FCC PART 22, 74, 80

TEST REPORT

For

Hytera Communications Corporation Limited

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

FCC ID: YAMMD78XGU2

Report Type:	**Product Type:**
Class II Permissive Change	Digital Mobile Radio

Report Number: RDG170907003-00A1

Report Date: 2017-09-27

Reviewed By: Xiangguang Kong — EMC Engineer

Xiangguang . Kong

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 test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

TABLE OF CONTENTS

GENERAL INFORMATION **3**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 3
OBJECTIVE 3
RELATED SUBMITTAL(S)/GRANT(S) 3
TEST METHODOLOGY 3
MEASUREMENT UNCERTAINTY 4
TEST FACILITY 4
SYSTEM TEST CONFIGURATION **5**
DESCRIPTION OF TEST CONFIGURATION 5
EUT EXERCISE SOFTWARE 5
SPECIAL ACCESSORIES 5
EQUIPMENT MODIFICATIONS 5
SUPPORT EQUIPMENT LIST AND DETAILS 5
EXTERNAL I/O CABLE 5
BLOCK DIAGRAM OF TEST SETUP 6
SUMMARY OF TEST RESULTS **7**
TEST EQUIPMENT LIST **8**
§1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE) **9**
APPLICABLE STANDARD 9
RESULT 9
FCC §2.1046 & § 22.727 & §74.461 & §80.215 - RF OUTPUT POWER **10**
APPLICABLE STANDARD 10
TEST PROCEDURE 10
TEST DATA 10
FCC §2.1047 - MODULATION CHARACTERISTIC **12**
APPLICABLE STANDARD 12
TEST PROCEDURE 12
TEST DATA 12
FCC §2.1049 & § 22.359 & § 22.731 & §74.462 & § 80.205 & § 80.211 – OCCUPIED BANDWIDTH & EMISSION MASK **38**
APPLICABLE STANDARD 38
TEST PROCEDURE 39
TEST DATA 39
FCC §2.1051 & §22.861 & §74.462 & § 80.211 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS **56**
APPLICABLE STANDARD 56
TEST PROCEDURE 56
TEST DATA 56
FCC §2.1053 & §22.861 & §74.462 & § 80.211 - RADIATED SPURIOUS EMISSIONS **66**
APPLICABLE STANDARD 66
TEST PROCEDURE 66
TEST DATA 66
FCC §2.1055 & § 22.355 & §74.464 & § 80.209 - FREQUENCY STABILITY **70**
APPLICABLE STANDARD 70
TEST PROCEDURE 70
TEST DATA 70

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Hytera Communications Corporation Limited's* product, model number: *MD782G U(2) (FCC ID: YAMMD78XGU2)* in this report is a *Digital Mobile Radio* which was measured approximately: 196 mm (L) x 174 mm (W) x 60 mm (H), rated input voltage: DC 13.60V.

Notes: This series products model: MD782 U(2) and MD782G U(2) are electrically identical. Model MD782G U(2) was selected for fully testing, the detailed information can be referred to the declaration which was stated and guaranteed by the applicant.

** All measurement and test data in this report was gathered from production sample serial number: 170907003 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2017-09-07.*

Objective

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

This is a CIIPC application of the device; the differences between the original device and the current one are as follows:

(1). Adding standars FCC Part 22, 74, 80.

(2) Changing the model number to "MD782G U(2),MD782 U(2)".

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

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

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
All emissions, radiated	±4.88dB
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.

Bay Area Compliance Laboratories Corp. (Shenzhen) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L2408). And accredited to ISO/IEC 17025 by NVLAP(Lab code: 200707-0), the FCC Designation No. CN5001 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. 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. (Shenzhen) was 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.

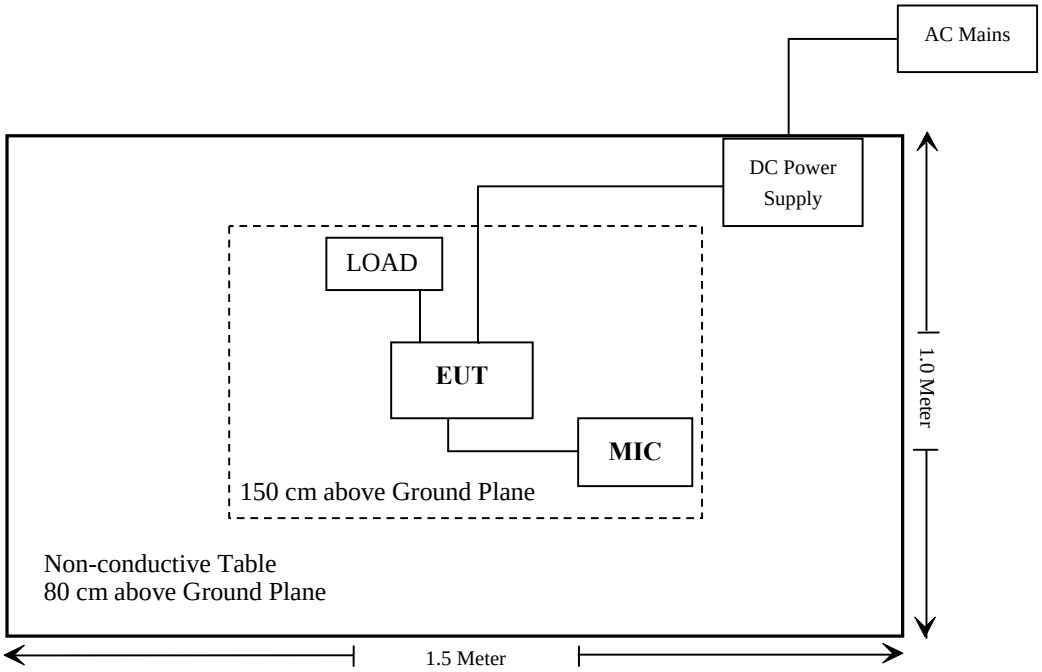
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
N/A	Load	N/A	N/A
TDK-Lambda	DC Power Supply	Z60-14-L-C	LOC-645A242-0004

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-Shileding Detachable DC Power Cable	2.0	DC Power Supply	EUT

Block Diagram of Test Setup



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	RF Output Power	Compliance
§2.1047	Modulation Characteristic	Compliance
§2.1049; § 22.359;§ 22.731; §74.462; § 80.205; § 80.211	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §22.861; §74.462; § 80.211	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §22.861; §74.462; § 80.211	Spurious Radiated Emissions	Compliance
§2.1055; § 22.355; §74.464; § 80.209	Frequency Stability	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-29	2017-12-28
Rohde & Schwarz	Signal Generator	FSIQ26	8386001028	2017-04-24	2018-04-24
Sunol Sciences	Bi-log Antenna	JB1	A040904-2	2014-12-17	2017-12-16
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2017-02-14	2018-02-14
HP	Amplifier	HP8447E	1937A01046	2017-05-21	2017-11-19
Anritsu	Signal Generator	68369B	004114	2016-12-05	2017-12-05
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2016-12-07	2017-12-07
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	2017-05-21	2017-11-19
Ducommun technologies	RF Cable	104PEA	218124002	2017-05-21	2017-11-19
Ducommun technologies	RF Cable	RG-214	1	2017-05-21	2017-11-19
Ducommun technologies	RF Cable	RG-214	2	2017-05-22	2017-11-22
RF Conducted Test					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2016-12-05	2017-12-05
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2016-11-22	2017-11-22
TDK-Lambda	DC Power Supply	Z60-14-L-C	LOC-645A242-0004	NCR	NCR
HP Agilent	RF Communication Test Set	HP8920	3325U00859	2017-05-07	2018-05-07
Ducommun technologies	RF Cable	RG-214	3	2017-05-22	2017-11-22
WEINSCHEL	30dB Attenuator	53-30-43	PG633	2017-05-22	2017-11-22

*** 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).

§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 General Population/Controlled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	6
1.34-30	1824/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/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)

Frequency Range (MHz)	Antenna Gain		Conducted Power	Evaluation Distance (cm)	Power Density (mW/cm^2)	Strictest MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(mW)			
450-520	5.5	3.55	22500	100	0.636	1.5

Note: The rated max tune-up output power is 46.53dBm(45W), 50% duty cycle was used in evaluation, so the power is 22500mW
To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 100cm from nearby persons.

Result: Compliance

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

Applicable Standard

FCC §2.1046, § 22.727, §74.461, § 80.215

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 Dylan Li on 2017-09-11.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power	Conducted Output Power (dBm)	Conducted Output Power (W)	Note
Digital	12.5	453.2125	H	46.16	41.30	For Part 74
			L	36.18	4.15	
		454.5	H	46.17	41.40	For Part 22
			L	36.21	4.18	

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power	Conducted Output Power (dBm)	Conducted Output Power (W)	Note
Analog	12.5	453.2125	High	46.19	41.59	For Part 74
			Low	36.37	4.34	
		454.5	High	46.19	41.59	For Part 22
			Low	36.43	4.40	
	25	453.2125	High	46.18	41.50	For Part 74
			Low	36.31	4.28	
		454.5	High	46.19	41.59	For Part 22
			Low	36.37	4.34	
		458.2125	High	46.22	41.88	For Part 80
			Low	36.44	4.41	

Note: The high rated power is 45W, Limit is 36W-54W.
The low rated power is 5W, Limit is 4W-6W.

FCC §2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

FCC§2.1047:

(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 Dylan Li on 2017-09-25.

Test Mode: Transmitting

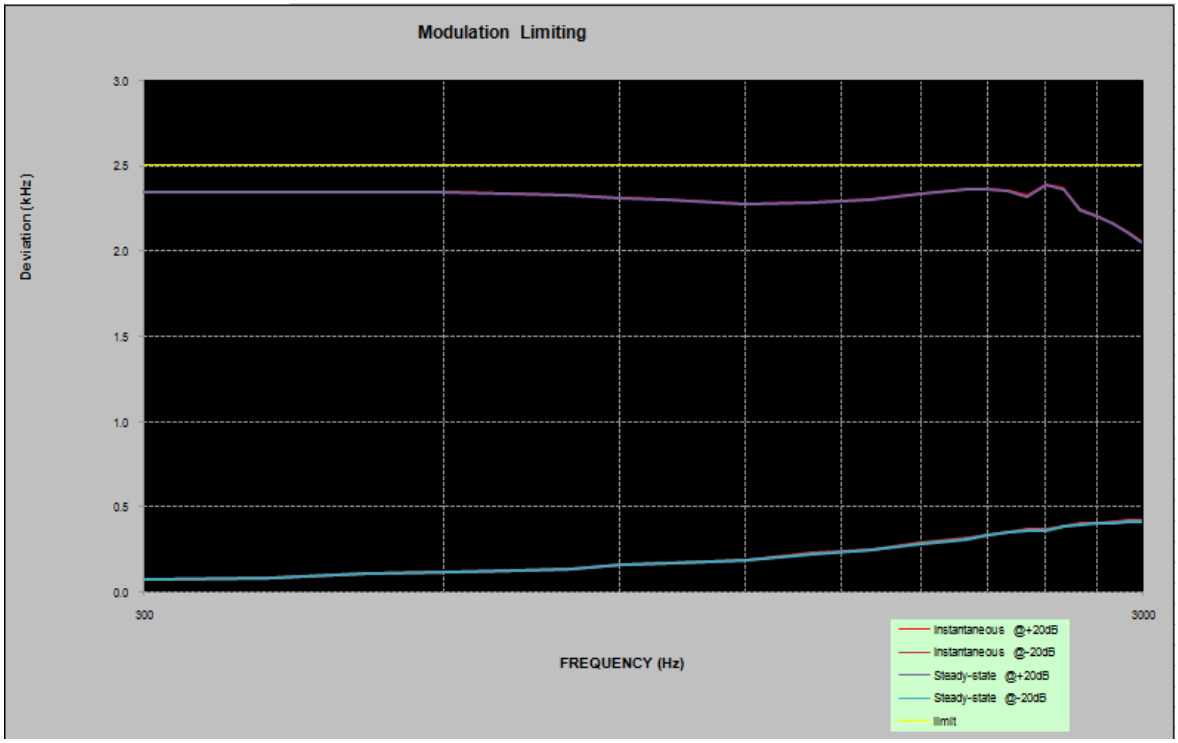
Result: Compliance.

