ACCREDITED
TESTING LABORATORY
CERTIFICATE # 4821.01

Bay Area Compliance Labs Corp.

FCC PART 22, 74, 80 and 90

TEST REPORT

For

Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, 518057 China

FCC ID: YAMEPRADGU1

Report Type:	**Product Type:**
Original Report	Professional Radio Access Device

Report Number:	RDG180424003-00B
Report Date:	2018-08-20
Reviewed By:	Rocky Kang RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Note: This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*".

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Hytera Communications Corporation Limited's* product, model number: *E-PRAD(G) U(1) (FCC ID: YAMEPRADGU1)* in this report is a *Professional Radio Access Device*,which was measured approximately: 300 mm (L) x 200 mm (W) x 105 mm(H), rated input voltage: DC 13.6V±15% and AC 100-240V.

Item	Parameter
	DMR
Frequency Range(MHz)	400-470
Rated Output power(Watts)	20 (High) / 5(Low)
Modulation	FM,4FSK
Channel Spacing(kHz)	12.5, 25

** All measurement and test data in this report was gathered from production sample serial number: 180424003 (Assigned by BACL,Shenzhen). The EUT supplied by the applicant was received on 2018-04-24.*

Objective

This test report is prepared on behalf of *Hytera Communications Corporation Limited* in accordance with Part 2, and Part 22,74,80,90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

FCC Part 22H & 24E PCB submissions with FCC ID: YAMEPRADGU1.

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 22 – Public Mobile Service
Part 74 – Experimental Radio, Auxiliary, Special Broadcast and other Program Distributonal Service
Part 80 – Stantions in the Maritme Service
Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D.

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

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF output power, conducted		±1.5dB
Unwanted Emission, conducted		±1.5dB
Emissions, radiated	Below 1GHz	±4.70dB
	Above 1GHz	±4.80dB
Temperature		±1℃
Supply voltages		±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 342867, the FCC Designation No. : CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

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.

Support Equipment List and Details

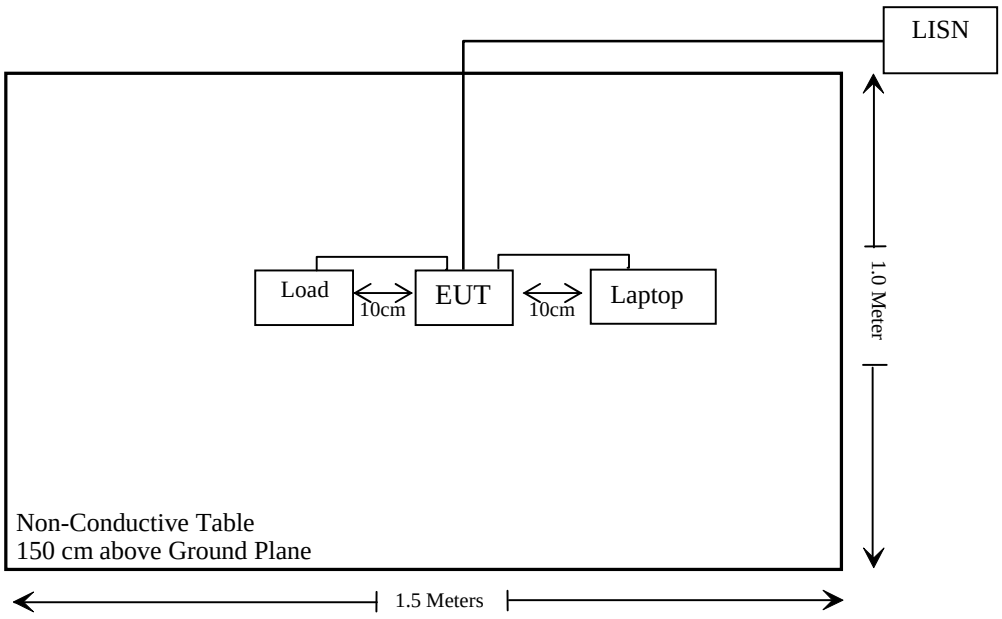
Manufacturer	Description	Model	Serial Number
HP	Laptop	516	Gjh511644g
N/A	Load	N/A	N/A

External I/O Cable

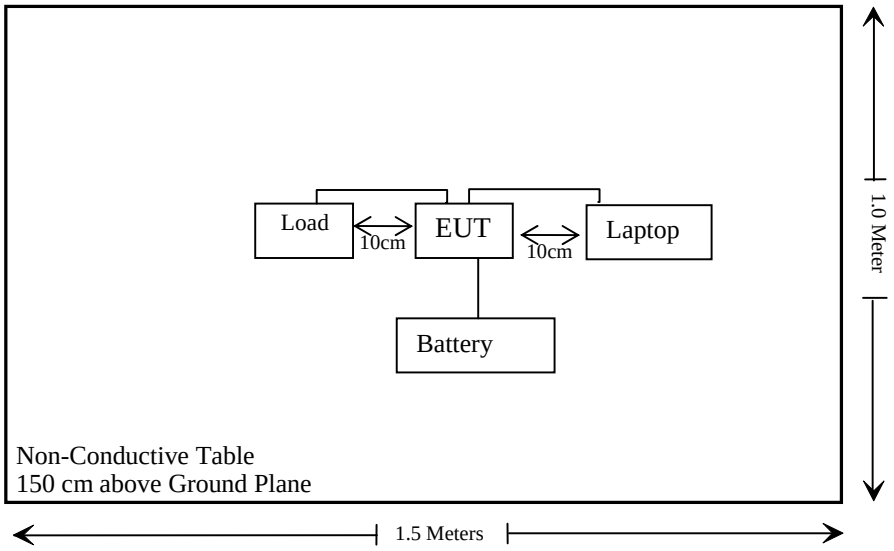
Cable Description	Length (m)	From Port	To
Shielding Detachable RJ45 Cable	3.0	Laptop	EUT
Shielding Detachable RF Cable	0.5	EUT	Load

Block Diagram of Test Setup

AC Mains:



DC Power:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307(b), §2.1091	Maximum Permissible exposure (MPE)	Compliance
§2.1046; § 22.727; §74.461; § 80.215; §90.205	RF Output Power	Compliance
§2.1047	Modulation Characteristic	Not Applicable
§2.1049;§22.357;§ 22.731; §74.462; § 80.205; § 80.207;§90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §22.861; §74.462; § 80.211;§90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §22.861; §74.462; § 80.211;§90.210	Spurious Radiated Emissions	Compliance
§2.1055; § 22.355; §74.464; § 80.209;§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					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017-12-22	2018-12-21
Rohde & Schwarz	Signal Generator	FSIQ26	8386001028	2018-04-24	2019-04-24
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-05-21	2019-05-21
HP	Amplifier	HP8447E	1937A01046	2018-05-21	2018-11-19
Anritsu	Signal Generator	68369B	004114	2017-12-24	2018-12-24
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR
A.H. System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	RG-214	1	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	RG-214	2	2018-05-22	2018-11-22
RF Conducted Test					
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2017-12-21	2018-12-21
Fluke	Digital Multimeter	287	19000011	2018-04-12	2019-04-12
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
HP Agilent	RF Communication test set	8920B	3325U00859	2017-10-25	2018-10-25
N/A	RF Notch filter	SKU 5G3	ATR0205-04-13	NCR	NCR
N/A	30dB Attenuator	53-30-43	PG633	Each time	

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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.

Limits for Occupational/Controlled Exposure

Limits for occupational/Controlled 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)	6
1.34-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5.0	6

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/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)

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

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

Worst case as below:

Frequency (MHz)	Antenna Gain		Tune up Conducted Power		Tune up Average power	Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)	(mW)			
824-849	1.0	1.26	33.5	2238.72	279.84	40	0.02	2.75
1850-1910	3.5	2.24	29.5	891.25	111.41	40	0.01	5.00
400-470	3.5	2.24	43.5	22387.21	11193.61	40	1.25	1.33

Note:
For GSM mode, the Time-base average power was consideration, Average power as below:
GSM850: 2238.72*(1/8)mW=279.84mW.
PCS1900: 891.25*(1/8)mW=111.41mW.

For DMR mode, the duty cycle of 50% was consideration, Average power as below:
22387.21*50%mW=11193.61mW.

Simultaneous transmitting consideration: GSM850 and DMR, or PCS1900 and DMR

The ratio=MPE/$limit_{824MHz}$+MPE/$limit_{410MHz}$=0.02/2.75+1.25/1.33=0.95＜1.0, simultaneous exposure is not required.

The ratio=MPE/$limit_{1850MHz}$+MPE/$limit_{410MHz}$=0.01/5.00+1.25/1.33=0.94＜1.0, simultaneous exposure is not required.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 40 cm from nearby persons to antenna.

Result: Compliance

FCC §2.1046 & § 22.727 & §74.461 & §80.215 & §90.205 - RF OUTPUT POWER

Applicable Standard

FCC §2.1046, § 22.727, §74.461, § 80.215 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:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu on 2018-05-31.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Mode	Frequency Spacing (kHz)	Frequency (MHz)	Power level	Output (dBm)	Output Power(W)	Note
Digital	12.5	400.0125	High	43.15	20.65	Federal
			Low	37.02	5.04	
	12.5	453.2125	High	43.22	20.99	For Part 90
			Low	37.13	5.16	
	12.5	454.0125	High	43.22	20.99	For Part 22
			Low	37.11	5.14	
	12.5	455.0125	High	43.25	21.13	For Part 74
			Low	37.21	5.26	
	12.5	469.9875	High	43.16	20.70	For Part 90
			Low	37.04	5.06	
Analog	12.5	400.0125	High	42.28	16.90	Federal
			Low	36.85	4.84	
	12.5	453.2125	High	42.16	16.44	For Part 90
			Low	36.74	4.72	
	12.5	454.0125	High	42.12	16.29	For Part 22
			Low	36.80	4.79	
	12.5	455.0125	High	42.13	16.33	For Part 74
			Low	36.83	4.82	
	12.5	469.9875	High	42.21	16.63	For Part 90
			Low	36.79	4.78	
	25	454.0125	High	42.28	16.90	For Part 22
			Low	36.84	4.83	
	25	455.0125	High	42.10	16.22	For Part 74
			Low	36.87	4.86	
	25	456.0125	High	42.04	16.00	For Part 80
			Low	36.78	4.76	

FCC §2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

FCC§2.1047, §74.463, §80.213 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 2.2.3

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu on 2018-06-16.

Test Mode: Transmitting

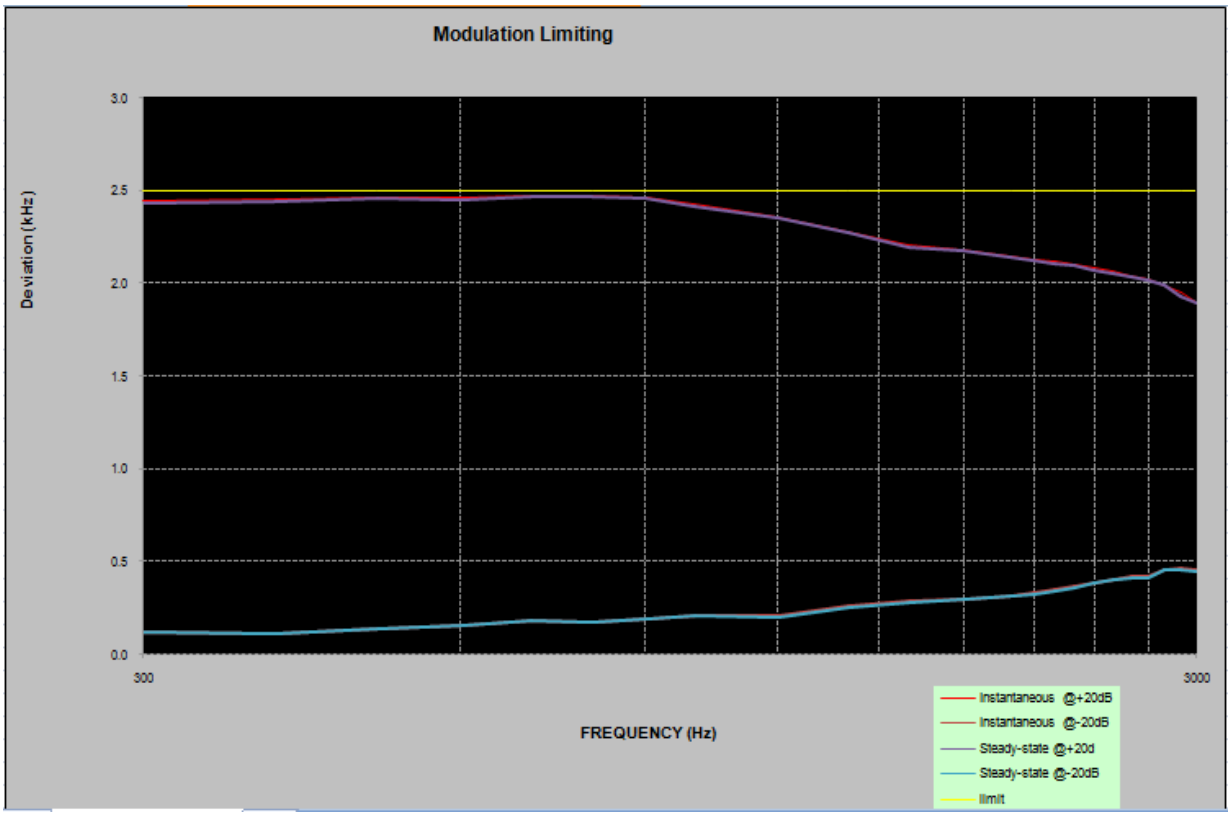
Result: Compliance.

Analog Modulation:

MODULATION LIMITING

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

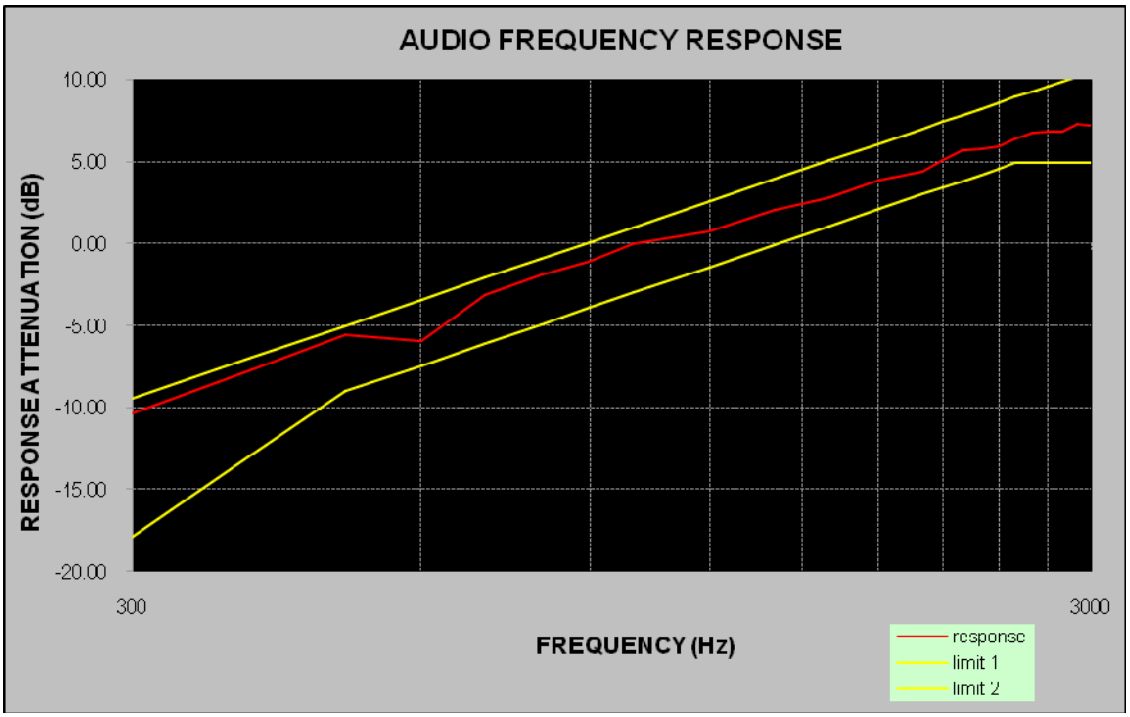
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	2.447	0.122	2.435	0.118	2.5
400	2.456	0.113	2.442	0.111	2.5
500	2.465	0.142	2.457	0.136	2.5
600	2.462	0.160	2.449	0.156	2.5
700	2.471	0.184	2.470	0.179	2.5
800	2.476	0.173	2.471	0.173	2.5
900	2.465	0.195	2.459	0.188	2.5
1000	2.429	0.212	2.417	0.212	2.5
1200	2.361	0.207	2.356	0.201	2.5
1400	2.277	0.262	2.274	0.258	2.5
1600	2.211	0.286	2.199	0.278	2.5
1800	2.180	0.301	2.176	0.301	2.5
2000	2.151	0.319	2.142	0.319	2.5
2100	2.131	0.330	2.127	0.324	2.5
2200	2.119	0.348	2.105	0.344	2.5
2300	2.102	0.365	2.095	0.359	2.5
2400	2.083	0.389	2.073	0.385	2.5
2500	2.063	0.406	2.050	0.400	2.5
2600	2.044	0.418	2.037	0.413	2.5
2700	2.023	0.422	2.021	0.416	2.5
2800	1.990	0.458	1.989	0.456	2.5
2900	1.949	0.463	1.934	0.459	2.5
3000	1.902	0.456	1.896	0.452	2.5


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

Audio Frequency Response

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

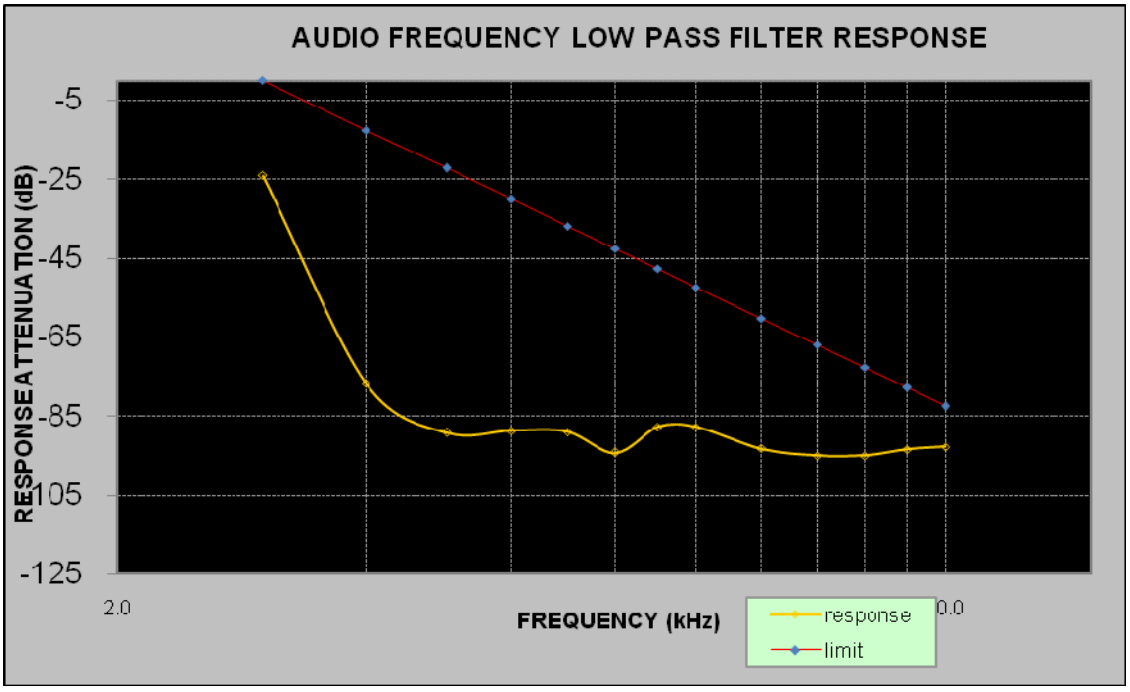
Audio Frequency (Hz)	Response Attenuation (dB)
300	-10.32
400	-7.67
500	-5.59
600	-5.90
700	-3.09
800	-1.93
900	-1.09
1000	0.00
1200	0.75
1400	2.08
1600	2.81
1800	3.85
2000	4.42
2100	5.07
2200	5.66
2300	5.79
2400	5.91
2500	6.36
2600	6.78
2700	6.84
2800	6.85
2900	7.31
3000	7.22


