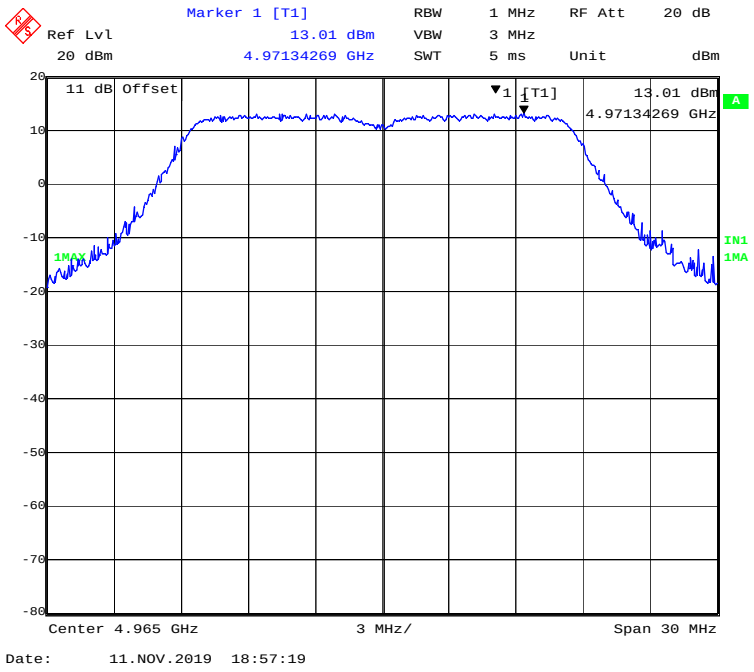

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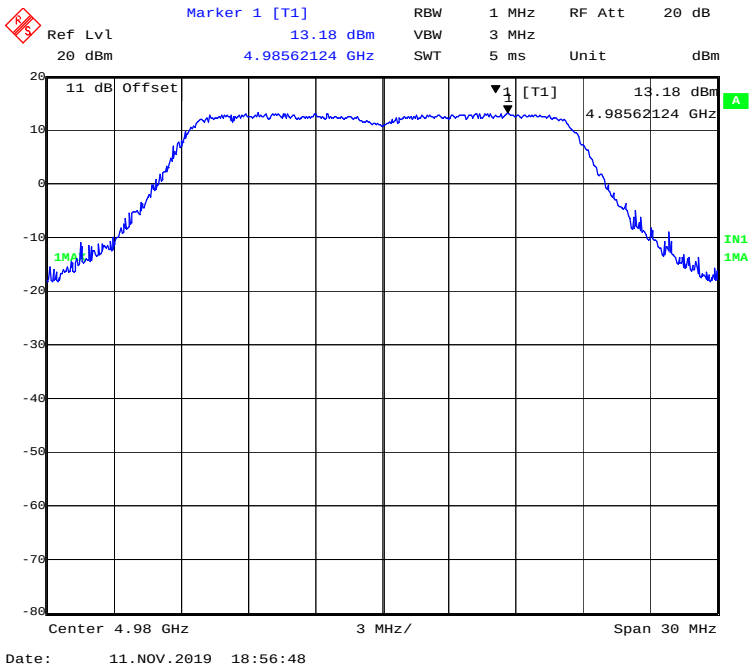
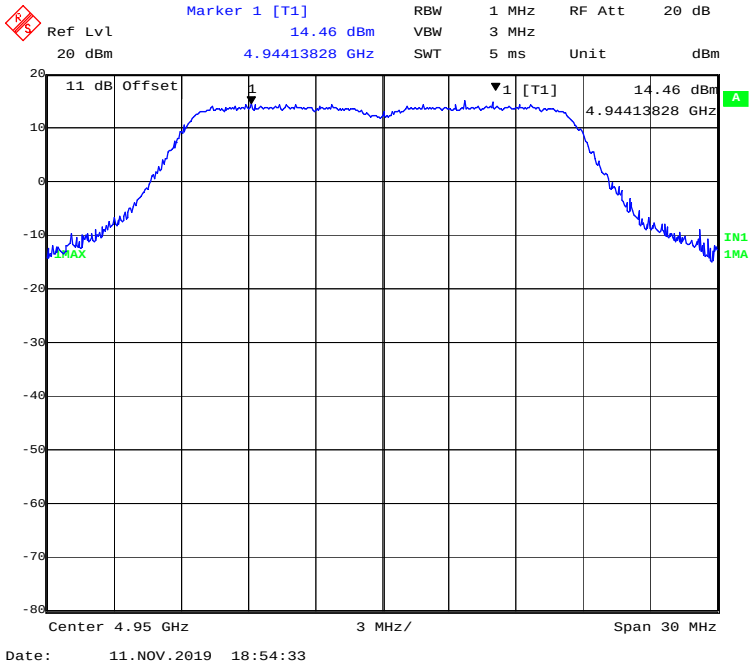


ANT 3

Low Channel



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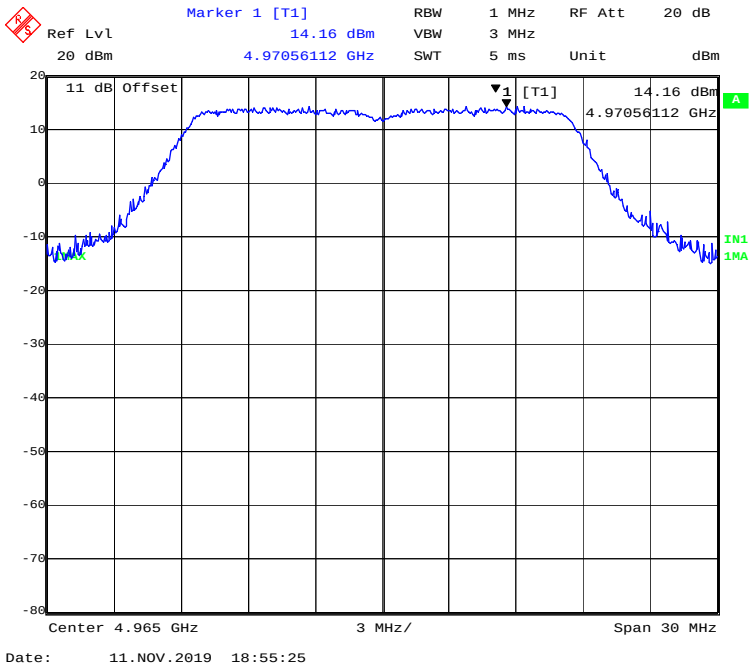
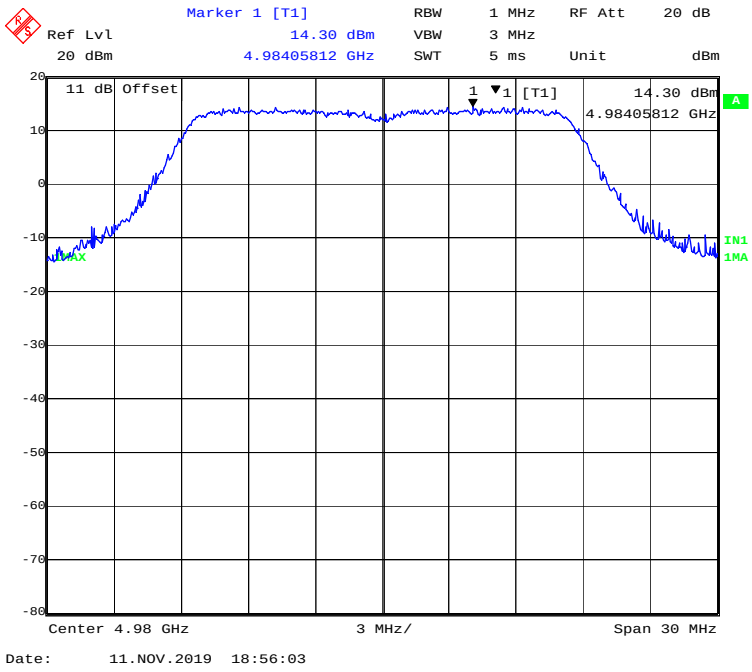


High Channel



FCC § 90.1215(e) - PEAK EXCURSION

Applicable Standard

FCC Part 90.1215(e)

Test Procedure

The inherent randomness of the power peaks in a noise-like digital signal makes it difficult to quantify the peak power using traditional measurement techniques for determining the peak power of an analog signal. The peak power of a digitally-modulated signal is predictable only on a statistical basis. Thus, for these types of signals, a statistical measurement of the peak power is necessary.

The power complementary cumulative distribution function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. The following guidelines are offered for performing a CCDF measurement.

a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
b) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
c) Set the number of counts to a value that stabilizes the measured CCDF curve;
d) Set the measurement interval as follows:
1) for continuous transmissions, set to 1 ms,
2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
e) Record the maximum PAPR level associated with a probability of 0.1%.

Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Carry Cai on 2019-11-12.

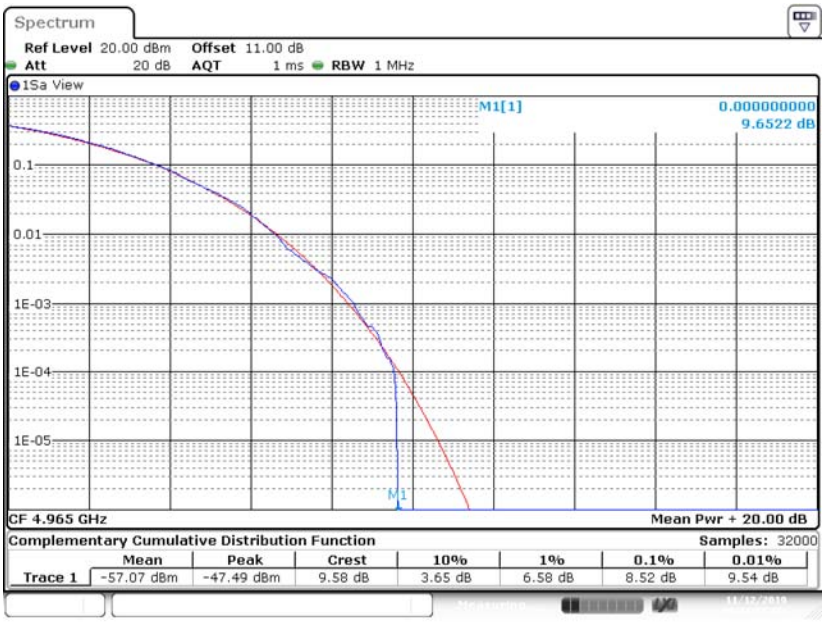
EUT Operation Mode: Transmitting

Test Result: Compliant.

ANT	Channel Bandwidth (MHz)	Frequency (MHz)	Resolution Bandwidth (MHz)	AQT (ms)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
1	20	4965	1	1	8.52	13	4.48
2	20	4965	1	1	7.77	13	5.23
3	20	4965	1	1	8.35	13	4.65

