FCC PART 90

TEST REPORT

For

Shenzhen Excera Technology Co., Ltd.

3rd Floor, Jiada R&D Building, No.5 Songpingshan Road , Hi-Tech Park North, Nanshan District , Shenzhen, China

FCC ID: 2AE6CEM8100U2

Report Type:	**Product Type:**
Original Report	Digital Mobile Radio

Report Number:	RSZ170508003-00A-Rev
Report Date:	2017-10-22
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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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RSZ170508003-00A	Original Report	2017-06-16
1	RSZ170508003-00A-Rev	Updated Rating power From 40 Watts to 45 Watts	2017-10-22

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shenzhen Excera Technology Co., Ltd.'s* product, model number: *EM8100 U2 (FCC ID: 2AE6CEM8100U2) in* this report is a *Digital Mobile Radio*, which was measured approximately: 174 mm (L)*190 mm (W)*60 mm (H), rated with input voltage: DC 13.6 V from DC power supply.

** All measurement and test data in this report was gathered from production sample serial number: 1700928 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-05-08.*

Objective

This test report is prepared on behalf of *Shenzhen Excera Technology 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 DSS and DTS submissions with FCC ID: 2AE6CEM8100U2.

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 individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D and ANSI C63.4-2014.

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
RF conducted test with spectrum		±0.9dB
Radiated emission	30MHz~1GHz	±5.91dB
	Above 1G	±4.92dB
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

Bay Area Compliance Laboratories Corp. (Kunshan) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L9963). And accredited to ISO/IEC 17025 by A2LA(Lab code: 4323.01), the FCC Designation No. CN1185 under the KDB 974614 D01.

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.

Bay Area Compliance Laboratories Corp. (Kunshan) was registered with ISED Canada under ISED Canada Registration Number 3062E.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

EUT Exercise Software

No exercise software was used.

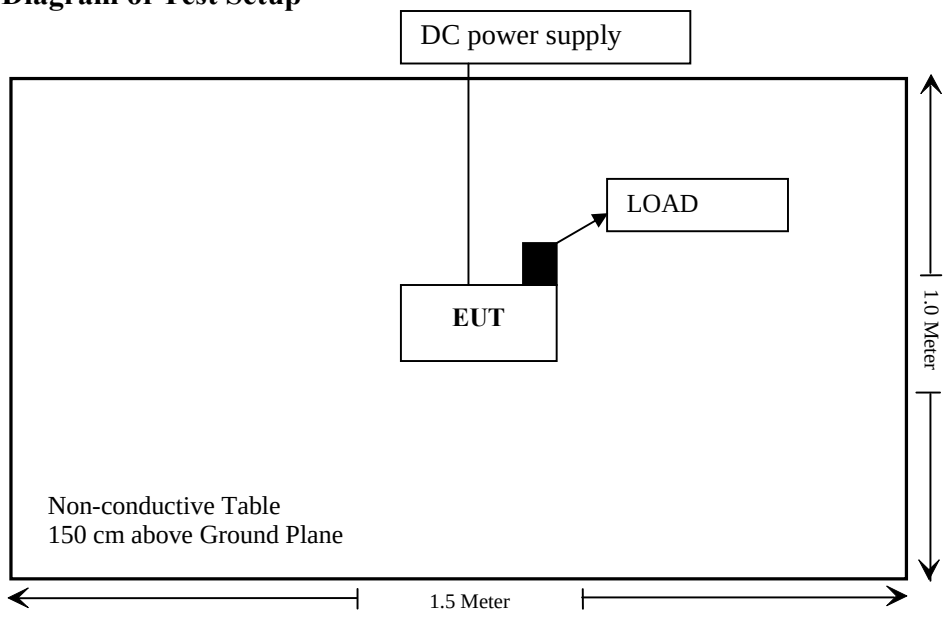
Special Accessories

No special accessory was used.

Equipment Modifications

No modification was made to the EUT tested.

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307 (b) (1) & §2.1091	Maximum Permissible exposure (MPE)	Compliance
§2.1046; §90.205	RF Output Power	Compliance
§2.1047; §90.207	Modulation Characteristic	Compliance
§2.1049; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051;§90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053;§90.210	Spurious Radiated Emissions	Compliance
§2.1055;§90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission 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
Sunol Sciences	Broadband Antenna	JB3	A090314-1	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	2016-12-12	2019-12-12
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
MICRO-COAX	Coaxial Cable	Cable-7	007	2016-12-12	2017-12-12
HP	Signal Generator	8341B	2624A00116	2016-08-29	2017-08-29
RF Conducted test					
BACL	TS 8997 Cable-01	T-KS-EMC086	T-KS-EMC086	2016-12-09	2017-12-08
BACL	RF cable	KS-LAB-012	KS-LAB-012	2016-12-15	2017-12-14
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
HEWLETT PACKARD	RF Communications Test SET	8920A	3438A05201	2016-09-21	2017-09-21
HONOVA	Power Splitter	ZFRSC-14-S+	019411452	2016-06-12	2017-06-12
N/A	30dB Attenuator	100W 30dB	N/A	2016-06-18	2017-06-18
N/A	Band Pass Filter	N/A	111632	2017-05-21	2017-11-19

*** 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 §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f^2	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
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
300-1,500			f/1500	30
1,500-100,000			1.0	30

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = 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)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \le 1$$

For TNB, The Controlled Exposure limit shall be applied:

Frequency (MHz)	Antenna Gain		Conducted Power	Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(mW)			
450-512	3.5	2.24	22500	60	1.11	1.5

Note: The Maximum power is 45 Watts, 50% duty cycle was used in evaluation, so the power is 22500 mW.

Simultaneous transmitting consideration：

Refer to the DSS and DTS report, the highest MPE for 2.4G band is 0.0001 mW/cm^2

$$\sum_i \frac{S_i}{S_{Limit,i}}$$ = 0.0001/1 + 1.11/1.5 =0.7401 < 1

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 60cm from nearby persons.

Result: Compliance

FCC §2.1046 & §90.205 - RF OUTPUT POWER

Applicable Standard

FCC §2.1046 and §90.205

Test Procedure

Conducted RF Output Power:

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

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Alisa Gao on 2017-06-03.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	Output Power (dBm)	Output Power (W)	Result
Analog	12.5	450.0125	High	46.13	41.02	Pass
			Middle	44.07	25.53	Pass
			Low	36.72	4.70	Pass
	12.5	458.0125	High	46.37	43.35	Pass
			Middle	44.28	26.79	Pass
			Low	36.31	4.28	Pass
	12.5	511.9875	High	46.51	44.77	Pass
			Middle	44.28	26.79	Pass
			Low	36.24	4.21	Pass

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	Output Power (dBm)	Output Power (W)	Result
Digital	12.5	450.0125	High	46.27	42.36	Pass
			Middle	44.13	25.88	Pass
			Low	36.28	4.25	Pass
	12.5	458.0125	High	46.11	40.83	Pass
			Middle	44.25	26.61	Pass
			Low	36.63	4.60	Pass
	12.5	511.9875	High	46.34	43.05	Pass
			Middle	44.15	26.00	Pass
			Low	36.79	4.78	Pass

Note: The rated high power is 45W. The limit of the high output power is 36W-54W.
The rated high power is 25W. The limit of the high output power is 20W-30W.
The rated low power is 5W. The limit of the low output power is 4W-6W.

FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC

Applicable Standard

FCC§2.1047 and §90.207:

(a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
(b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

Test Procedure

Test Method: TIA/EIA-603-D

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Alisa Gao on 2017-06-03.

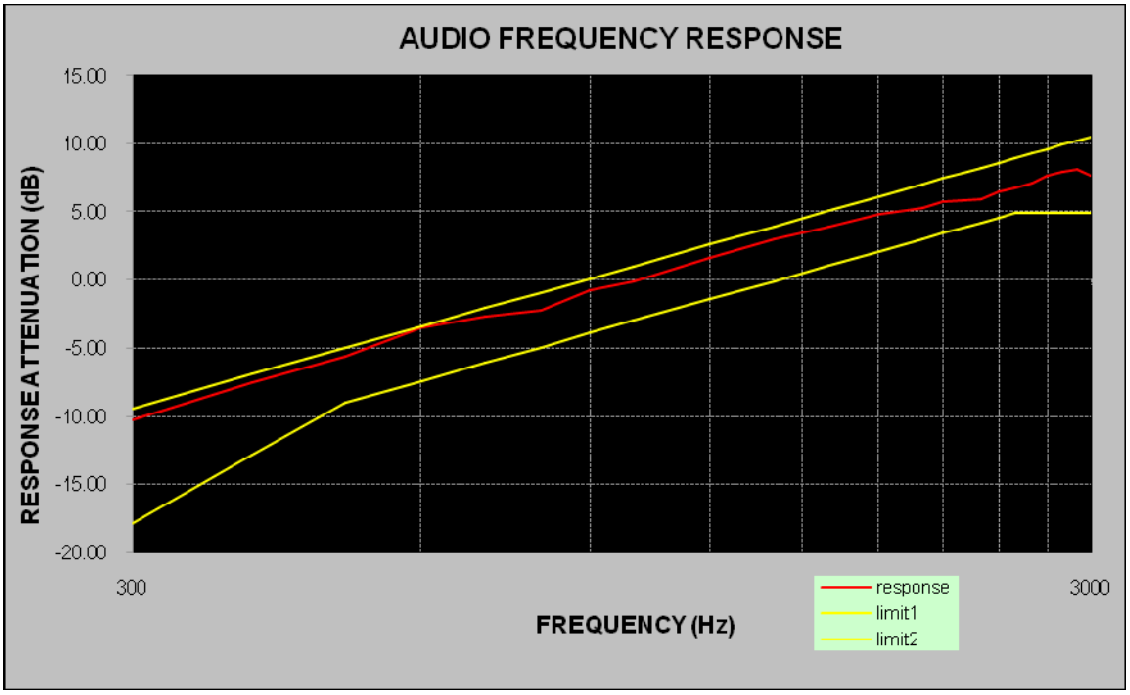
Please refer to the following tables and plots.