AUDIO FREQUENCY RESPONSE
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
RESPONSE ATTENUATION (dB)
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

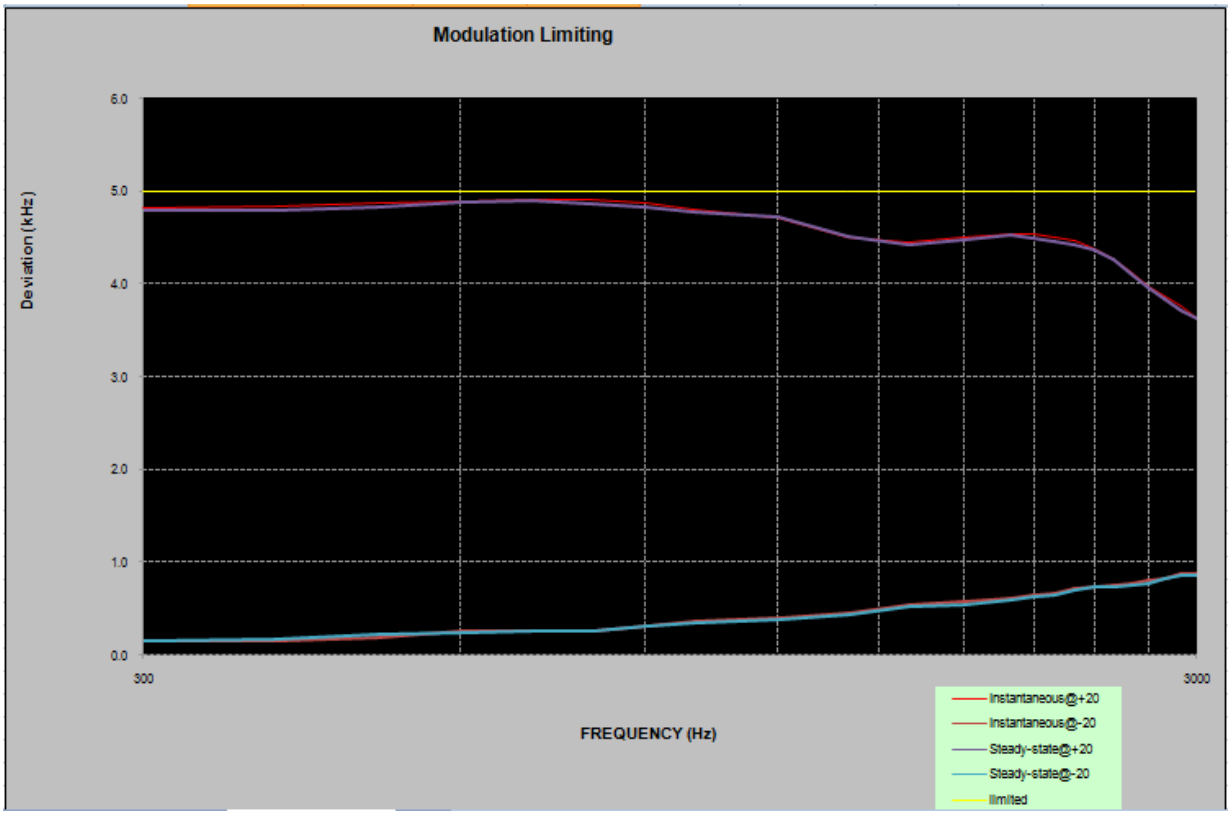
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-24.0	0.0
4.0	-76.8	-12.5
5.0	-89.2	-22.2
6.0	-88.6	-30.1
7.0	-88.9	-36.8
8.0	-94.2	-42.6
9.0	-87.8	-47.7
10.0	-87.7	-52.3
12.0	-93.2	-60.2
14.0	-94.9	-66.9
16.0	-94.9	-72.7
18.0	-93.4	-77.8
20.0	-92.8	-82.5



MODULATION LIMITING

Carrier Frequency: 454.0125 MHz, Channel Separation=25 kHz

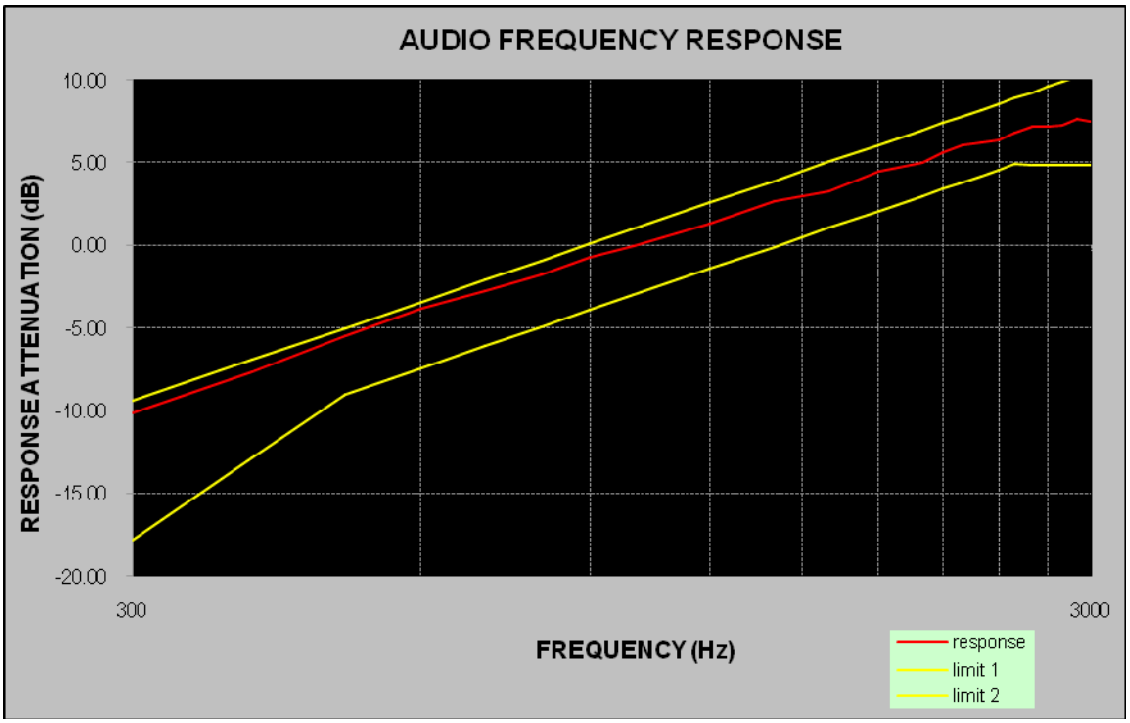
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	4.826	0.157	4.799	0.148	5
400	4.834	0.162	4.790	0.173	5
500	4.876	0.185	4.837	0.219	5
600	4.895	0.254	4.877	0.240	5
700	4.904	0.273	4.903	0.269	5
800	4.911	0.268	4.872	0.267	5
900	4.867	0.315	4.827	0.309	5
1000	4.805	0.361	4.784	0.354	5
1200	4.722	0.398	4.719	0.391	5
1400	4.513	0.456	4.506	0.439	5
1600	4.454	0.537	4.431	0.522	5
1800	4.506	0.581	4.471	0.549	5
2000	4.543	0.616	4.525	0.589	5
2100	4.538	0.643	4.500	0.626	5
2200	4.510	0.668	4.461	0.643	5
2300	4.469	0.711	4.430	0.694	5
2400	4.382	0.743	4.378	0.736	5
2500	4.267	0.758	4.261	0.737	5
2600	4.128	0.772	4.115	0.760	5
2700	3.982	0.801	3.968	0.769	5
2800	3.874	0.827	3.847	0.819	5
2900	3.765	0.879	3.718	0.865	5
3000	3.648	0.882	3.623	0.857	5


Modulation Limiting
Deviation (kHz)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
300
3000
FREQUENCY (Hz)
Instantaneous@+20
Instantaneous@-20
Steady-state@+20
Steady-state@-20
limited

Audio Frequency Response

Carrier Frequency: 454.0125 MHz, Channel Separation=25 kHz

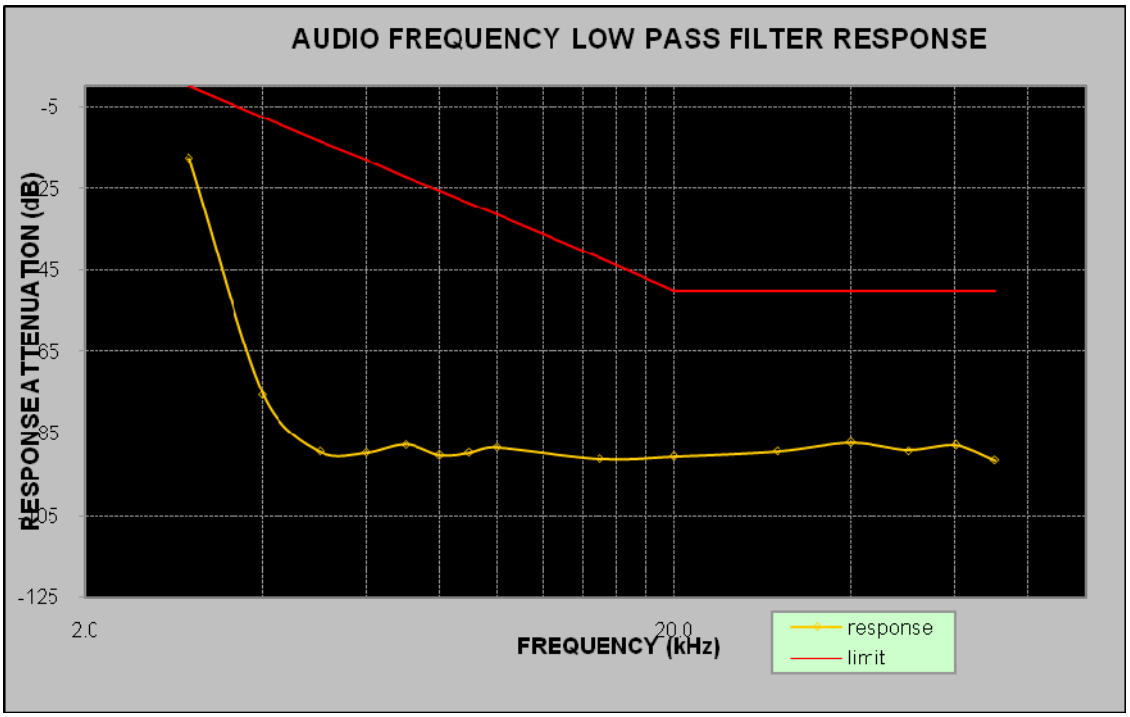
Audio Frequency (Hz)	Response Attenuation (dB)
300	-10.12
400	-7.62
500	-5.45
600	-3.78
700	-2.75
800	-1.77
900	-0.71
1000	0.00
1200	1.34
1400	2.65
1600	3.25
1800	4.46
2000	5.03
2100	5.60
2200	6.09
2300	6.23
2400	6.38
2500	6.82
2600	7.17
2700	7.18
2800	7.25
2900	7.64
3000	7.54


AUDIO FREQUENCY RESPONSE
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
RESPONSE ATTENUATION (dB)
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 454.0125 MHz, Channel Separation=25 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-17.6	0.0
4.0	-75.5	-7.5
5.0	-89.3	-13.3
6.0	-89.6	-18.1
7.0	-87.6	-22.1
8.0	-90.3	-25.6
9.0	-89.6	-28.6
10.0	-88.4	-31.4
15.0	-91.1	-41.9
20.0	-90.6	-50.0
30.0	-89.3	-50.0
40.0	-87.2	-50.0
50.0	-89.1	-50.0
60.0	-87.8	-50.0
70.0	-91.4	-50.0



FCC §2.1049 & §22.357 & § 22.731 & §74.462 & § 80.205 & § 80.207 & §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049, §22.357, § 22.731, §74.462, § 80.205, § 80.207, §90.209 and §90.210

Test Procedure

The test was performed in according to ANSI/TIA-603-D Section 2.2.11.2.

Test Data

Environmental Conditions

Temperature:	24~25 ℃
Relative Humidity:	50~56 %
ATM Pressure:	100.9~101.0 kPa

The testing was performed by Tracy Hu from 2018-05-10 to 2018-06-22.

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)	Note
Analog	12.5	453.2125	High	9.94	10.34	For Part 90
	12.5		Low	9.94	10.34	
	12.5	454.0125	High	10.02	10.34	For Part 22
	12.5		Low	9.94	10.34	
	12.5	455.0125	High	9.94	10.34	For Part 74
	12.5		Low	9.94	10.34	
Digital	12.5	453.2125	High	7.45	9.05	For Part 90
	12.5		Low	7.37	9.54	
	12.5	454.0125	High	7.21	9.21	For Part 22
	12.5		Low	7.53	9.70	
	12.5	455.0125	High	7.21	9.54	For Part 74
	12.5		Low	7.21	9.21	

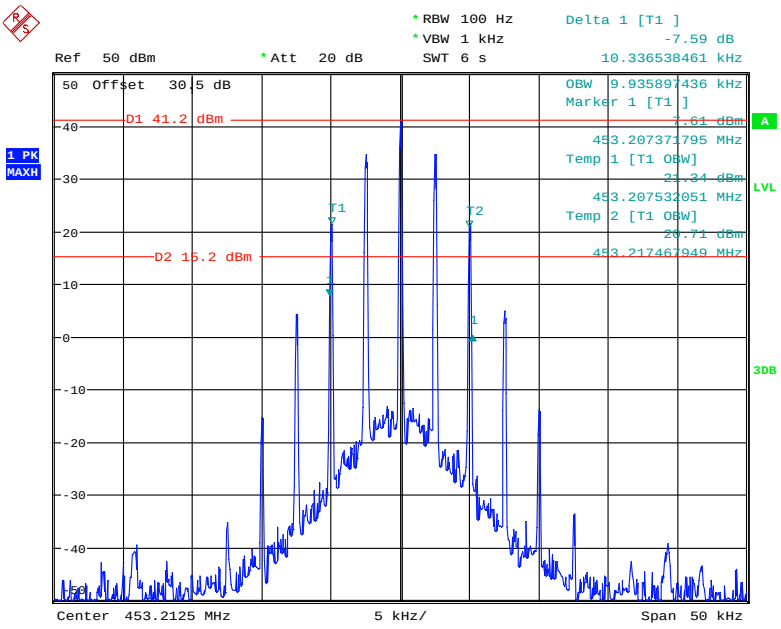
Emission designator is base on calculation instead of measurement
Emission Designator Per CFR 47 §2.201& §2.202&, Bn = 2M + 2D

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, 7.45 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.

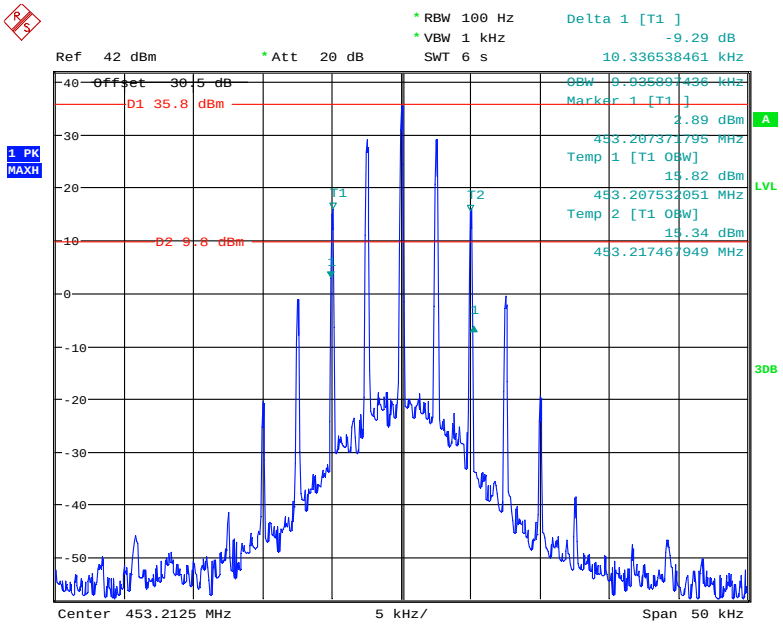
Analog Modulation:

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



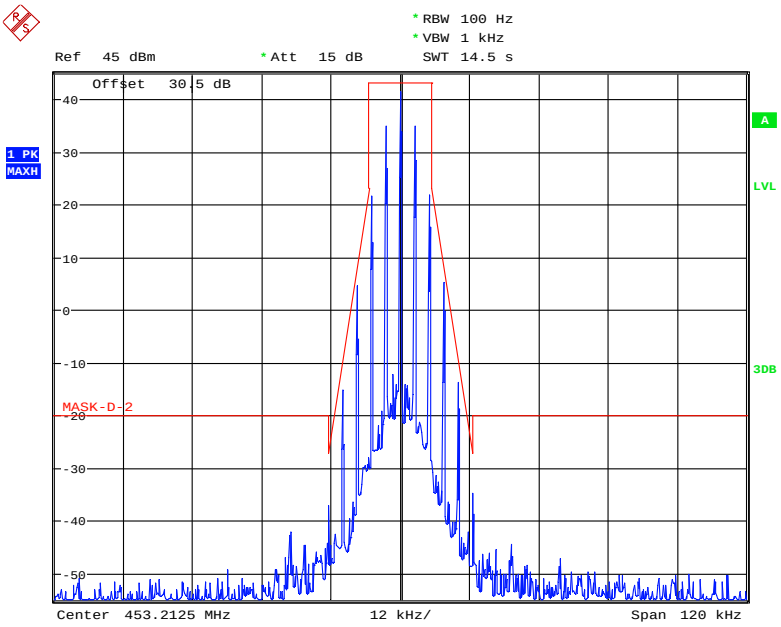
Date: 8.JUN.2018 20:27:42

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



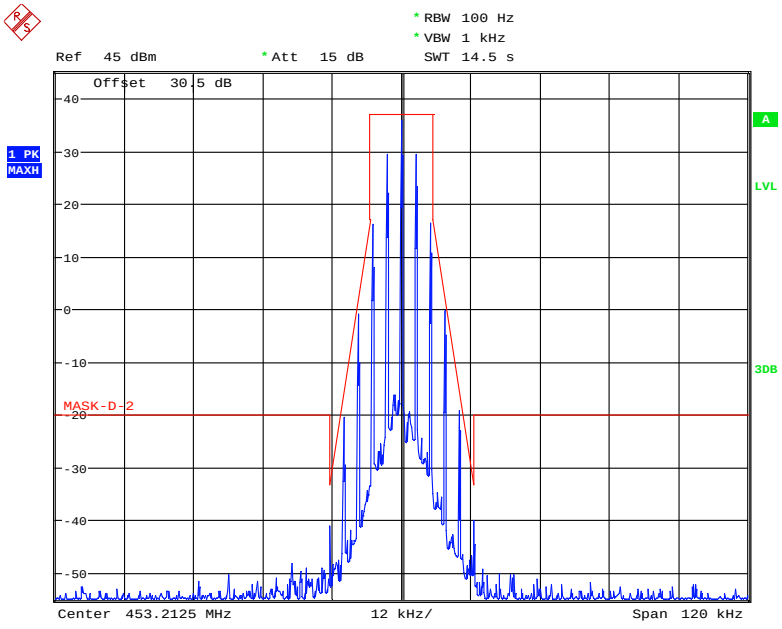
Date: 8.JUN.2018 20:41:51

Frequency 453.2125 MHz: Emission Mask D, High Power



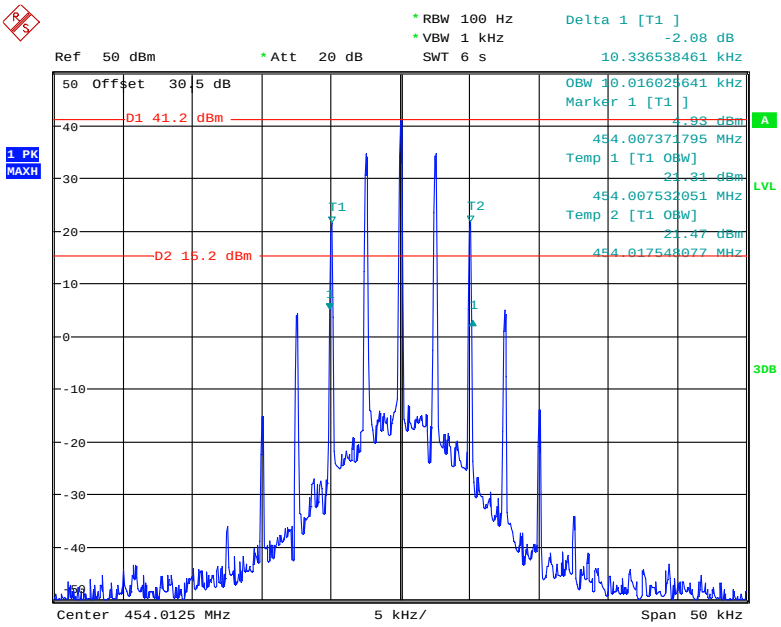
Date: 5.JUN.2018 01:42:57

Frequency 453.2125 MHz: Emission Mask D, Low Power



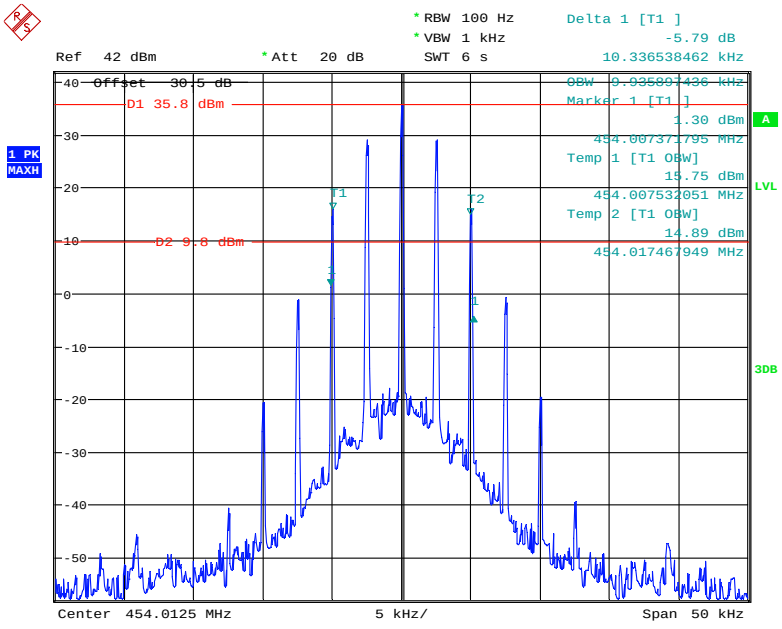
Date: 5.JUN.2018 01:44:49

Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



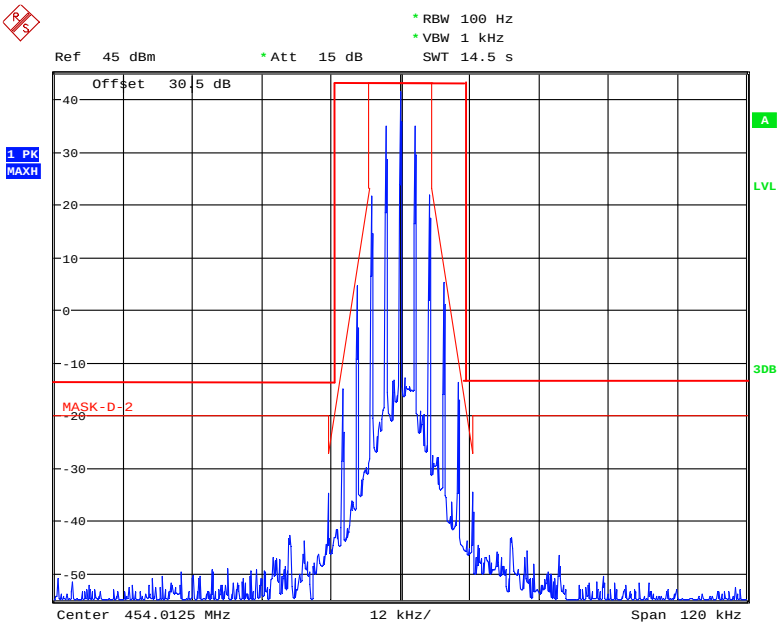
Date: 8.JUN.2018 20:24:30

Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



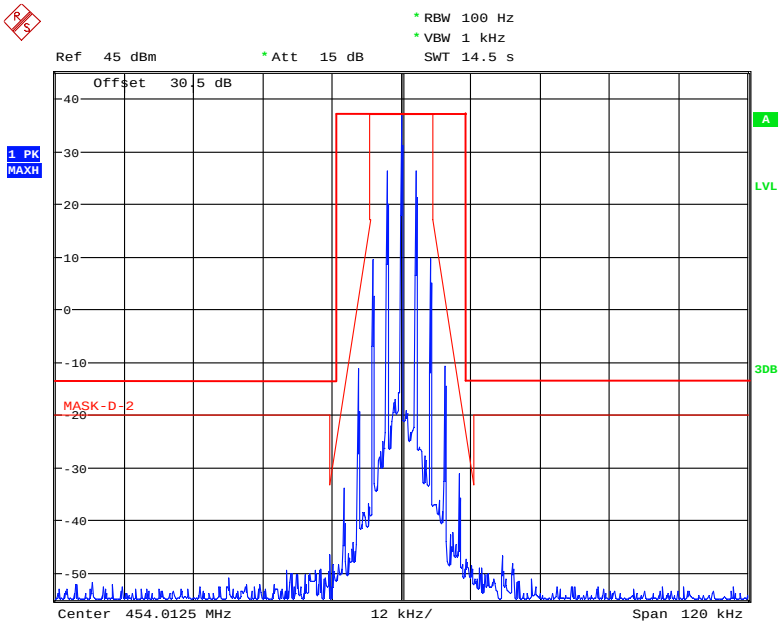
Date: 8.JUN.2018 20:39:33

Frequency 454.0125 MHz: Emission Mask, High Power, FCC part 22.359



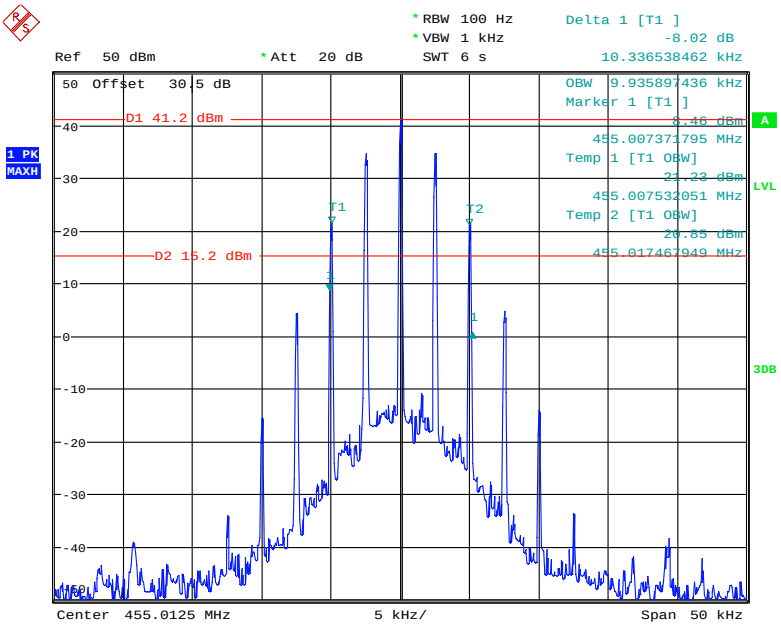
Date: 5.JUN.2018 01:39:37

Frequency 454.0125 MHz: Emission Mask, Low Power, FCC part 22.359



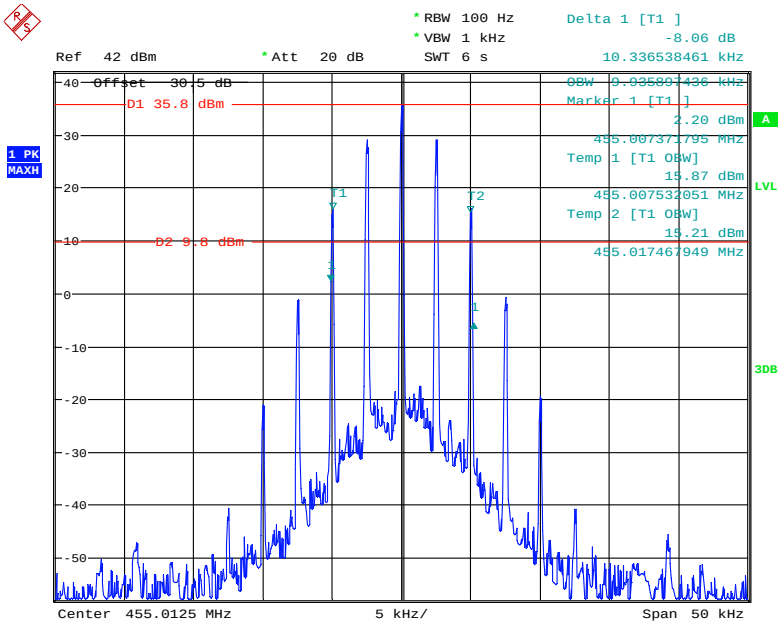
Date: 5.JUN.2018 01:37:10

Frequency 455.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



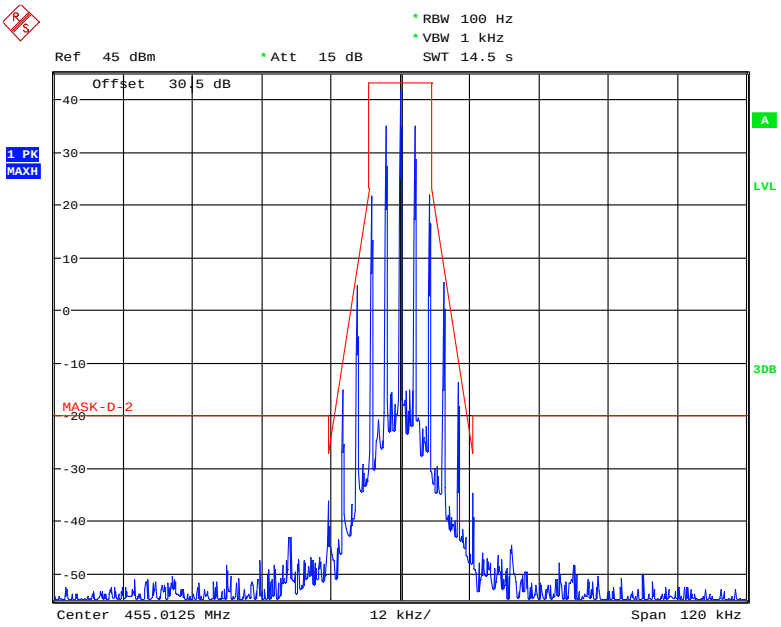
Date: 8.JUN.2018 20:30:07

Frequency 455.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



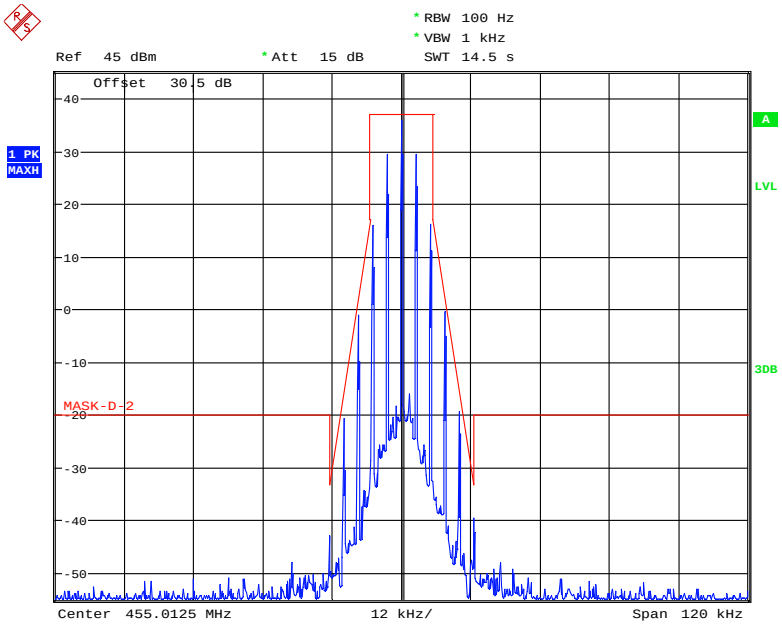
Date: 8.JUN.2018 20:36:15

Frequency 455.0125 MHz: Emission Mask D, High Power



Date: 5.JUN.2018 01:40:58

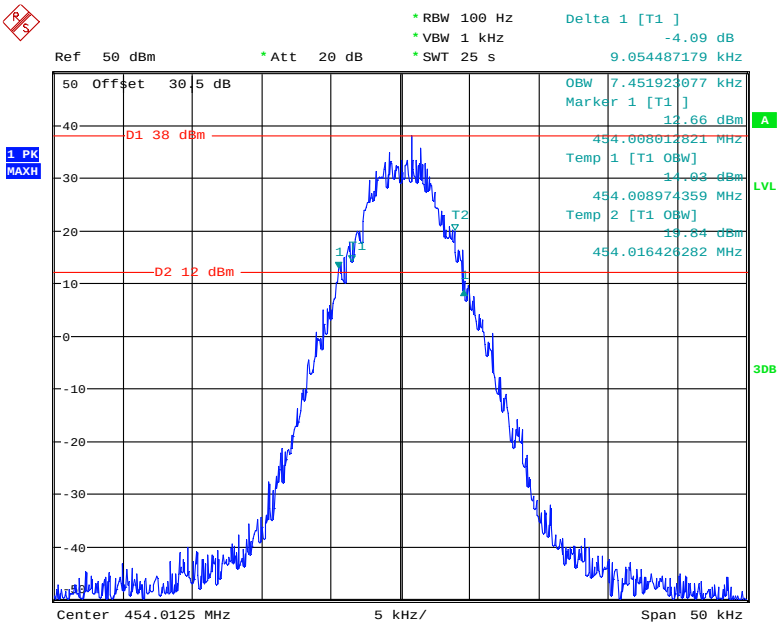
Frequency 455.0125 MHz: Emission Mask D, Low Power



Date: 5.JUN.2018 01:35:03

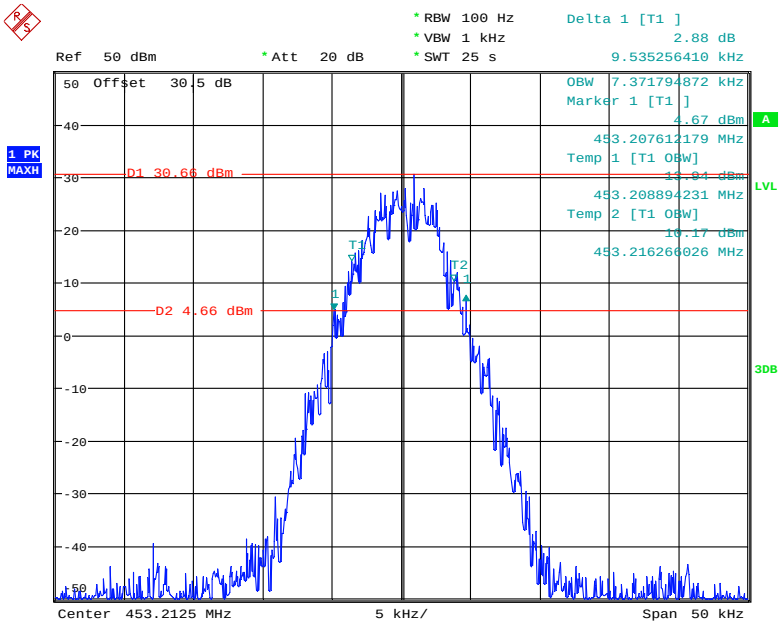
Digital Modulation:

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



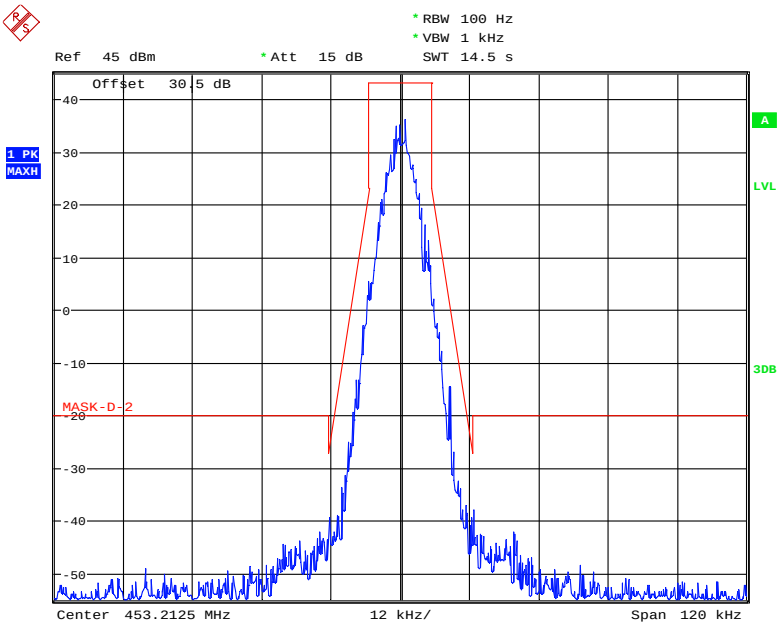
Date: 22.JUN.2018 15:22:13

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



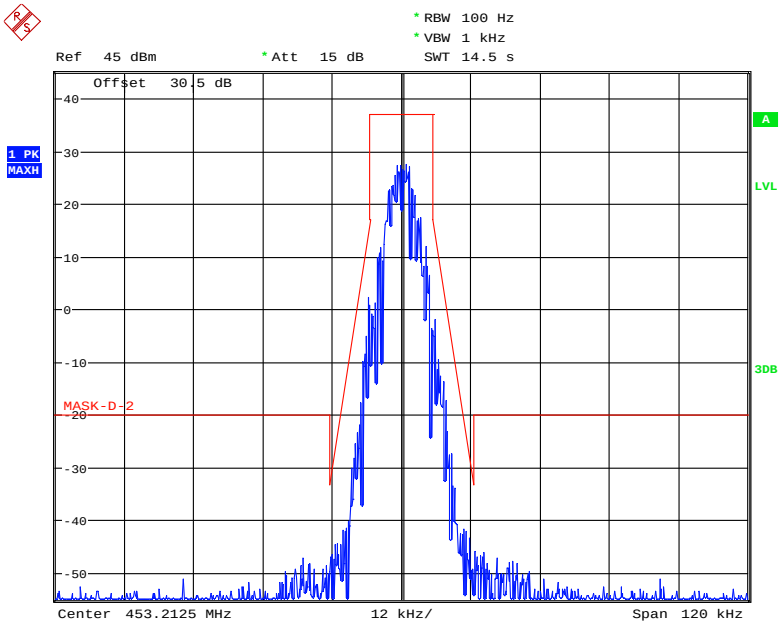
Date: 10.MAY.2018 23:11:50

Frequency 453.2125 MHz: Emission Mask D, High Power



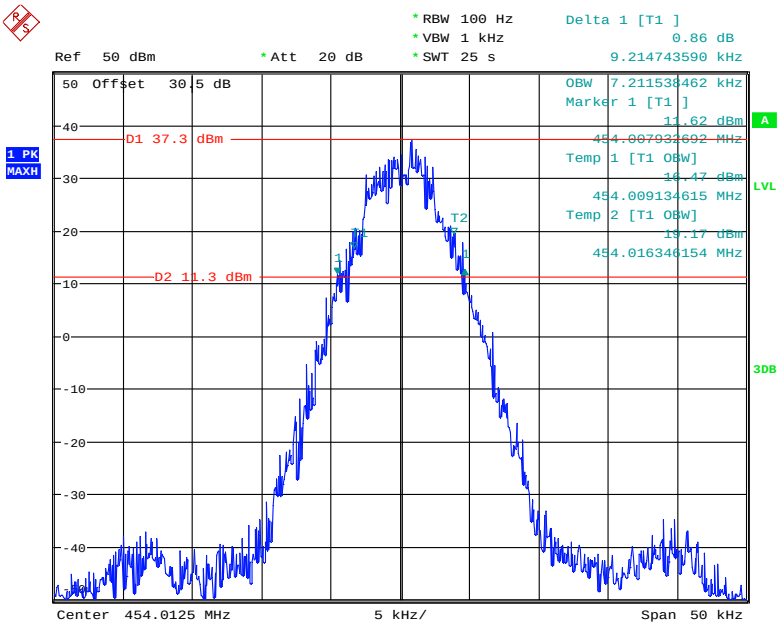
Date: 5.JUN.2018 01:57:58

Frequency 453.2125 MHz: Emission Mask D, Low Power



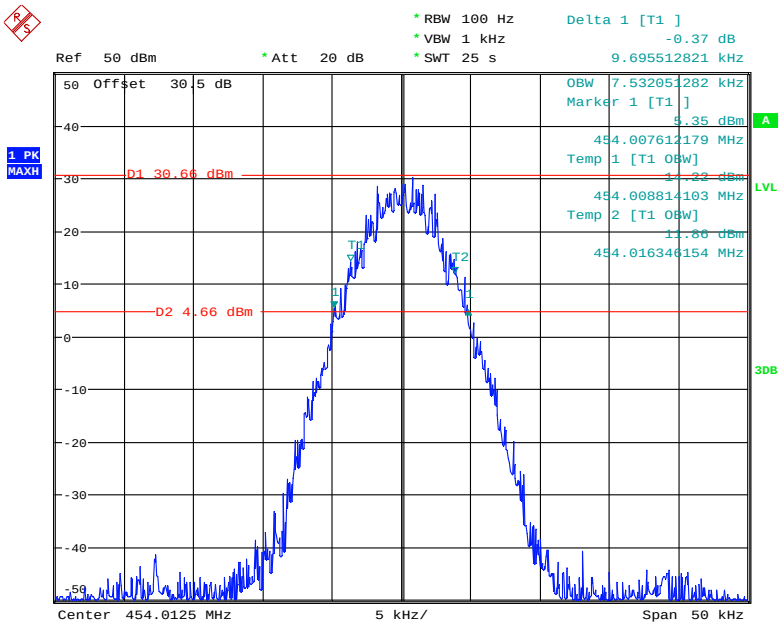
Date: 5.JUN.2018 02:00:20

Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



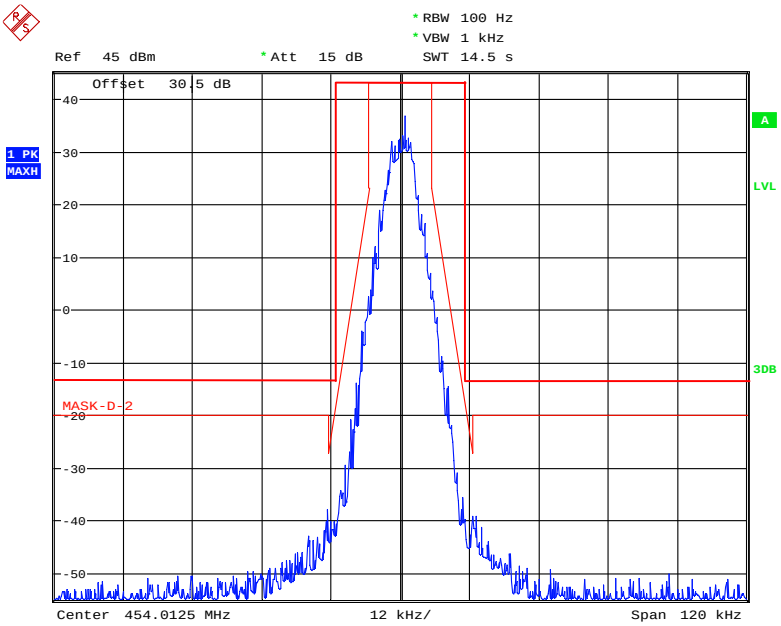
Date: 10.MAY.2018 23:20:23

Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



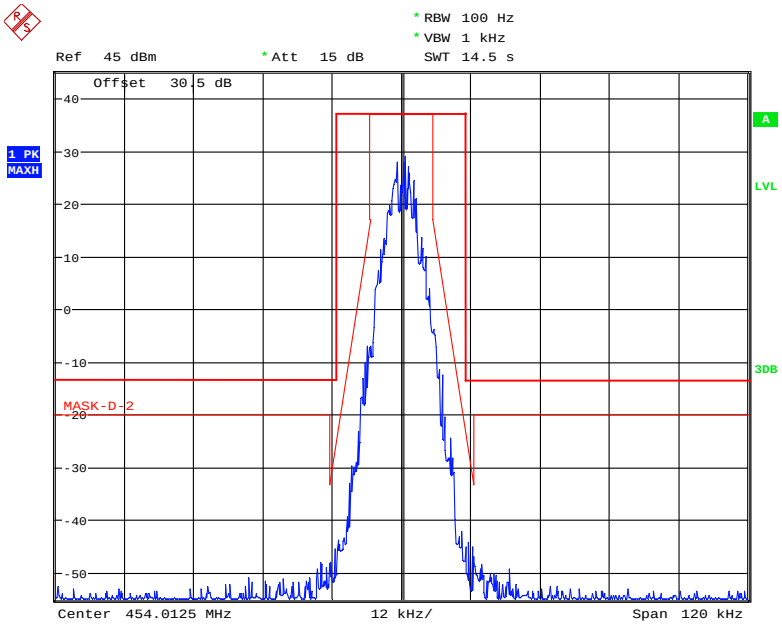
Date: 10.MAY.2018 23:16:35

Frequency 454.0125 MHz: Emission Mask, High Power, FCC part 22.359



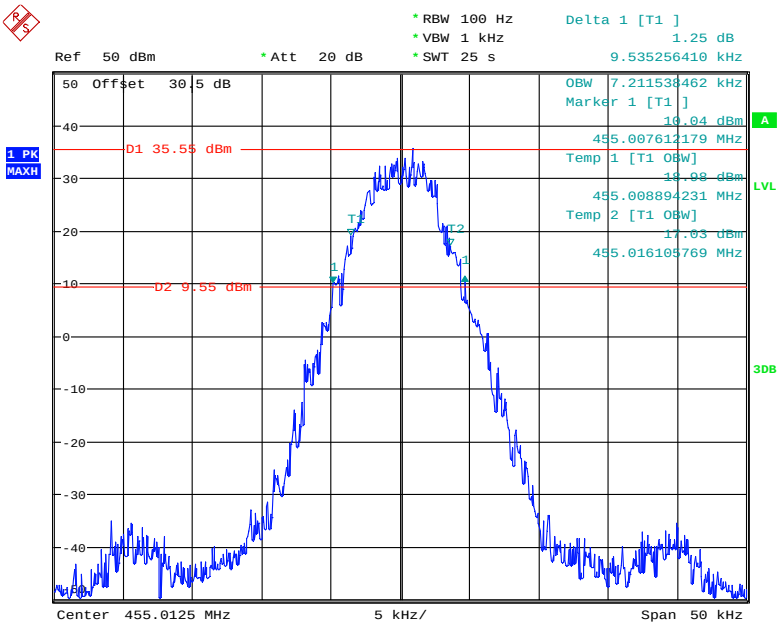
Date: 5.JUN.2018 23:34:08

Frequency 454.0125 MHz: Emission Mask, Low Power, FCC part 22.359



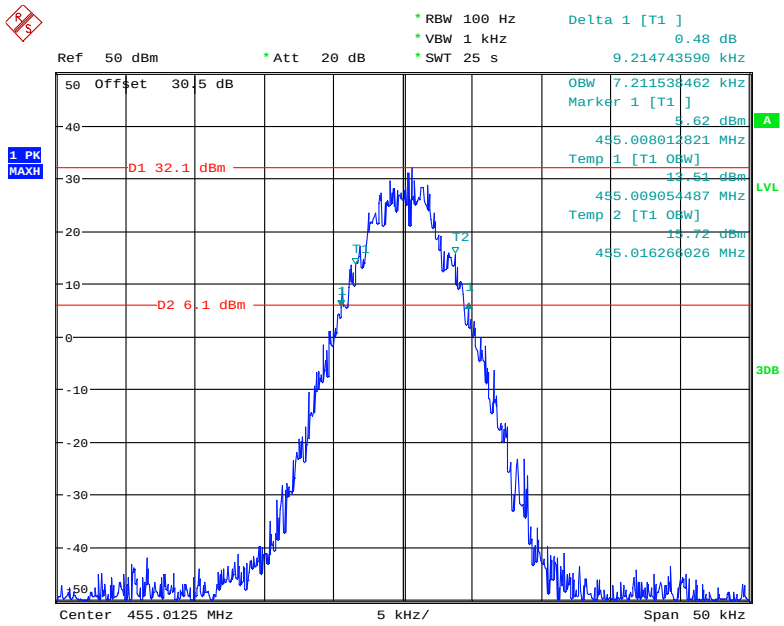
Date: 5.JUN.2018 23:26:01

Frequency 455.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



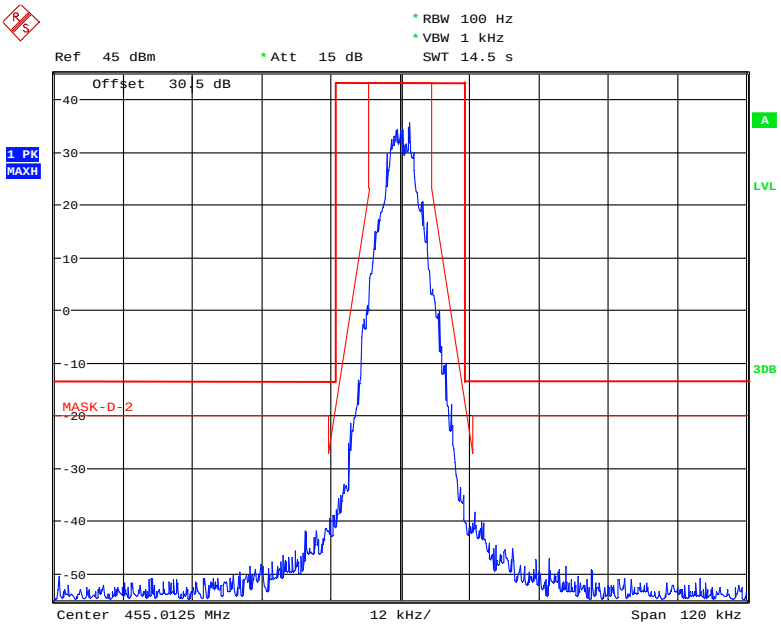
Date: 10.MAY.2018 23:27:34

Frequency 455.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



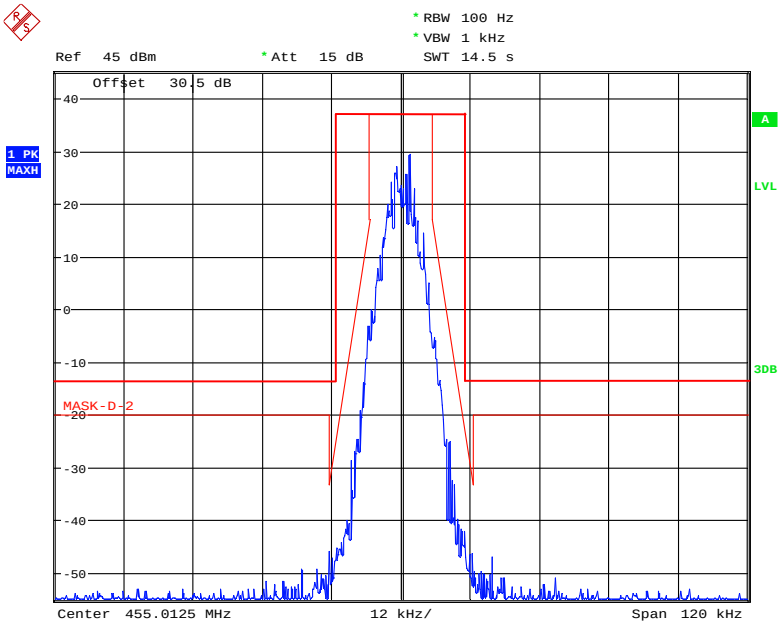
Date: 10.MAY.2018 23:24:17

Frequency 455.0125 MHz: Emission Mask D, High Power



Date: 5.JUN.2018 23:45:41

Frequency 455.0125 MHz: Emission Mask D, Low Power



Date: 5.JUN.2018 23:47:56

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)	Note
Analog	25	454.0125	High	14.98	15.63	For Part 22
	25		Low	14.98	15.63	
	25	455.0125	High	14.98	15.63	For Part 74
	25		Low	14.98	15.63	
	25	456.0125	High	14.90	15.63	For Part 80
	25		Low	14.90	15.63	

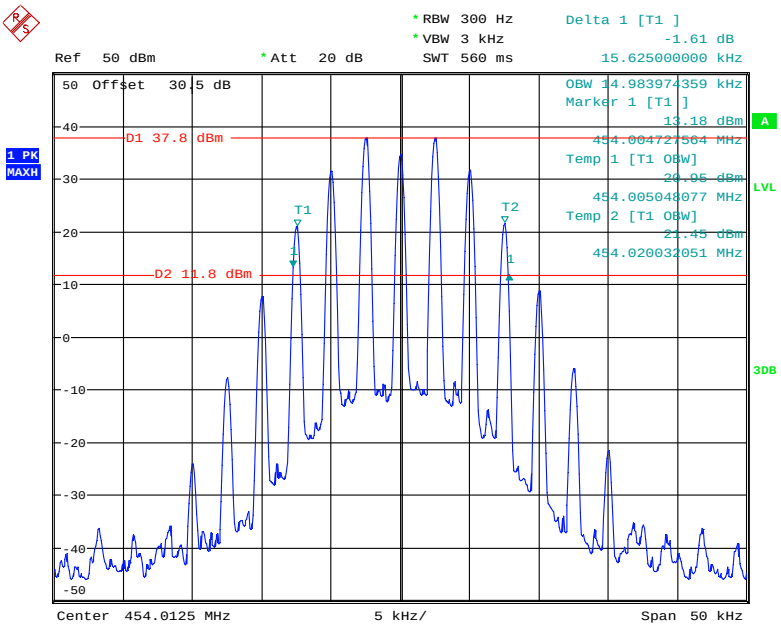
Emission designator is base on calculation instead of measurement
Emission Designator Per CFR 47 §2.201& §2.202&, Bn = 2M + 2D

For FM Mode (Channel Spacing: 25 kHz)

Emission Designator 16K0F3E In this case, the maximum modulating frequency is 5.0 kHz with a 3 kHz deviation. BW = 2(M+D) = 2(5 kHz + 3 kHz) = 16 kHz → 16K0*
F3E portion of the designator represents an FM voice transmission Therefore, the entire designator for 25 kHz channel spacing FM mode is 16K0F3E.