ANT 1

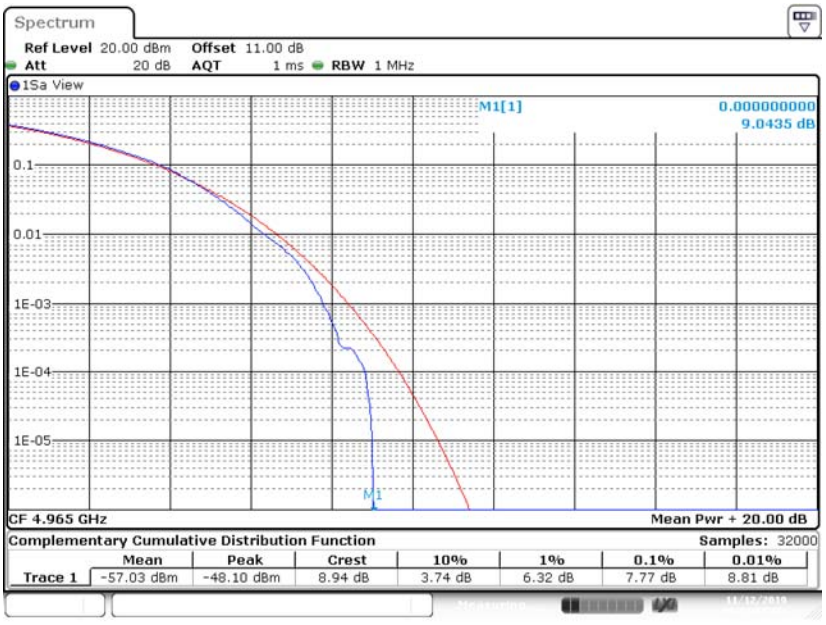
Middle Channel



Date: 12.NOV.2019 09:31:56

ANT 2

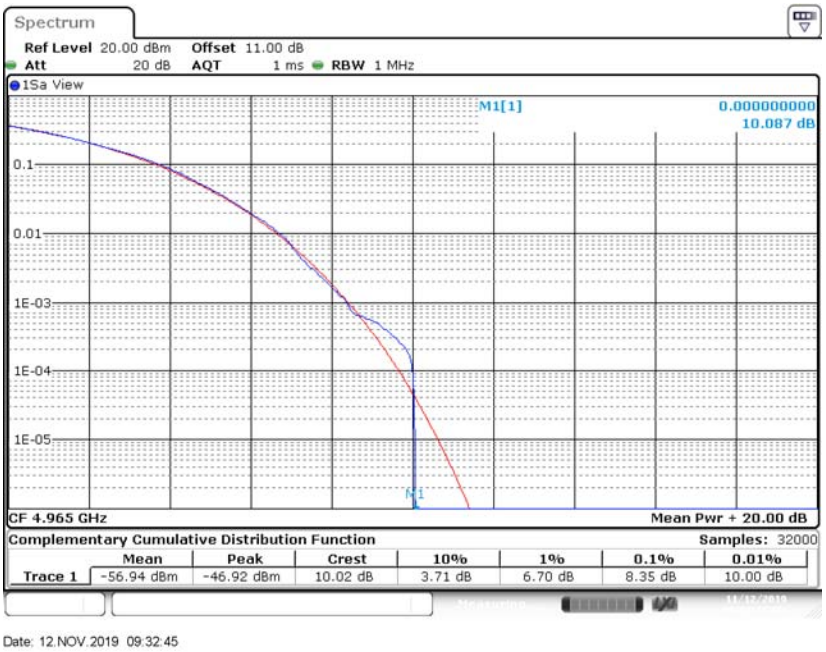
Middle Channel



Date: 12.NOV.2019 09:32:09

ANT 3

Middle Channel



FCC § 2.1051, § 90.210 (m) - CONDUCTED EMISSION MASK

Applicable Standard

FCC Part 2.1051, 90.210 (m)
High power transmitters (greater that 20 dBm) operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:
(1) On any frequency removed from the assigned frequency between 0-45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45-50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50-55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.
(4) On any frequency removed from the assigned frequency between 55-100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.
(5) On any frequency removed from the assigned frequency between 100-150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB.
(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

Test Procedure

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

The zero dB reference is measured relative to the highest average power of the fundamental emission, Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

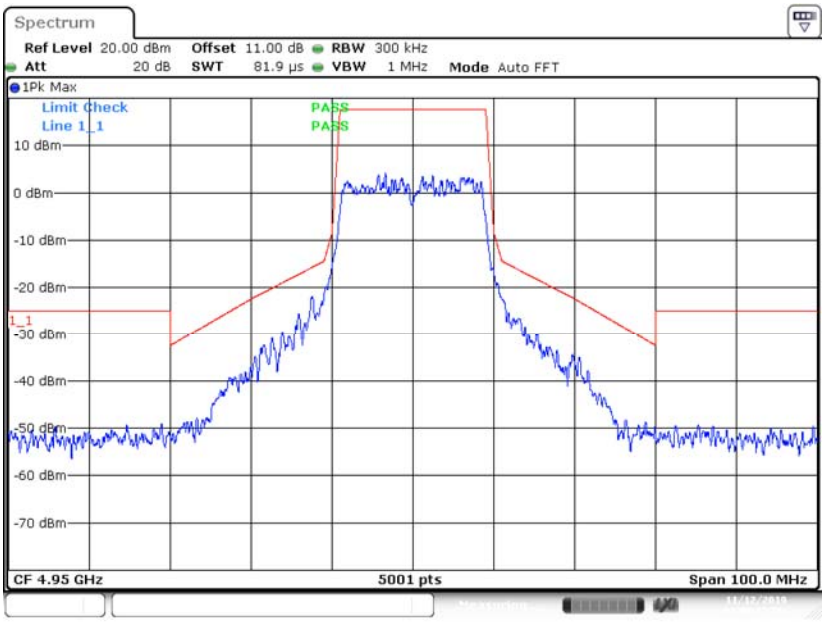
The testing was performed by Carry Cai on 2019-11-12.

EUT Operation Mode: Transmitting

Test Result: Compliant.