Test Mode: Transmitting

Audio Frequency Response

Carrier Frequency: 450.0125 MHz, authorized bandwidth=11.25 kHz

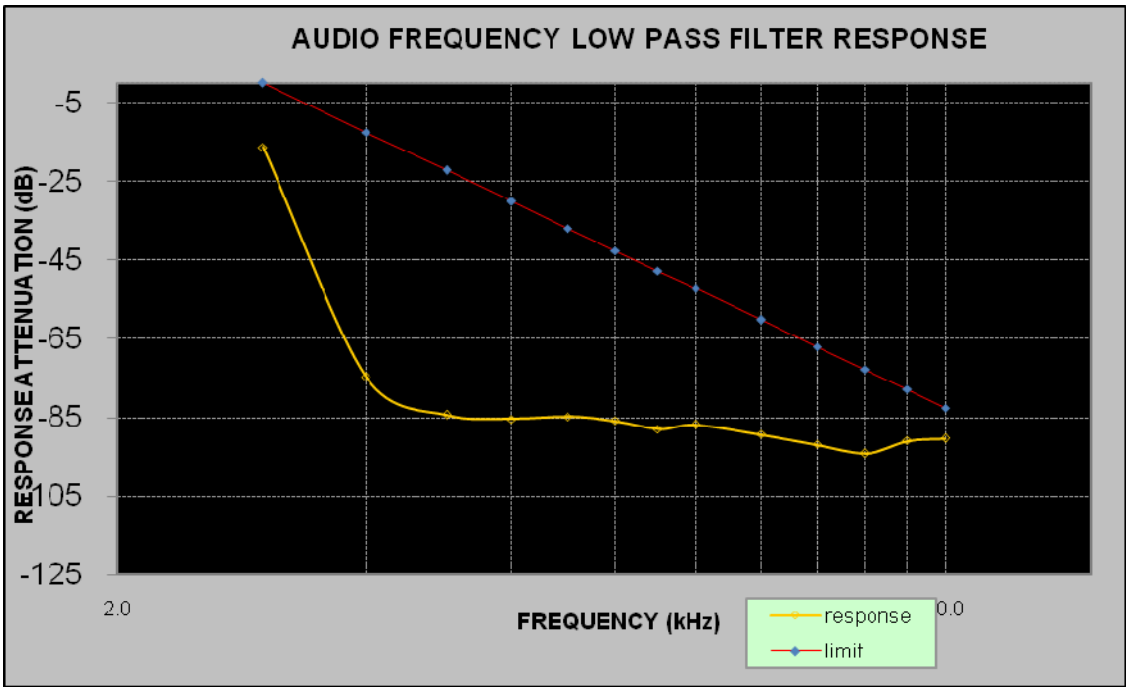
Audio Frequency (Hz)	Response Attenuation (dB)
300	-10.29
400	-7.58
500	-5.61
600	-3.56
700	-2.69
800	-2.27
900	-0.72
1000	-0.09
1200	1.58
1400	3.01
1600	3.87
1800	4.79
2000	5.26
2100	5.68
2200	5.81
2300	5.91
2400	6.48
2500	6.71
2600	7.14
2700	7.63
2800	7.90
2900	8.06
3000	7.65


AUDIO FREQUENCY RESPONSE
RESPONSE ATTENUATION (dB)
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
300
3000
FREQUENCY (Hz)
response
limit1
limit2

Audio frequency lows pass filter response

Carrier Frequency: 450.0125 MHz, authorized bandwidth=11.25 kHz

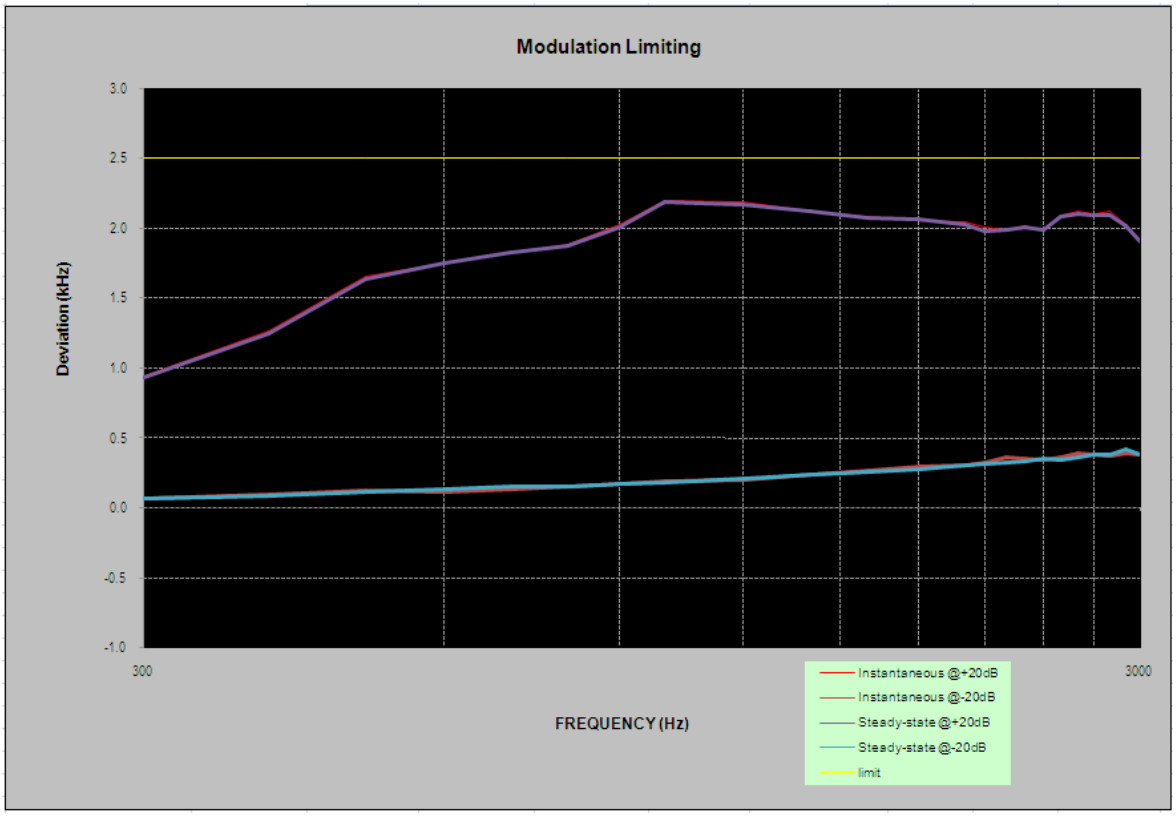
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-16.3	0.0
4.0	-74.8	-12.5
5.0	-84.3	-22.2
6.0	-85.3	-30.1
7.0	-84.7	-36.8
8.0	-85.8	-42.6
9.0	-87.9	-47.7
10.0	-86.8	-52.3
12.0	-89.3	-60.2
14.0	-91.8	-66.9
16.0	-94.1	-72.7
18.0	-90.9	-77.8
20.0	-90.3	-82.5



MODULATION LIMITING

Carrier Frequency: 450.0125 MHz, authorized bandwidth=11.25 kHz

Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	0.942	0.071	0.933	0.064	2.500
400	1.266	0.095	1.249	0.090	2.500
500	1.658	0.122	1.634	0.113	2.500
600	1.755	0.114	1.755	0.136	2.500
700	1.823	0.135	1.823	0.150	2.500
800	1.887	0.154	1.878	0.153	2.500
900	2.023	0.174	2.009	0.168	2.500
1000	2.194	0.187	2.193	0.184	2.500
1200	2.185	0.202	2.172	0.208	2.500
1400	2.126	0.233	2.119	0.235	2.500
1600	2.084	0.265	2.076	0.257	2.500
1800	2.060	0.297	2.066	0.279	2.500
2000	2.046	0.304	2.030	0.301	2.500
2100	2.012	0.324	1.984	0.316	2.500
2200	1.993	0.366	1.987	0.321	2.500
2300	2.016	0.353	2.005	0.335	2.500
2400	1.989	0.340	1.985	0.351	2.500
2500	2.092	0.364	2.080	0.341	2.500
2600	2.125	0.387	2.108	0.363	2.500
2700	2.103	0.384	2.091	0.385	2.500
2800	2.122	0.372	2.089	0.381	2.500
2900	2.023	0.392	2.017	0.421	2.500
3000	1.903	0.380	1.907	0.382	2.500


Modulation Limiting
Deviation (kHz)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
300
3000
FREQUENCY (Hz)
Instantaneous @+20dB
Instantaneous @-20dB
Steady-state @+20dB
Steady-state @-20dB
limit

FCC §2.1049 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049 and §90.210

Emission Mask D - 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

1) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0, 0dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least: At least 50 + 10 log (P) dB or 70 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 resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band ±50 kHz from the carrier frequency.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Alisa Gao on 2017-06-01 and 2017-06-16.

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	12.5	450.0125	High	9.92	10.12
			Middle	9.92	10.12
			Low	9.92	10.42
		453.2125	High	9.92	10.02
			Middle	9.92	10.02
			Low	9.92	10.02
Digital	12.5	450.0125	High	7.72	10.12
			Middle	7.52	9.62
			Low	7.62	9.52
		453.2125	High	7.72	9.22
			Middle	7.72	9.22
			Low	7.72	9.22

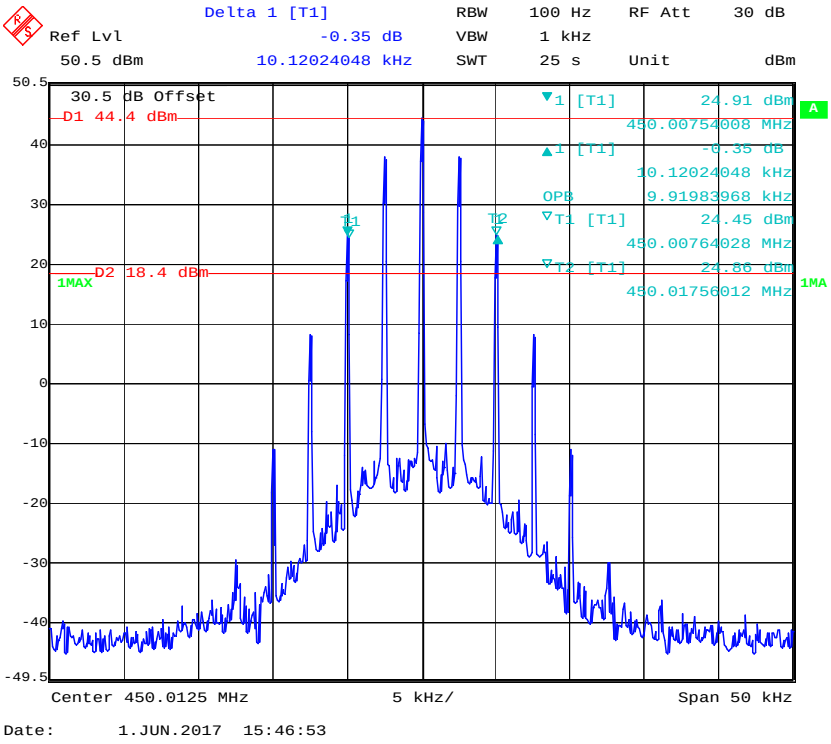
Emission Designator Per CFR 47 §2.201& §2.202&, Bn = 2M + 2D

For FM Mode (Channel Spacing: 12.5 kHz)
Emission Designator 11K0F3E In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation. BW = 2(M+D) = 2*(3.0 kHz + 2.5 kHz) = 11 kHz → 11K0
F3E portion of the designator represents an FM voice transmission Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

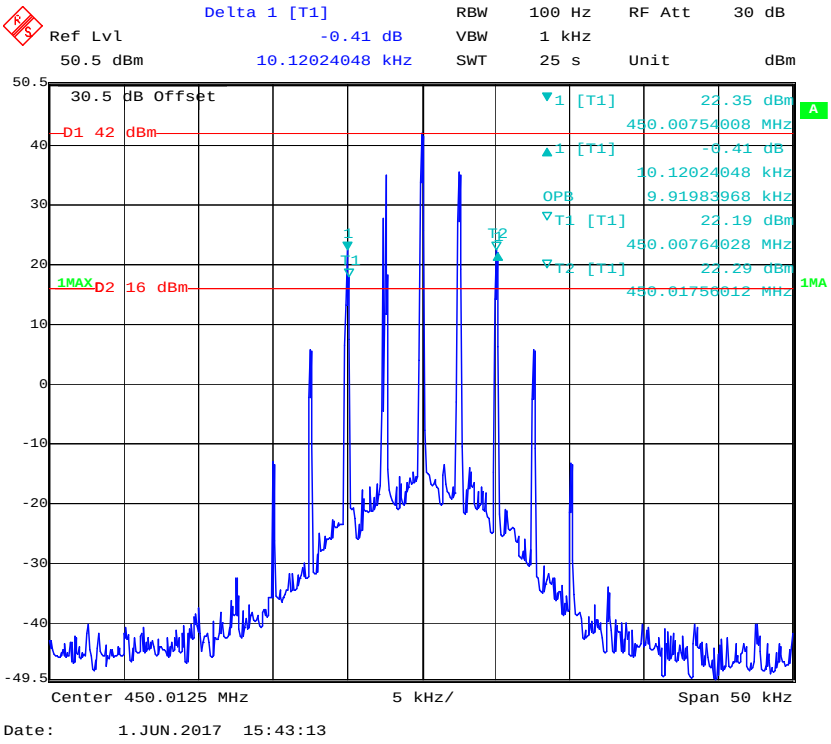
For Digital Mode (Channel Spacing: 12.5 kHz)
Emission Designator 7K60F1D and 7K60F1E
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.72 kHz. The emission mask was obtained from 47CFR 90.210(d).
F1D and F1E portion of the designator indicates digital information.
Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1E.