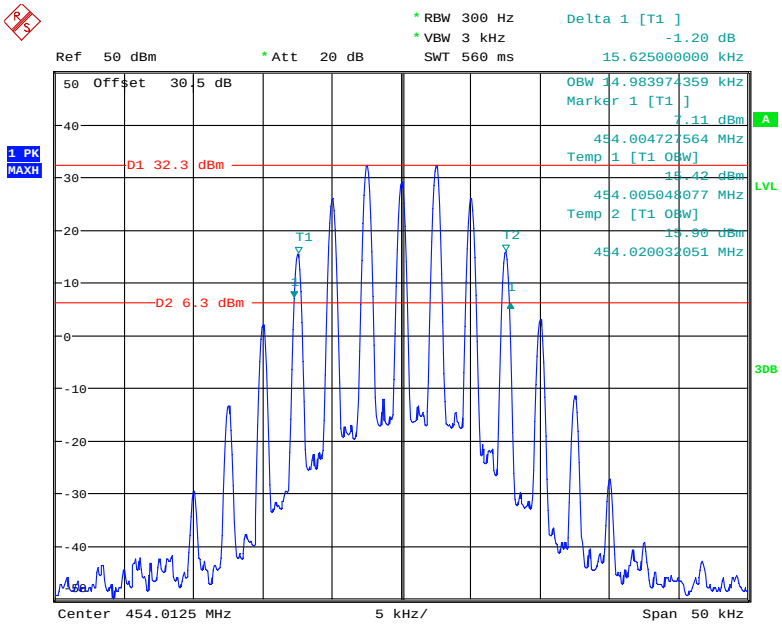
Analog Modulation

Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



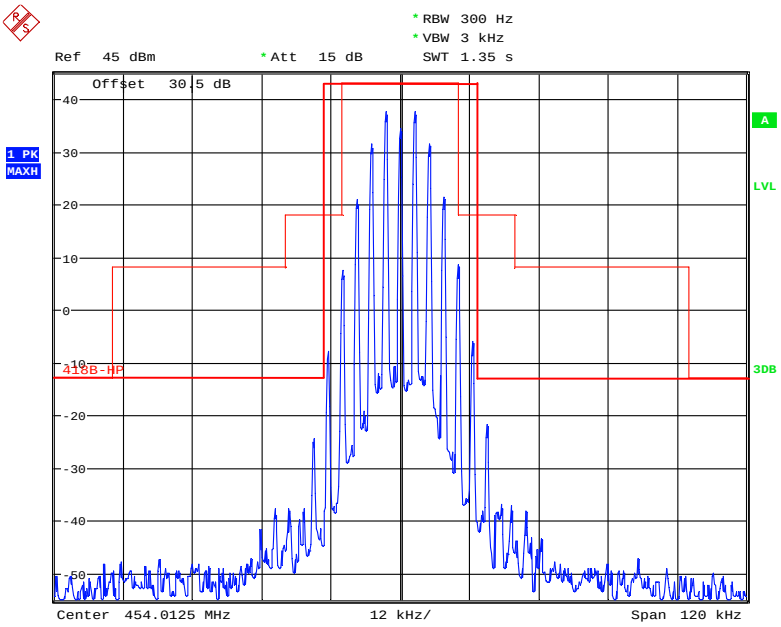
Date: 1.JUN.2018 22:59:46

Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



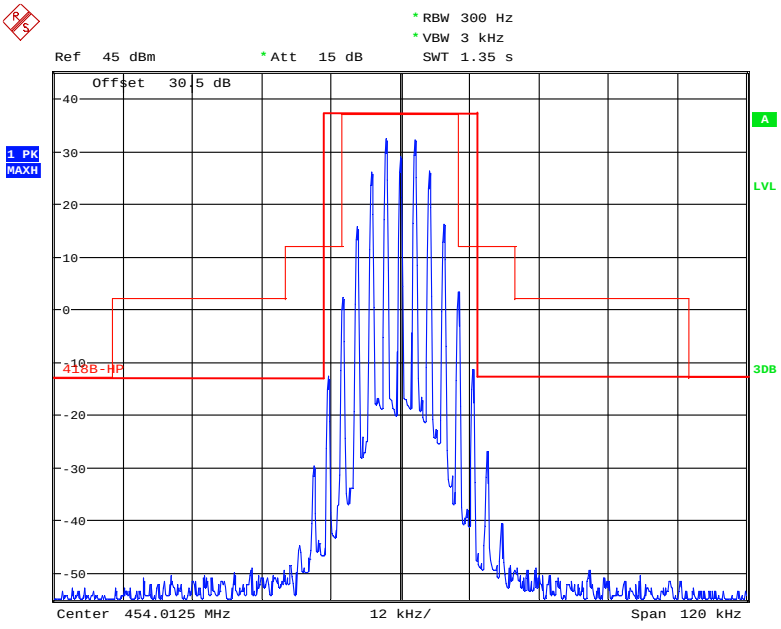
Date: 1.JUN.2018 22:58:10

Frequency 454.0125 MHz: Emission Mask, PART 22.359, High Power



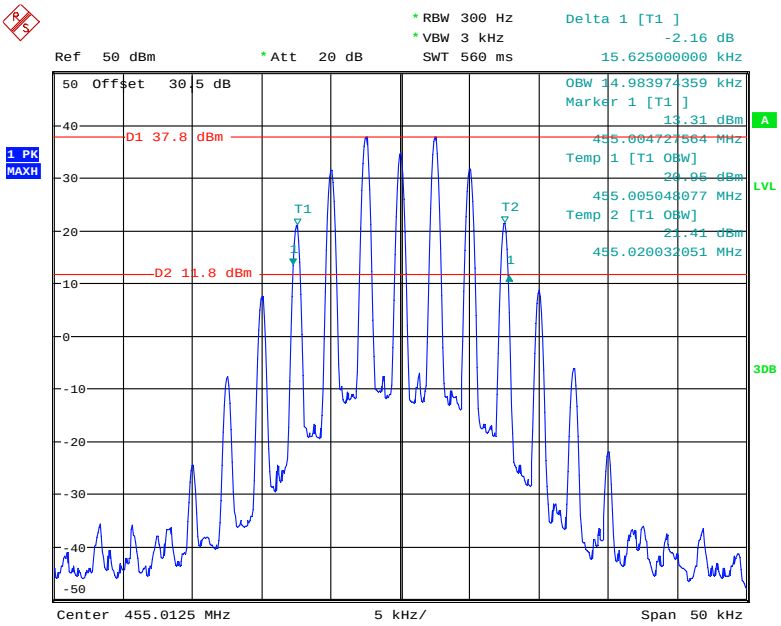
Date: 2.JUN.2018 01:46:48

Frequency 454.0125 MHz: Emission Mask B, PART 22.359, Low Power



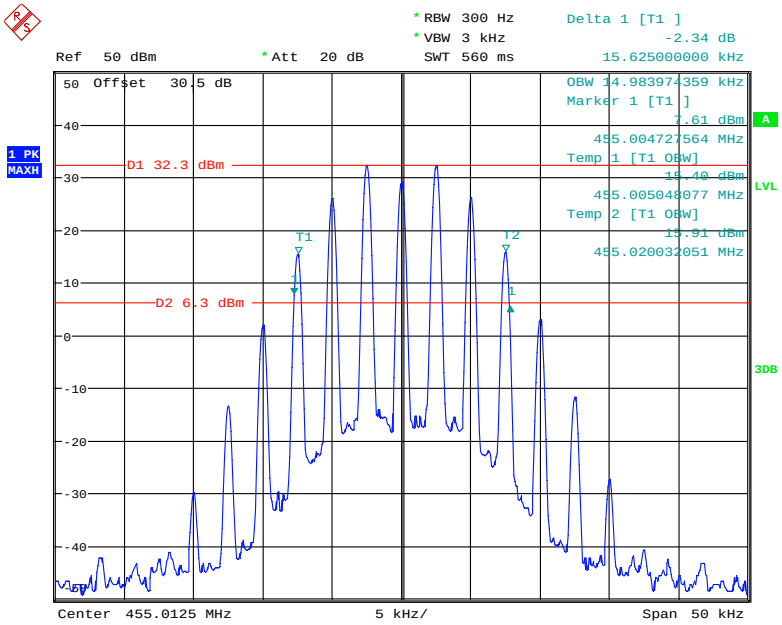
Date: 6.JUN.2018 01:17:31

Frequency 455.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



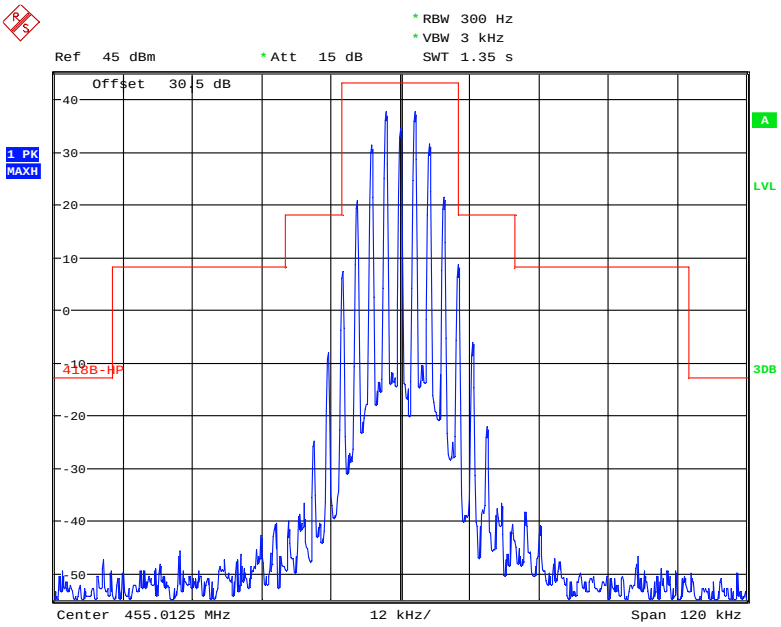
Date: 1.JUN.2018 22:55:29

Frequency 455.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



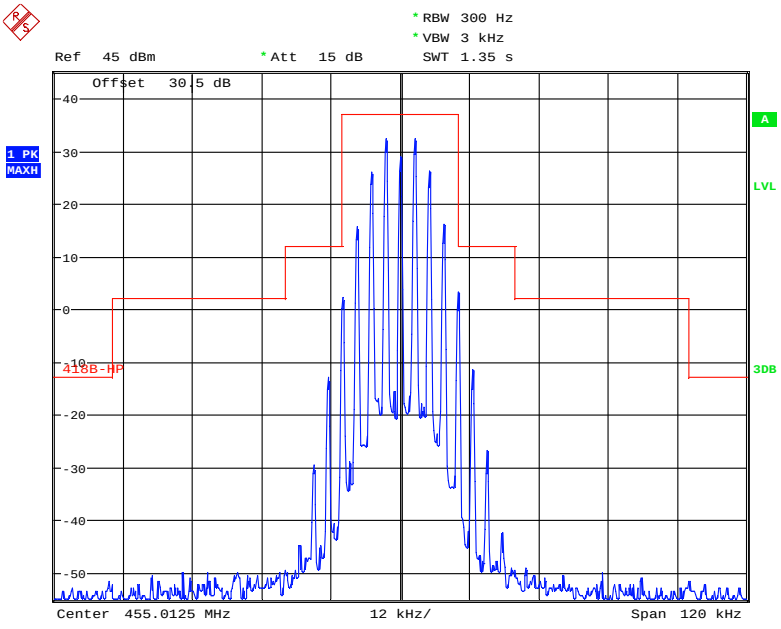
Date: 1.JUN.2018 22:56:51

Frequency 455.0125 MHz: Emission Mask B, High Power



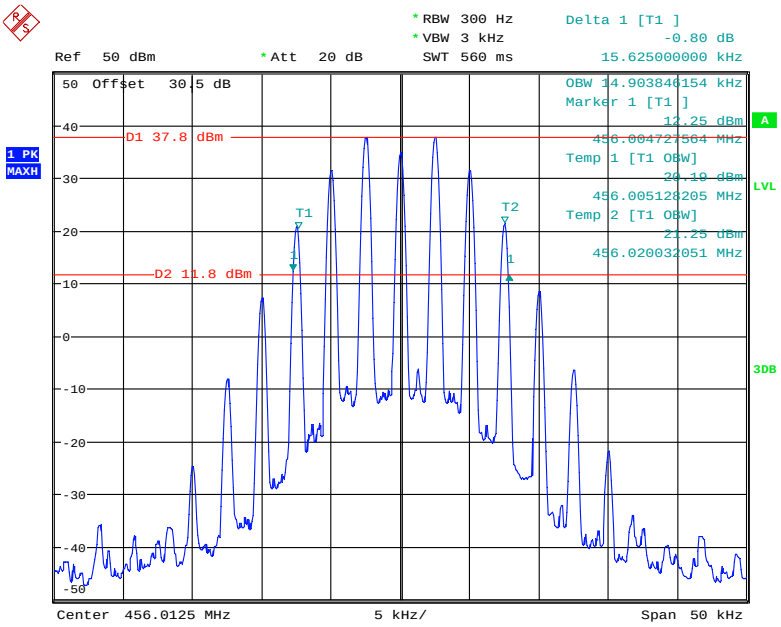
Date: 2.JUN.2018 01:50:00

Frequency 455.0125 MHz: Emission Mask B, Low Power



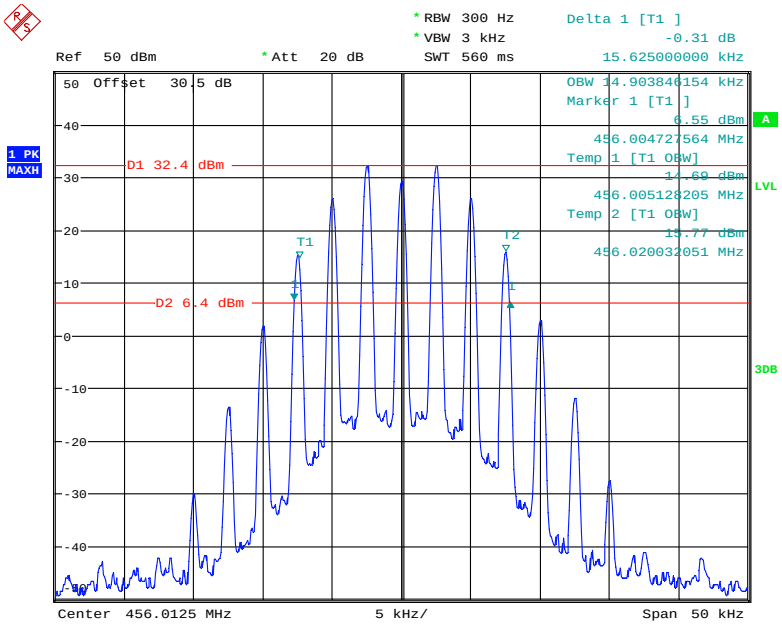
Date: 6.JUN.2018 01:13:31

Frequency 456.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



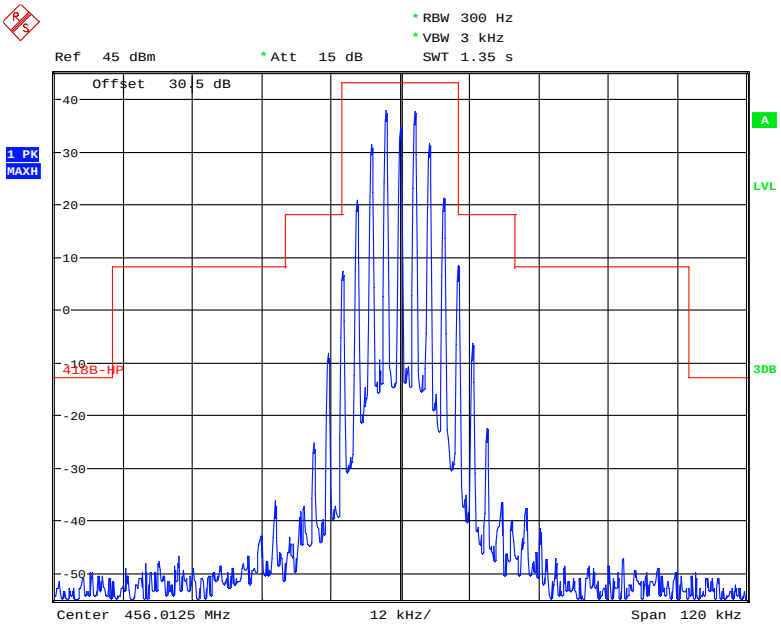
Date: 1.JUN.2018 23:01:04

Frequency 456.0125MHz: 99% Occupied & 26 dB Bandwidth, Low Power



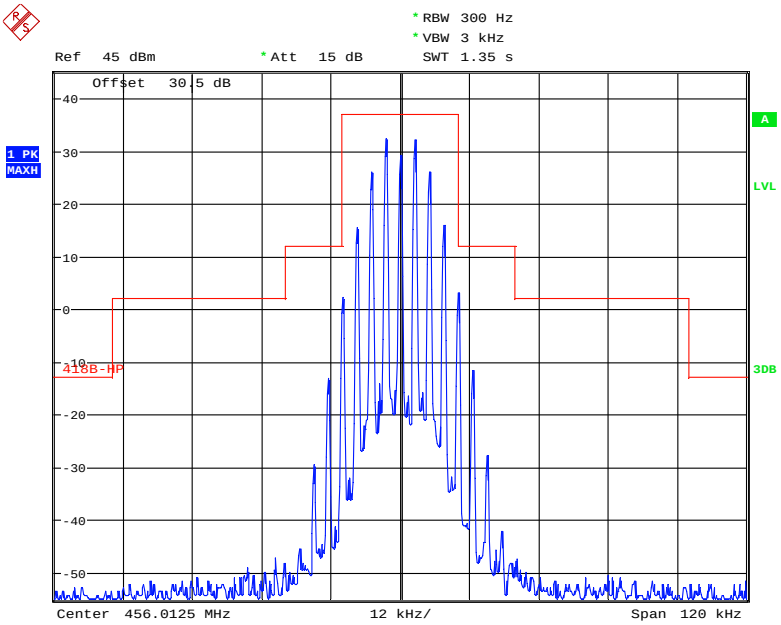
Date: 1.JUN.2018 23:02:39

Frequency456.0125 MHz: Emission Mask, FCC part 80.211(f), High Power



Date: 2.JUN.2018 01:54:06

Frequency 456.0125 MHz: Emission Mask, FCC part 80.211(f), Low Power



Date: 6.JUN.2018 01:10:41

FCC §2.1051 & §22.861 & §74.462 & § 80.211 & §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.

Emission Mask B—25 kHz channel bandwidth equipment. For transmitters designed to operate with a 25 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

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

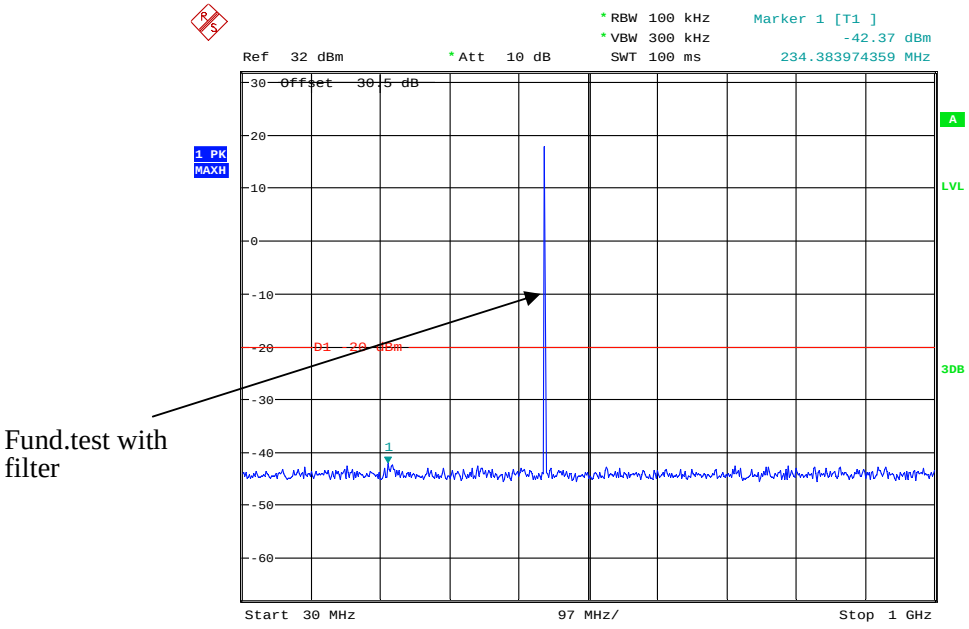
Temperature:	24 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu from 2018-05-10 to2018-06-06.