Analog Modulation:

MODULATION LIMITING

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

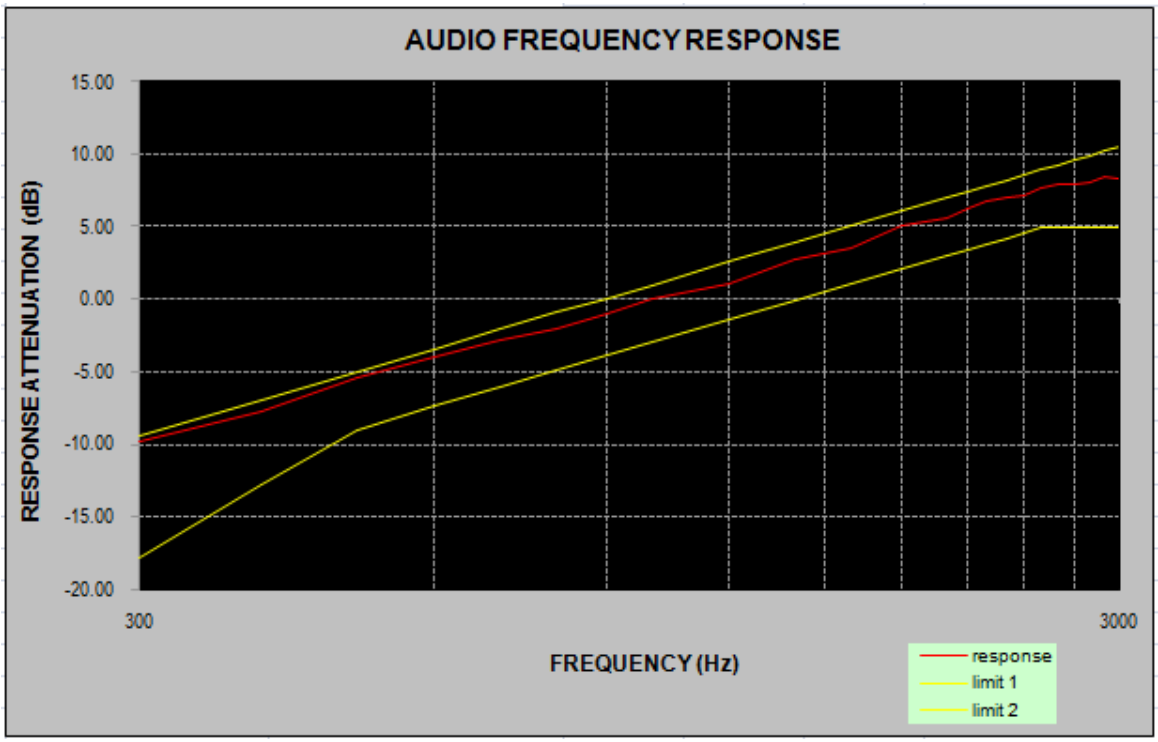
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	2.343	0.073	2.340	0.071	2.5
400	2.347	0.086	2.343	0.085	2.5
500	2.351	0.105	2.344	0.104	2.5
600	2.347	0.118	2.342	0.115	2.5
700	2.335	0.128	2.330	0.124	2.5
800	2.327	0.137	2.324	0.133	2.5
900	2.316	0.159	2.311	0.156	2.5
1000	2.306	0.170	2.302	0.168	2.5
1200	2.281	0.187	2.275	0.185	2.5
1400	2.286	0.225	2.281	0.221	2.5
1600	2.308	0.249	2.301	0.245	2.5
1800	2.340	0.290	2.335	0.285	2.5
2000	2.368	0.312	2.362	0.310	2.5
2100	2.364	0.333	2.358	0.329	2.5
2200	2.354	0.354	2.349	0.348	2.5
2300	2.328	0.366	2.321	0.356	2.5
2400	2.392	0.367	2.385	0.355	2.5
2500	2.369	0.386	2.361	0.381	2.5
2600	2.242	0.403	2.236	0.398	2.5
2700	2.207	0.406	2.201	0.399	2.5
2800	2.169	0.407	2.165	0.401	2.5
2900	2.113	0.424	2.107	0.415	2.5
3000	2.055	0.418	2.049	0.413	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 @+20dB
Steady-state @-20dB
limit

Audio Frequency Response

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

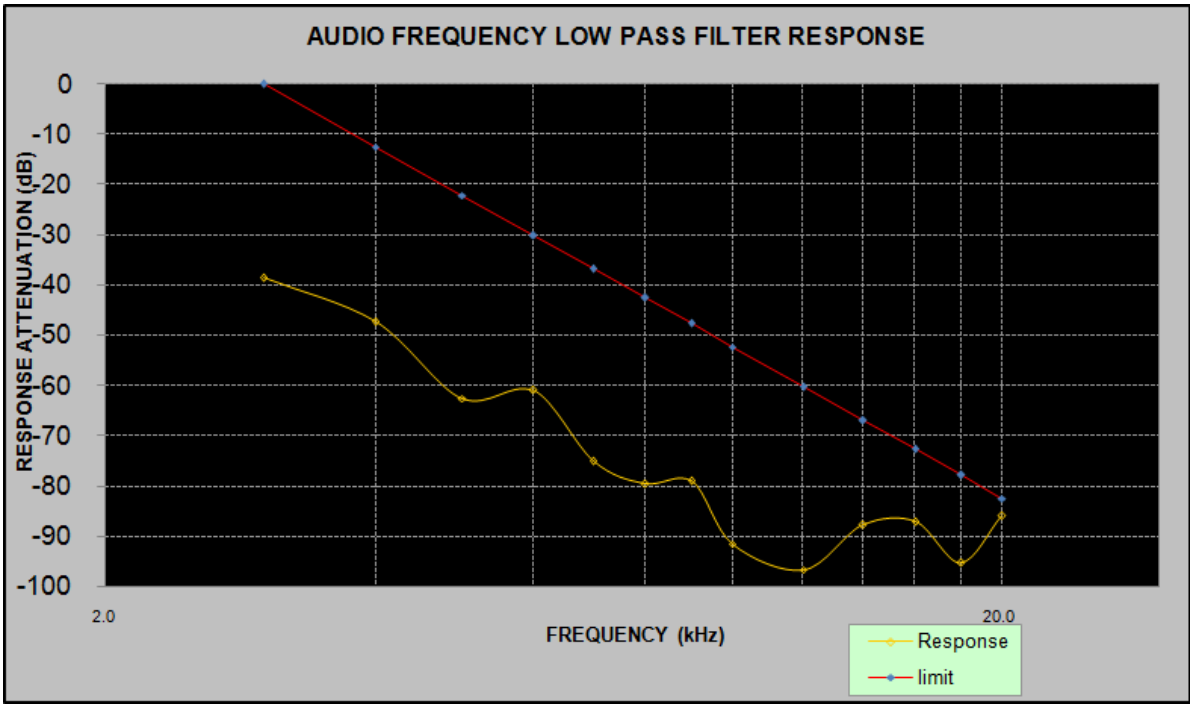
Audio Frequency (Hz)	Response Attenuation (dB)
300	-9.84
400	-7.70
500	-5.45
600	-3.93
700	-2.81
800	-2.00
900	-0.97
1000	0.00
1200	1.05
1400	2.71
1600	3.59
1800	5.03
2000	5.65
2100	6.29
2200	6.79
2300	7.00
2400	7.15
2500	7.62
2600	7.92
2700	7.94
2800	8.04
2900	8.41
3000	8.31


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
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

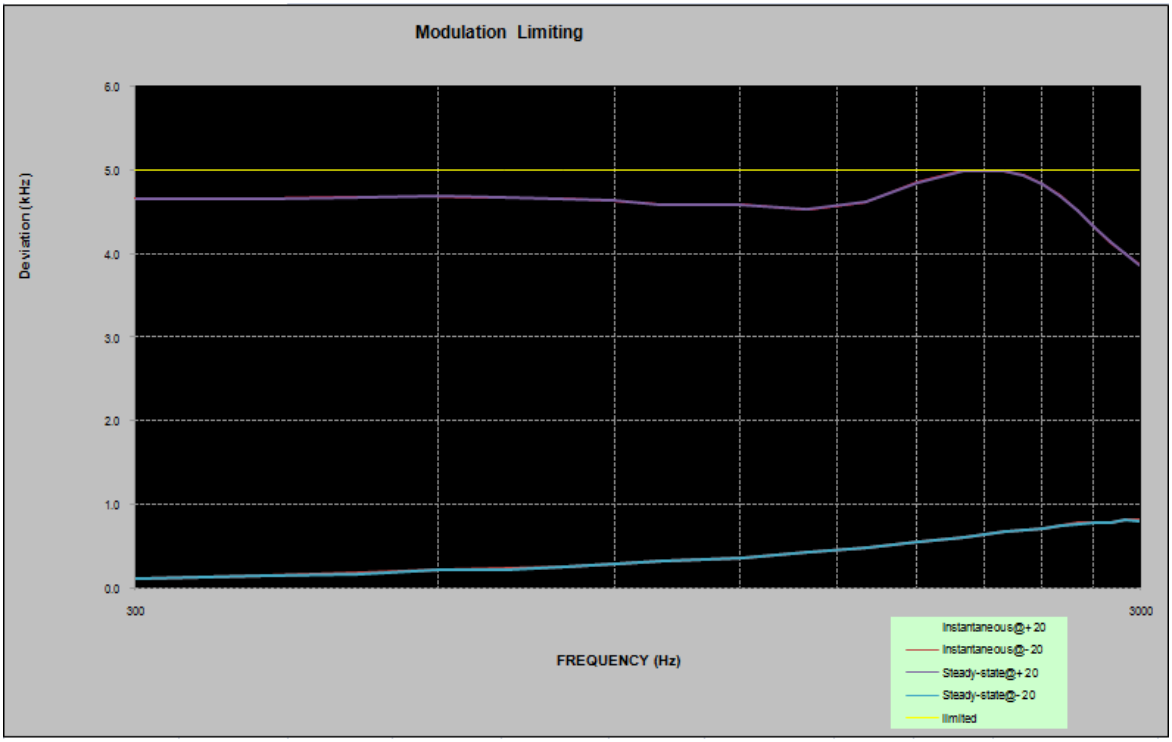
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-38.55	0.0
4.0	-47.37	-12.5
5.0	-62.53	-22.2
6.0	-60.98	-30.1
7.0	-75.04	-36.8
8.0	-79.50	-42.6
9.0	-79.05	-47.7
10.0	-91.47	-52.3
12.0	-96.62	-60.2
14.0	-87.75	-66.9
16.0	-87.04	-72.7
18.0	-95.33	-77.8
20.0	-85.85	-82.5