Analog Modulation:

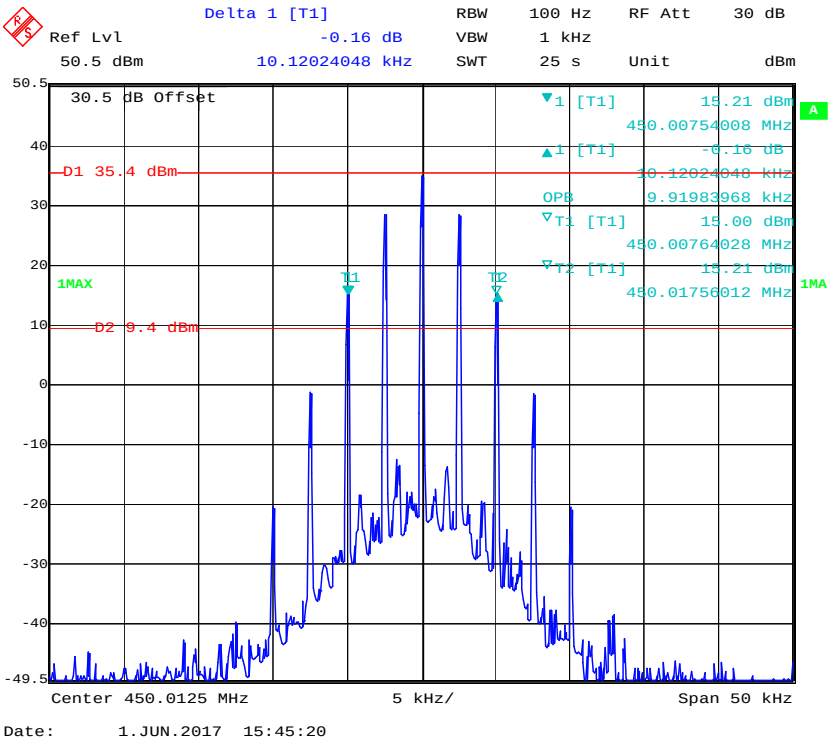
Frequency 450.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



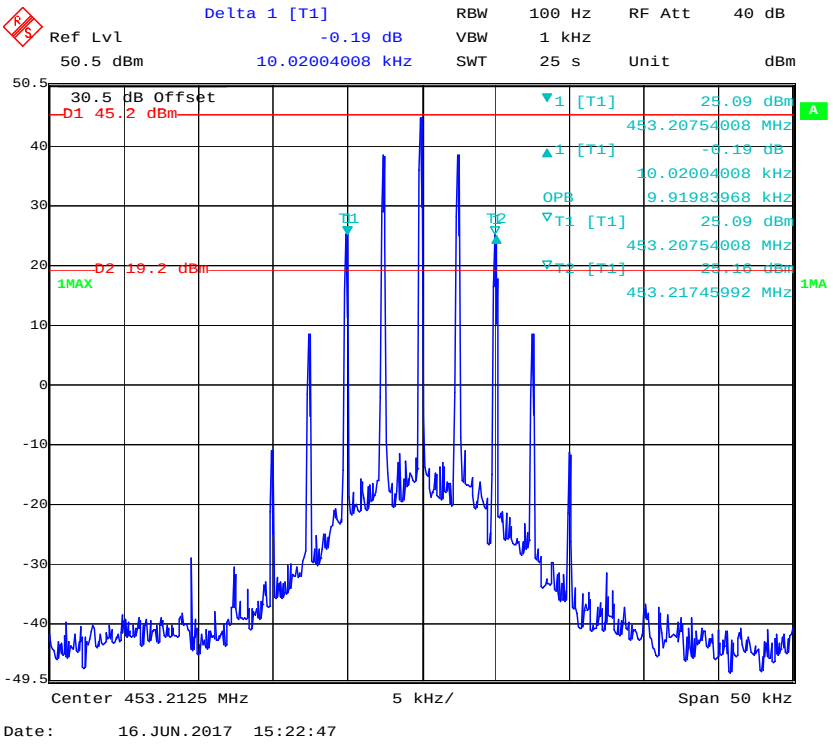
Frequency 450.0125 MHz: 99% Occupied & 26 dB Bandwidth, Middle Power



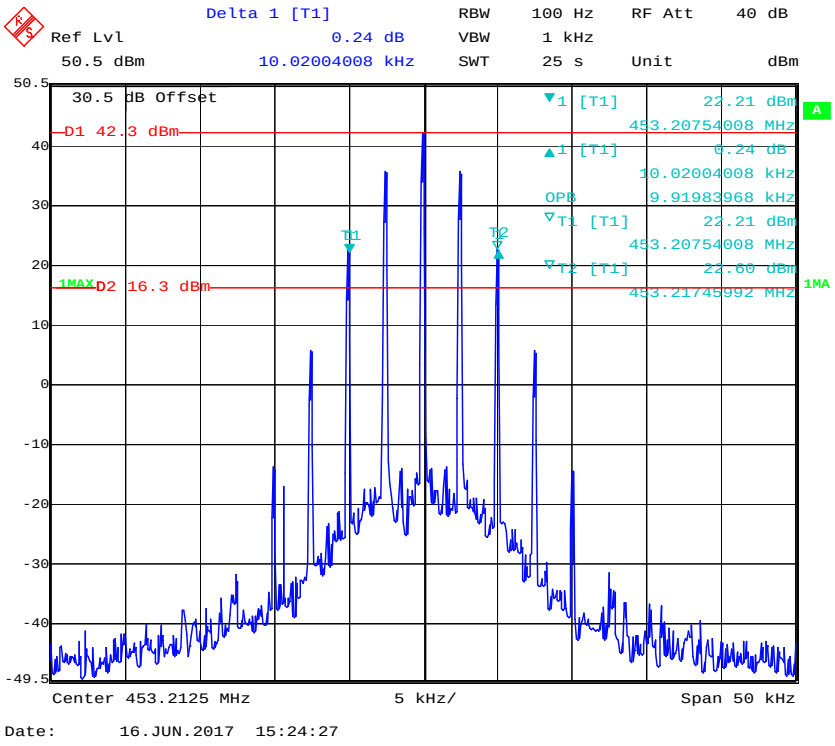
Frequency 450.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



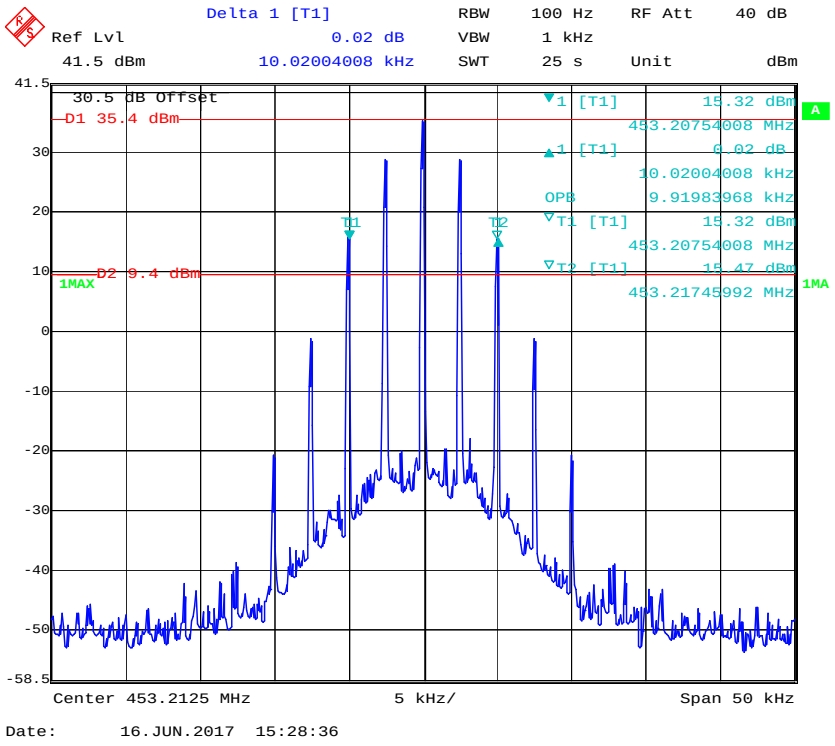
Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



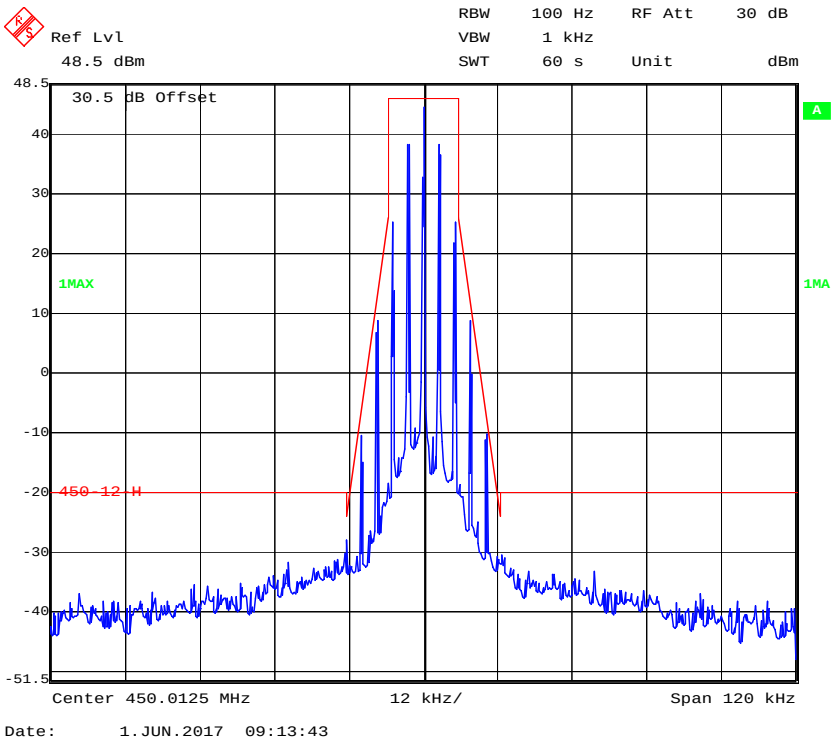
Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, Middle Power