Test Mode: Transmitting, please refer to the following plots.
Note: All test was performed under the high power.

Analog Modulation:

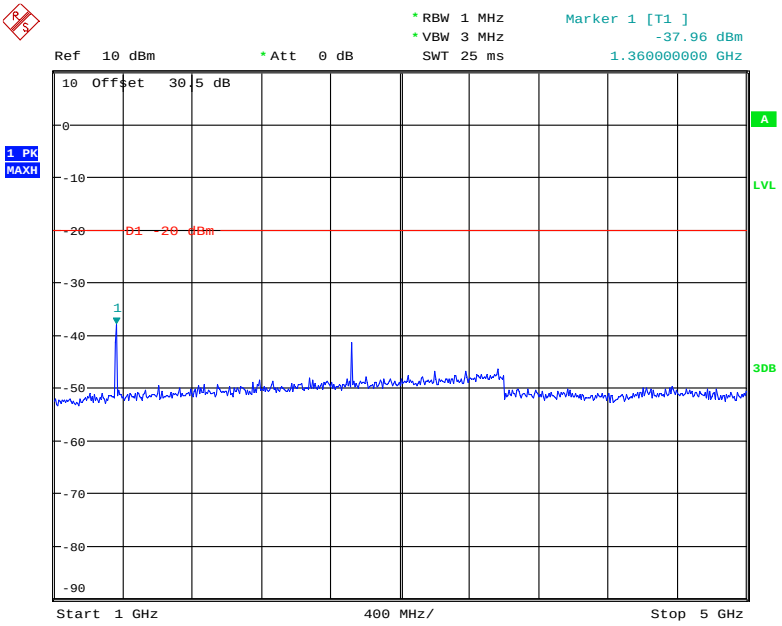
30MHz – 1 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz, For FCC part 90



Fund.test with filter

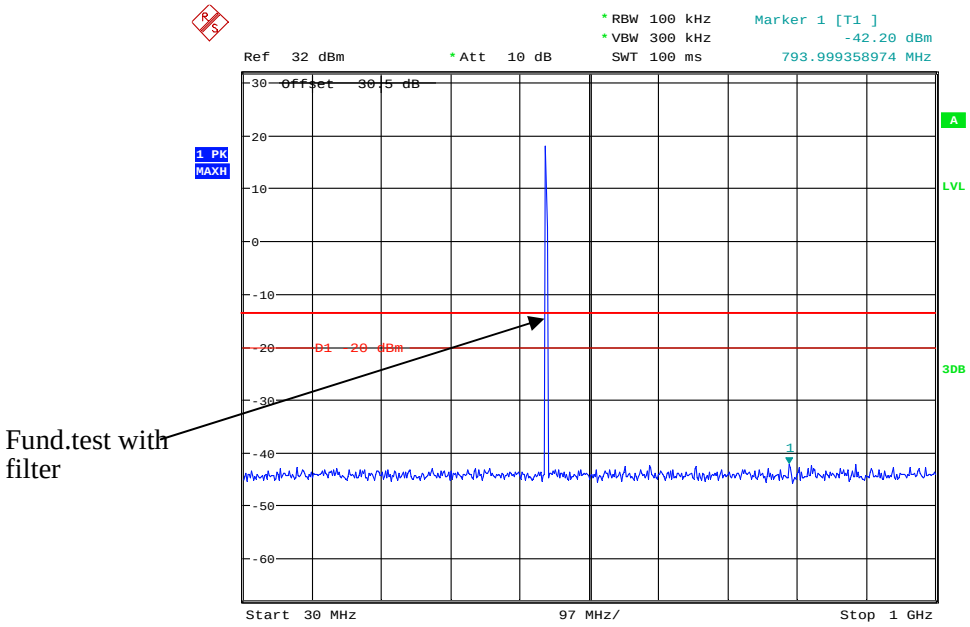
Date: 31.MAY.2018 21:56:43

1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz, For FCC part 90



Date: 31.MAY.2018 21:47:28

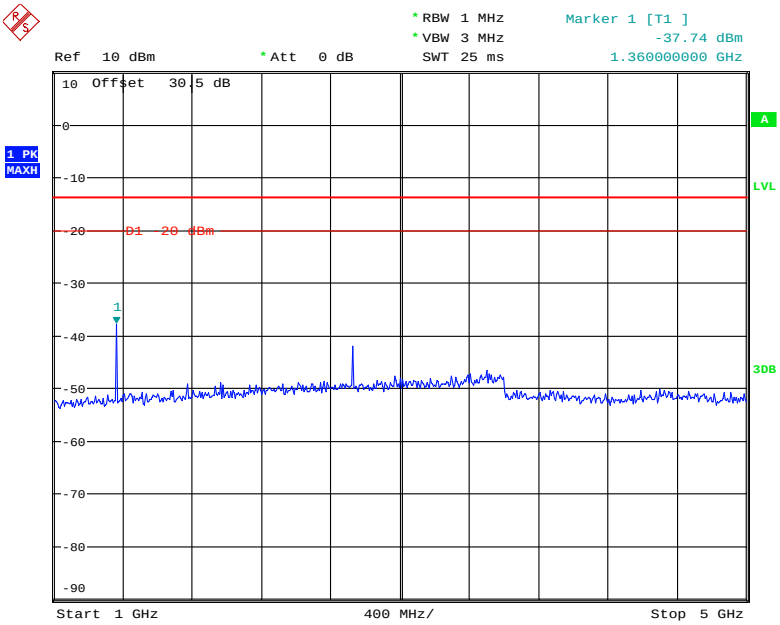
30MHz – 1 GHz, Channel Spacing 12.5 kHz, 454.0125 MHz, For FCC part 22



Fund.test with filter

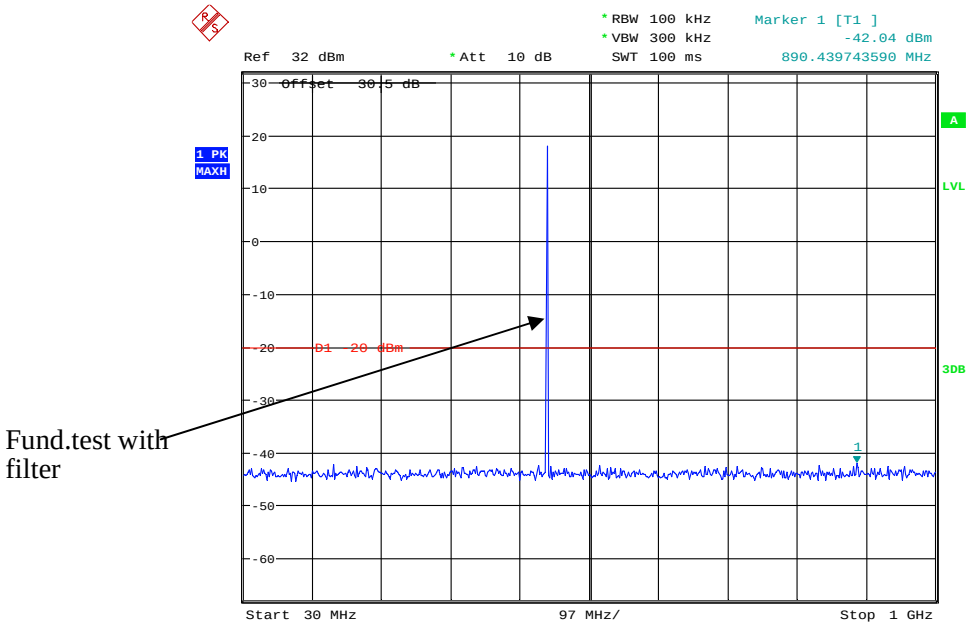
Date: 31.MAY.2018 21:55:58

1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 454.0125 MHz, For FCC part 22



Date: 31.MAY.2018 21:49:36

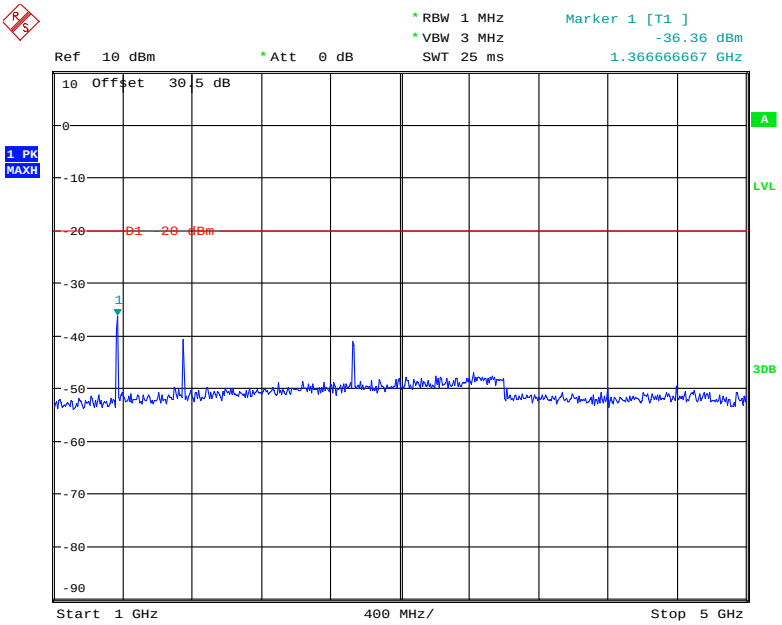
30MHz – 1 GHz, Channel Spacing 12.5 kHz, 455.0125 MHz, For FCC part 74



Fund.test with filter

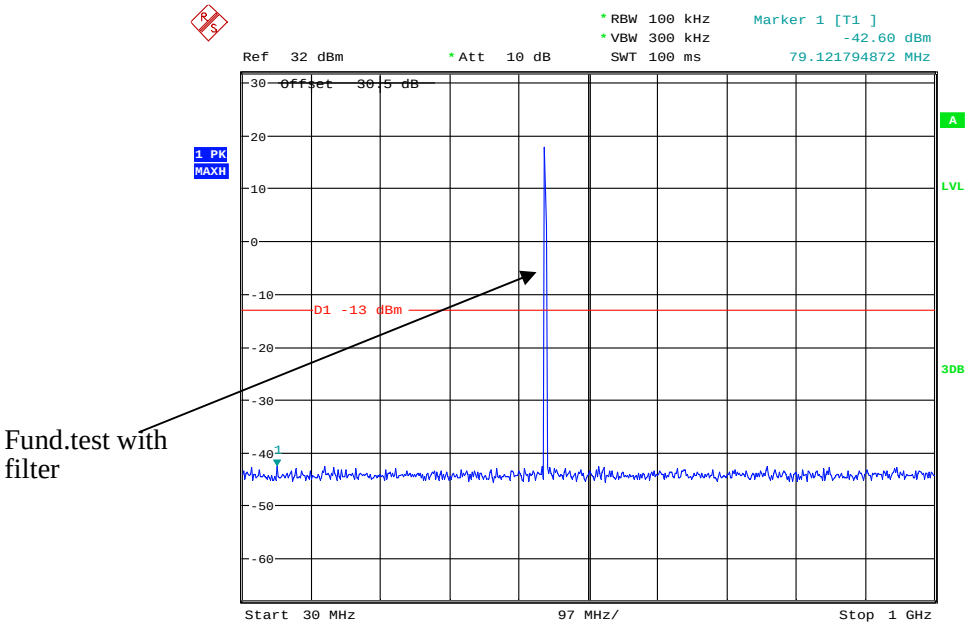
Date: 31.MAY.2018 21:54:11

1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 455.0125 MHz, For FCC part 74