MODULATION LIMITING

Carrier Frequency: 453.2125 MHz, Channel Separation= 25 kHz

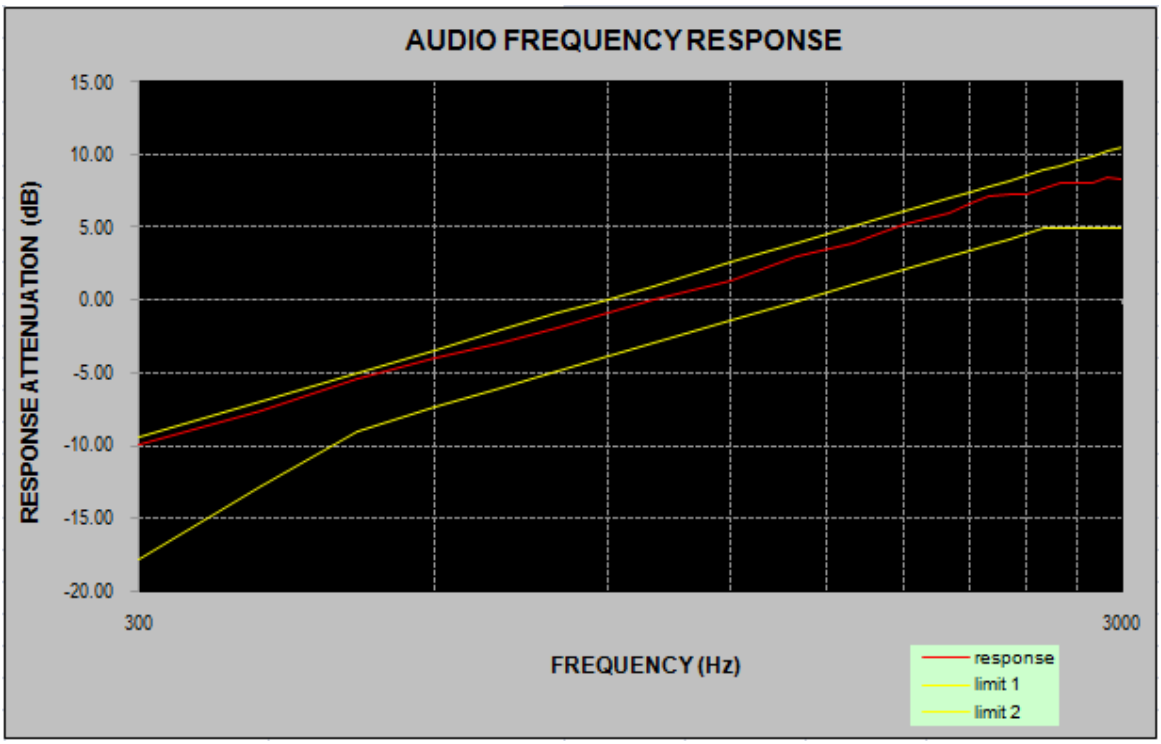
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	4.663	0.110	4.658	0.108	5.000
400	4.661	0.149	4.659	0.146	5.000
500	4.686	0.172	4.683	0.170	5.000
600	4.693	0.213	4.690	0.212	5.000
700	4.672	0.227	4.668	0.223	5.000
800	4.667	0.257	4.664	0.254	5.000
900	4.634	0.289	4.632	0.286	5.000
1000	4.589	0.325	4.586	0.322	5.000
1200	4.592	0.361	4.590	0.358	5.000
1400	4.534	0.431	4.531	0.429	5.000
1600	4.620	0.477	4.616	0.475	5.000
1800	4.856	0.558	4.855	0.556	5.000
2000	4.997	0.601	4.994	0.598	5.000
2100	4.998	0.643	4.995	0.640	5.000
2200	4.987	0.676	4.985	0.674	5.000
2300	4.940	0.691	4.936	0.689	5.000
2400	4.837	0.707	4.836	0.704	5.000
2500	4.696	0.744	4.688	0.740	5.000
2600	4.527	0.771	4.520	0.768	5.000
2700	4.325	0.778	4.322	0.774	5.000
2800	4.143	0.783	4.140	0.781	5.000
2900	4.003	0.821	4.000	0.815	5.000
3000	3.870	0.807	3.865	0.801	5.000


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: 453.2125 MHz, Channel Separation= 25 kHz

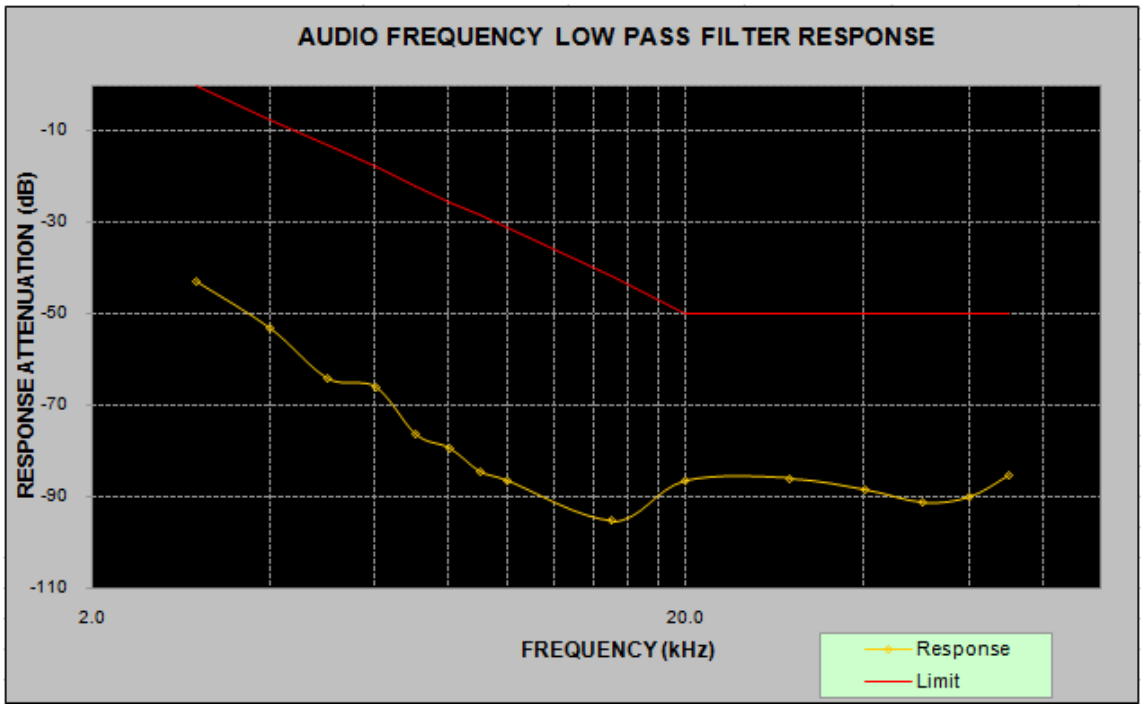
Audio Frequency (Hz)	Response Attenuation (dB)
300	-9.90
400	-7.62
500	-5.38
600	-3.99
700	-2.90
800	-1.96
900	-0.83
1000	0.00
1200	1.27
1400	2.95
1600	3.86
1800	5.28
2000	6.02
2100	6.59
2200	7.10
2300	7.24
2400	7.35
2500	7.74
2600	8.08
2700	8.06
2800	8.11
2900	8.46
3000	8.34


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
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 453.2125 MHz, Channel Separation= 25 kHz

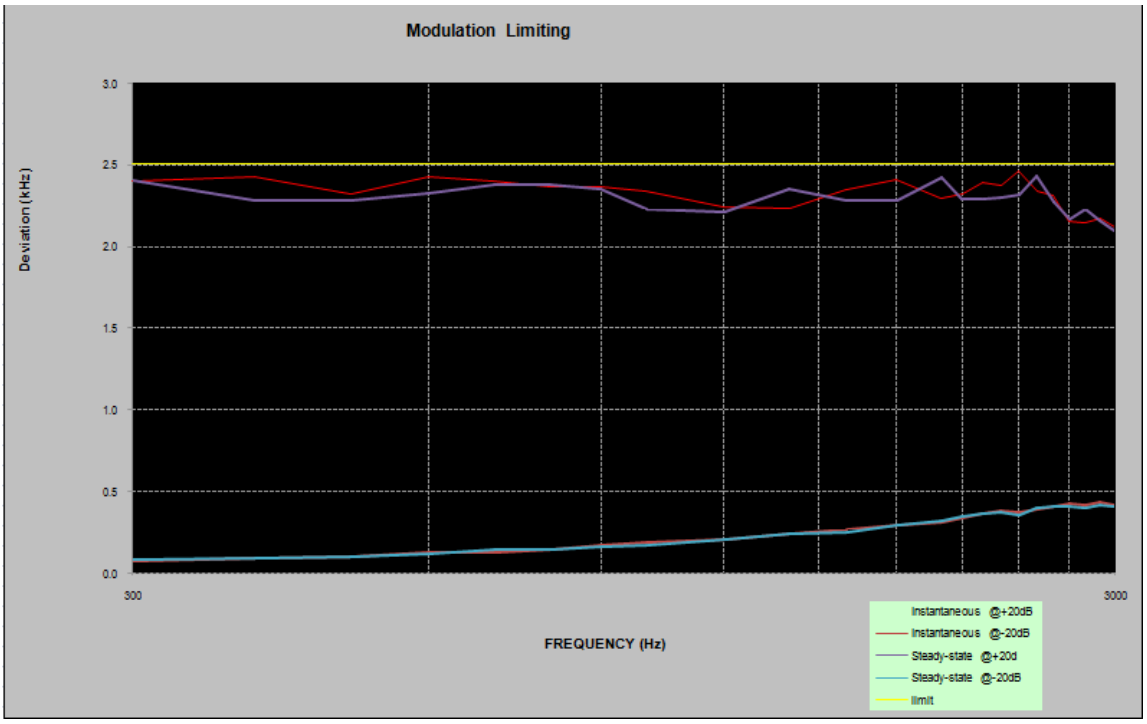
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-43.06	0.0
4.0	-53.14	-7.5
5.0	-64.13	-13.3
6.0	-66.11	-18.1
7.0	-76.48	-22.1
8.0	-79.42	-25.6
9.0	-84.82	-28.6
10.0	-86.52	-31.4
15.0	-95.44	-41.9
20.0	-86.78	-50.0
30.0	-86.14	-50.0
40.0	-88.46	-50.0
50.0	-91.37	-50.0
60.0	-90.15	-50.0
70.0	-85.48	-50.0