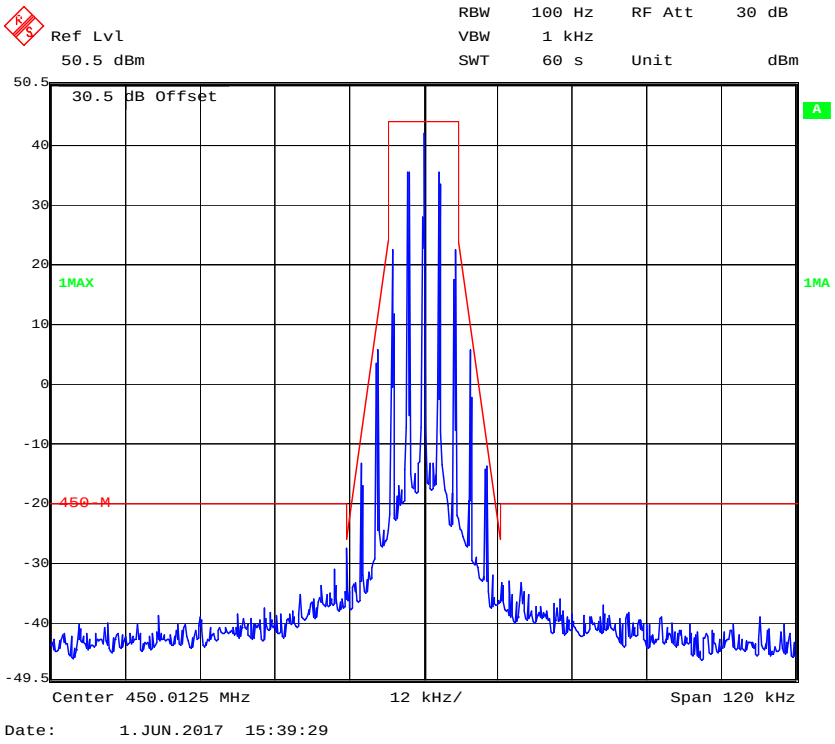
Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



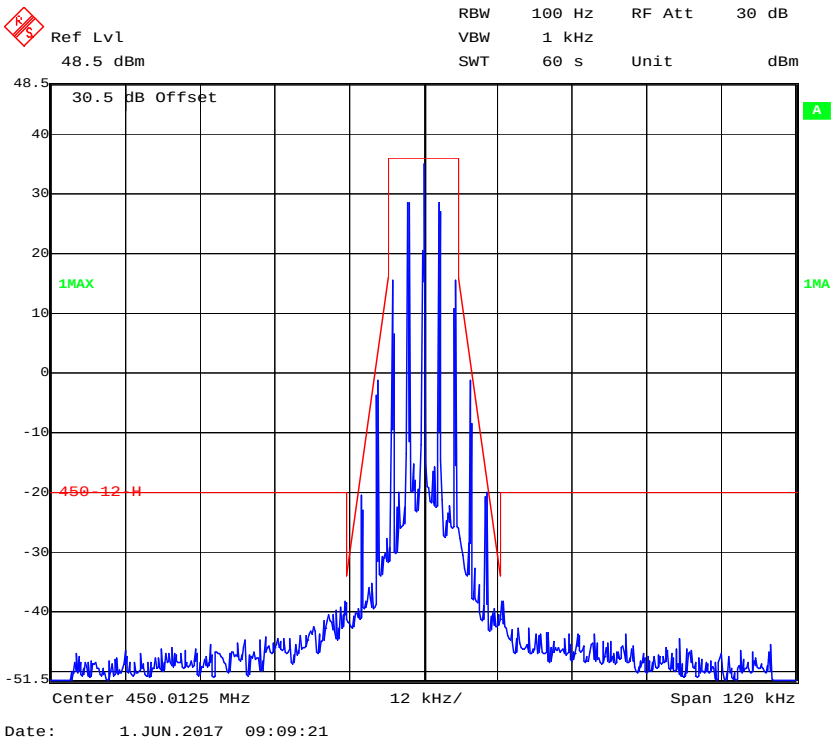
Frequency 450.0125 MHz: Emission Mask, High Power



Frequency 450.0125 MHz: Emission Mask, Middle Power

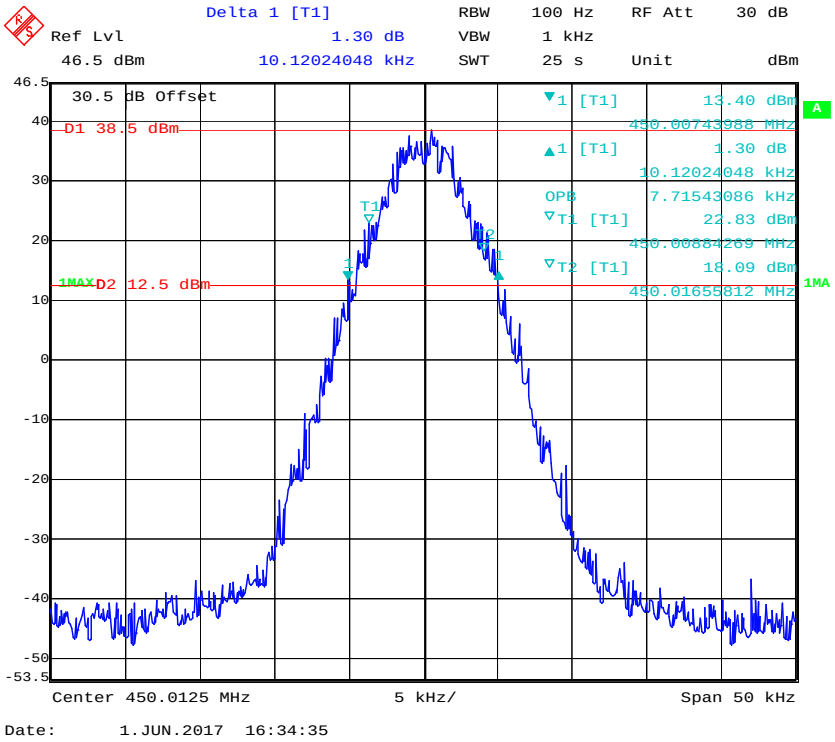


Frequency 450.0125 MHz: Emission Mask, Low Power

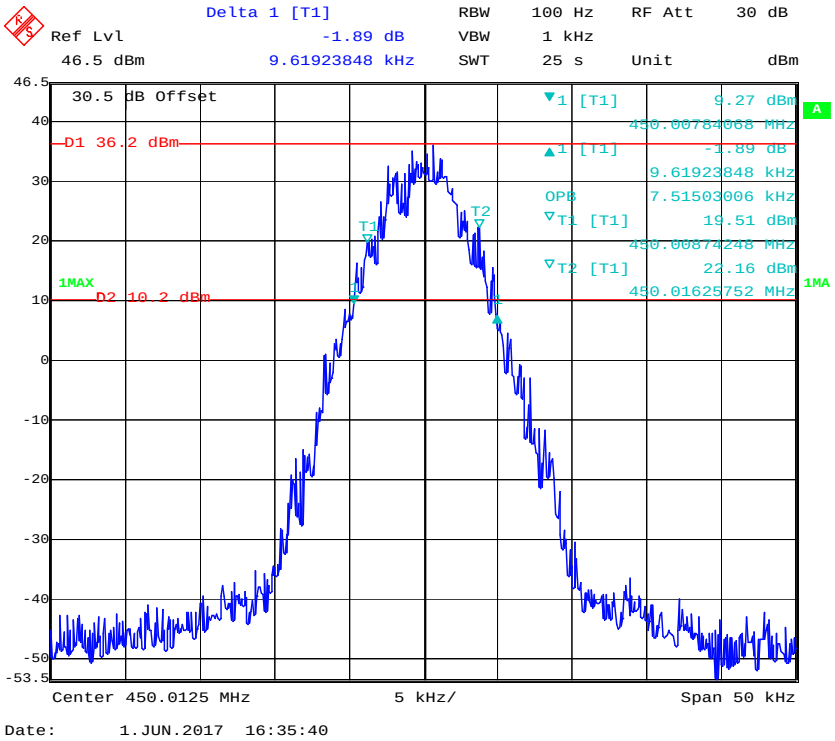


Digital Modulation:

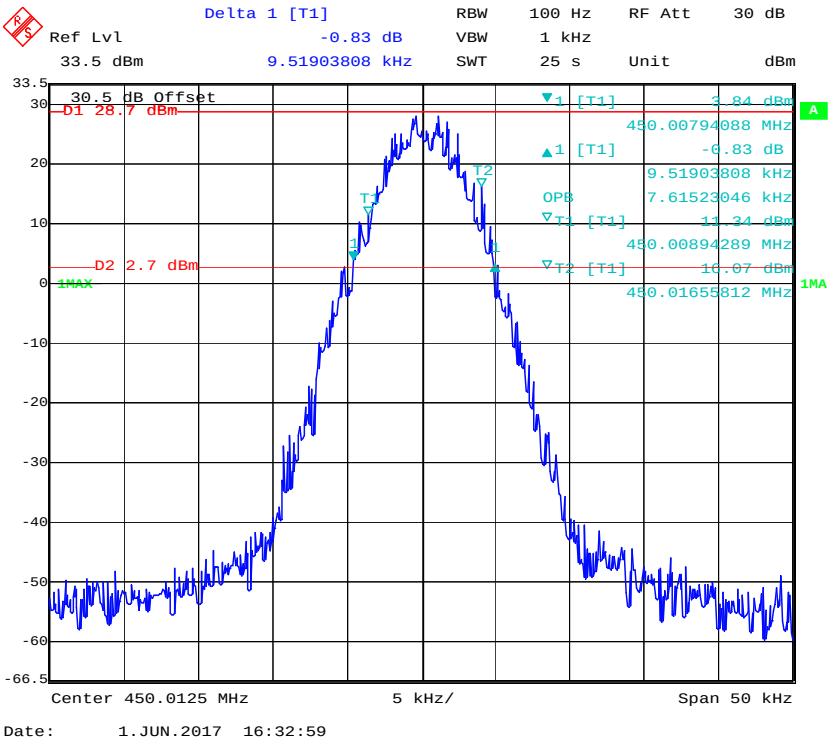
Frequency 450.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



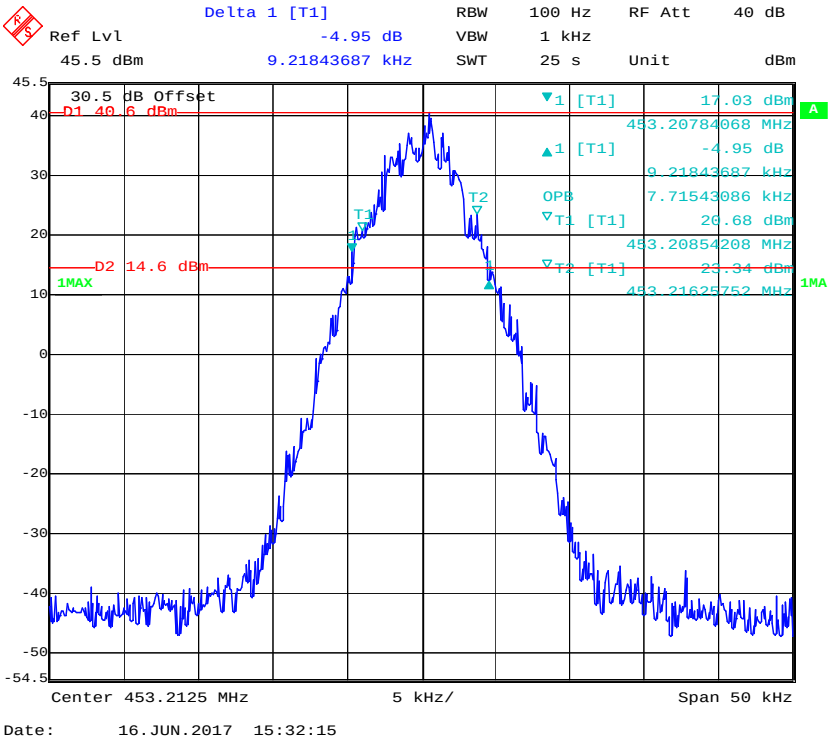
Frequency 450.0125 MHz: 99% Occupied & 26 dB Bandwidth, Middle Power