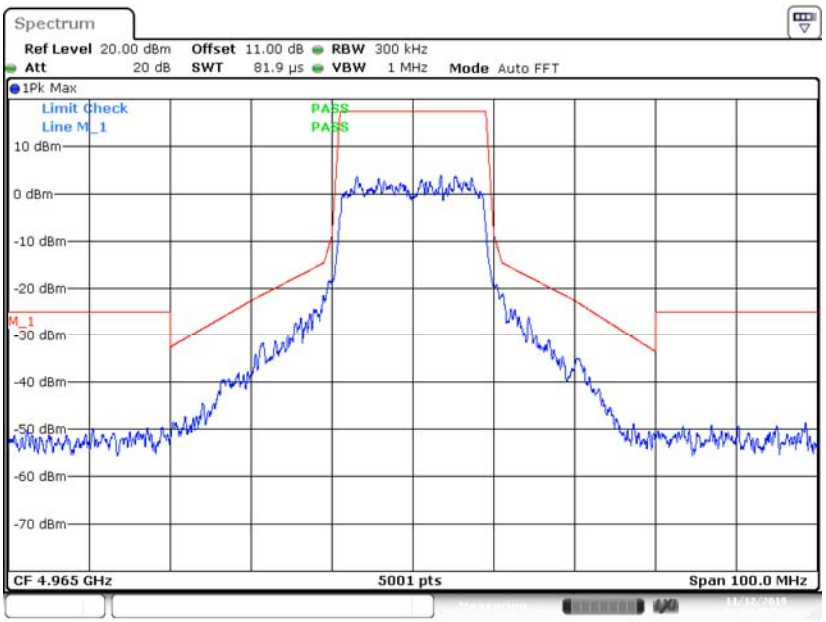
ANT 1

Low Channel



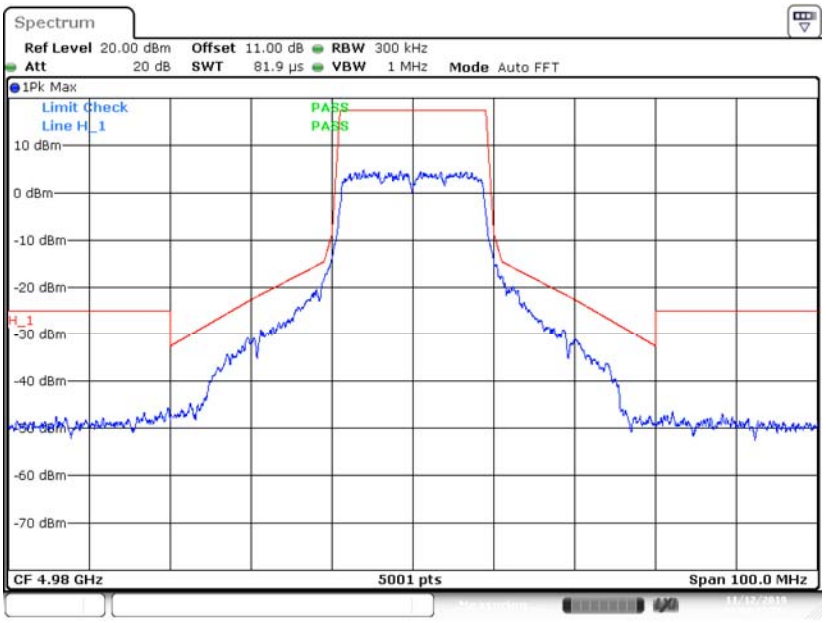
Date: 12.NOV.2019 19:05:12

Middle Channel



Date: 12.NOV.2019 19:03:48

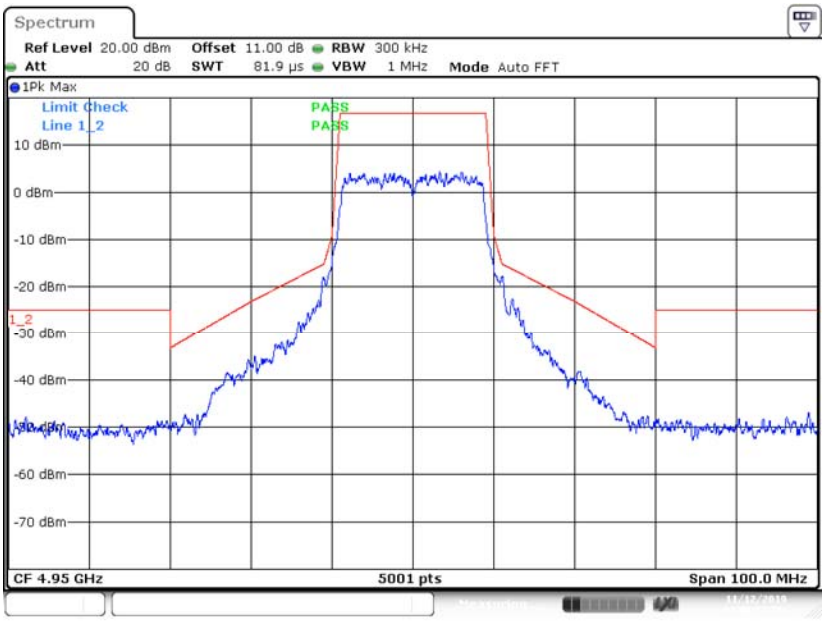
High Channel



Date: 12.NOV.2019 19:02:24

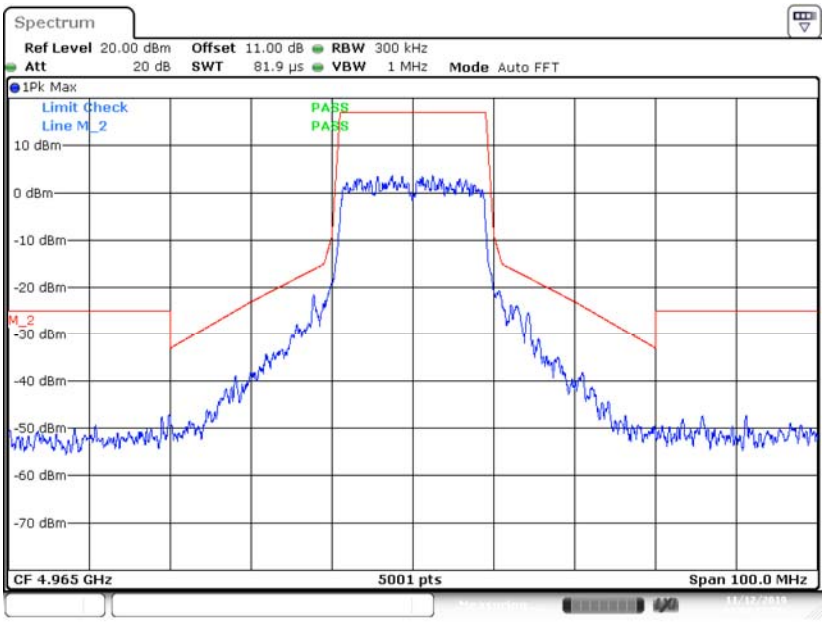
ANT 2

Low Channel



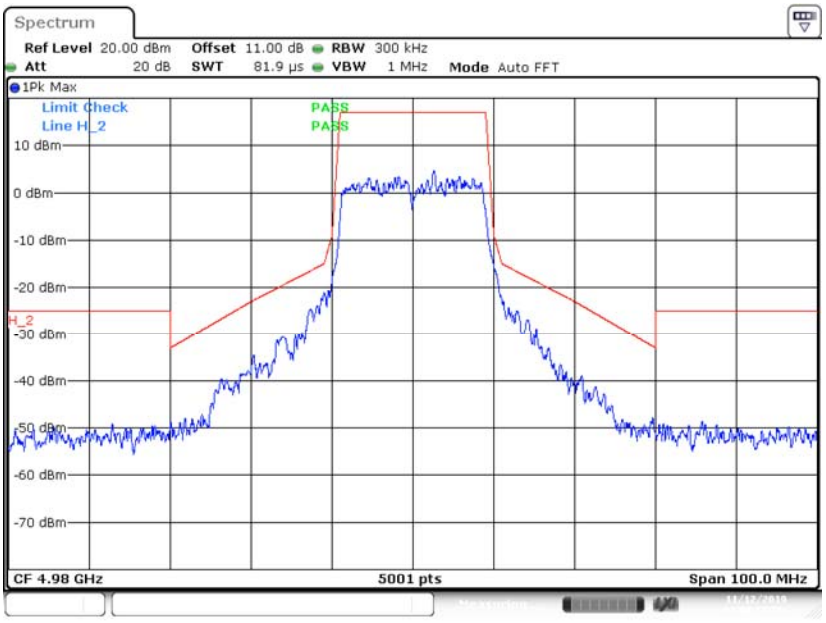
Date: 12.NOV.2019 19:06:54

Middle Channel



Date: 12.NOV.2019 19:07:57

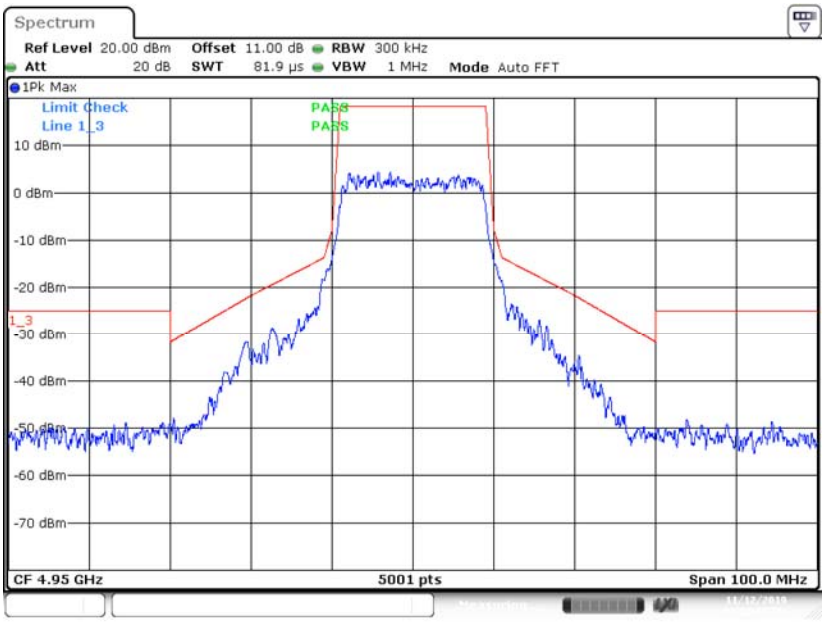
High Channel



Date: 12.NOV.2019 19:08:59

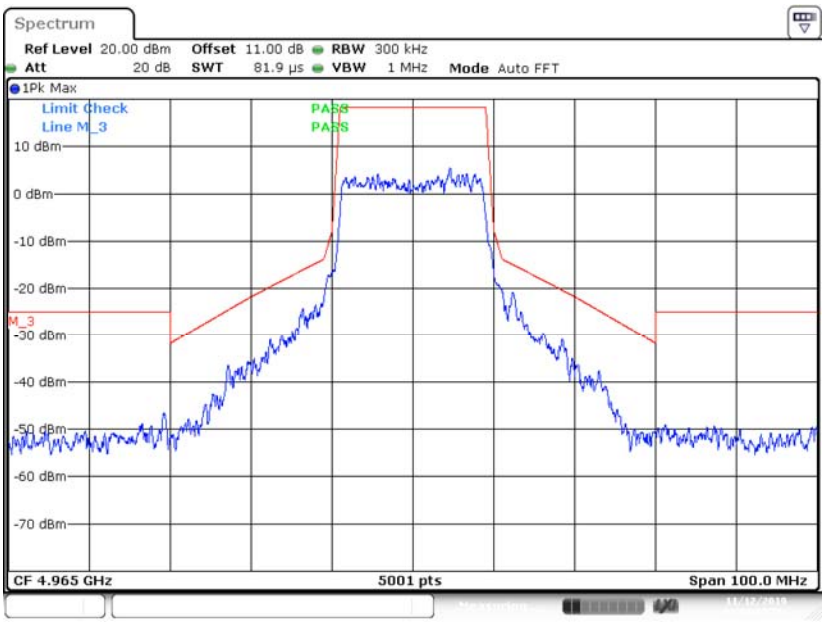
ANT 3

Low Channel



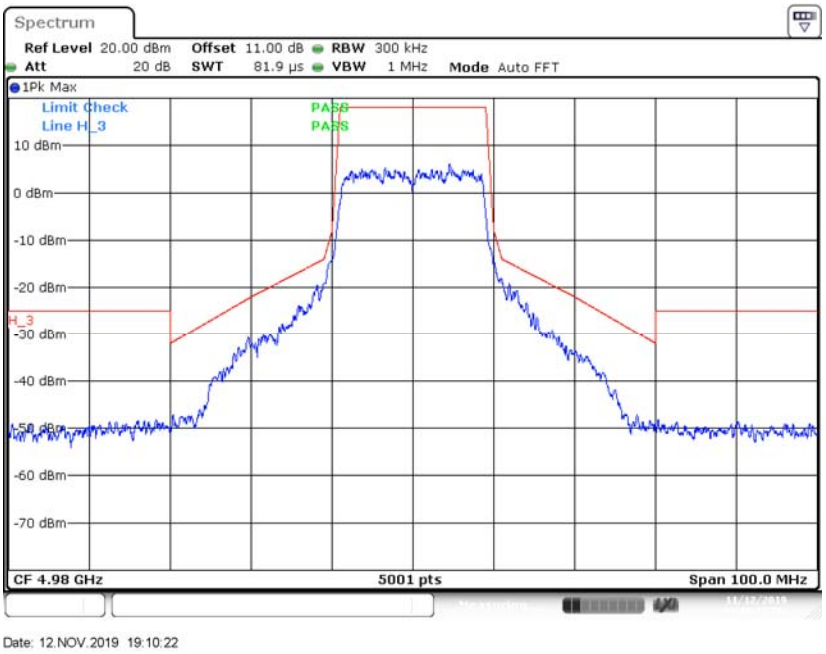
Date: 12.NOV.2019 19:12:09

Middle Channel



Date: 12.NOV.2019 19:11:08

High Channel



FCC § 2.1051, § 90.210 (m)(6)(7) - CONDUCTED SPURIOUS EMISSIONS

Applicable Standard

FCC Part 2.1051, 90.210 (m)(6)(7)

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Carry Cai on 2019-11-12.

EUT Operation Mode: Transmitting

Test Result: Compliant.

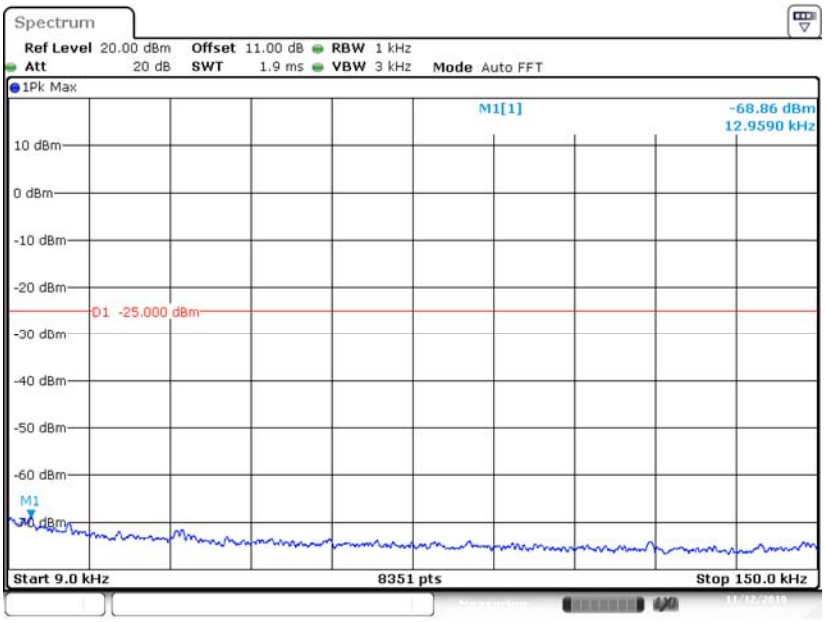
For ANT1+2+3 transmitting simultaneously the worst case as below:

Frequency (GHz)	Reading (dBm)				Limit (dBm)
	ANT 1	ANT 2	ANT 3	Total	
Low channel					
6.6032	-32.06	-28.44	-31.15	-25.49	-25
14.8539	-29.94	-40.85	-42.95	-29.40	-25
Middle channel					
6.6188	-33.15	-29.54	-31.78	-26.46	-25
14.9007	-31.68	-40.83	-43.56	-30.94	-25
High channel					
6.6422	-32.65	-30.55	-32.02	-26.88	-25
14.9553	-31.49	-40.96	-41.87	-30.68	-25

So 3*3 MIMO mode is compliant

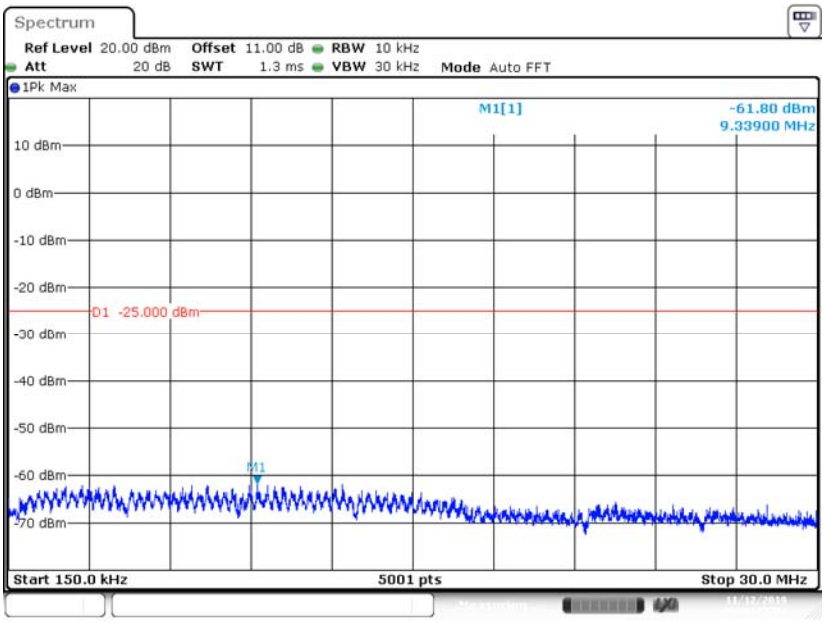
ANT 1

Low Channel (9kHz~150kHz)



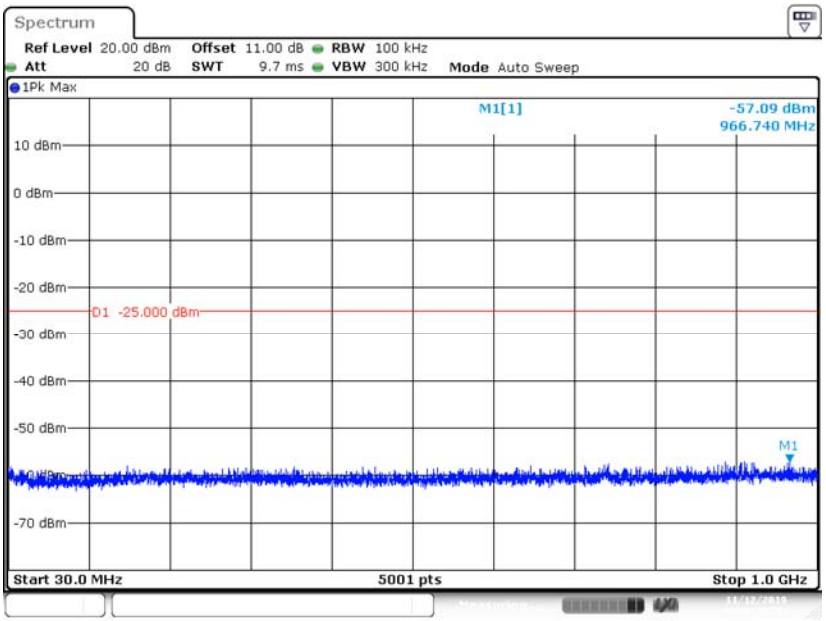
Date: 12.NOV.2019 17:52:18

Low Channel (150kHz~30MHz)