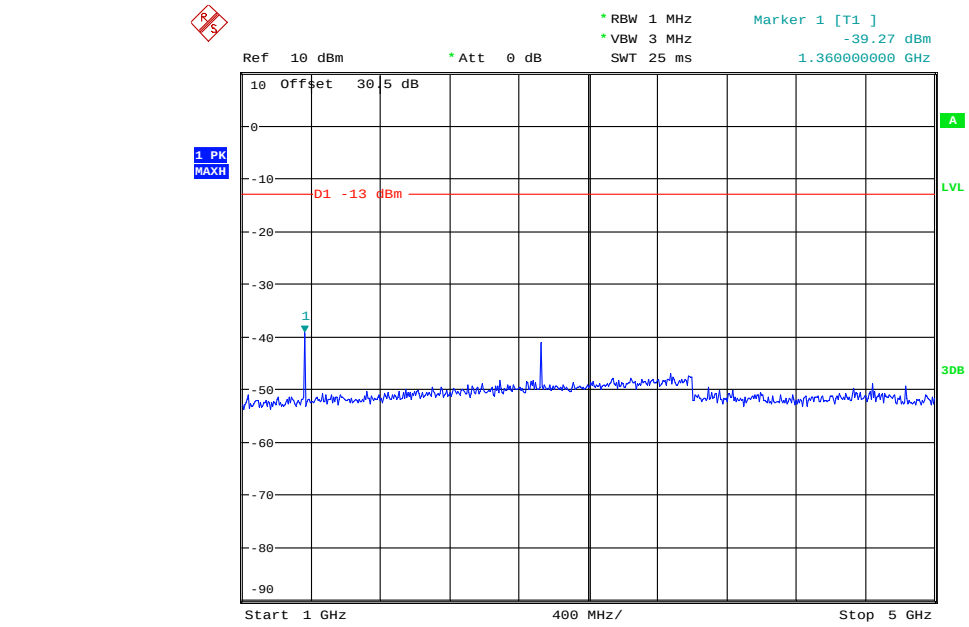
Date: 31.MAY.2018 21:50:54

30MHz – 1 GHz, Channel Spacing 25 kHz, 454.0125 MHz, For FCC part 22



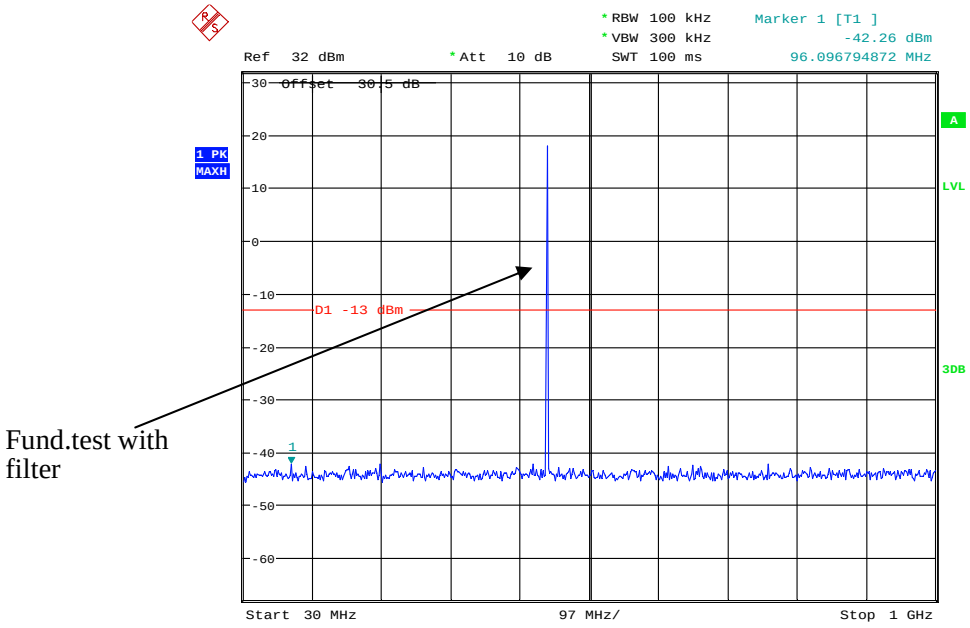
Date: 31.MAY.2018 22:06:18

1 GHz – 5 GHz, Channel Spacing 25 kHz, 454.0125 MHz, For FCC part 22



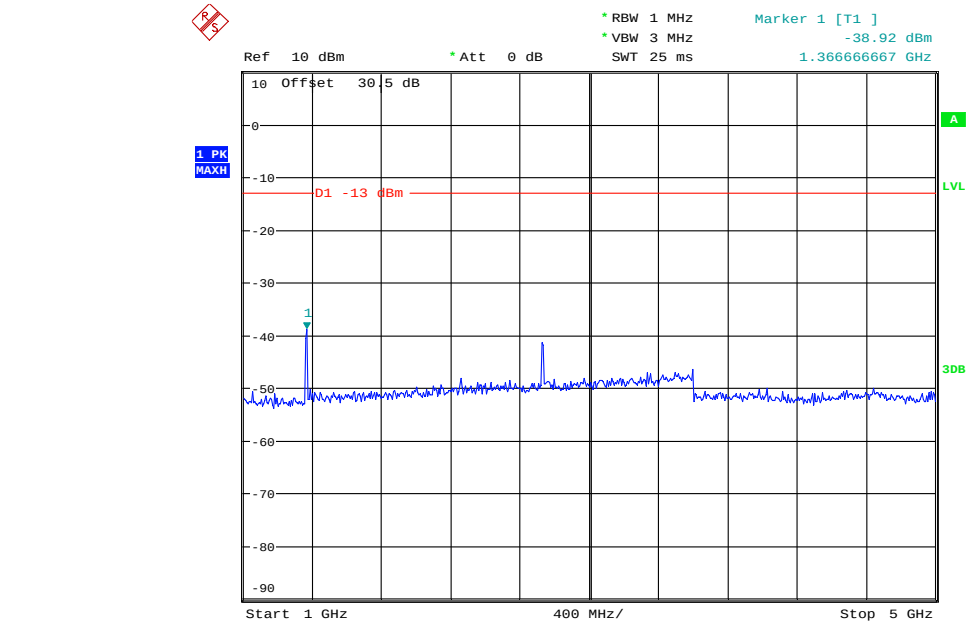
Date: 31.MAY.2018 21:38:46

30MHz – 1 GHz, Channel Spacing 25 kHz, 455.0125 MHz, For FCC part 74



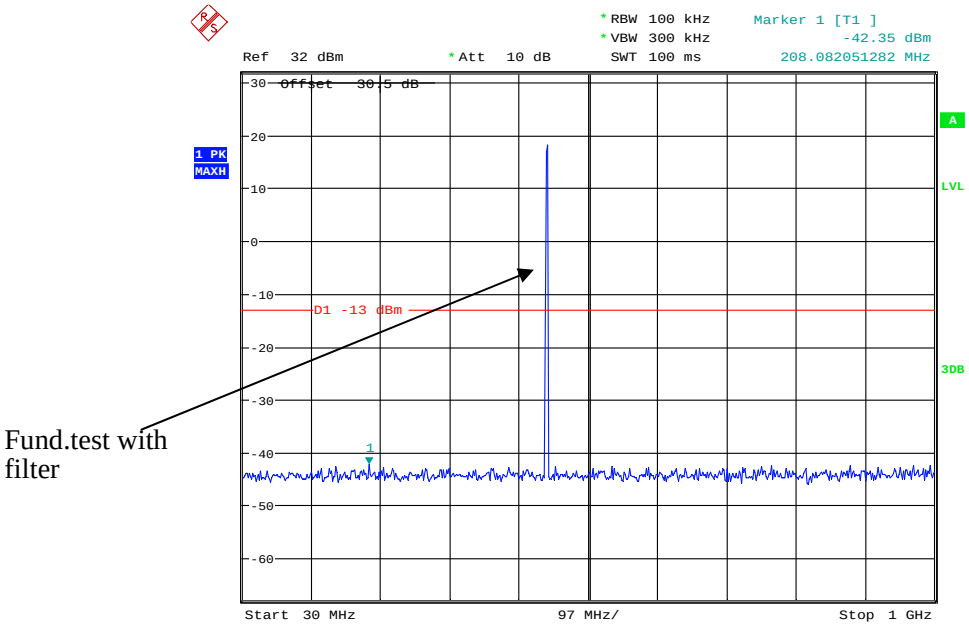
Date: 31.MAY.2018 22:07:46

1 GHz – 5 GHz, Channel Spacing 25 kHz, 455.0125 MHz, For FCC part 74



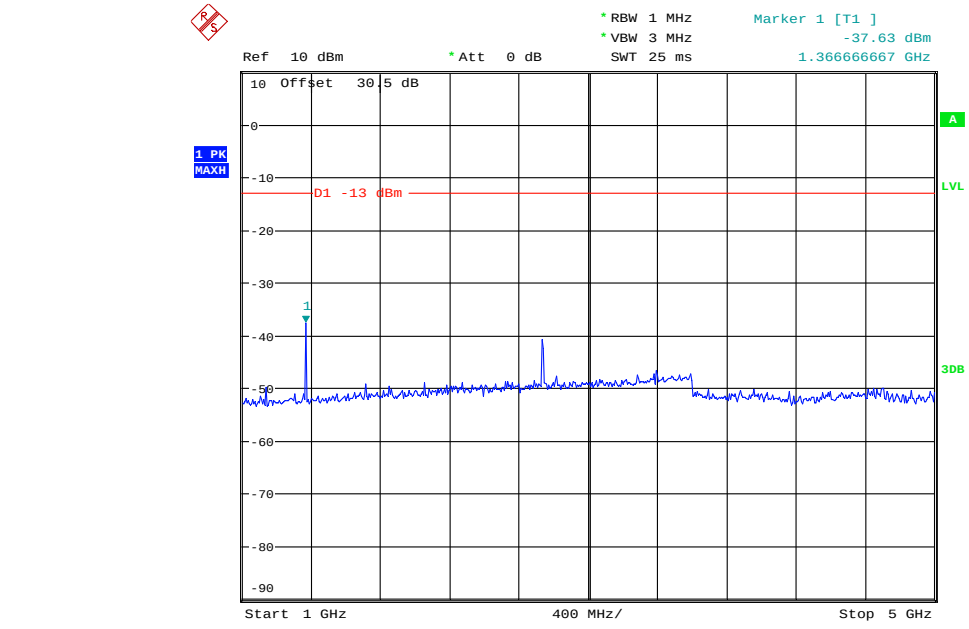
Date: 31.MAY.2018 21:40:26

30MHz – 1 GHz, Channel Spacing 25 kHz, 456.0125 MHz, For FCC part 80



Date: 31.MAY.2018 22:12:20

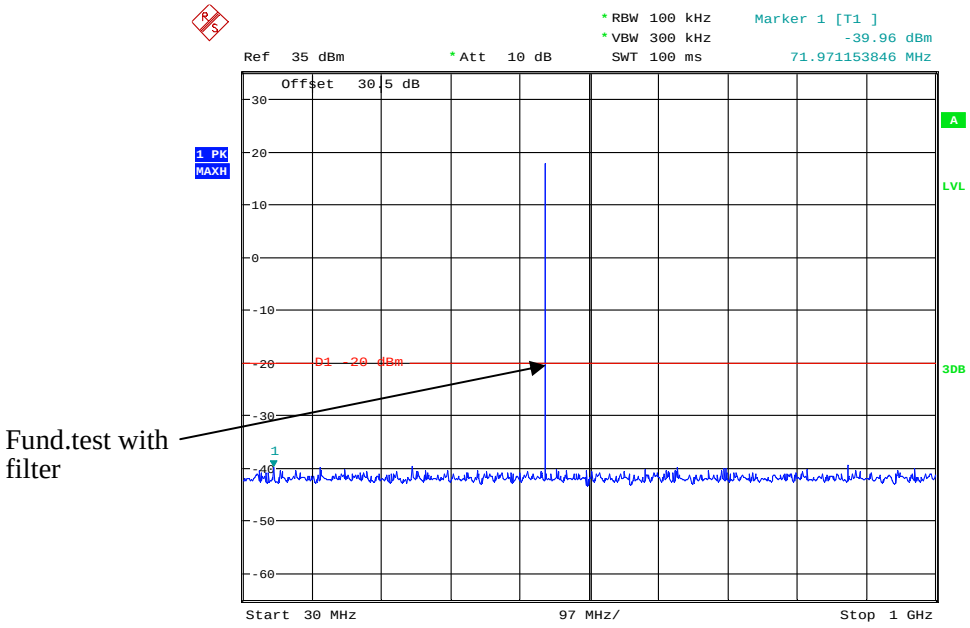
1 GHz – 5 GHz, Channel Spacing 25 kHz, 456.0125 MHz, For FCC part 80



Date: 31.MAY.2018 21:44:10

Digital Modulation:

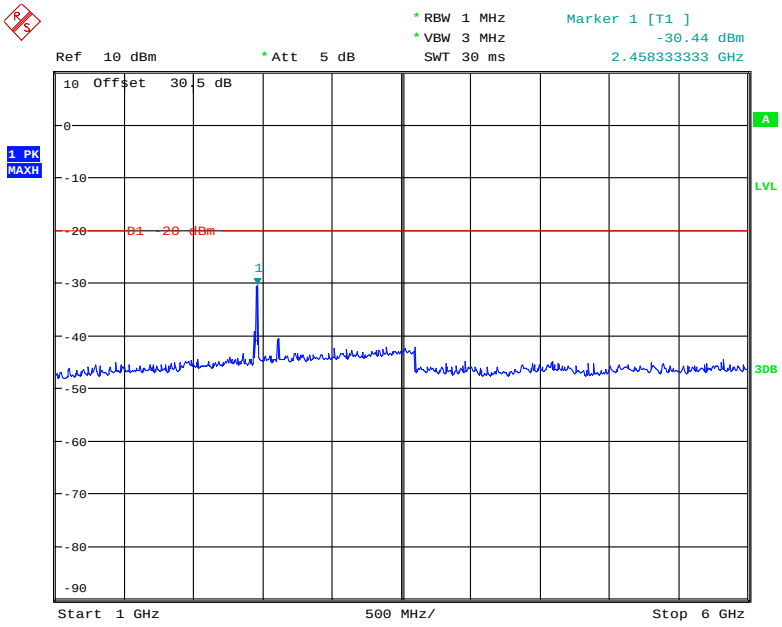
30MHz – 1 GHz, 453.2125 MHz, For FCC part 90



Fund.test with filter

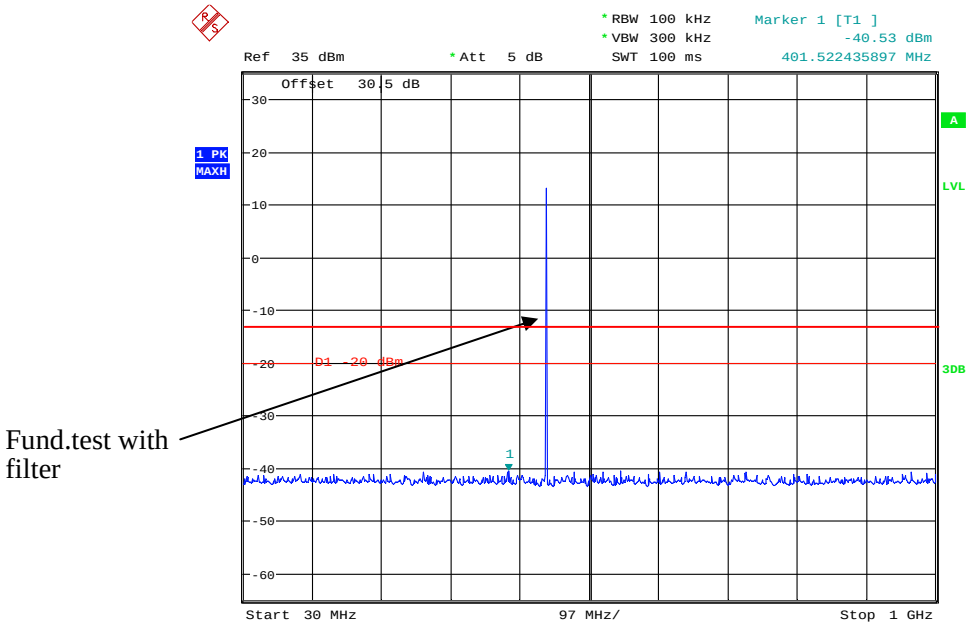
Date: 6.JUN.2018 00:43:36

1 GHz – 6 GHz, 453.2125 MHz, For FCC part 90



Date: 10.MAY.2018 22:20:36

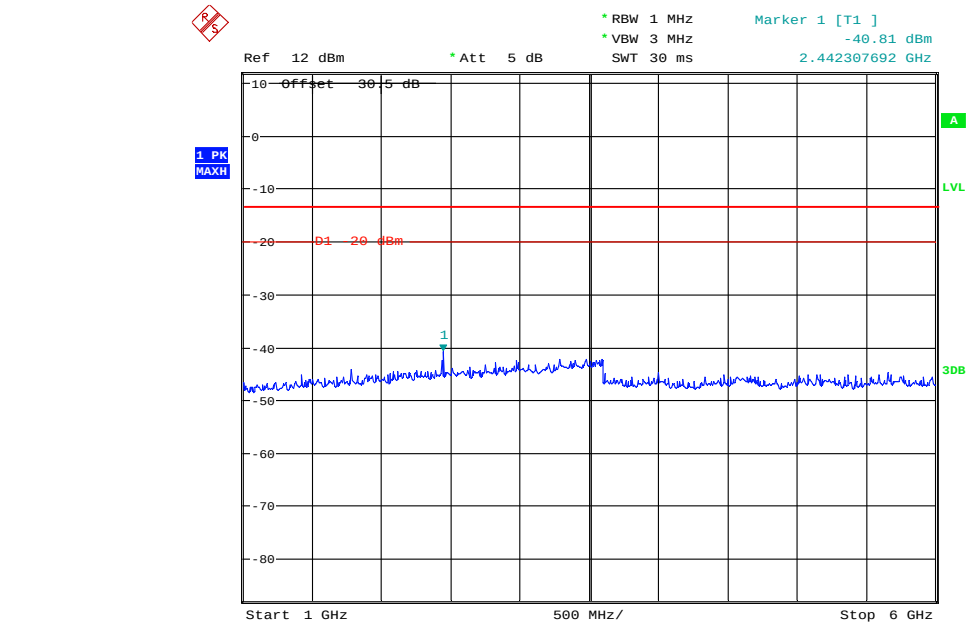
30MHz – 1 GHz, 454.0125 MHz, For FCC part 22



Fund.test with filter

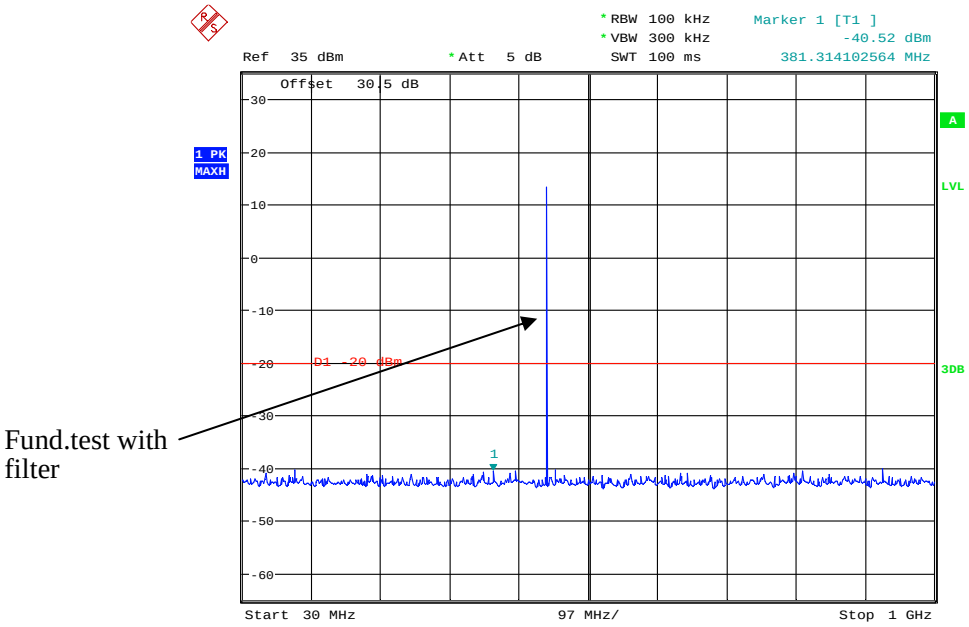
Date: 10.MAY.2018 22:33:18

1 GHz – 6 GHz, 454.0125 MHz, For FCC part 22



Date: 10.MAY.2018 22:38:32

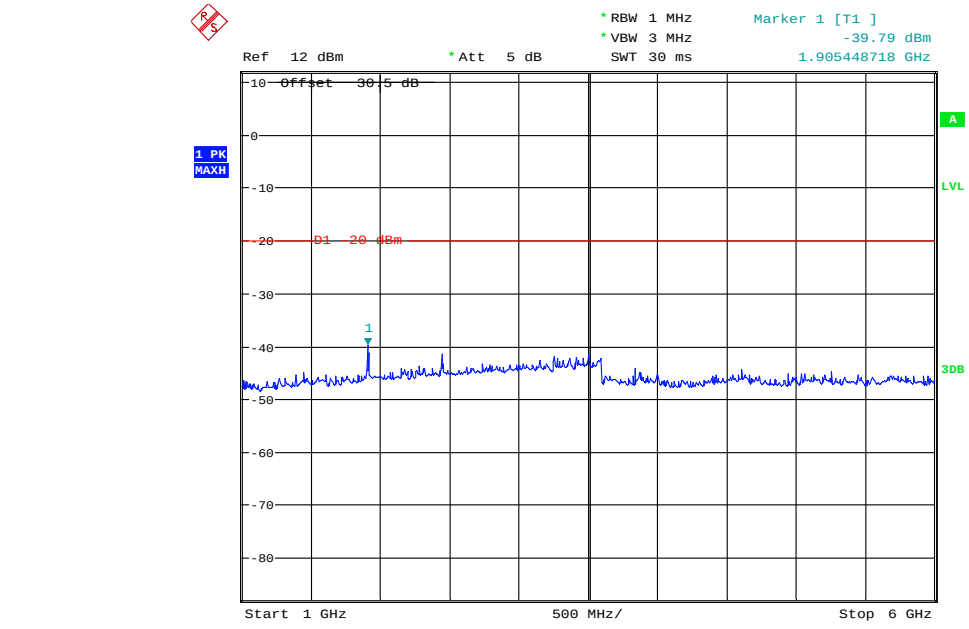
30MHz – 1 GHz, 455.0125 MHz, For FCC part 74



Fund.test with filter

Date: 10.MAY.2018 22:35:19

1 GHz – 6 GHz, 455.0125 MHz, For FCC part 74



Date: 10.MAY.2018 22:37:43

FCC §2.1053 & §22.861 & §74.462 & § 80.211 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053, §22.861, §74.462, § 80.211 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.

Spurious attenuation limit in dB =43+10 Log_{10} (power out in Watts) for EUT with a 25 kHz channel bandwidth.

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu on 2018-06-18.

Test Mode: Transmitting

30MHz - 6GHz(AC Main):

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 (dBi)			
Analog Modulation 453.2125MHz-12.5 kHz For part 90										
906.425	34.16	71	1.9	H	-62.80	0.70	0	-63.50	-20	43.50
906.425	32.68	193	1.2	V	-64.30	0.70	0	-65.00	-20	45.00
1359.64	43.21	330	2.1	H	-64.6	1.60	7.90	-58.30	-20	38.30
1359.64	42.69	61	1.9	V	-65.4	1.60	7.90	-59.10	-20	39.10
Digital Modulation 453.2125MHz For part 90										
906.425	34.18	328	2.0	H	-62.80	0.70	0	-63.50	-20	43.50
906.425	32.14	142	1.8	V	-64.90	0.70	0	-65.60	-20	45.60
1359.64	43.36	188	1.3	H	-64.5	1.60	7.90	-58.20	-20	38.20
1359.64	42.51	337	1.5	V	-65.6	1.60	7.90	-59.30	-20	39.30
Analog Modulation 454.0125MHz-12.5 kHz For part 22										
908.025	34.43	14	2.2	H	-62.60	0.70	0	-63.30	-13	50.3
908.025	33.79	41	2.1	V	-63.20	0.70	0	-63.90	-13	50.9
1362.04	42.77	249	1.8	H	-65.1	1.60	7.90	-58.80	-13	45.8
1362.04	42.95	84	1.2	V	-65.1	1.60	7.90	-58.80	-13	45.8
Digital Modulation 454.0125 MHz For part 22										
908.025	34.11	307	1.3	H	-62.90	0.70	0	-63.60	-13	50.6
908.025	33.38	311	2.4	V	-63.60	0.70	0	-64.30	-13	51.3
1362.04	43.26	62	2.1	H	-64.6	1.60	7.90	-58.30	-13	45.3
1362.04	42.13	184	1.3	V	-66.0	1.60	7.90	-59.70	-13	46.7
Analog Modulation 455.0125MHz-12.5 kHz For part 74										
910.025	33.72	80	1.4	H	-63.30	0.70	0	-64.00	-20	44.00
910.025	32.56	211	1.9	V	-64.40	0.70	0	-65.10	-20	45.10
1365.04	43.02	203	1.5	H	-64.8	1.60	7.90	-58.50	-20	38.50
1365.04	42.89	242	1.1	V	-65.2	1.60	7.90	-58.90	-20	38.90
Digital Modulation 455.0125 MHz For part 74										
910.025	34.60	2	2.0	H	-62.40	0.70	0	-63.10	-20	43.10
910.025	33.94	318	2.1	V	-63.10	0.70	0	-63.80	-20	43.80
1365.04	43.51	129	1.0	H	-64.3	1.60	7.90	-58.00	-20	38.00
1365.04	42.36	198	2.0	V	-65.7	1.60	7.90	-59.40	-20	39.40

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 (dBi)			
Analog Modulation 454.0125 MHz-25 kHz For part 22										
908.025	34.29	244	1.6	H	-62.70	0.70	0	-63.40	-13	50.40
908.025	32.59	38	1.5	V	-64.40	0.70	0	-65.10	-13	52.10
1362.04	42.75	85	1.4	H	-65.1	1.60	7.90	-58.80	-13	45.80
1362.04	42.81	232	2.4	V	-65.3	1.60	7.90	-59.00	-13	46.00
Analog Modulation 455.0125 MHz-25 kHz For part 74										
910.025	33.57	192	1.5	H	-63.40	0.70	0	-64.10	-13	51.10
910.025	33.49	33	2.1	V	-63.50	0.70	0	-64.20	-13	51.20
1365.04	42.95	318	2.4	H	-65.0	1.60	7.90	-58.70	-13	45.70
1365.04	42.67	297	1.3	V	-65.5	1.60	7.90	-59.20	-13	46.20
Analog Modulation 456.0125 MHz-25 kHz For part 80										
912.025	34.60	118	1.6	H	-62.40	0.70	0	-63.10	-13	50.10
912.025	33.76	158	2.2	V	-63.20	0.70	0	-63.90	-13	50.90
1368.04	42.89	47	2.2	H	-64.9	1.60	7.90	-58.60	-13	45.60
1368.04	43.01	96	2.2	V	-65.1	1.60	7.90	-58.80	-13	45.80