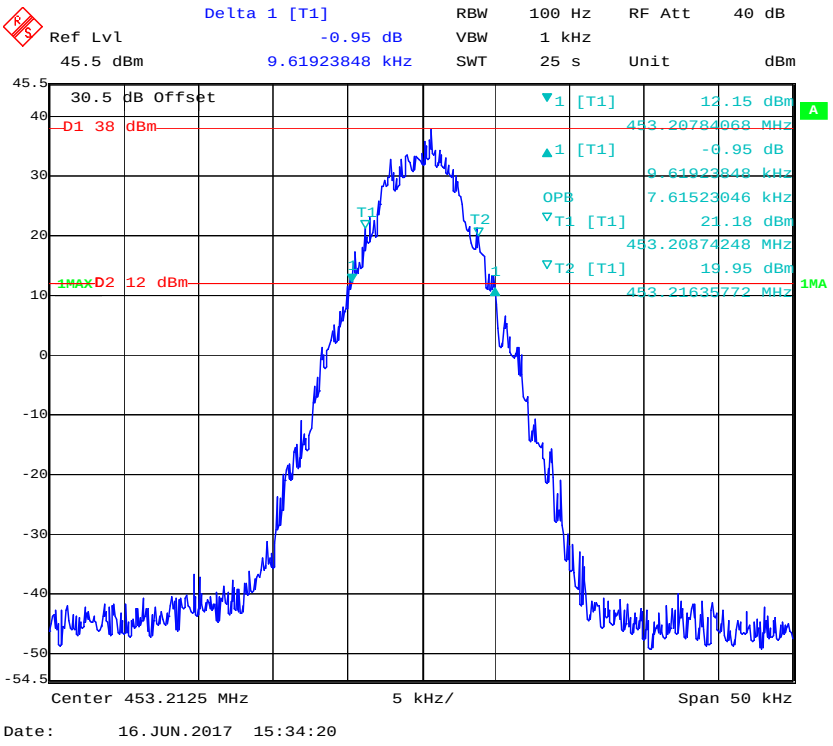
Frequency 450.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



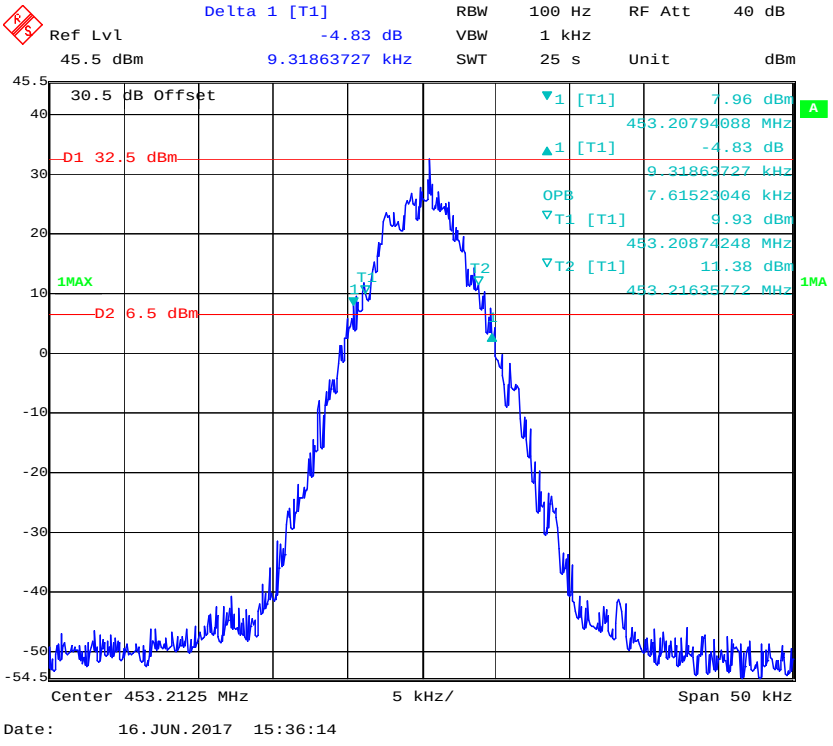
Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



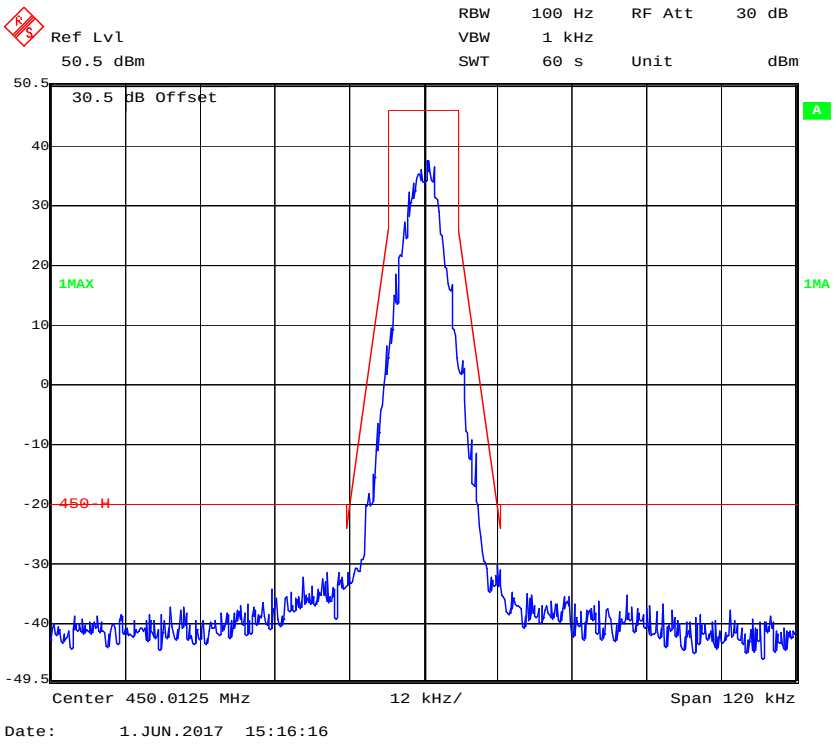
Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, Middle Power



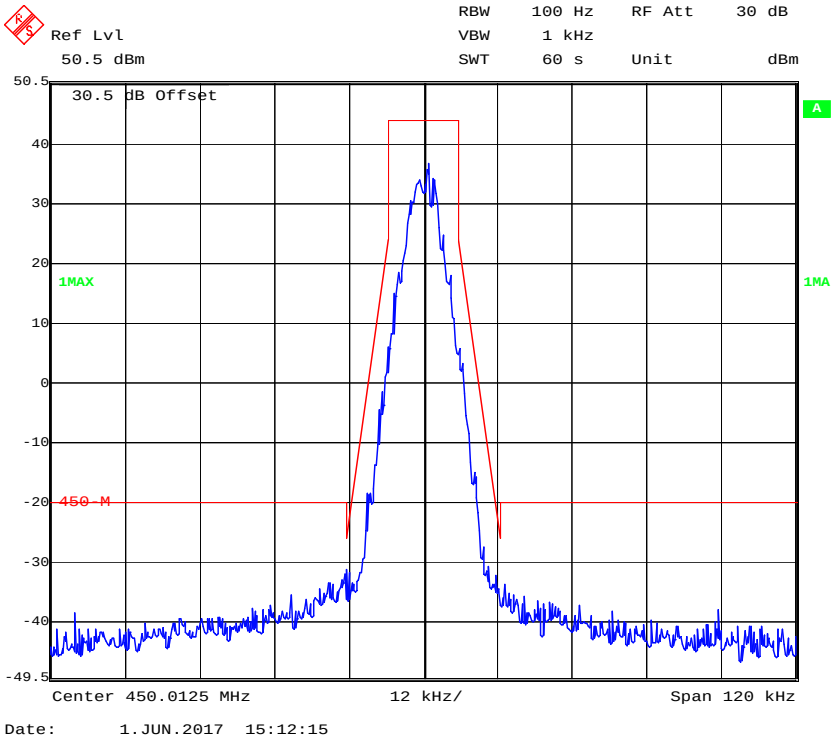
Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



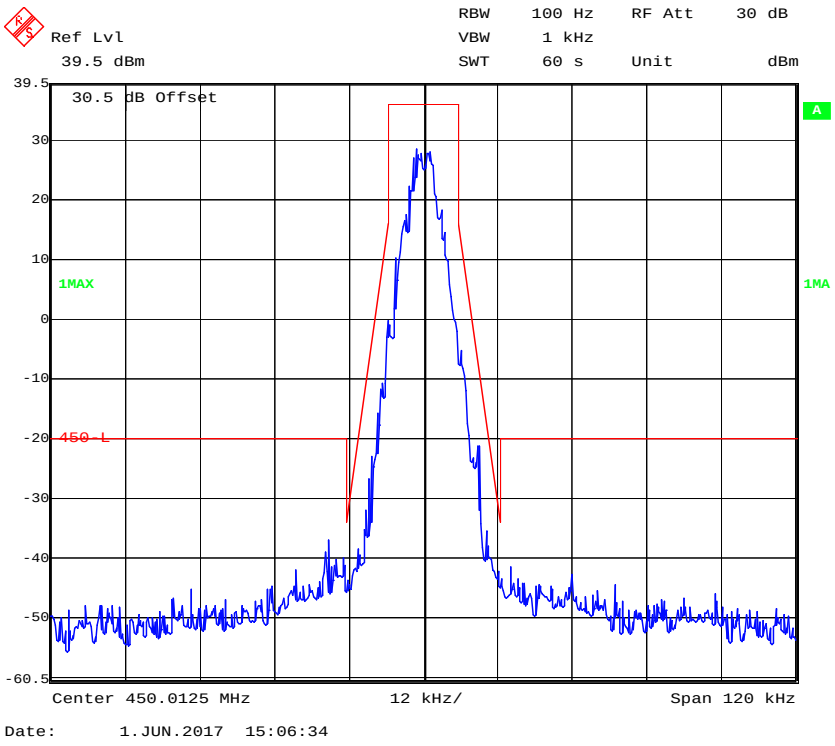
Frequency 450.0125 MHz: Emission Mask, High Power



Frequency 450.0125 MHz: Emission Mask, Middle Power



Frequency 450.0125 MHz: Emission Mask, Low Power



FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

1) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0, 0 dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

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

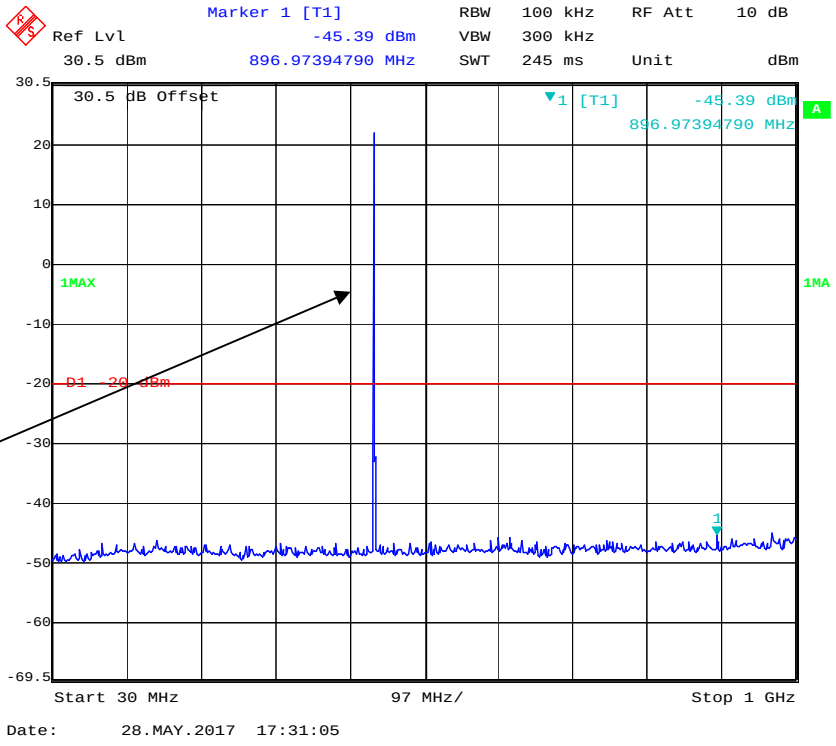
Temperature:	23~25 ℃
Relative Humidity:	50~55 %
ATM Pressure:	100.0~101.0 kPa

The testing was performed by Alisa Gao from 2017-05-28 to 2017-06-03.