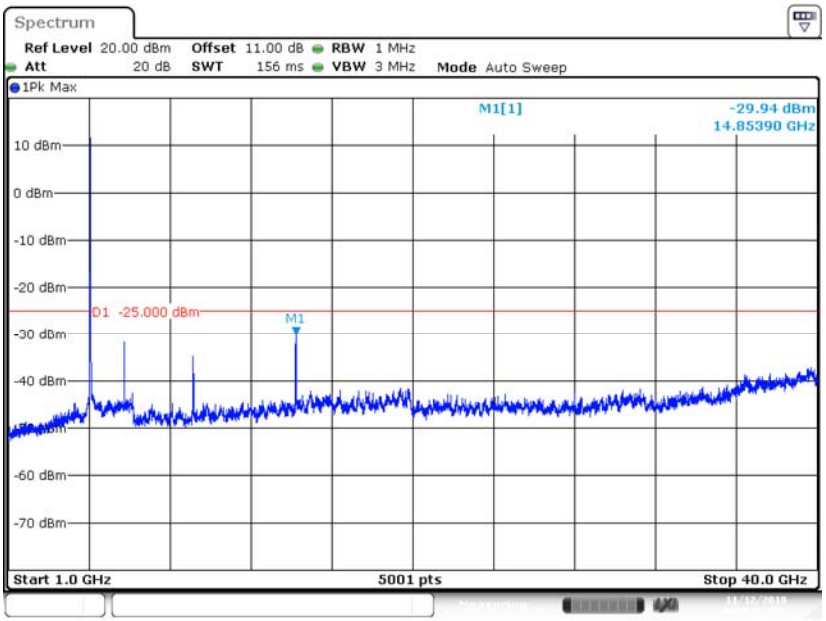
Date: 12.NOV.2019 18:33:42

Low Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:41:21

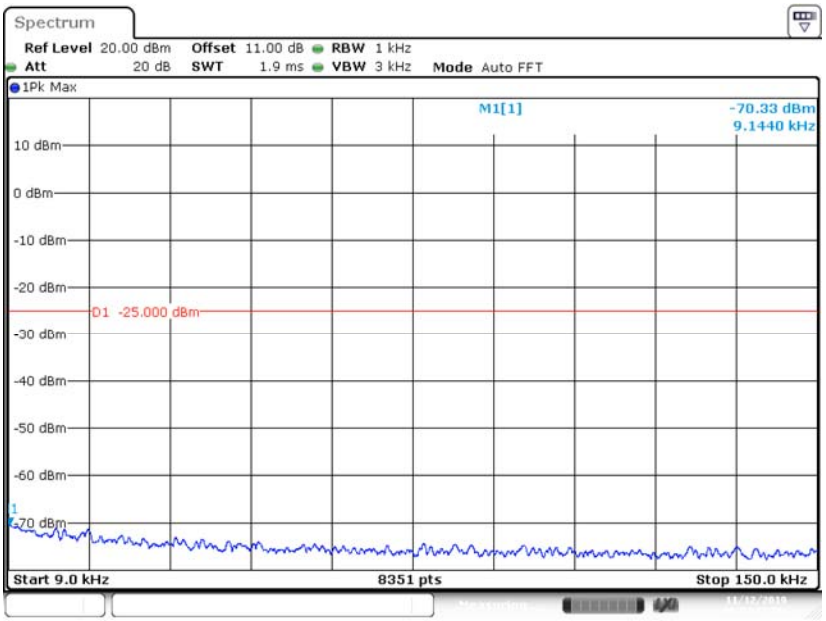
Low Channel (1GHz~40GHz)



Fundamental test

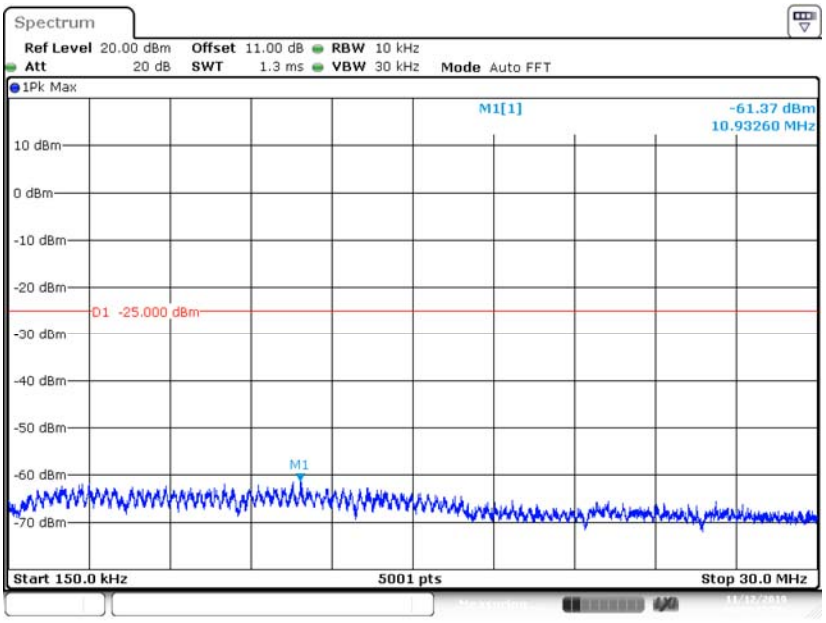
Date: 12.NOV.2019 18:46:53

Middle Channel (9kHz~150kHz)



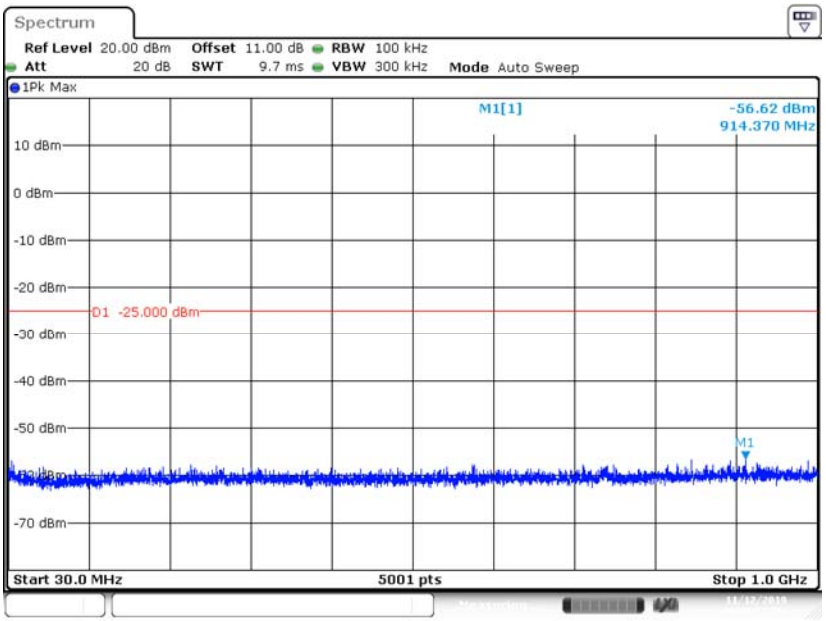
Date: 12.NOV.2019 17:53:17

Middle Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:35:12

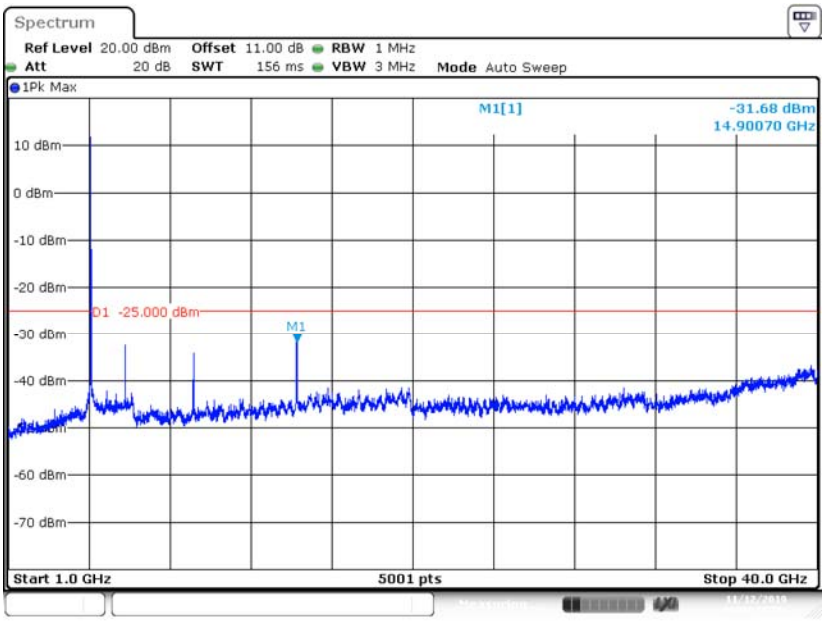
Middle Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:41:52

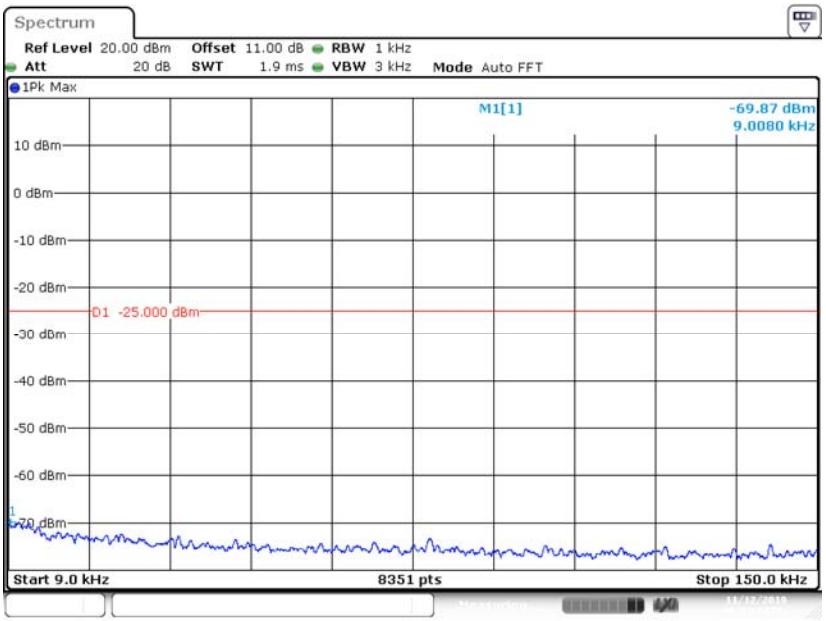
Middle Channel (1GHz~40GHz)

Fundamental test



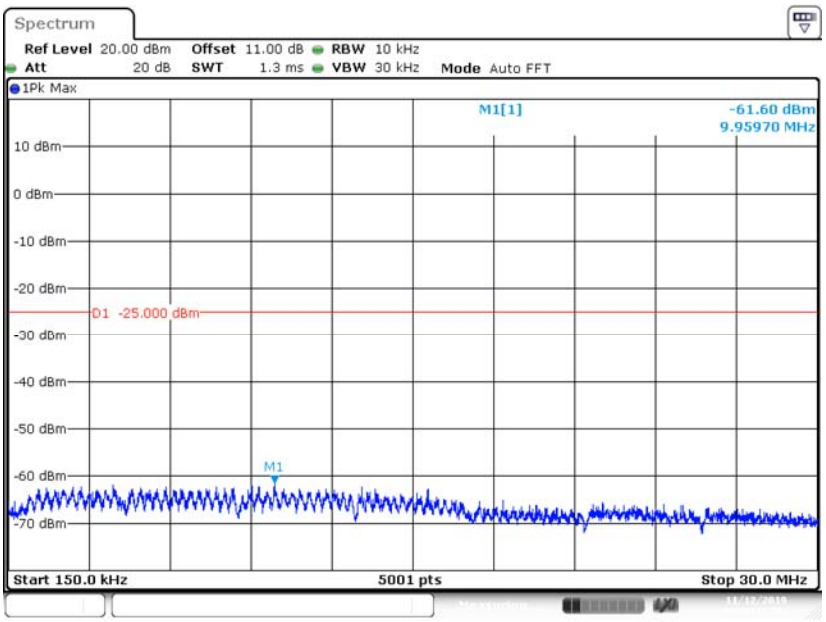
Date: 12.NOV.2019 18:47:37

High Channel (9kHz~150kHz)