MODULATION LIMITING

Carrier Frequency: 454.5 MHz, Channel Separation=12.5 kHz

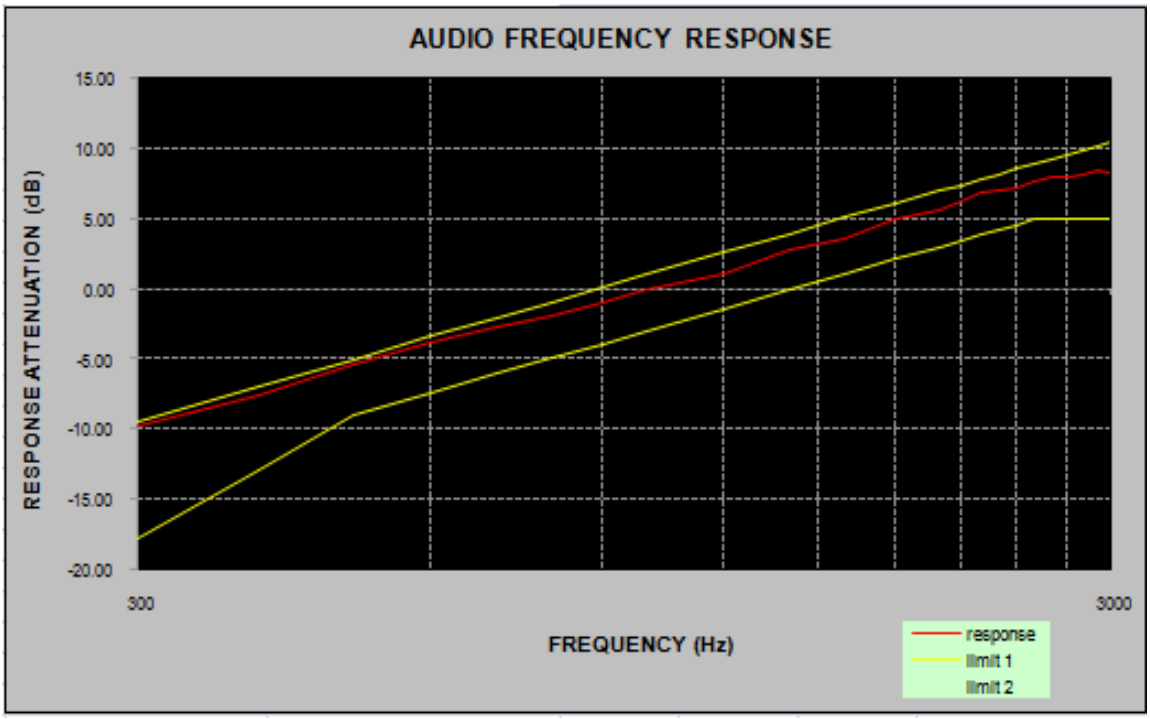
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	2.398	0.069	2.405	0.078	2.5
400	2.423	0.092	2.277	0.090	2.5
500	2.319	0.100	2.277	0.100	2.5
600	2.425	0.125	2.320	0.120	2.5
700	2.399	0.124	2.378	0.140	2.5
800	2.360	0.143	2.378	0.140	2.5
900	2.360	0.165	2.354	0.162	2.5
1000	2.341	0.186	2.228	0.165	2.5
1200	2.236	0.203	2.208	0.201	2.5
1400	2.230	0.241	2.346	0.238	2.5
1600	2.343	0.266	2.278	0.252	2.5
1800	2.407	0.295	2.282	0.290	2.5
2000	2.292	0.307	2.417	0.317	2.5
2100	2.317	0.338	2.292	0.346	2.5
2200	2.388	0.360	2.287	0.364	2.5
2300	2.371	0.383	2.296	0.373	2.5
2400	2.458	0.372	2.312	0.350	2.5
2500	2.334	0.392	2.428	0.396	2.5
2600	2.308	0.408	2.270	0.404	2.5
2700	2.155	0.421	2.165	0.404	2.5
2800	2.145	0.412	2.223	0.396	2.5
2900	2.170	0.430	2.161	0.411	2.5
3000	2.120	0.413	2.094	0.409	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: 454.5 MHz, Channel Separation=12.5 kHz

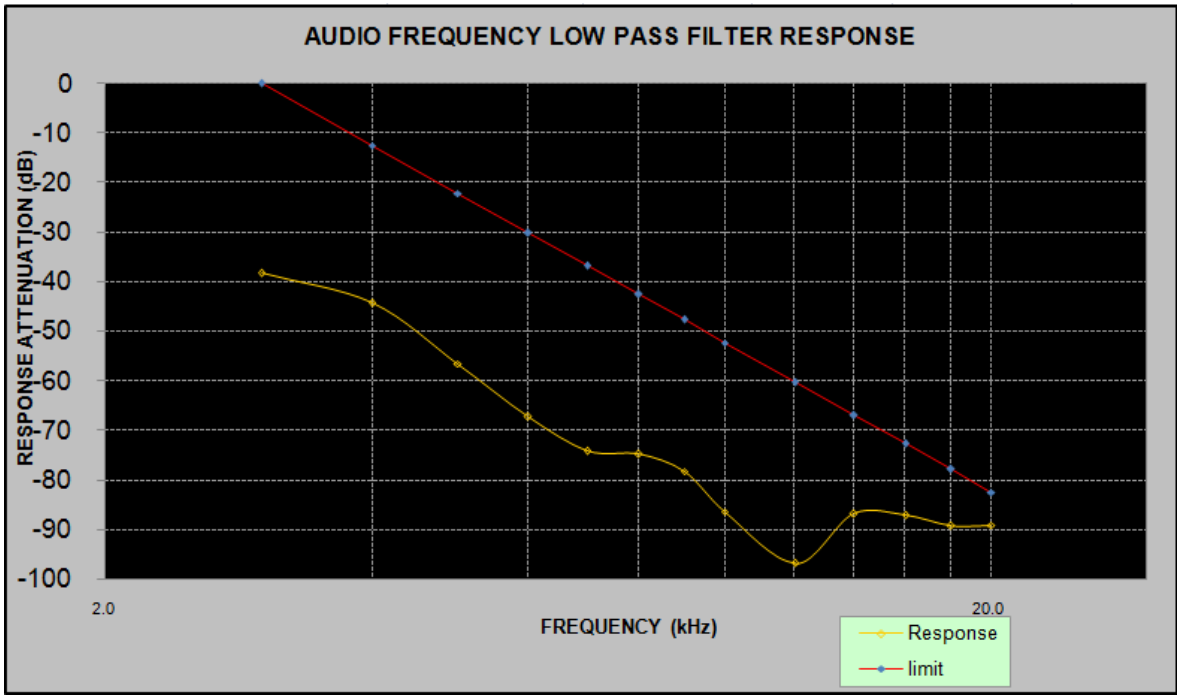
Audio Frequency (Hz)	Response Attenuation (dB)
300	-9.74
400	-7.66
500	-5.42
600	-3.88
700	-2.76
800	-1.96
900	-0.95
1000	0.00
1200	1.08
1400	2.73
1600	3.61
1800	5.06
2000	5.68
2100	6.32
2200	6.82
2300	7.04
2400	7.19
2500	7.65
2600	7.94
2700	7.97
2800	8.07
2900	8.43
3000	8.34


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
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 454.5 MHz, Channel Separation=12.5 kHz

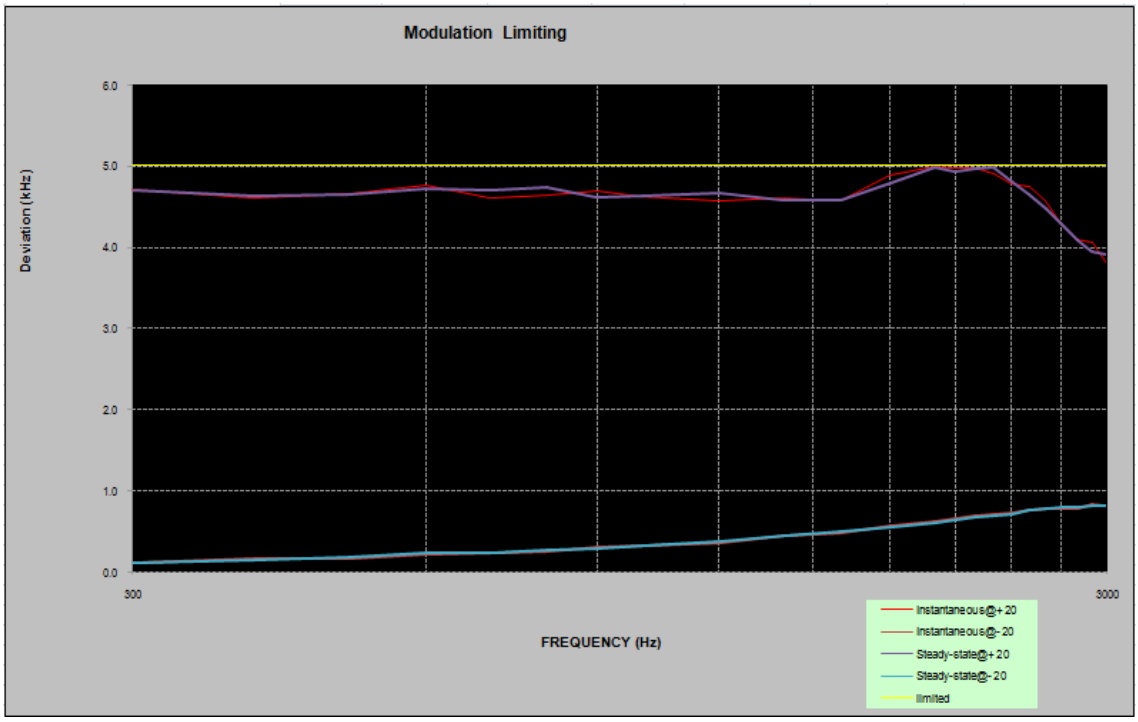
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-38.35	0.0
4.0	-44.37	-12.5
5.0	-56.53	-22.2
6.0	-67.18	-30.1
7.0	-74.14	-36.8
8.0	-74.80	-42.6
9.0	-78.25	-47.7
10.0	-86.37	-52.3
12.0	-96.82	-60.2
14.0	-86.75	-66.9
16.0	-87.14	-72.7
18.0	-89.23	-77.8
20.0	-89.05	-82.5



MODULATION LIMITING

Carrier Frequency: 454.5 MHz, Channel Separation= 25 kHz

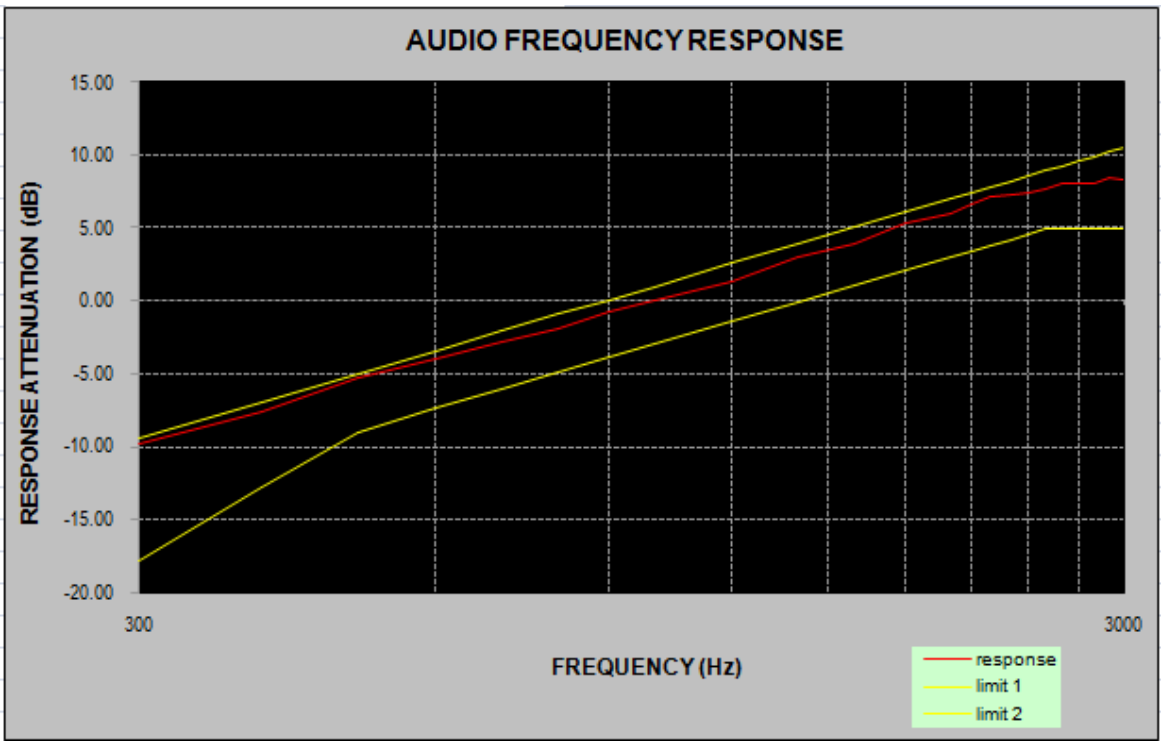
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	4.710	0.117	4.703	0.104	5.000
400	4.605	0.156	4.625	0.152	5.000
500	4.653	0.167	4.641	0.175	5.000
600	4.760	0.218	4.724	0.229	5.000
700	4.608	0.233	4.706	0.230	5.000
800	4.635	0.254	4.730	0.261	5.000
900	4.699	0.305	4.606	0.282	5.000
1000	4.622	0.322	4.621	0.317	5.000
1200	4.566	0.356	4.657	0.365	5.000
1400	4.600	0.446	4.568	0.445	5.000
1600	4.573	0.473	4.573	0.491	5.000
1800	4.891	0.564	4.792	0.551	5.000
2000	4.986	0.617	4.975	0.594	5.000
2100	4.966	0.659	4.930	0.645	5.000
2200	4.965	0.683	4.958	0.671	5.000
2300	4.898	0.707	4.990	0.695	5.000
2400	4.774	0.723	4.810	0.710	5.000
2500	4.751	0.761	4.643	0.755	5.000
2600	4.560	0.786	4.475	0.774	5.000
2700	4.292	0.784	4.270	0.790	5.000
2800	4.098	0.780	4.084	0.797	5.000
2900	4.049	0.837	3.944	0.821	5.000
3000	3.794	0.813	3.909	0.807	5.000