Test Mode: Transmitting, please refer to the following plots.

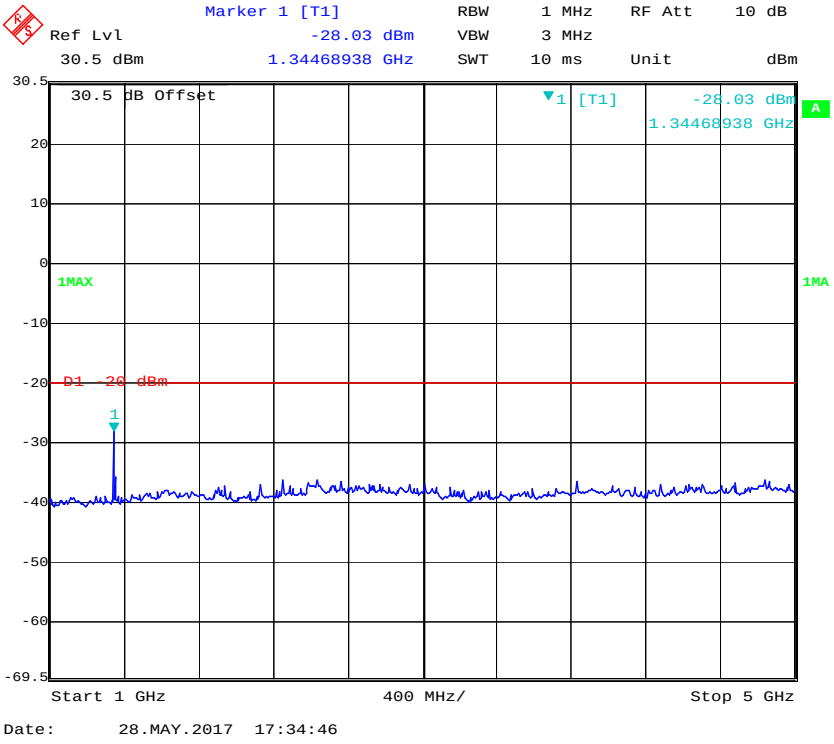
Analog Modulation (Test channel 450.0125MHz):