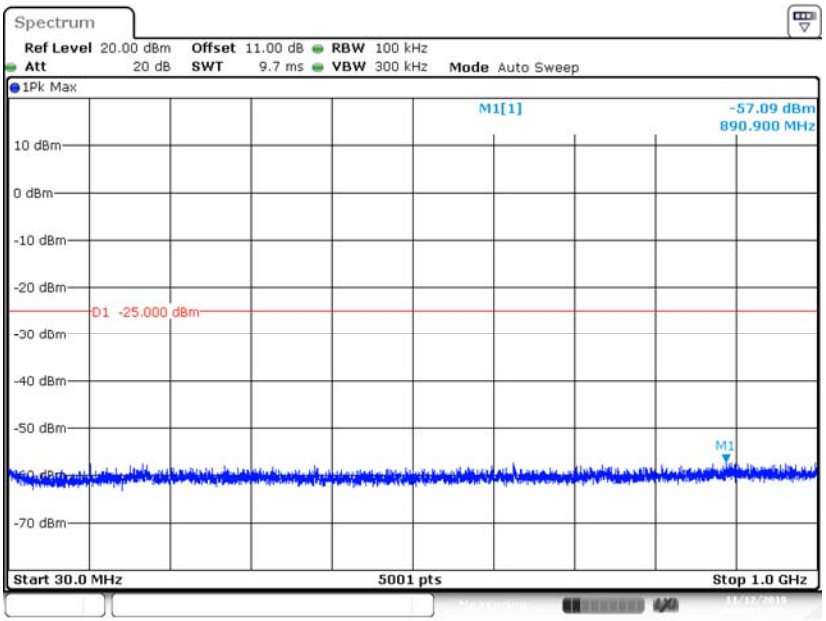
Date: 12.NOV.2019 17:53:44

High Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:36:15

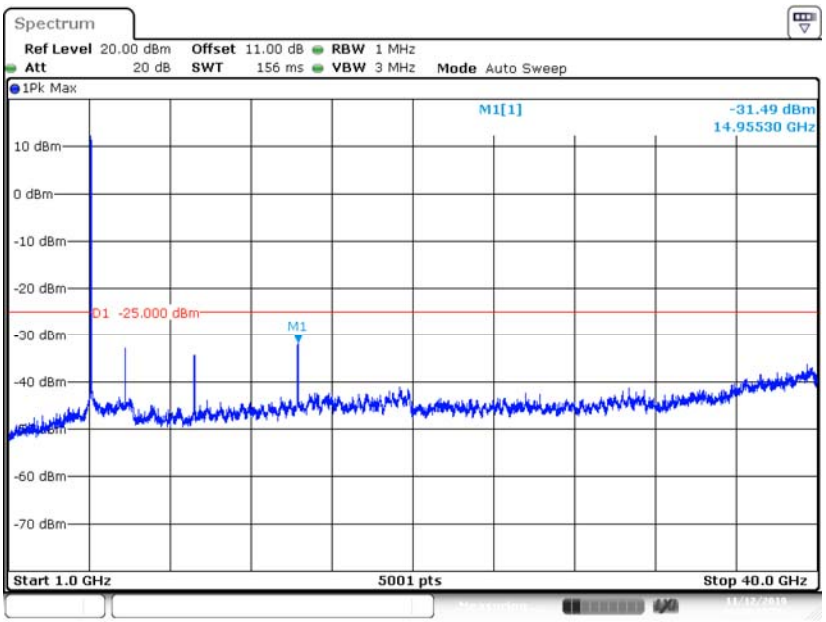
High Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:42:16

High Channel (1GHz~40GHz)

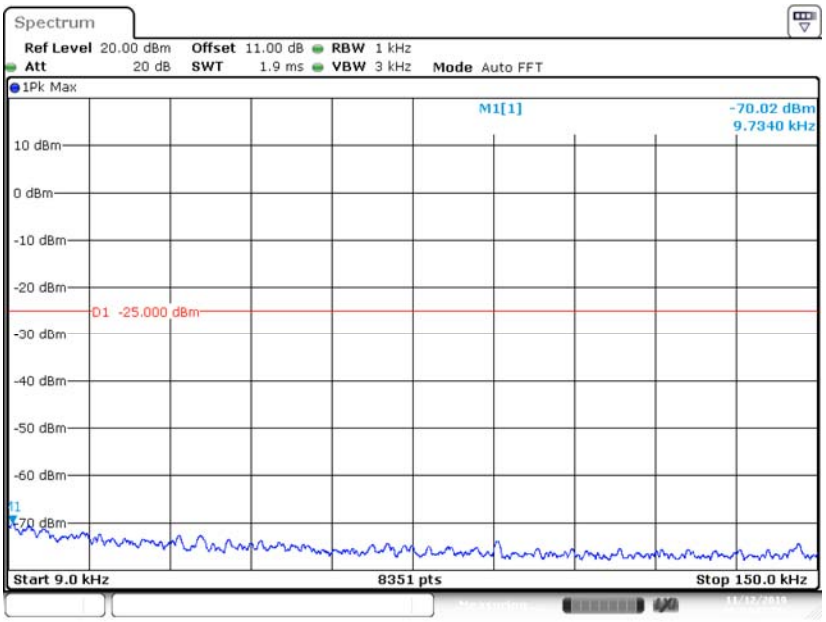
Fundamental test



Date: 12.NOV.2019 18:49:39

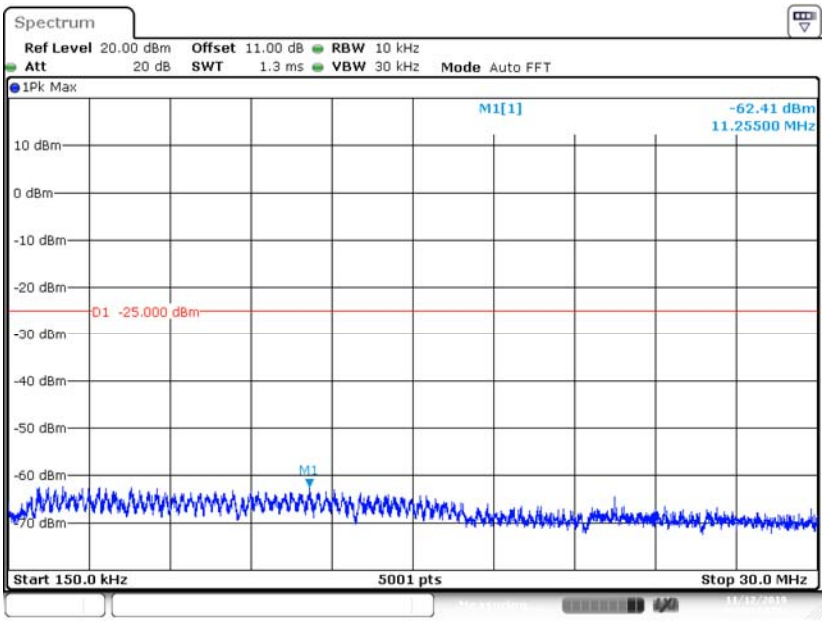
ANT 2

Low Channel (9kHz~150kHz)



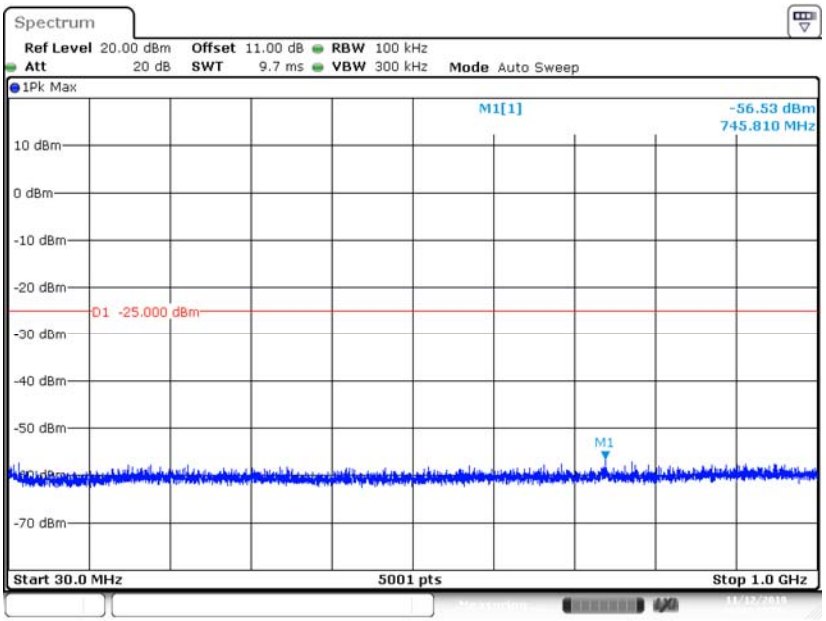
Date: 12.NOV.2019 17:54:07

Low Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:36:44

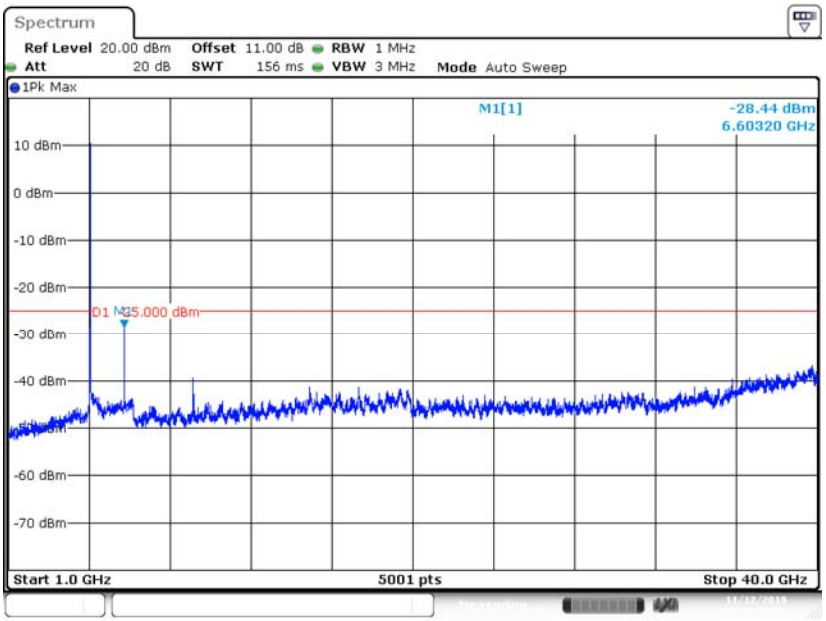
Low Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:42:40

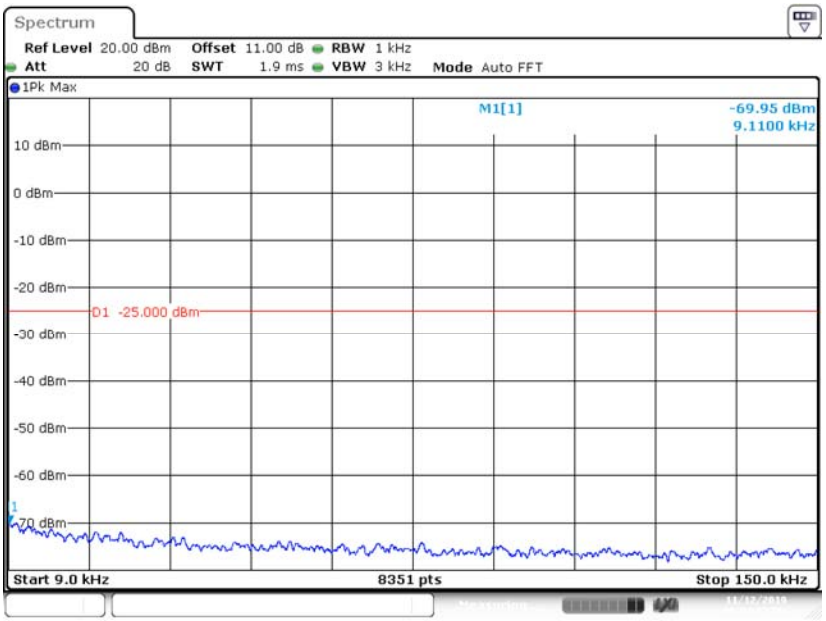
Low Channel (1GHz~40GHz)