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: 454.5 MHz, Channel Separation= 25 kHz

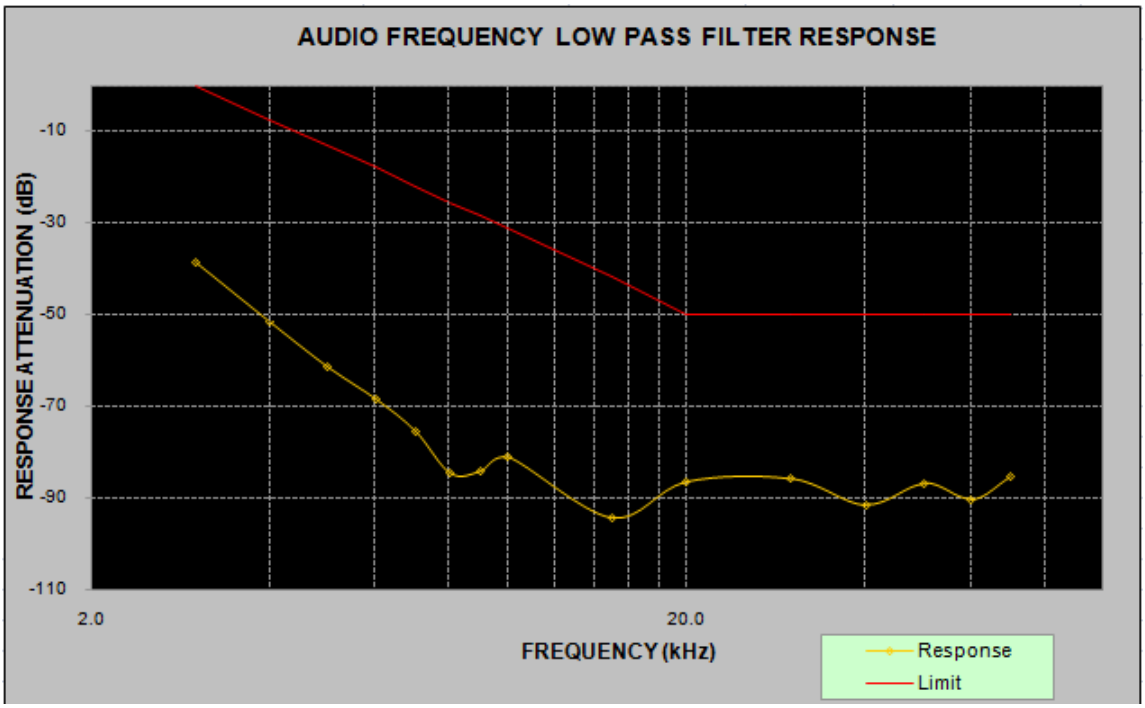
Audio Frequency (Hz)	Response Attenuation (dB)
300	-9.84
400	-7.58
500	-5.34
600	-3.94
700	-2.88
800	-1.92
900	-0.81
1000	0.00
1200	1.28
1400	2.97
1600	3.87
1800	5.29
2000	6.05
2100	6.58
2200	7.11
2300	7.25
2400	7.36
2500	7.74
2600	8.09
2700	8.07
2800	8.12
2900	8.48
3000	8.36


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
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 454.5 MHz, Channel Separation= 25 kHz

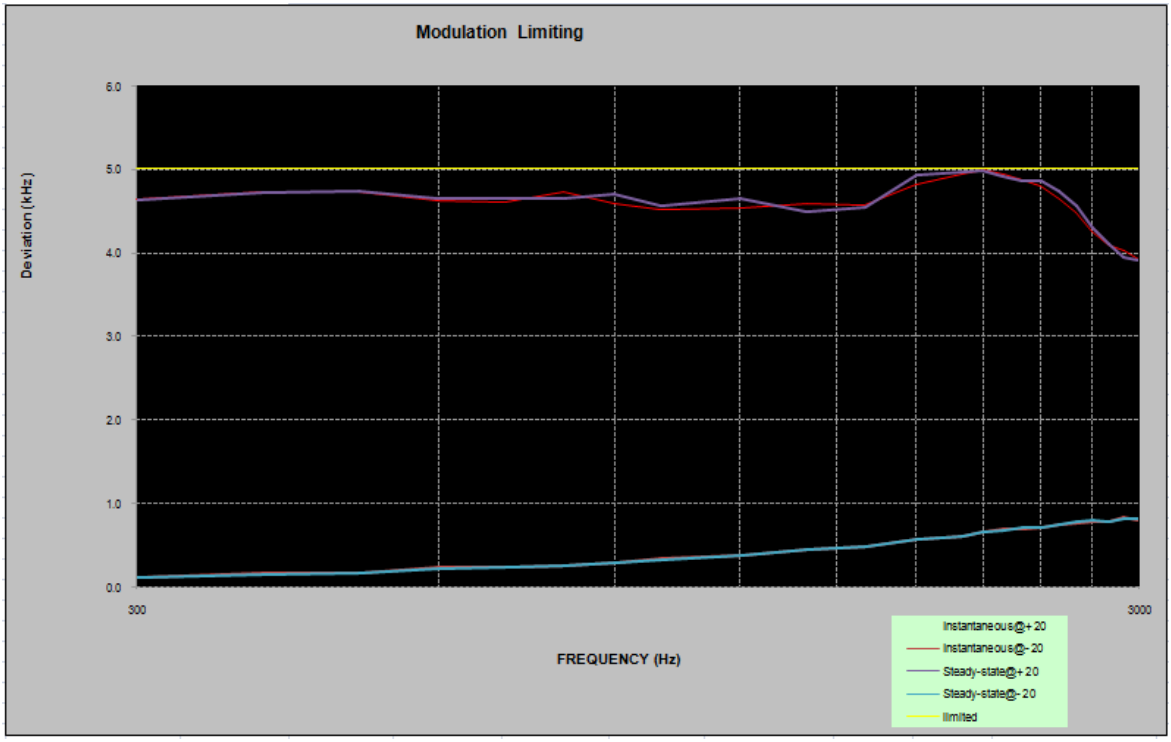
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-38.76	0.0
4.0	-51.64	-7.5
5.0	-61.43	-13.3
6.0	-68.51	-18.1
7.0	-75.48	-22.1
8.0	-84.82	-25.6
9.0	-84.42	-28.6
10.0	-81.32	-31.4
15.0	-94.44	-41.9
20.0	-86.58	-50.0
30.0	-85.94	-50.0
40.0	-91.56	-50.0
50.0	-86.87	-50.0
60.0	-90.45	-50.0
70.0	-85.48	-50.0



MODULATION LIMITING

Carrier Frequency: 458.2125 MHz, Channel Separation= 25 kHz

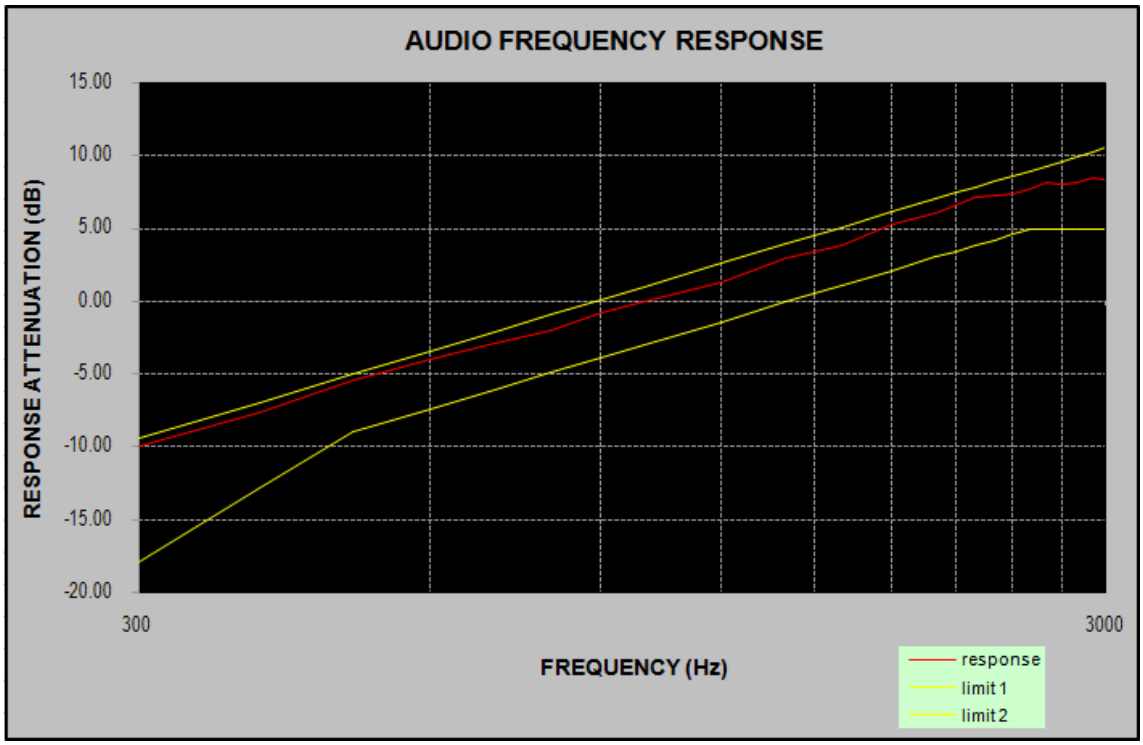
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	4.639	0.107	4.623	0.113	5.000
400	4.718	0.156	4.726	0.142	5.000
500	4.732	0.168	4.740	0.166	5.000
600	4.626	0.229	4.644	0.208	5.000
700	4.605	0.232	4.643	0.230	5.000
800	4.734	0.252	4.642	0.251	5.000
900	4.581	0.285	4.695	0.293	5.000
1000	4.512	0.332	4.554	0.318	5.000
1200	4.540	0.366	4.646	0.364	5.000
1400	4.588	0.437	4.487	0.444	5.000
1600	4.564	0.482	4.539	0.480	5.000
1800	4.813	0.574	4.928	0.573	5.000
2000	4.942	0.607	4.970	0.594	5.000
2100	4.984	0.659	4.973	0.656	5.000
2200	4.941	0.692	4.919	0.680	5.000
2300	4.865	0.688	4.853	0.706	5.000
2400	4.793	0.713	4.860	0.700	5.000
2500	4.630	0.750	4.731	0.747	5.000
2600	4.483	0.767	4.556	0.773	5.000
2700	4.248	0.784	4.290	0.790	5.000
2800	4.100	0.779	4.106	0.777	5.000
2900	4.028	0.828	3.936	0.820	5.000
3000	3.914	0.802	3.902	0.808	5.000