30MHz – 1 GHz, Spacing Channel 12.5 kHz, High Power

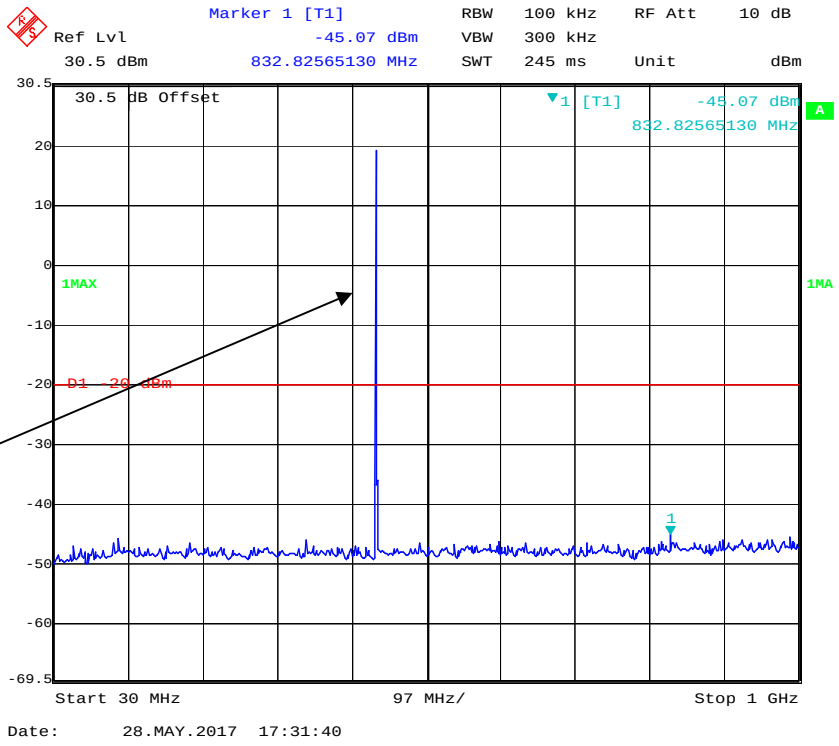


Fund.test with notch filter

1 GHz – 5 GHz, Spacing Channel 12.5 kHz, High Power

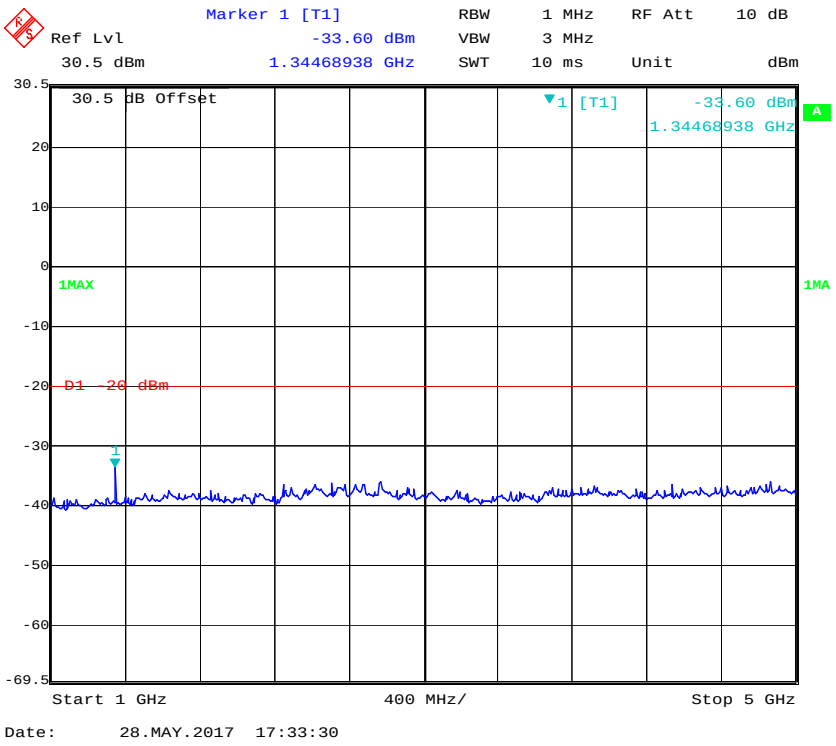


30MHz – 1 GHz, Spacing Channel 12.5 kHz, Middle Power

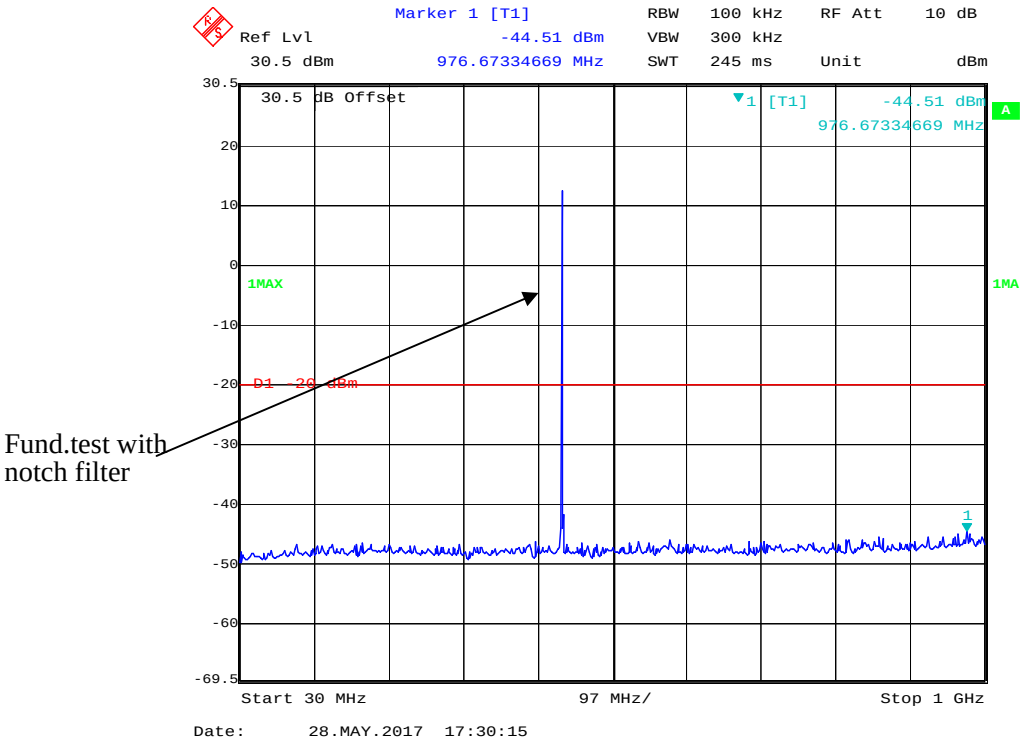


Fund.test with notch filter

1 GHz – 5 GHz, Spacing Channel 12.5 kHz, Middle Power

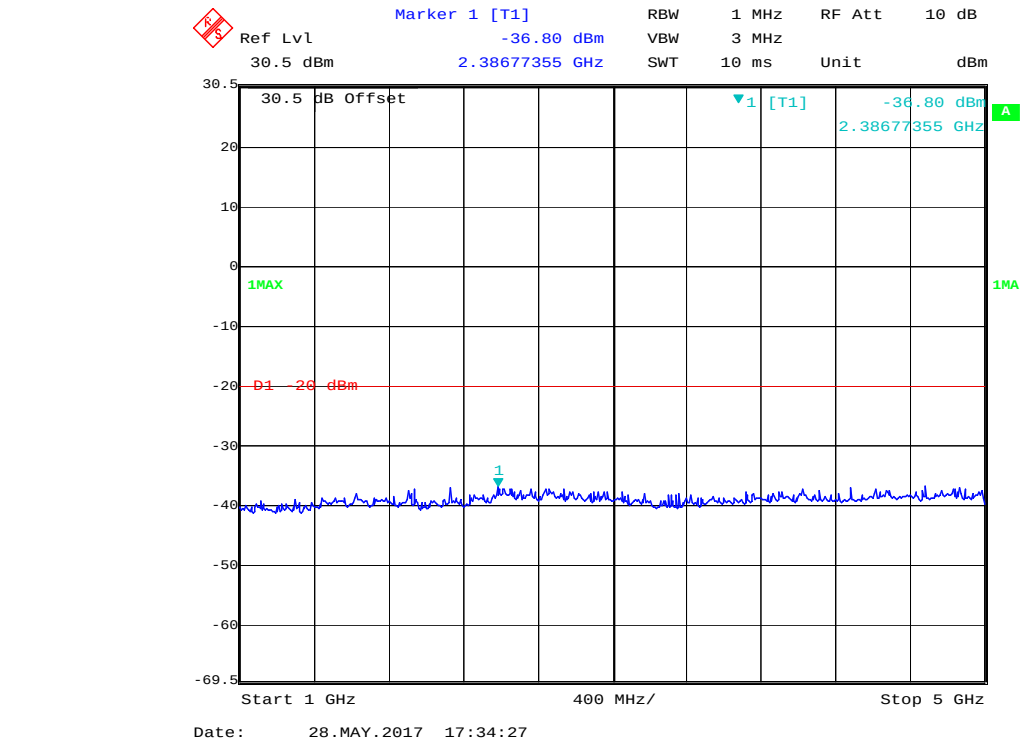


30MHz – 1 GHz, Spacing Channel 12.5 kHz, Low Power



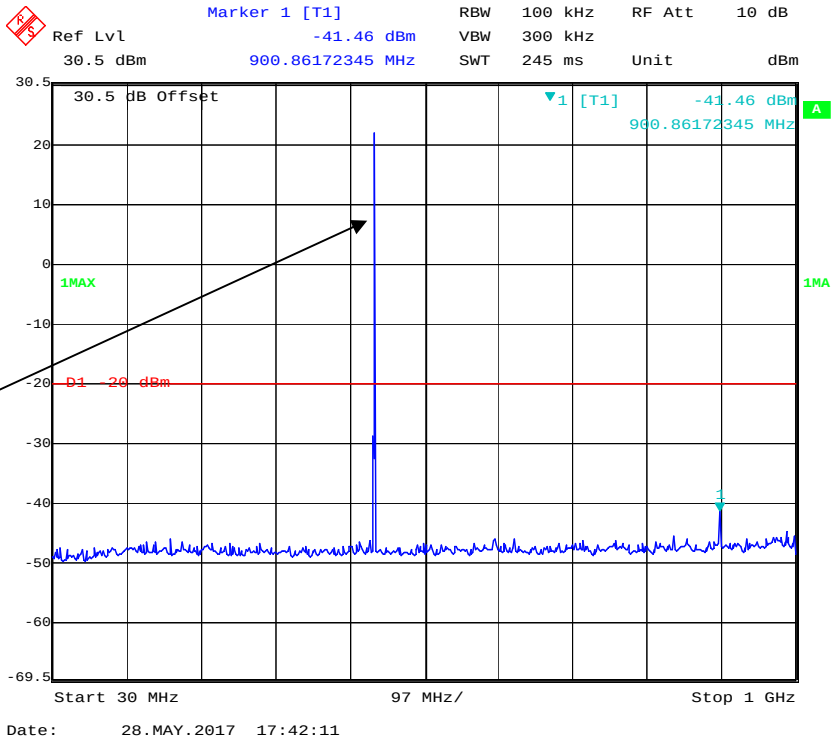
Fund.test with notch filter

1 GHz – 5 GHz, Spacing Channel 12.5 kHz, Low Power



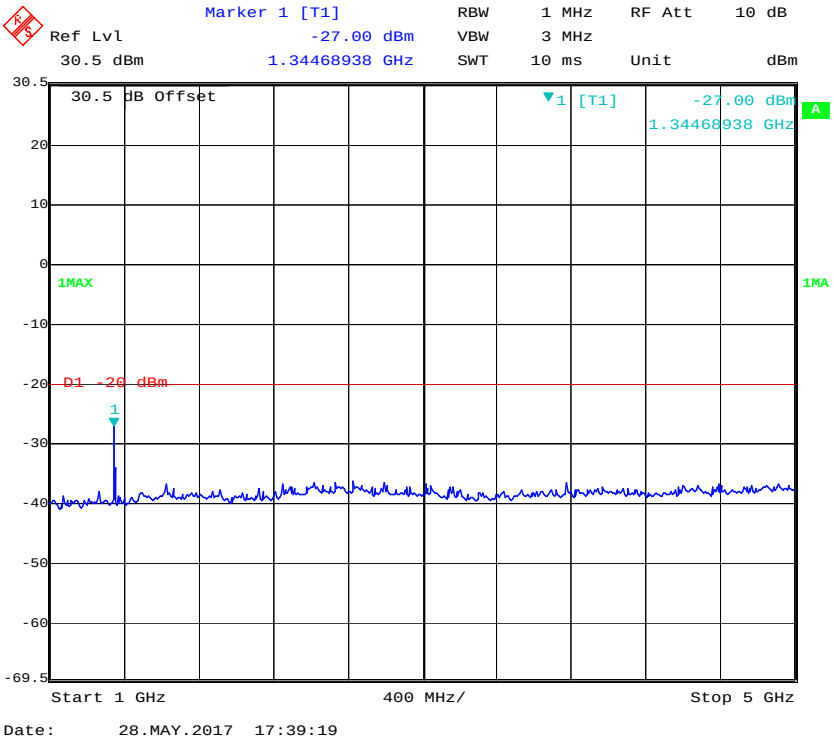
Digital Modulation (Test channel 450.0125MHz):