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

30MHz - 6GHz(DC Power):

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 (dBi)			
Analog Modulation 453.2125MHz-12.5 kHz For part 90										
906.425	34.68	174	1.9	H	-62.30	0.70	0	-63.00	-20	43.00
906.425	34.57	36	1.7	V	-62.40	0.70	0	-63.10	-20	43.10
1359.64	43.11	237	1.3	H	-64.7	1.60	7.90	-58.40	-20	38.40
1359.64	42.87	300	2.0	V	-65.2	1.60	7.90	-58.90	-20	38.90
Digital Modulation 453.2125MHz For part 90										
906.425	34.50	196	2.1	H	-62.50	0.70	0	-63.20	-20	43.20
906.425	35.73	59	1.1	V	-61.30	0.70	0	-62.00	-20	42.00
1359.64	43.26	73	2.5	H	-64.7	1.60	7.90	-58.40	-20	38.40
1359.64	42.32	145	2.0	V	-65.9	1.60	7.90	-59.60	-20	39.60
Analog Modulation 454.0125MHz-12.5 kHz For part 22										
908.025	35.01	355	1.8	H	-62.00	0.70	0	-62.70	-13	49.7
908.025	33.91	134	2.3	V	-63.10	0.70	0	-63.80	-13	50.8
1362.04	43.35	112	1.9	H	-64.5	1.60	7.90	-58.20	-13	45.2
1362.04	42.85	154	2.3	V	-65.2	1.60	7.90	-58.90	-13	45.9
Digital Modulation 454.0125 MHz For part 22										
908.025	35.64	242	2.2	H	-61.40	0.70	0	-62.10	-13	49.1
908.025	34.07	62	1.7	V	-62.90	0.70	0	-63.60	-13	50.6
1362.04	43.28	259	2.1	H	-64.7	1.60	7.90	-58.40	-13	45.4
1362.04	42.57	210	2.3	V	-65.6	1.60	7.90	-59.30	-13	46.3
Analog Modulation 455.0125MHz-12.5 kHz For part 74										
910.025	34.78	136	1.1	H	-62.20	0.70	0	-62.90	-20	42.90
910.025	33.88	20	1.0	V	-63.10	0.70	0	-63.80	-20	43.80
1365.04	42.31	157	1.1	H	-65.5	1.60	7.90	-59.20	-20	39.20
1365.04	42.49	319	1.0	V	-65.6	1.60	7.90	-59.30	-20	39.30
Digital Modulation 455.0125 MHz For part 74										
910.025	35.64	95	1.1	H	-61.40	0.70	0	-62.10	-20	42.10
910.025	35.61	185	1.7	V	-61.40	0.70	0	-62.10	-20	42.10
1365.04	42.84	99	2.0	H	-65.1	1.60	7.90	-58.80	-20	38.80
1365.04	42.19	124	2.2	V	-66.0	1.60	7.90	-59.70	-20	39.70

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 (dBi)			
Analog Modulation 454.0125 MHz-25 kHz For part 22										
908.025	34.76	188	2.4	H	-62.20	0.70	0	-62.90	-13	49.90
908.025	33.62	101	2.2	V	-63.40	0.70	0	-64.10	-13	51.10
1362.04	42.13	151	2.1	H	-65.7	1.60	7.90	-59.40	-13	46.40
1362.04	42.54	307	2.4	V	-65.6	1.60	7.90	-59.30	-13	46.30
Analog Modulation 455.0125 MHz-25 kHz For part 74										
910.025	34.29	0	1.3	H	-62.70	0.70	0	-63.40	-13	50.40
910.025	33.91	174	1.4	V	-63.10	0.70	0	-63.80	-13	50.80
1365.04	42.78	344	2.3	H	-65.1	1.60	7.90	-58.80	-13	45.80
1365.04	42.59	265	2.5	V	-65.5	1.60	7.90	-59.20	-13	46.20
Analog Modulation 456.0125 MHz-25 kHz For part 80										
912.025	34.89	126	1.2	H	-62.10	0.70	0	-62.80	-13	49.80
912.025	34.42	130	2.4	V	-62.60	0.70	0	-63.30	-13	50.30
1368.04	43.04	63	1.9	H	-64.8	1.60	7.90	-58.50	-13	45.50
1368.04	42.35	164	1.7	V	-65.7	1.60	7.90	-59.40	-13	46.40

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

FCC §2.1055 & § 22.355 & §74.464 & § 80.209 & §90.213 - FREQUENCY STABILITY

Applicable Standard

FCC §2.1055, § 22.355, §74.464, § 80.209 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:	24 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu on 2018-06-18.

Test Mode: Transmitting

DC Power：
For 12.5 kHz:

Analog Modulation, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.6	453.212488	-0.0265
40	13.6	453.212482	-0.0397
30	13.6	453.212488	-0.0265
20	13.6	453.212495	-0.011
10	13.6	453.212496	-0.0088
0	13.6	453.212483	-0.0375
-10	13.6	453.212496	-0.0088
-20	13.6	453.212489	-0.0243
-30	13.6	453.212483	-0.0375
Frequency Stability Versus Input Voltage			
20	11.6	453.212496	-0.0088
20	15.6	453.212486	-0.0309

Digital Modulation, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.6	453.212482	-0.0397
40	13.6	453.212479	-0.0463
30	13.6	453.212488	-0.0265
20	13.6	453.212483	-0.0375
10	13.6	453.212483	-0.0375
0	13.6	453.212482	-0.0397
-10	13.6	453.212481	-0.0419
-20	13.6	453.212484	-0.0353
-30	13.6	453.212483	-0.0375
Frequency Stability Versus Input Voltage			
20	11.6	453.212482	-0.0397
20	15.6	453.212485	-0.0331

Analog Modulation, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.6	454.012485	-0.033
40	13.6	454.012483	-0.0374
30	13.6	454.012492	-0.0176
20	13.6	454.012484	-0.0352
10	13.6	454.012484	-0.0352
0	13.6	454.012491	-0.0198
-10	13.6	454.012489	-0.0242
-20	13.6	454.012492	-0.0176
-30	13.6	454.012482	-0.0396
Frequency Stability versus Input Voltage			
20	11.6	454.012488	-0.0264
20	15.6	454.012478	-0.0485

Digital Modulation, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.6	454.012482	-0.0396
40	13.6	454.012478	-0.0485
30	13.6	454.012479	-0.0463
20	13.6	454.012481	-0.0418
10	13.6	454.012485	-0.033
0	13.6	454.012477	-0.0507
-10	13.6	454.012478	-0.0485
-20	13.6	454.012478	-0.0485
-30	13.6	454.012485	-0.033
Frequency Stability versus Input Voltage			
20	11.6	454.012477	-0.0507
20	15.6	454.012480	-0.0441

Analog Modulation, Reference Frequency: 455.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.6	455.012485	-0.033
40	13.6	455.012487	-0.0286
30	13.6	455.01249	-0.022
20	13.6	455.01248	-0.044
10	13.6	455.012481	-0.0418
0	13.6	455.012487	-0.0286
-10	13.6	455.012482	-0.0396
-20	13.6	455.012482	-0.0396
-30	13.6	455.012487	-0.0286
Frequency Stability versus Input Voltage			
20	11.6	455.012476	-0.0527
20	15.6	455.012474	-0.0571

Digital Modulation, Reference Frequency: 455.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.6	455.012488	-0.0264
40	13.6	455.012484	-0.0352
30	13.6	455.012483	-0.0374
20	13.6	455.012483	-0.0374
10	13.6	455.012489	-0.0242
0	13.6	455.012483	-0.0374
-10	13.6	455.01249	-0.022
-20	13.6	455.012486	-0.0308
-30	13.6	455.012493	-0.0154
Frequency Stability versus Input Voltage			
20	11.6	455.012486	-0.0308
20	15.6	455.012483	-0.0374

For 25 kHz:

Analog Modulation, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	13.6	454.012486	-0.0308
40	13.6	454.012492	-0.0176
30	13.6	454.012484	-0.0352
20	13.6	454.012484	-0.0352
10	13.6	454.012485	-0.033
0	13.6	454.012486	-0.0308
-10	13.6	454.012481	-0.0418
-20	13.6	454.012488	-0.0264
-30	13.6	454.012488	-0.0264
Frequency Stability versus Input Voltage			
20	11.6	454.012492	-0.0176
20	15.6	454.012485	-0.033

Analog Modulation, Reference Frequency: 455.0125 MHz, Limit: ±5.0 ppm			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	13.6	455.012489	-0.0242
40	13.6	455.012477	-0.0505
30	13.6	455.012492	-0.0176
20	13.6	455.012489	-0.0242
10	13.6	455.012488	-0.0264
0	13.6	455.012478	-0.0484
-10	13.6	455.012491	-0.0198
-20	13.6	455.012488	-0.0264
-30	13.6	455.012488	-0.0264
Frequency Stability versus Input Voltage			
20	11.6	455.012482	-0.0396
20	15.6	455.012488	-0.0264

Analog Modulation, Reference Frequency: 456.0125 MHz, Limit: ±5.0 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.6	456.012477	-0.0504
40	13.6	456.012474	-0.057
30	13.6	456.012474	-0.057
20	13.6	456.012478	-0.0482
10	13.6	456.012472	-0.0614
0	13.6	456.012477	-0.0504
-10	13.6	456.012474	-0.057
-20	13.6	456.012482	-0.0395
-30	13.6	456.01248	-0.0439
Frequency Stability versus Input Voltage			
20	11.6	456.012475	-0.0548
20	15.6	456.012474	-0.057

AC POWER:
For 12.5K

Analog Modulation, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{AC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	120	453.212479	-0.0463
40	120	453.212468	-0.0706
30	120	453.212409	-0.2008
20	120	453.212531	0.0684
10	120	453.212472	-0.0618
0	120	453.212424	-0.1677
-10	120	453.212494	-0.0132
-20	120	453.212521	0.0463
-30	120	453.212511	0.0243
Frequency Stability Versus Input Voltage			
20	102	453.212438	-0.1368
20	138	453.212385	-0.2537

Digital Modulation, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{AC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	120	453.212483	-0.0375
40	120	453.212473	-0.0596
30	120	453.212486	-0.0309
20	120	453.212509	0.0199
10	120	453.212493	-0.0154
0	120	453.212462	-0.0838
-10	120	453.212438	-0.1368
-20	120	453.212487	-0.0287
-30	120	453.212419	-0.1787
Frequency Stability Versus Input Voltage			
20	102	453.212444	-0.1236
20	138	453.212375	-0.2758

Analog Modulation, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{AC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	120	454.012478	-0.0485
40	120	454.012506	0.0132
30	120	454.012479	-0.0463
20	120	454.012474	-0.0573
10	120	454.012422	-0.1718
0	120	454.012456	-0.0969
-10	120	454.01238	-0.2643
-20	120	454.012472	-0.0617
-30	120	454.012492	-0.0176
Frequency Stability versus Input Voltage			
20	102	454.012472	-0.0617
20	138	454.012459	-0.0903

Digital Modulation, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{AC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	120	454.012475	-0.0551
40	120	454.012536	0.0793
30	120	454.012452	-0.1057
20	120	454.012524	0.0529
10	120	454.012503	0.0066
0	120	454.012483	-0.0374
-10	120	454.012501	0.0022
-20	120	454.012471	-0.0639
-30	120	454.012465	-0.0771
Frequency Stability versus Input Voltage			
20	102	454.012468	-0.0705
20	138	454.012473	-0.0595

Analog Modulation, Reference Frequency: 455.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{AC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	120	455.012477	-0.0505
40	120	455.012525	0.0549
30	120	455.012479	-0.0462
20	120	455.012514	0.0308
10	120	455.012431	-0.1516
0	120	455.012531	0.0681
-10	120	455.012538	0.0835
-20	120	455.012446	-0.1187
-30	120	455.012466	-0.0747
Frequency Stability versus Input Voltage			
20	102	455.012451	-0.1077
20	138	455.012494	-0.0132

Digital Modulation, Reference Frequency: 455.0125 MHz, Limit: ±2.5 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{AC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	120	455.012467	-0.0725
40	120	455.012453	-0.1033
30	120	455.012447	-0.1165
20	120	455.012484	-0.0352
10	120	455.012456	-0.0967
0	120	455.012465	-0.0769
-10	120	455.012469	-0.0681
-20	120	455.012459	-0.0901
-30	120	455.012417	-0.1824
Frequency Stability versus Input Voltage			
20	102	455.012478	-0.0484
20	138	455.012499	-0.0022

For 25 kHz:

Analog Modulation, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	120	454.012472	-0.0617
40	120	454.012450	-0.1101
30	120	454.012485	-0.033
20	120	454.012477	-0.0507
10	120	454.012496	-0.0088
0	120	454.012423	-0.1696
-10	120	454.012548	0.1057
-20	120	454.012546	0.1013
-30	120	454.012422	-0.1718
Frequency Stability versus Input Voltage			
20	102	454.012488	-0.0264
20	138	454.012479	-0.0463

Analog Modulation, Reference Frequency: 455.0125 MHz, Limit: ±5.0 ppm			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	120	455.012479	-0.0462
40	120	455.012483	-0.0374
30	120	455.012469	-0.0681
20	120	455.012572	0.1582
10	120	455.012514	0.0308
0	120	455.012467	-0.0725
-10	120	455.012411	-0.1956
-20	120	455.012497	-0.0066
-30	120	455.012497	-0.0066
Frequency Stability versus Input Voltage			
20	102	455.012498	-0.0044
20	138	455.012442	-0.1275

Analog Modulation, Reference Frequency: 456.0125 MHz, Limit: ±5.0 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Voltage Supplied (V_{AC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	120	456.012477	-0.0504
40	120	456.012473	-0.0592
30	120	456.012462	-0.0833
20	120	456.012473	-0.0592
10	120	456.012444	-0.1228
0	120	456.012455	-0.0987
-10	120	456.012463	-0.0811
-20	120	456.012498	-0.0044
-30	120	456.012495	-0.0110
Frequency Stability versus Input Voltage			
20	102	456.012413	-0.1908
20	138	456.012452	-0.1053

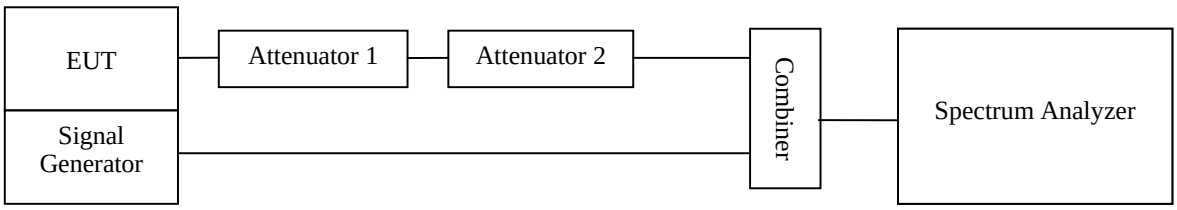
FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214
Test method: ANSI/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:	56 %
ATM Pressure:	101.0 kPa

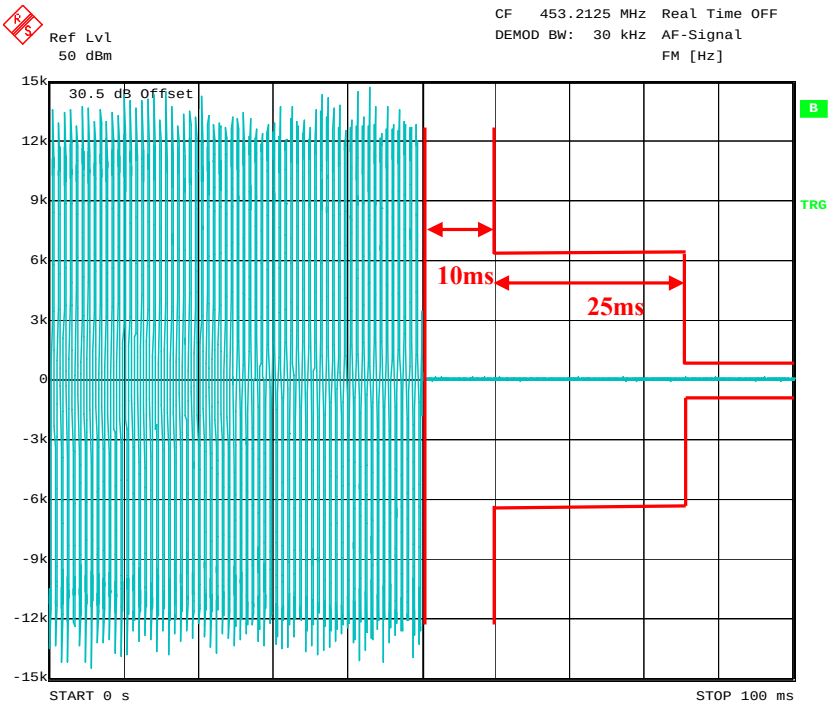
The testing was performed by Tracy Hu on 2018-06-04.

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.

Channel: 453.2125 MHz, 12.5 kHz

Turn on



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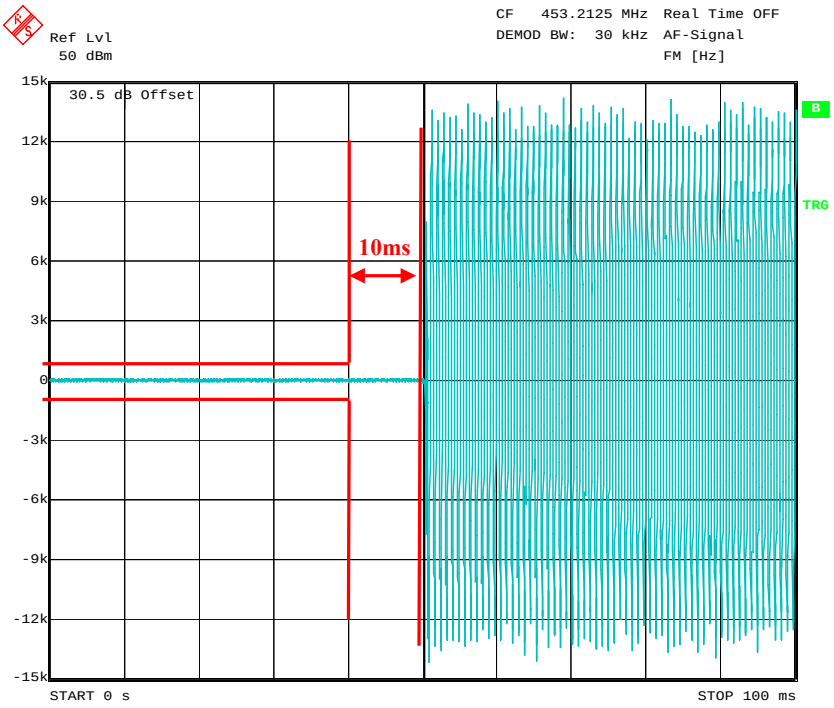
Turn off



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