Fundamental test



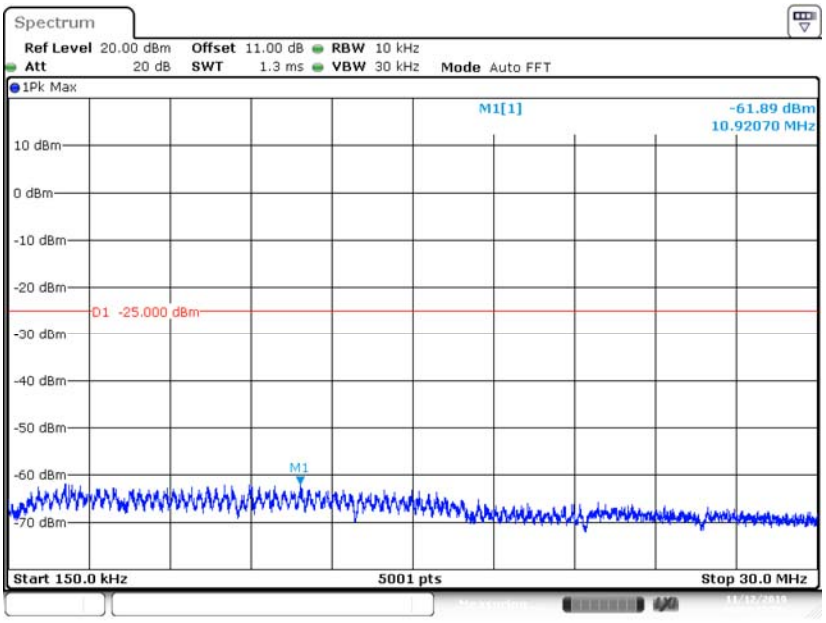
Date: 12.NOV.2019 19:24:56

Middle Channel (9kHz~150kHz)



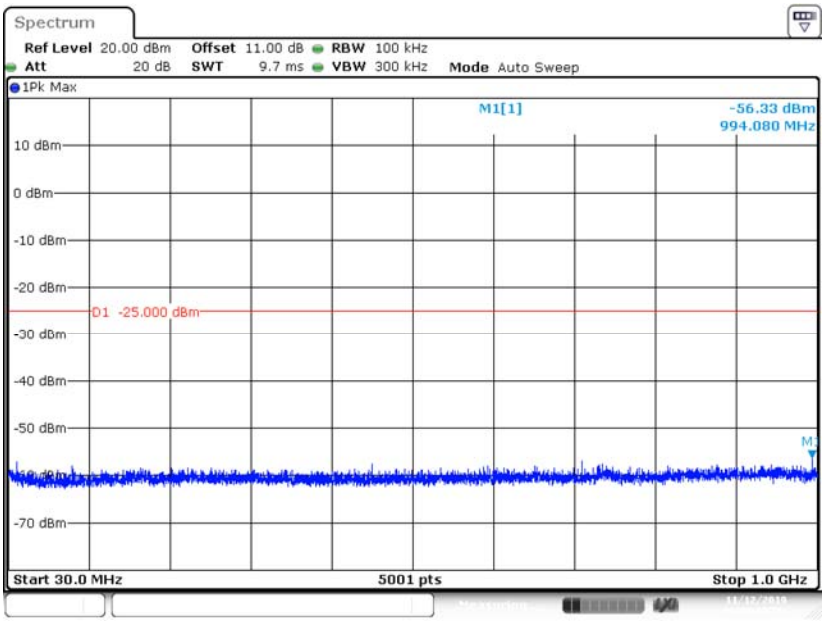
Date: 12.NOV.2019 17:54:32

Middle Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:37:33

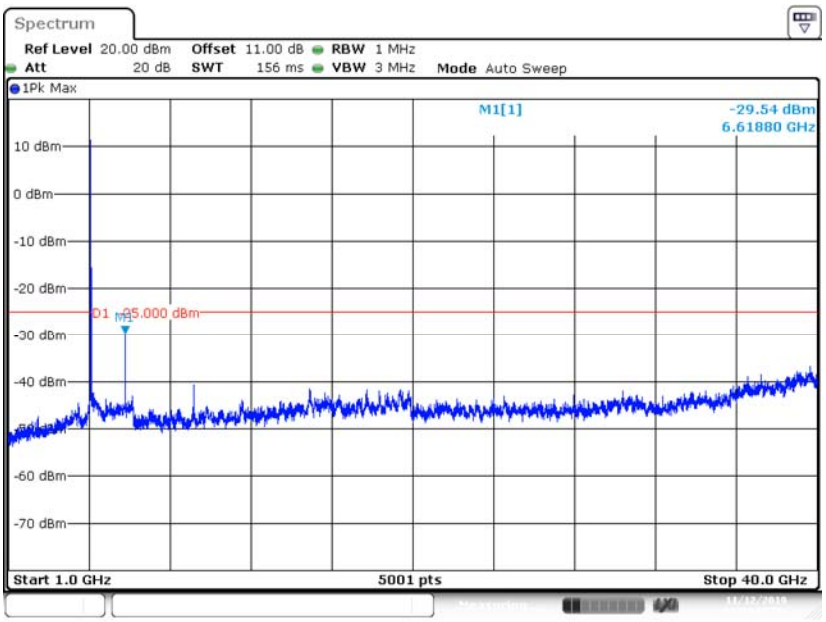
Middle Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:43:01

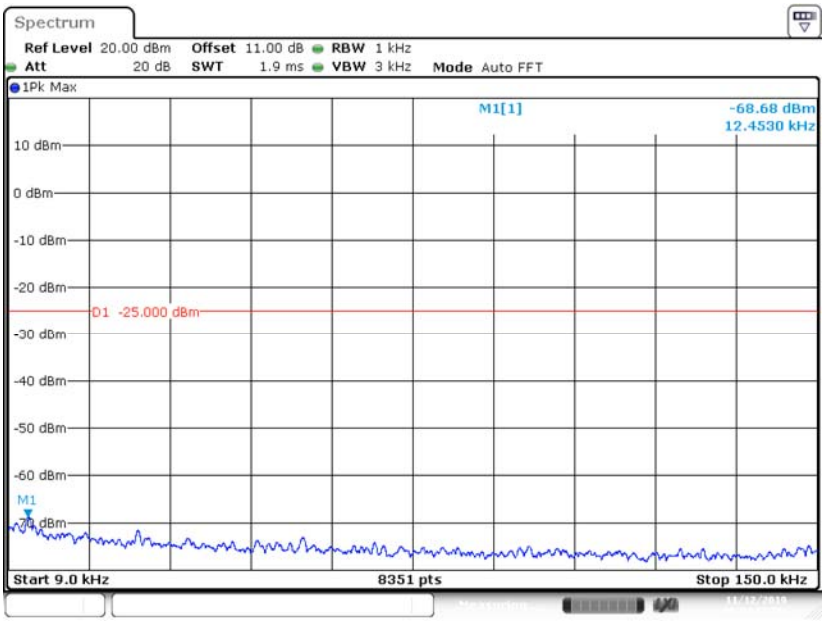
Middle Channel (1GHz~40GHz)

Fundamental test



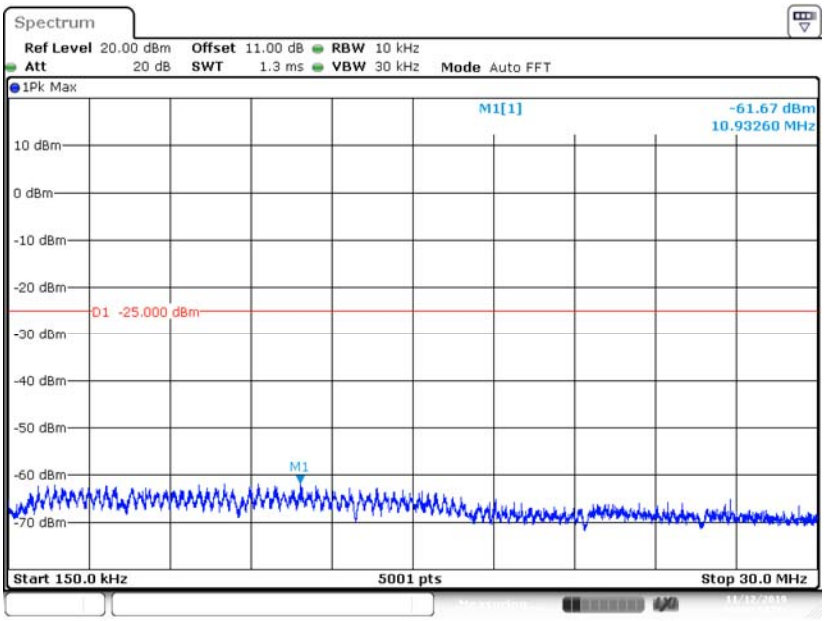
Date: 12.NOV.2019 19:24:09

High Channel (9kHz~150kHz)



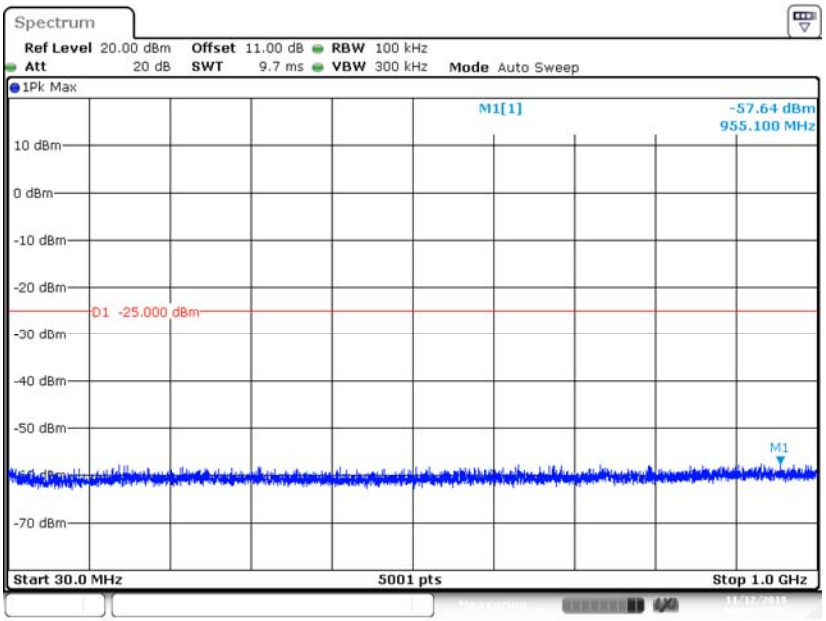
Date: 12.NOV.2019 17:54:53

High Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:38:44

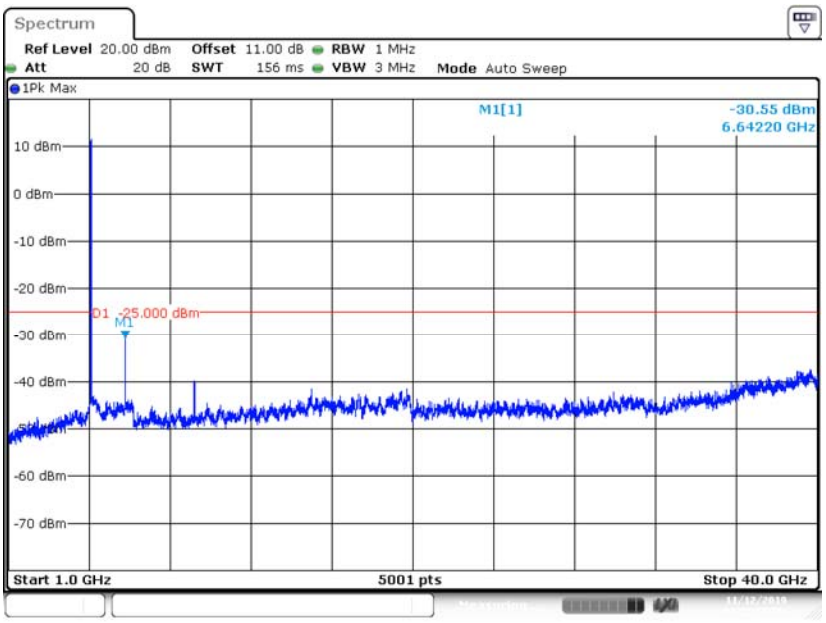
High Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:43:20

High Channel (1GHz~40GHz)