30MHz - 1 GHz, High Power

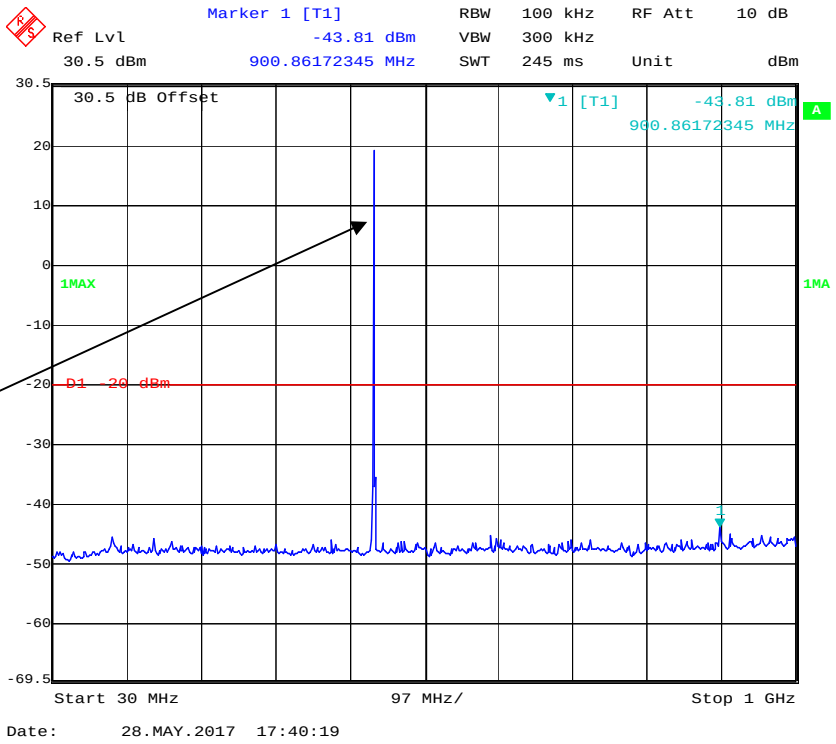


Fund.test with notch filter

1 GHz – 5 GHz, High Power

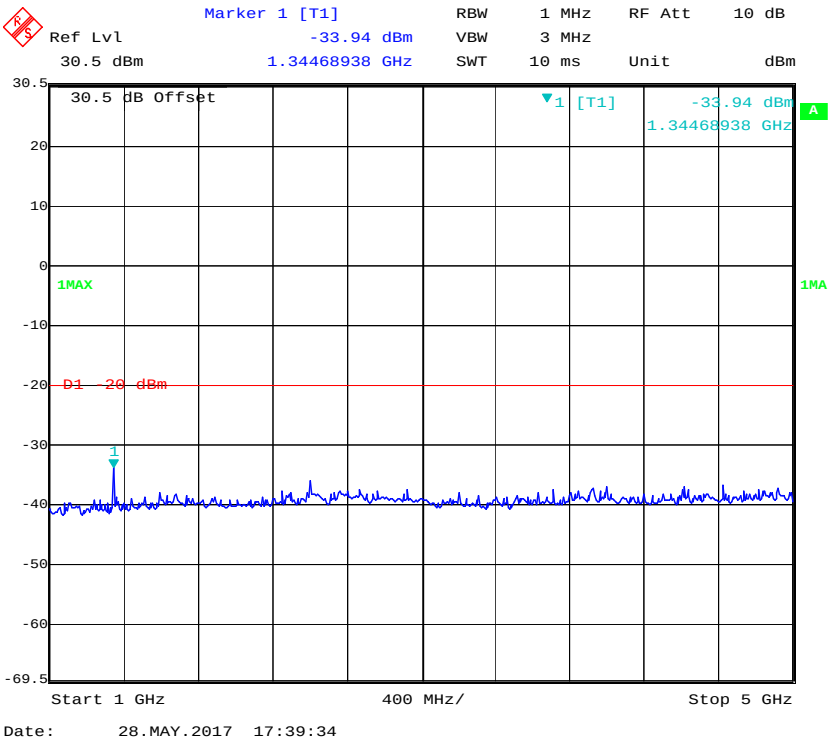


30MHz - 1 GHz, Middle Power

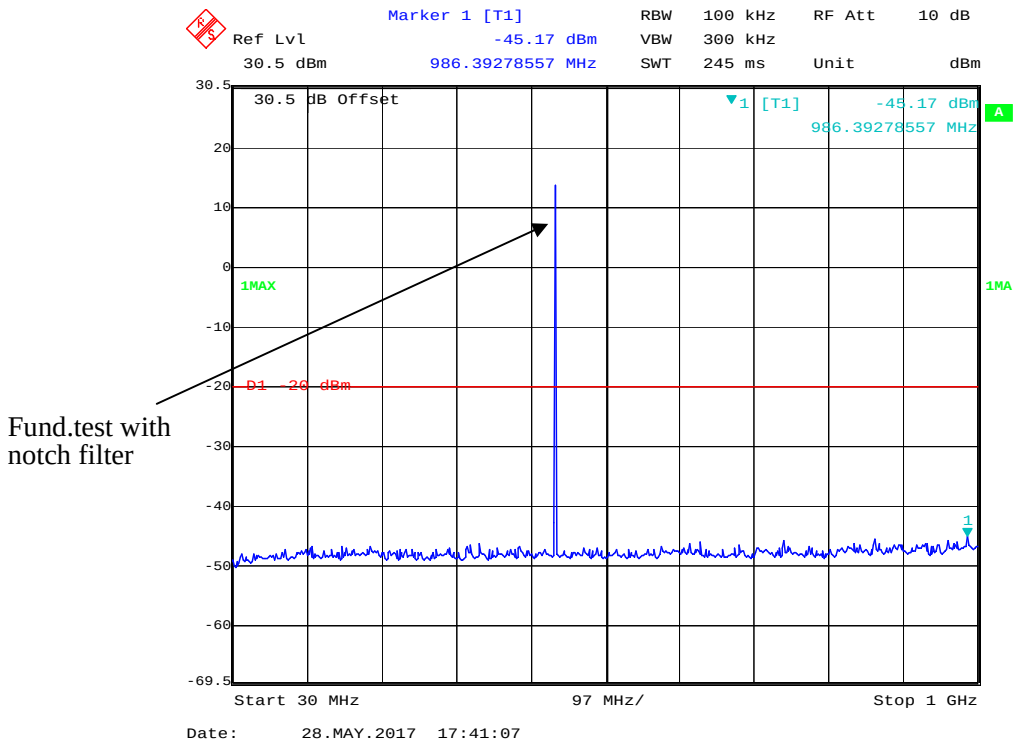


Fund.test with notch filter

1 GHz – 5 GHz, Middle Power

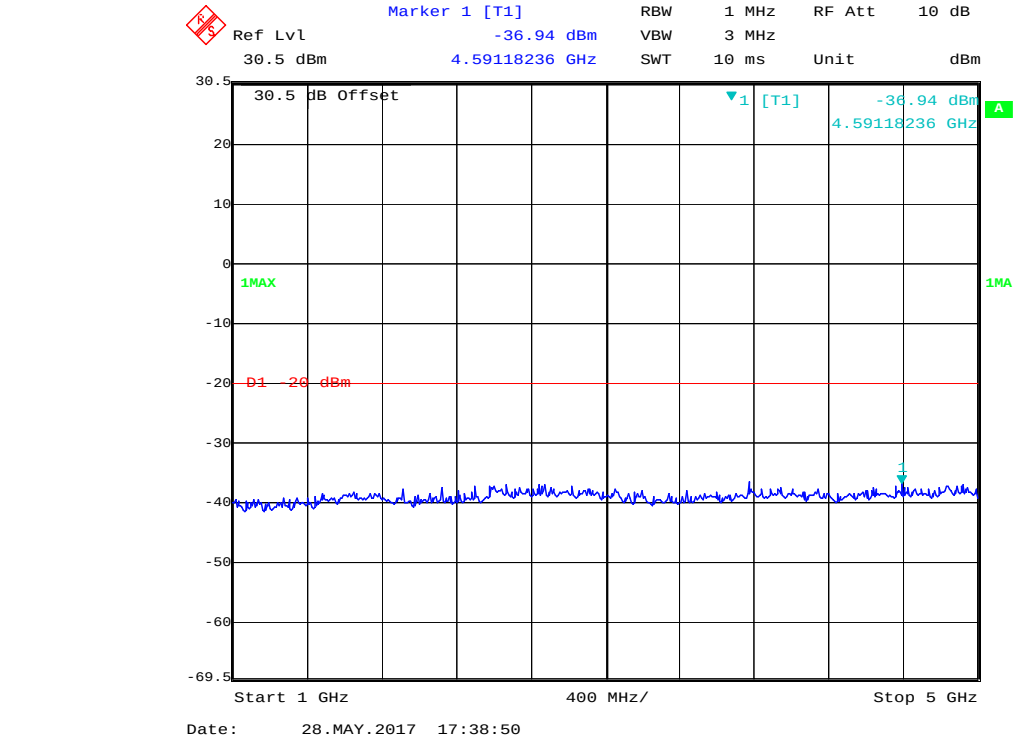


30MHz - 1 GHz, Low Power



Fund.test with notch filter

1 GHz – 5 GHz, Low Power



FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §90.210

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 dB =50+10 Log_{10} (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Alisa Gao on 2017-06-03.

Test Mode: Transmitting(High power level)

30MHz - 5GHz:

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)			
Analog Modulation 450.0125MHz										
900.03	45.73	132	1.7	H	-54.2	0.27	5.05	-49.42	-20	29.42
900.03	41.78	184	2.5	V	-54.7	0.27	5.05	-49.92	-20	29.92
1350.04	52.47	33	1.5	H	-51.6	0.34	7.92	-44.02	-20	24.02
1350.04	54.00	168	1.7	V	-51.8	0.34	7.92	-44.22	-20	24.22
Digital Modulation 450.0125MHz										
900.03	48.03	78	1.9	H	-51.9	0.27	5.05	-47.12	-20	27.12
900.03	43.18	252	1.0	V	-53.3	0.27	5.05	-48.52	-20	28.52
1350.04	56.37	145	2.1	H	-47.7	0.34	7.92	-40.12	-20	20.12
1350.04	58.60	4	2.1	V	-47.2	0.34	7.92	-39.62	-20	19.62

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

FCC §2.1055 & §90.213 - FREQUENCY STABILITY

Applicable Standard

FCC §2.1055 and §90.213

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to 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:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Alisa Gao on 2017-06-05.

Test Mode: Transmitting

Reference Frequency: 450.0125MHz, Limit: ±2.5 ppm, Analog 12.5 kHz			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Power Supplied (V_{DC})**	**Measured Frequency error (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	13.6	450.012420	-0.1781
40	13.6	450.012207	-0.6522
30	13.6	450.012350	-0.3338
20	13.6	450.012200	-0.6662
10	13.6	450.012116	-0.8535
0	13.6	450.012390	-0.2439
-10	13.6	450.012451	-0.1084
-20	13.6	450.012265	-0.5226
-30	13.6	450.012131	-0.8204
Frequency Stability versus Input Voltage			
20	11.6	450.012451	-0.1084

Reference Frequency: 450.0125MHz, Limit: ±2.5 ppm, Digital 12.5 kHz			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Power Supplied (V_{DC})**	**Measured Frequency error (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	13.6	450.012482	-0.0400
40	13.6	450.012158	-0.7600
30	13.6	450.012384	-0.2578
20	13.6	450.012690	0.4222
10	13.6	450.012459	-0.0911
0	13.6	450.012369	-0.2911
-10	13.6	450.012975	1.0555
-20	13.6	450.012681	0.4022
-30	13.6	450.012542	0.0933
Frequency Stability versus Input Voltage			
20	11.6	450.012681	0.4022

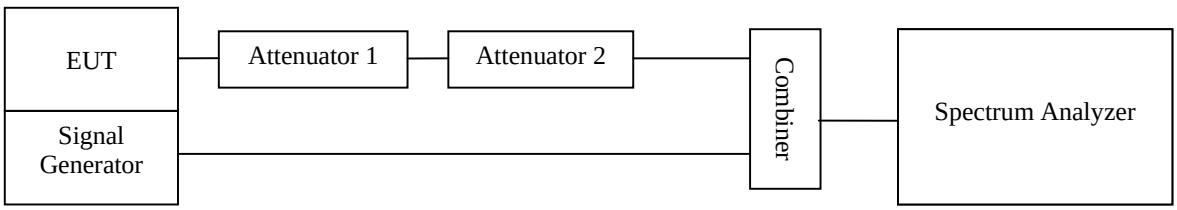
FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214
Test method: TIA-603-D 2010, section 2.2.19.3

Test Procedure

a) Connect the EUT and test equipment as shown on the following block diagram.
b) Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
c) Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at ±12.5 kHz deviation and set its output level to -100dBm.
d) Turn on the transmitter.
e) Supply sufficient attenuation via the RF attenuator to provide an input level to the Spectrum Analyzer that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the Spectrum Analyzer as P_0.
f) Turn off the transmitter.
g) Adjust the RF level of the signal generator to provide RF power equal to P_0. This signal generator RF level shall be maintained throughout the rest of the measurement.
h) Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
i) Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at ±4 divisions vertically centered on the display. Set trigger mode of the Spectrum Analyzer to "Video", and tune the "trigger level" on suitable level. Then set the "tiger offset" to -10ms for turn on and -15ms for turn off.
j) Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be t_{on}. The trace should be maintained within the allowed divisions during the period t_1 and t_2.
k) Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period t_3.



Test Data

Environmental Conditions

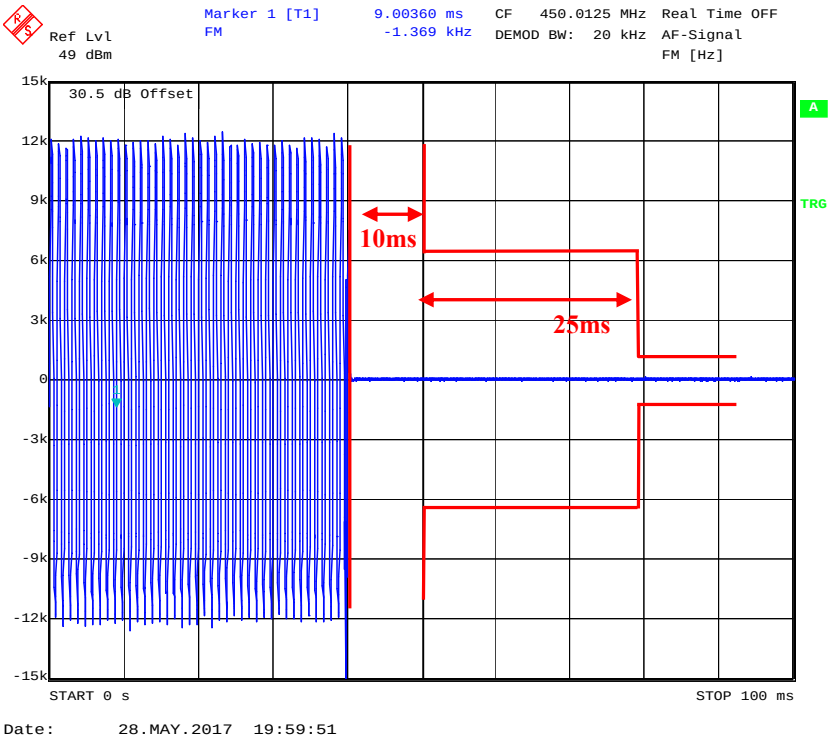
Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Alisa Gao on 2017-06-03.

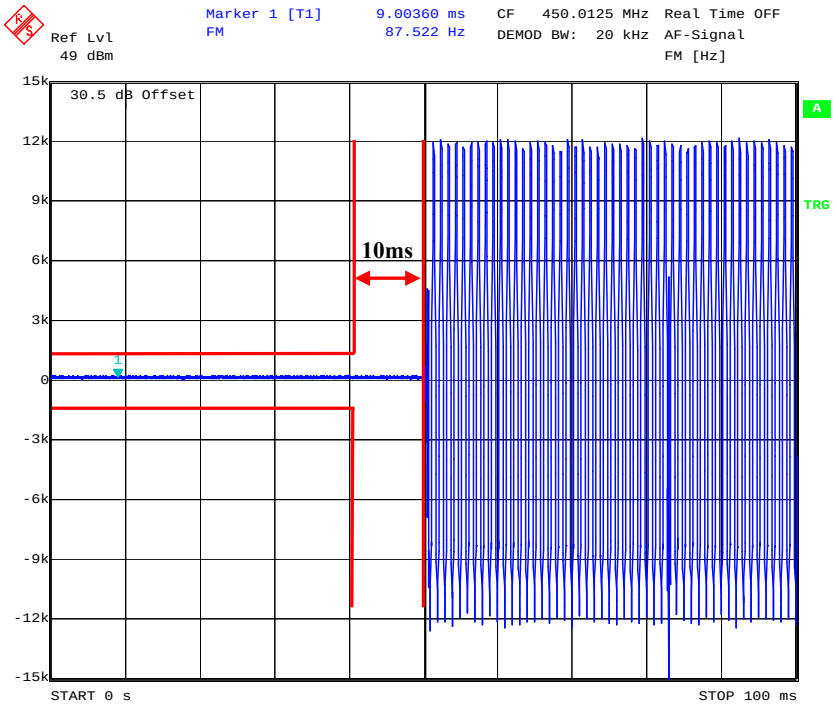
Channel Separation (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	10 (t1)	<+/-12.5 kHz	Pass
	25(t2)	<+/-6.25 kHz	
	10 (t3)	<+/-12.5 kHz	

Please refer to the following plots.

Turn on



Turn off



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