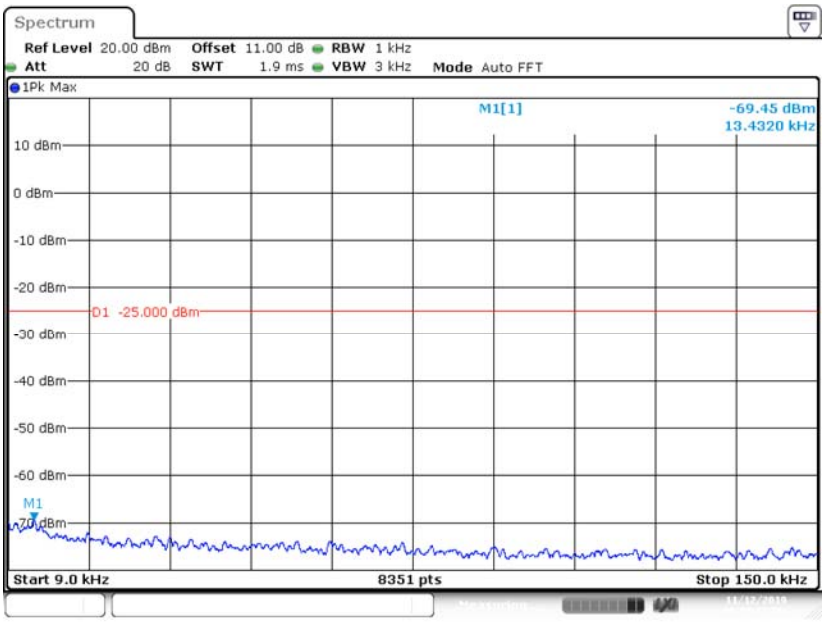
Fundamental test



Date: 12.NOV.2019 19:25:59

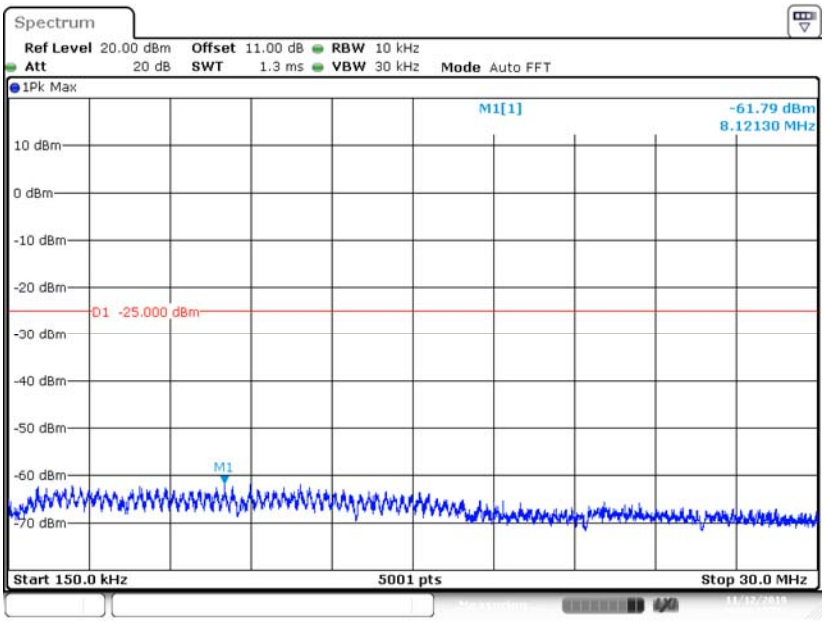
ANT 3

Low Channel (9kHz~150kHz)



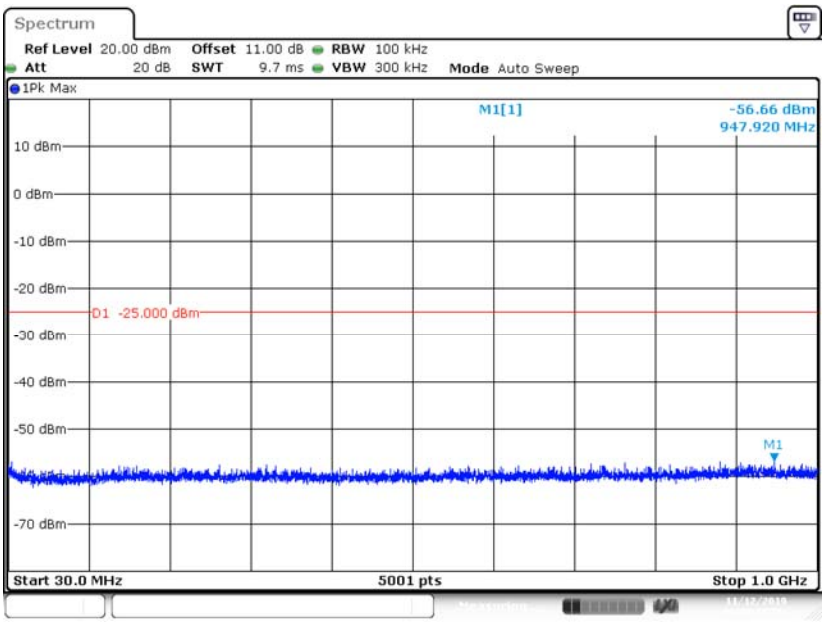
Date: 12.NOV.2019 17:55:13

Low Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:39:39

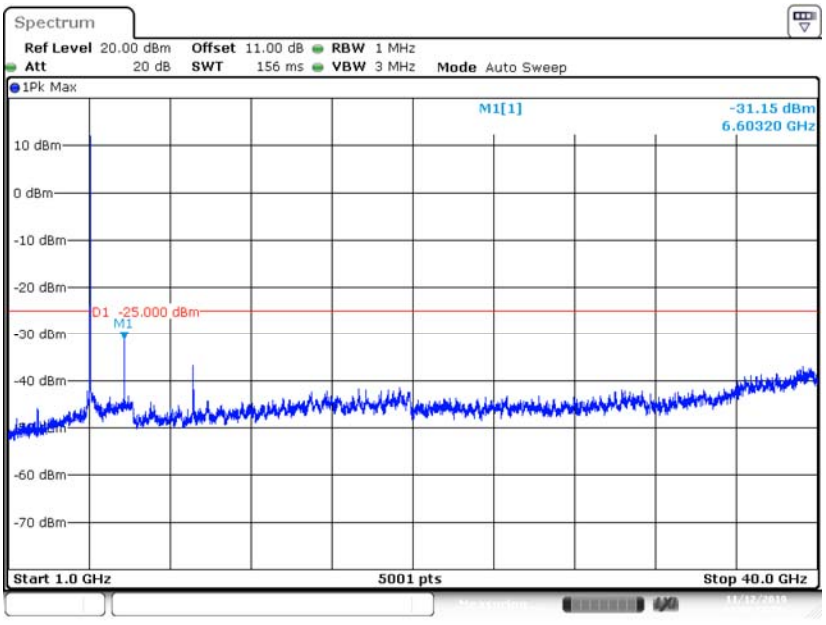
Low Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:43:35

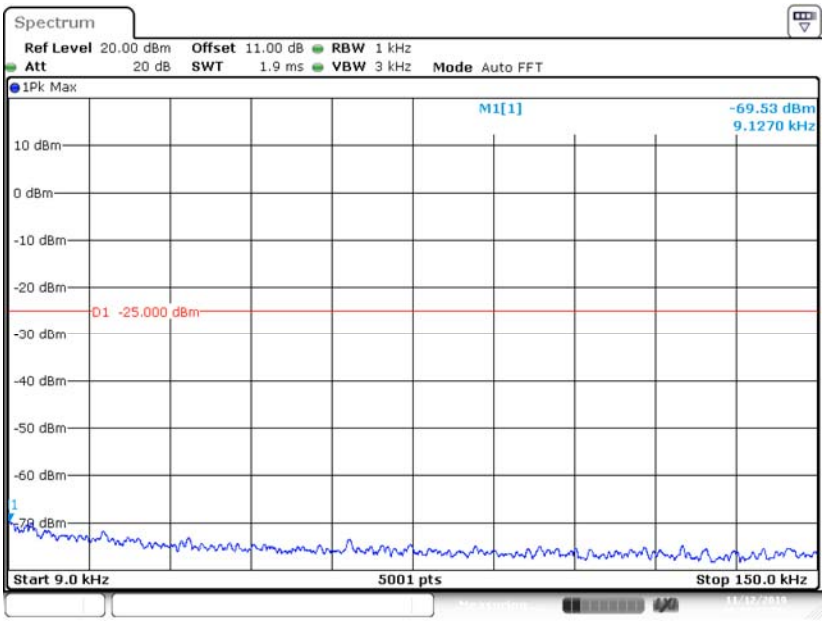
Low Channel (1GHz~40GHz)

Fundamental test



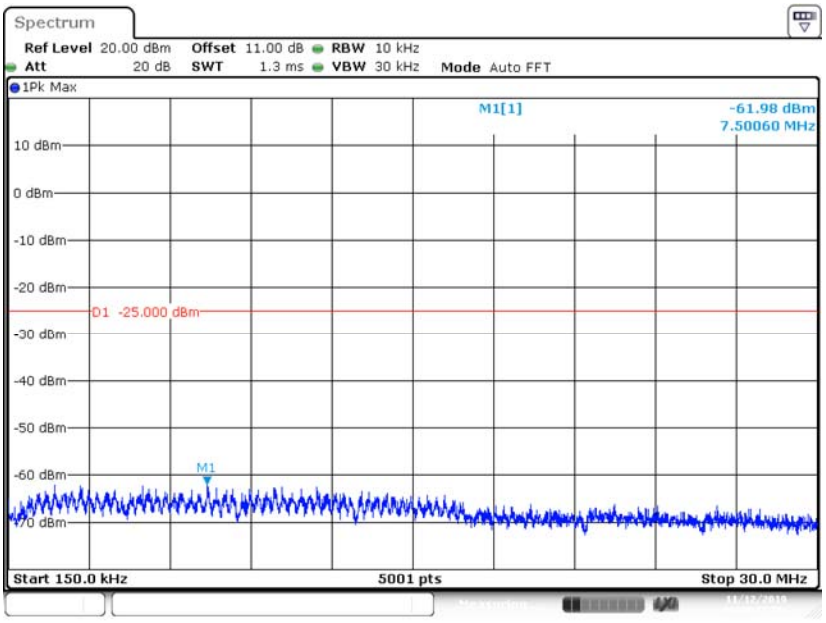
Date: 12.NOV.2019 19:28:57

Middle Channel (9kHz~150kHz)



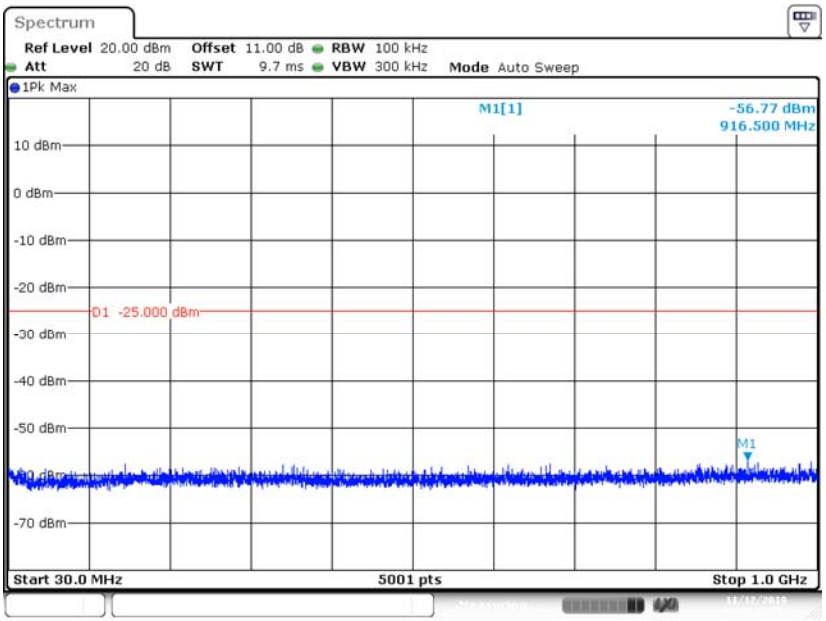
Date: 12.NOV.2019 17:55:53

Middle Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:40:11

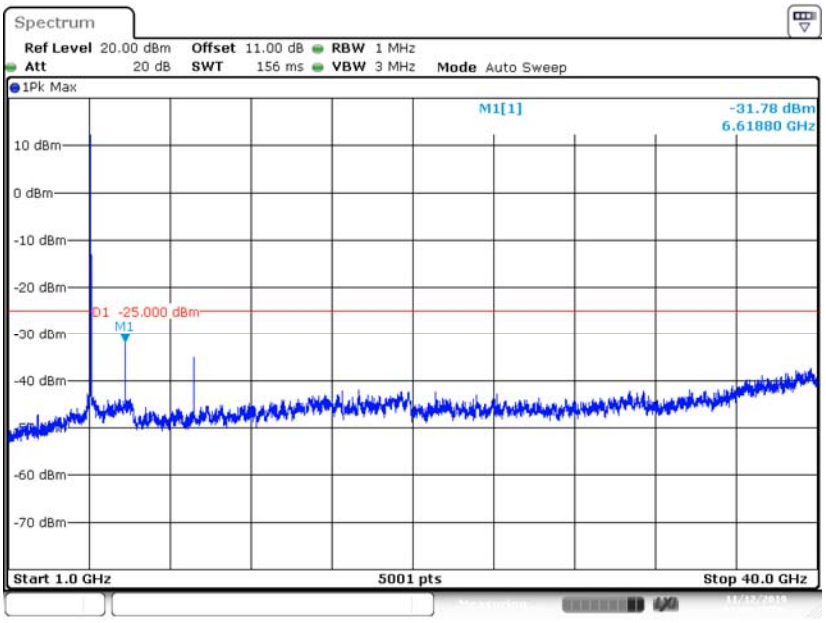
Middle Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:43:57

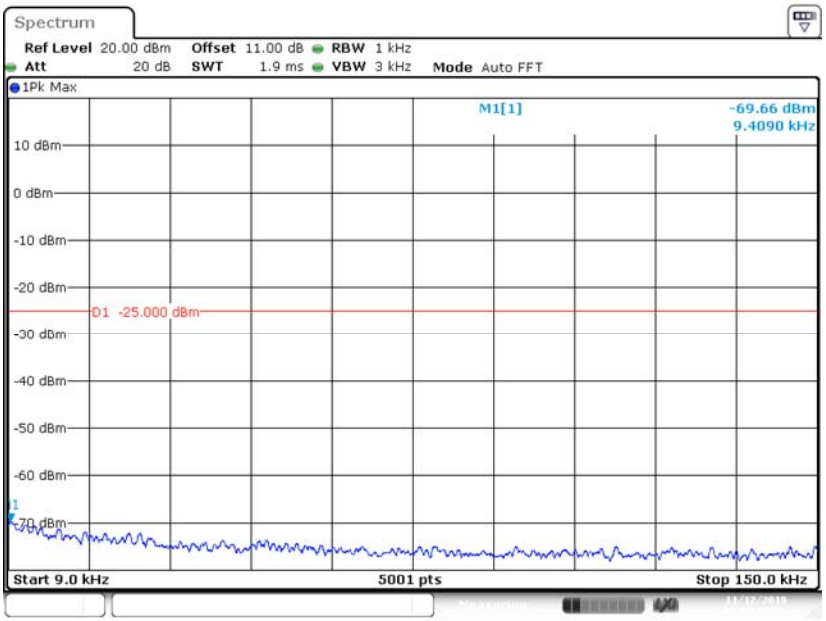
Middle Channel (1GHz~40GHz)

Fundamental test



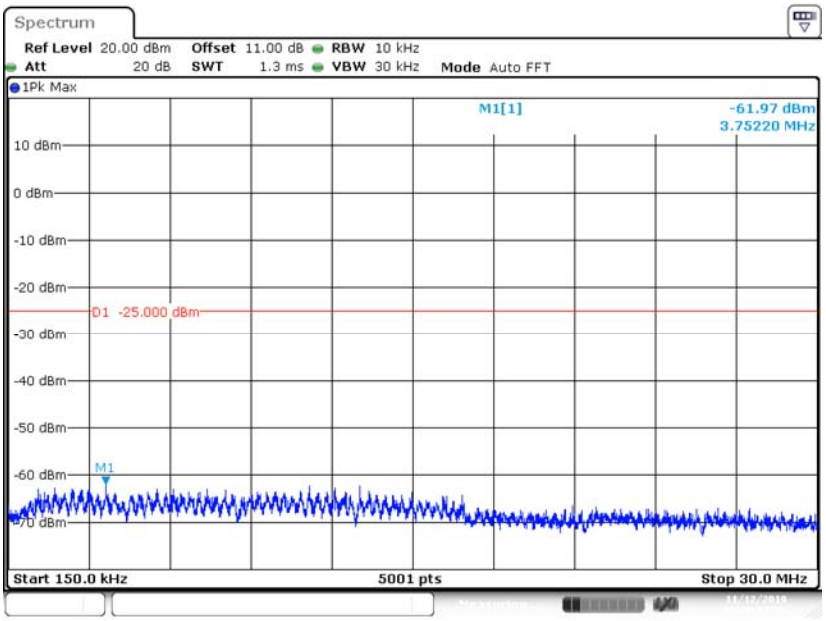
Date: 12.NOV.2019 19:28:29

High Channel (9kHz~150kHz)



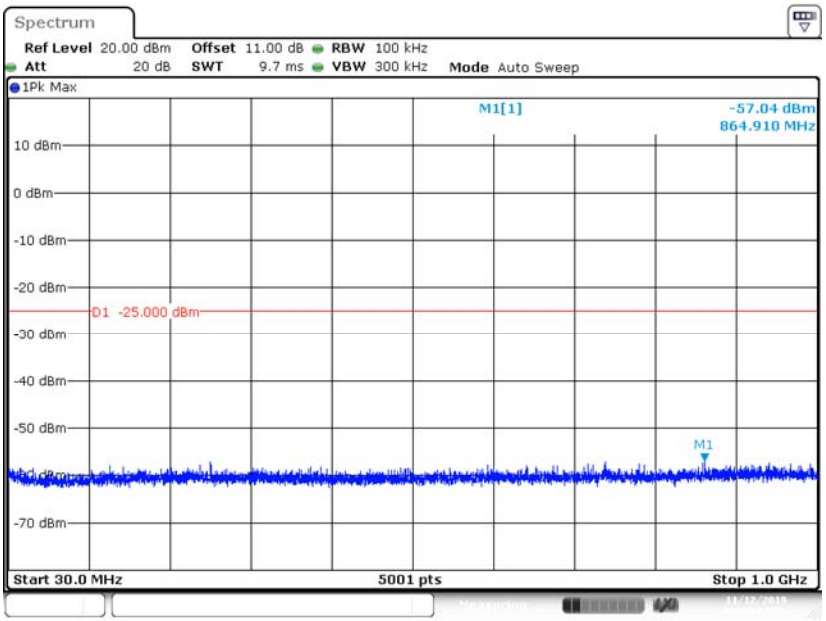
Date: 12.NOV.2019 17:56:14

High Channel (150kHz~30MHz)



Date: 12.NOV.2019 18:40:35

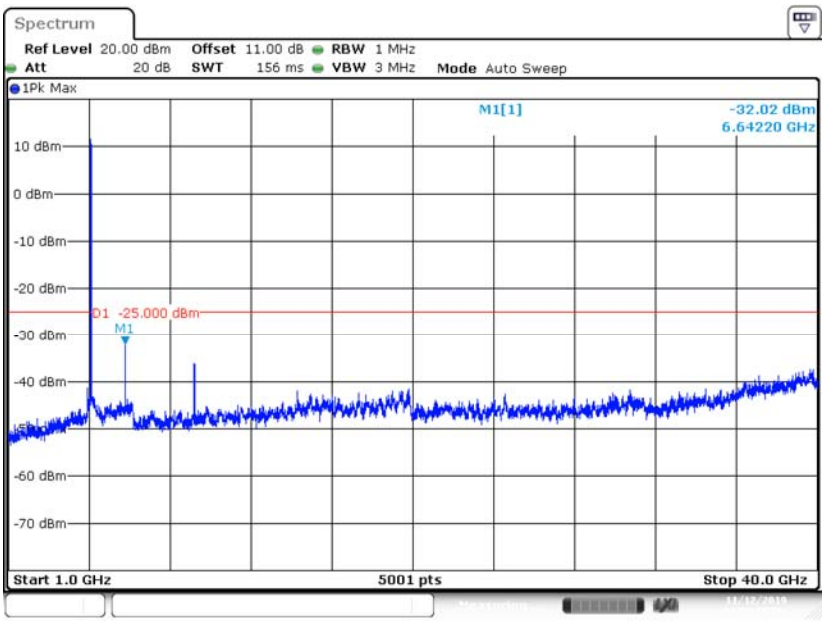
High Channel (30MHz~1GHz)



Date: 12.NOV.2019 18:44:24

High Channel (1GHz~40GHz)

Fundamental test



Date: 12.NOV.2019 19:27:27

FCC § 2.1053, § 90.210 (m)(6)(7) - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC Part 2.1053, 90.210 (m)(6)(7)

Test Procedure

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

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the 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 teeth 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.

Spurious emissions in dB =10 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.1 kPa

The testing was performed by Carry Cai on 2019-11-12.

EUT operation mode: Transmitting (ANT 1&ANT 2&ANT 3 transmitting simultaneously)

Test Result: Compliant.

30MHz - 40GHz:

*Pre-scan with X,Y and Z axes of orientation, the worst case **Z-axis of orientation** was recorded*

Frequency (MHz)	Receiver Reading (dBµV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)			
Channel 4950MHz										
265.68	48.78	180	150	H	-54.46	0.45	-2.22	-57.13	-25.00	32.13
265.68	52.01	190	150	V	-56.54	0.45	-2.22	-59.21	-25.00	34.21
6600.00	46.11	139	150	H	-52.58	1.48	10.48	-43.58	-25.00	18.58
6600.00	44.67	19	150	V	-54.31	1.48	10.48	-45.31	-25.00	20.31
9900.00	44.84	270	200	H	-47.26	1.95	11.62	-37.59	-25.00	12.59
9900.00	42.97	323	200	V	-49.29	1.95	11.62	-39.62	-25.00	14.62
Channel 4965MHz										
625.08	45.17	71	200	H	-53.70	0.60	-0.93	-55.23	-25.00	30.23
625.08	45.14	283	200	V	-56.11	0.60	-0.93	-57.64	-25.00	32.64
6620.00	45.10	342	200	H	-53.55	1.49	10.47	-44.57	-25.00	19.57
6620.00	43.30	274	200	V	-55.64	1.49	10.47	-46.66	-25.00	21.66
9930.00	42.82	258	250	H	-49.23	1.95	11.64	-39.54	-25.00	14.54
9930.00	41.05	288	250	V	-51.16	1.95	11.64	-41.47	-25.00	16.47
Channel 4980MHz										
625.08	45.37	165	100	H	-53.50	0.60	-0.93	-55.03	-25.00	30.03
625.08	45.37	187	100	V	-55.88	0.60	-0.93	-57.41	-25.00	32.41
6640.00	44.32	27	200	H	-54.30	1.50	10.45	-45.35	-25.00	20.35
6640.00	42.72	196	200	V	-56.19	1.50	10.45	-47.24	-25.00	22.24
9960.00	41.21	227	150	H	-50.79	1.95	11.67	-41.07	-25.00	16.07
9960.00	39.28	337	150	V	-52.88	1.95	11.67	-43.16	-25.00	18.16

FCC § 2.1055 - FREQUENCY STABILITY

Applicable Standard

FCC Part 2.1055

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

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Test Data

Environmental Conditions

Temperature:	22.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.1 kPa

The testing was performed by Carry Cai on 2019-11-27.

EUT Operation Mode: Transmitting

Test Result: Compliant.

ANT1

Temperature (℃)	Voltage (V_{DC})	f_L at Low Test Channel (MHz)	F_H at High Test Channel (MHz)	Limit
-40	3.3	4940.8823	4989.1278	f_L and f_H Within 4940~4990MHz range
-30		4940.8359	4989.0478	
-20		4940.8092	4989.1075	
-10		4940.8231	4989.0470	
0		4940.8474	4989.1293	
10		4940.8814	4989.0296	
20		4940.8316	4989.1683	
30		4940.8518	4989.0317	
40		4940.8561	4989.1474	
50		4940.8658	4989.1277	
60		4940.8014	4989.0534	
70		4940.8428	4989.0621	

ANT2

Temperature (℃)	Voltage (V_{DC})	f_L at Low Test Channel (MHz)	F_H at High Test Channel (MHz)	Limit
-40	3.3	4940.9503	4988.9886	f_L and f_H Within 4940~4990MHz range
-30		4940.9496	4988.9893	
-20		4940.9511	4988.9891	
-10		4940.9532	4988.9887	
0		4940.9501	4988.9884	
10		4940.9546	4988.9865	
20		4940.9519	4988.9879	
30		4940.9466	4988.9823	
40		4940.9636	4988.9732	
50		4940.9577	4988.9812	
60		4940.9613	4988.9838	
70		4940.9578	4988.9893	

ANT3

Temperature (℃)	Voltage (V_{DC})	f_L at Low Test Channel (MHz)	F_H at High Test Channel (MHz)	Limit
-40	3.3	4940.8911	4989.0253	f_L and f_H Within 4940~4990MHz range
-30		4940.8902	4989.0118	
-20		4940.8941	4989.1031	
-10		4940.8941	4989.0420	
0		4940.8902	4989.0513	
10		4940.8917	4989.0396	
20		4940.8918	4989.0481	
30		4940.8938	4989.0377	
40		4940.8953	4989.0752	
50		4940.8952	4989.0277	
60		4940.8915	4989.0156	
70		4940.8927	4989.0628	

Note: As user manual required, only 3.3V constant volatge working with this device.

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