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: 458.2125 MHz, Channel Separation= 25 kHz

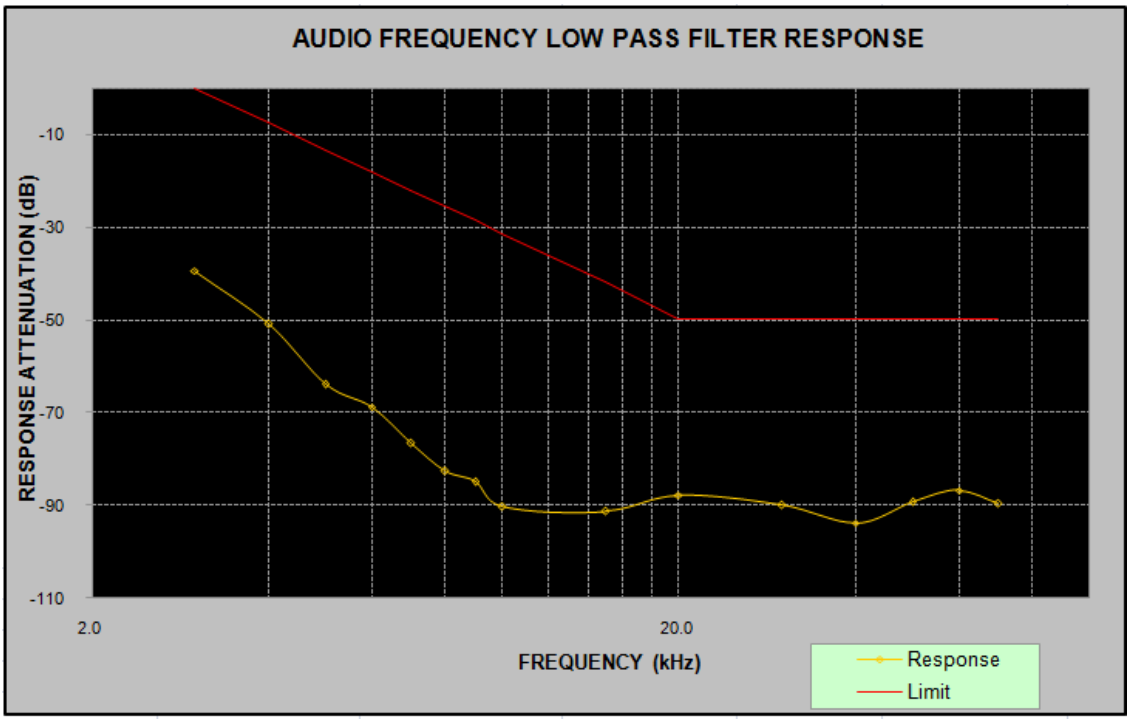
Audio Frequency (Hz)	Response Attenuation (dB)
300	-9.92
400	-7.64
500	-5.42
600	-4.01
700	-2.91
800	-1.98
900	-0.86
1000	0.00
1200	1.25
1400	2.93
1600	3.84
1800	5.27
2000	6.01
2100	6.58
2200	7.09
2300	7.23
2400	7.34
2500	7.73
2600	8.07
2700	8.06
2800	8.11
2900	8.46
3000	8.34


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
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 458.2125 MHz, Channel Separation= 25 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-39.46	0.0
4.0	-50.94	-7.5
5.0	-63.93	-13.3
6.0	-68.81	-18.1
7.0	-76.68	-22.1
8.0	-82.72	-25.6
9.0	-84.92	-28.6
10.0	-90.42	-31.4
15.0	-91.34	-41.9
20.0	-87.78	-50.0
30.0	-89.94	-50.0
40.0	-93.86	-50.0
50.0	-89.27	-50.0
60.0	-86.75	-50.0
70.0	-89.58	-50.0



FCC §2.1049 & § 22.359 & § 22.731 & §74.462 & § 80.205 & § 80.211 – OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049, § 22.359, § 22.731, §74.462, § 80.205, § 80.211

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.

Emission Mask B - 25 kHz channel bandwidth equipment. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) 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.

Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 30 kHz or more. In the 60 kHz bands immediately outside and adjacent to the authorized frequency range or channel, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 30 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Test Procedure

The resolution bandwidth of the spectrum analyzer was set at 100 Hz or 300 Hz and the spectrum was recorded in the frequency band ±50 kHz from the carrier frequency.

Test Data

Environmental Conditions

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

The testing was performed by Dylan Li on 2017-09-11 and 2017-09-25.

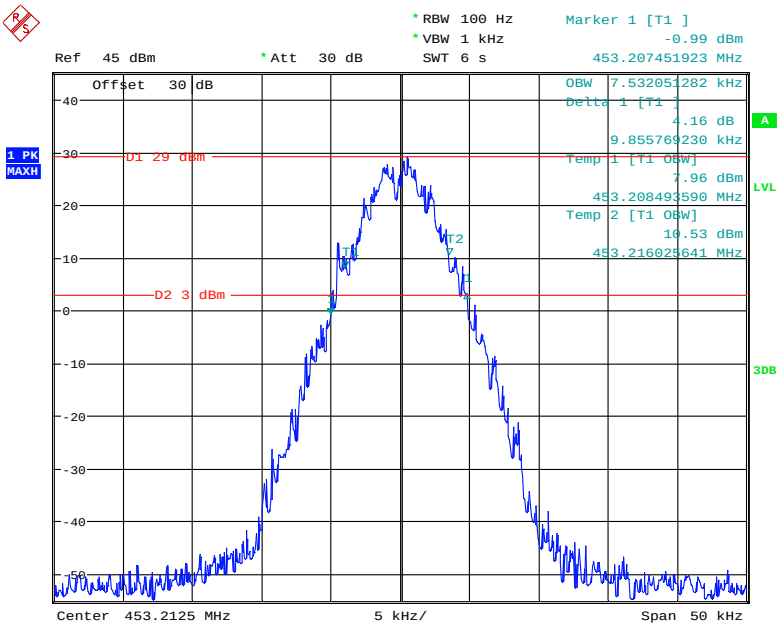
Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)	Note
Digital	12.5	453.2125	High	7.53	8.89	For Part 74
	12.5		Low	7.53	9.86	
	12.5	454.5	High	7.05	9.21	For Part 22
	12.5		Low	7.77	9.62	

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

For Digital Mode （Channel Spacing:12.5 kHz）
Emission Designator 7K60FXD and 7K60FXW
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,7.77 kHz. The emission mask was obtained from 47CFR 90.210(d).
FXD and FXW portion of the designator indicates digital information.
Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60FXD and 7K60FXW.

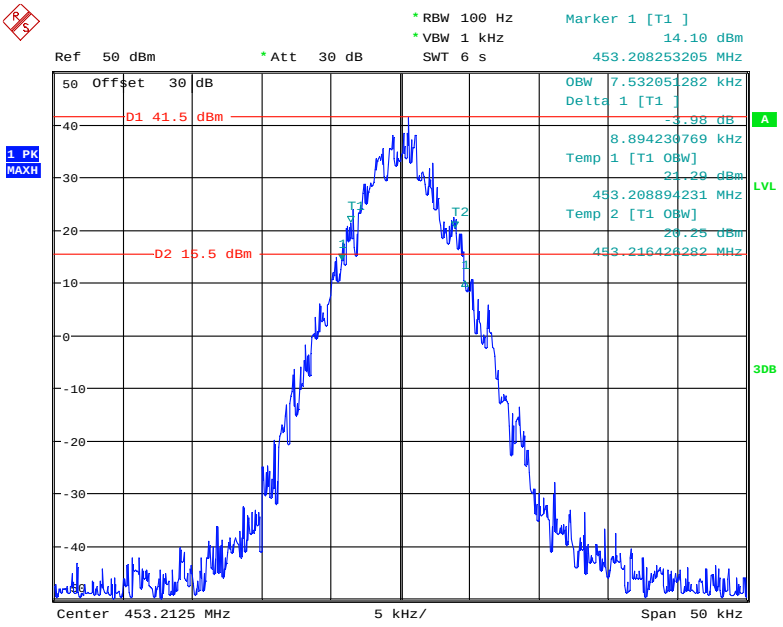
Digital Modulation:

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



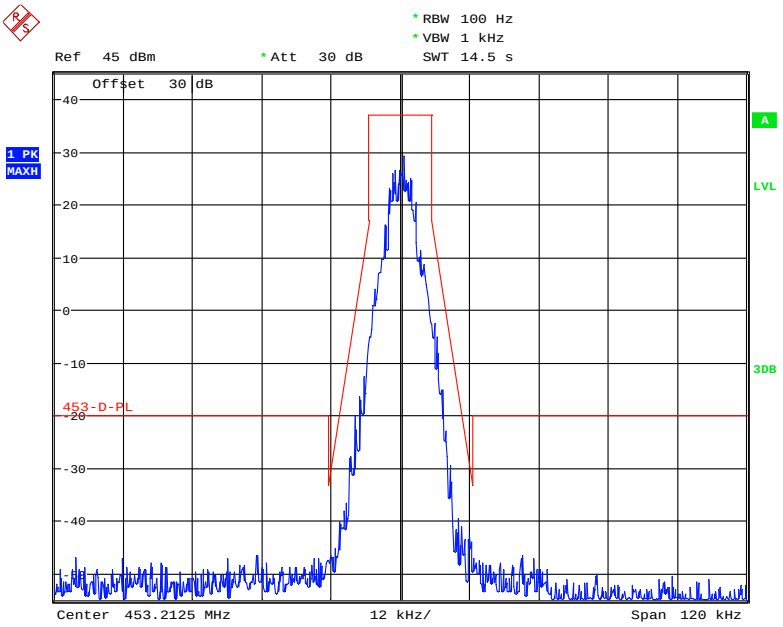
Date: 11.SEP.2017 19:45:47

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



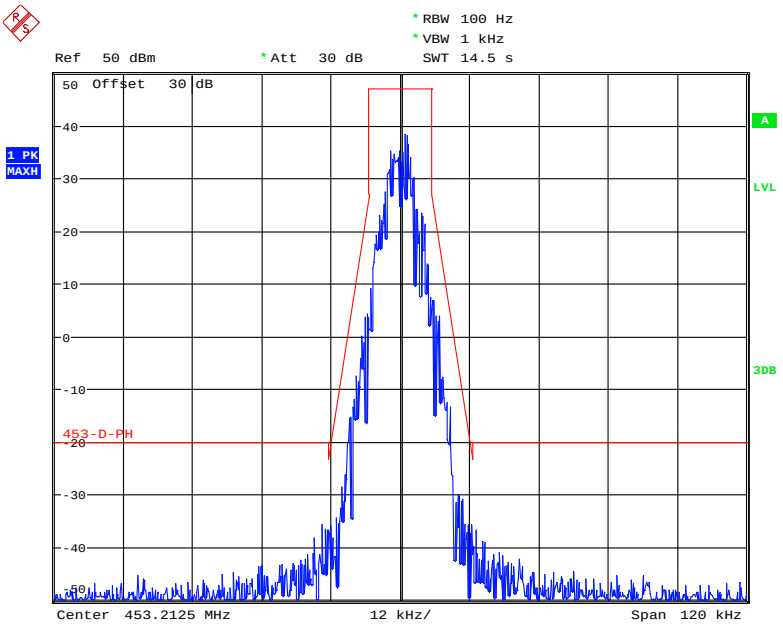
Date: 11.SEP.2017 19:37:54

Frequency 453.2125 MHz: Emission Mask D,FCC part 74.462, Low Power



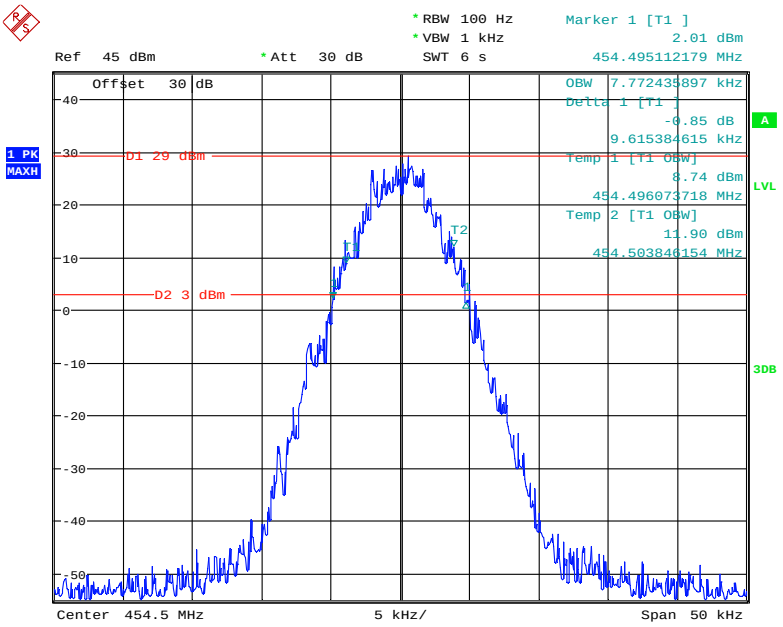
Date: 25.SEP.2017 23:14:43

Frequency 453.2125 MHz: Emission Mask D, FCC part 74.462, High Power



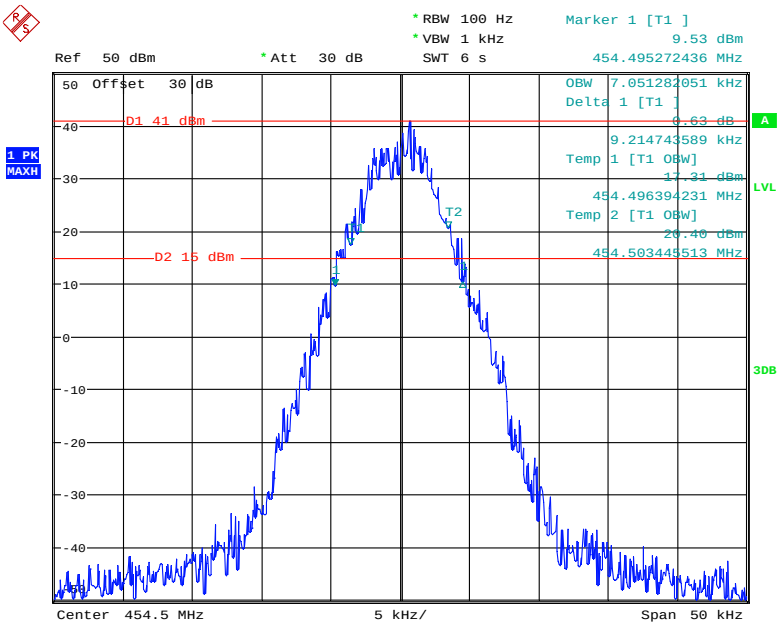
Date: 25.SEP.2017 23:11:38

Frequency 454.5 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



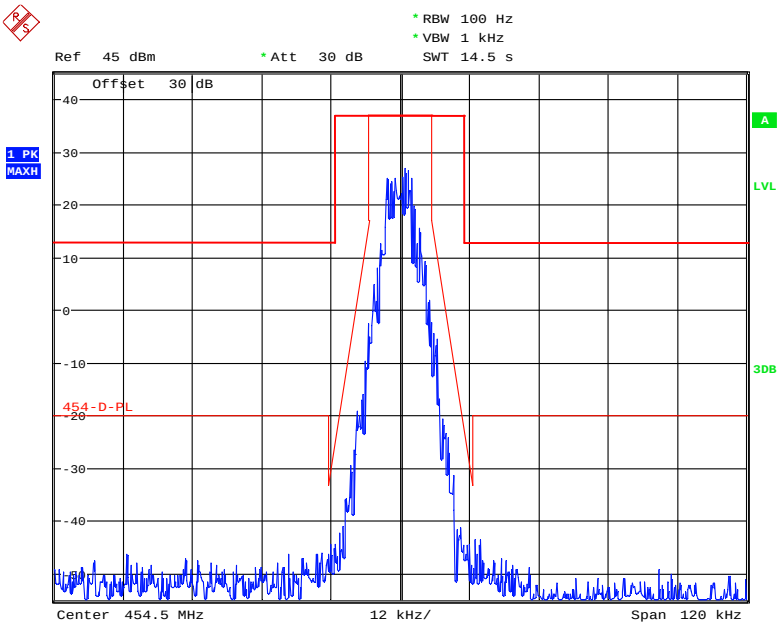
Date: 11.SEP.2017 19:47:05

Frequency 454.5 MHz: 99% Occupied & 26 dB Bandwidth, High Power



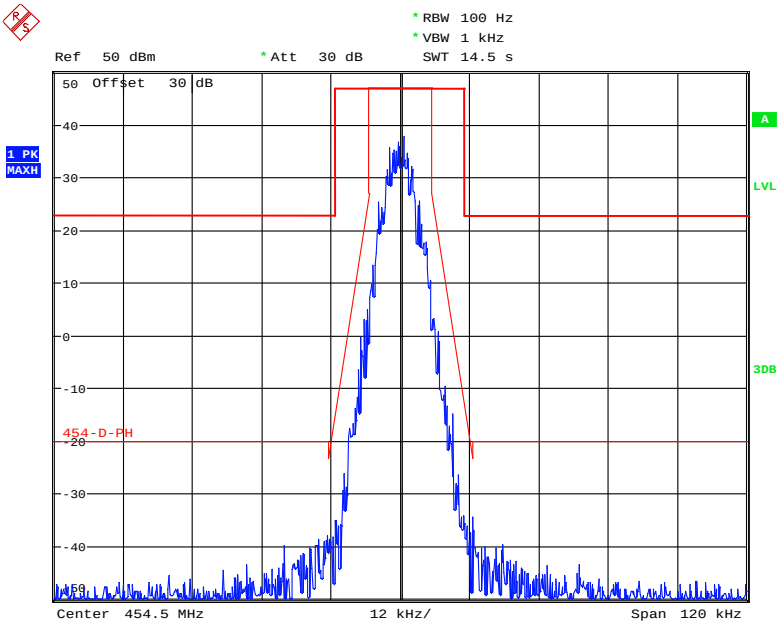
Date: 11.SEP.2017 19:48:18

Frequency 454.5 MHz: Emission Mask ,FCC part 22.359, Low Power



Date: 25.SEP.2017 23:19:21

Frequency 454.5 MHz: Emission Mask ,FCC part 22.359, High Power



Date: 25.SEP.2017 23:18:37

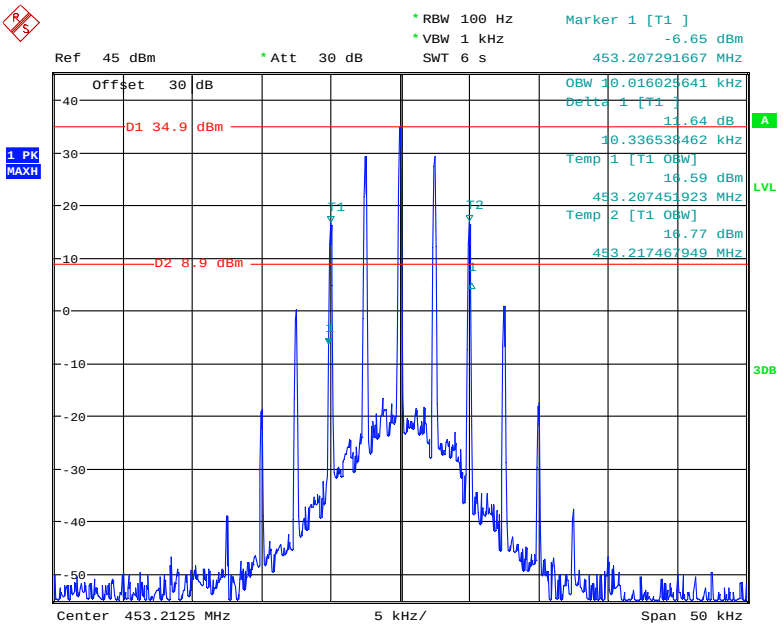
Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)	Note
Analog	12.5	453.2125	High	10.02	10.34	For Part 74
	12.5		Low	10.02	10.34	
	12.5	454.5	High	10.02	10.34	For Part 22
	12.5		Low	10.02	10.34	

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.

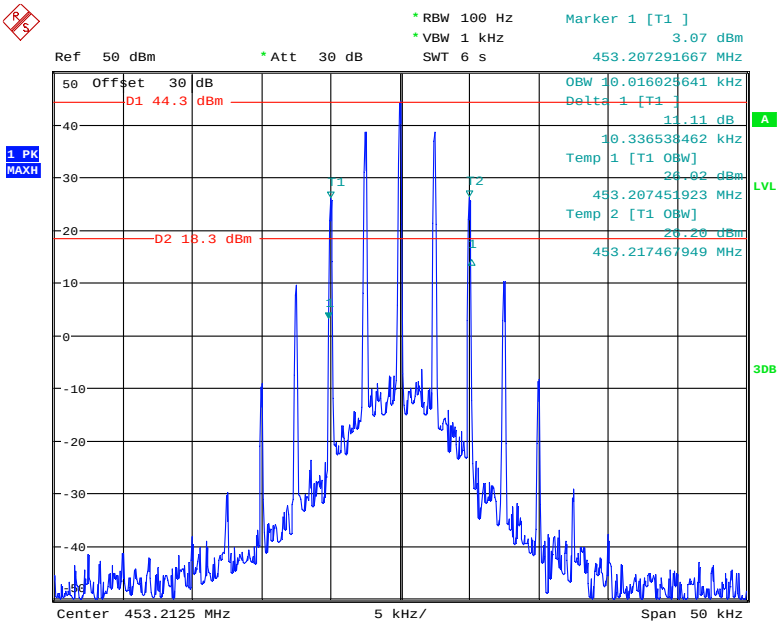
Analog Modulation 12.5k:

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



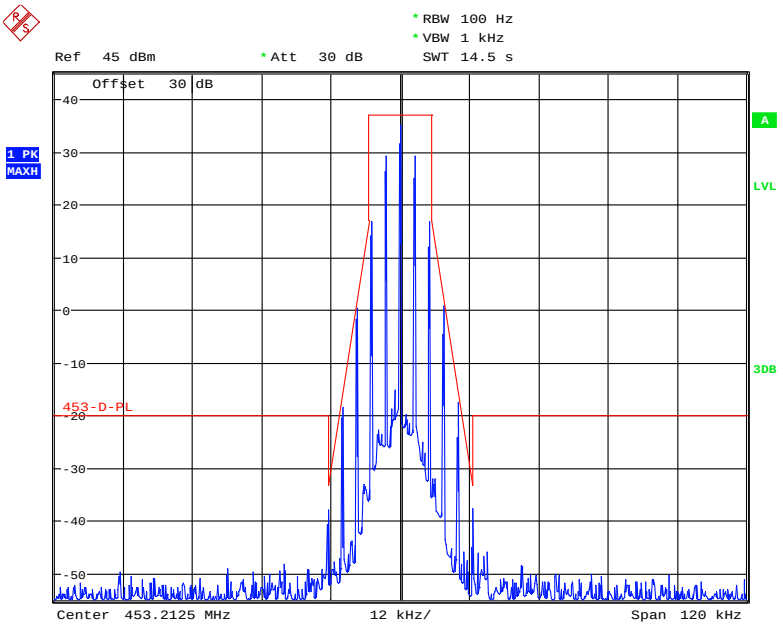
Date: 25.SEP.2017 23:32:41

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



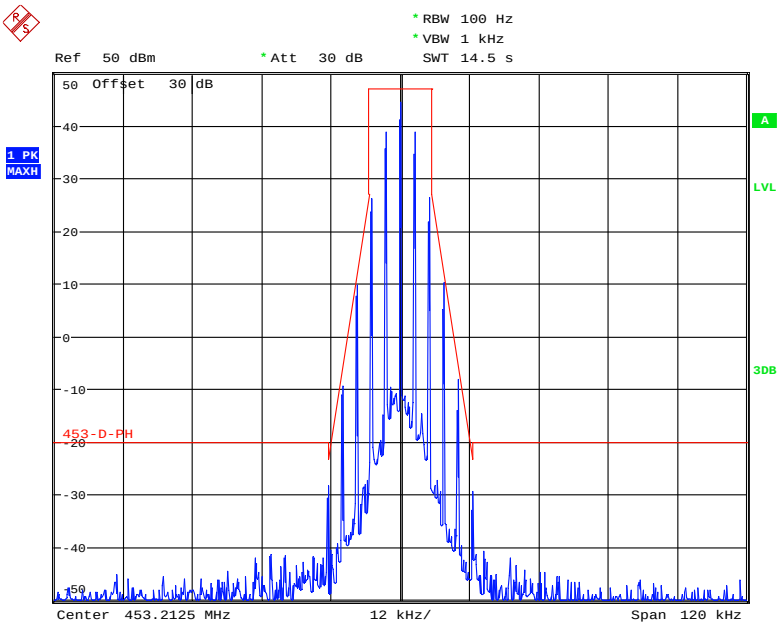
Date: 25.SEP.2017 23:33:11

Frequency 453.2125 MHz: Emission Mask D, FCC part 74.462, Low Power



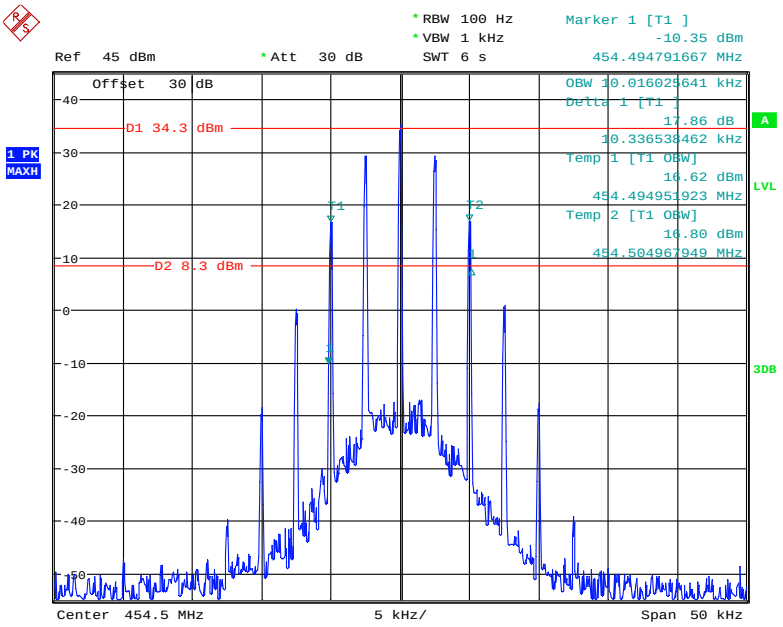
Date: 25.SEP.2017 23:23:30

Frequency 453.2125 MHz: Emission Mask D, FCC part 74.462,High Power



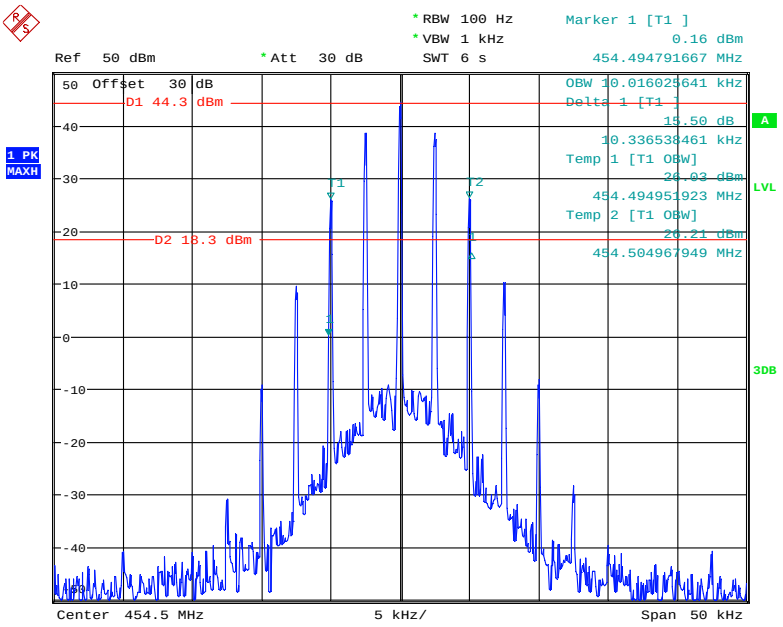
Date: 25.SEP.2017 23:24:06

Frequency 454.5 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



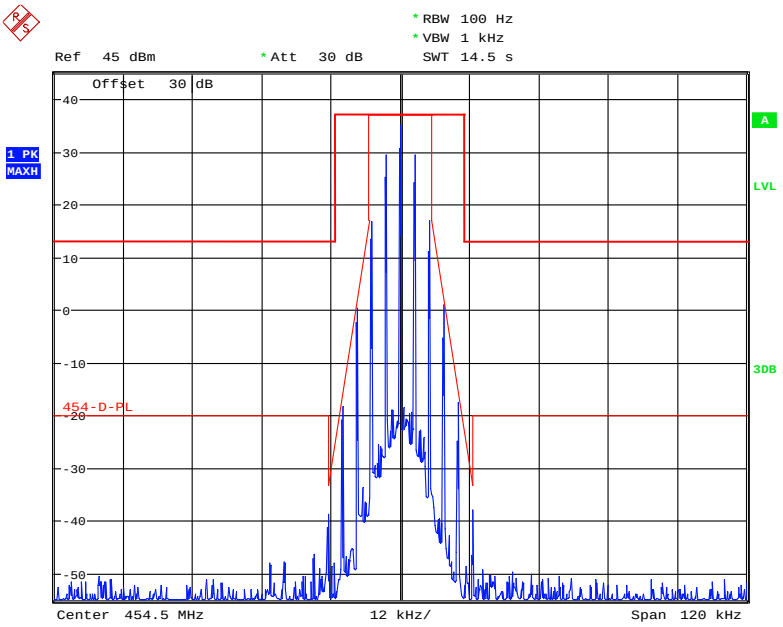
Date: 25.SEP.2017 23:34:17

Frequency 454.5 MHz: 99% Occupied & 26 dB Bandwidth, High Power



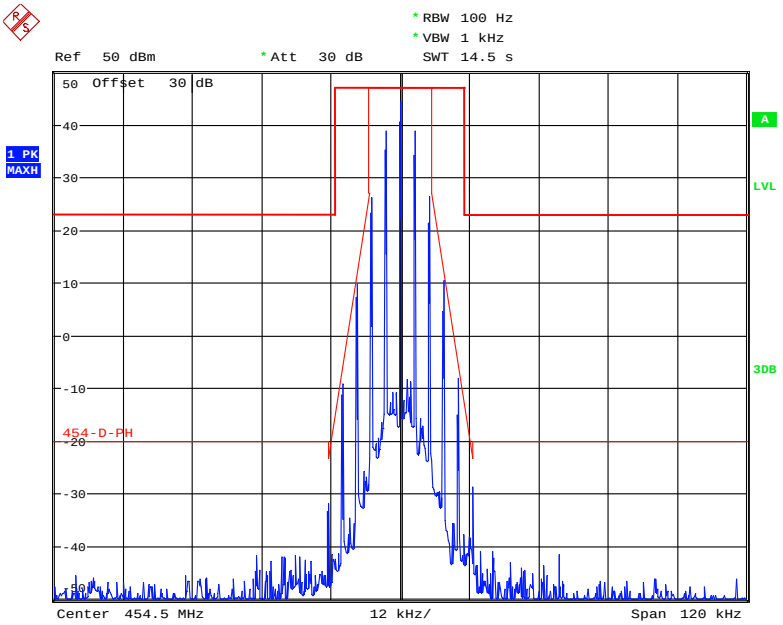
Date: 25.SEP.2017 23:33:41

Frequency 454.5 MHz: Emission Mask ,FCC part 22.359, Low Power



Date: 25.SEP.2017 23:20:37

Frequency 454.5 MHz: Emission Mask ,FCC part 22.359, High Power



Date: 25.SEP.2017 23:21:08

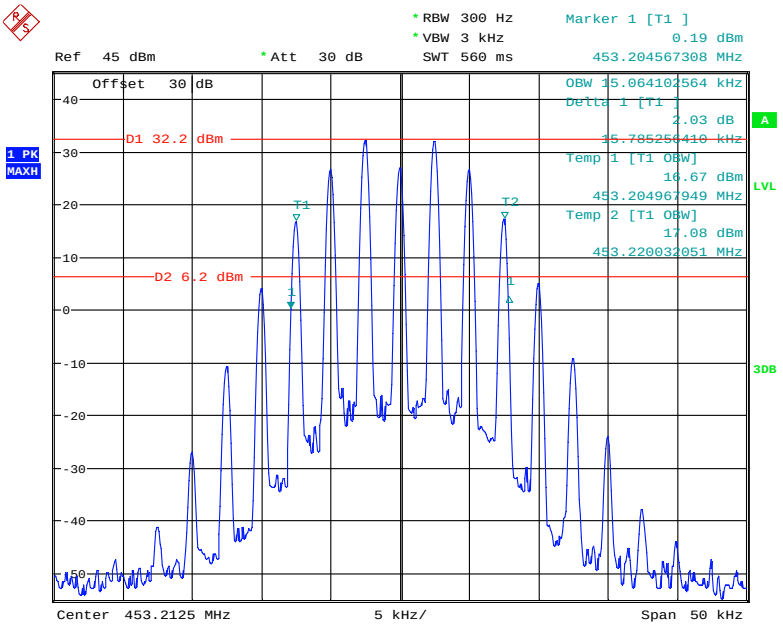
Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)	Note
Analog	25	453.2125	High	15.14	15.79	For Part 74
	25		Low	15.06	15.79	
	25	454.5	High	15.06	15.79	For Part 22
	25		Low	15.06	15.79	
	25	458.2125	High	15.06	15.79	For Part 80
	25		Low	15.06	15.79	

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 3.0 kHz with a 5.0 kHz deviation. BW= 2(M+D)=2(3.0 kHz + 5.0 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.

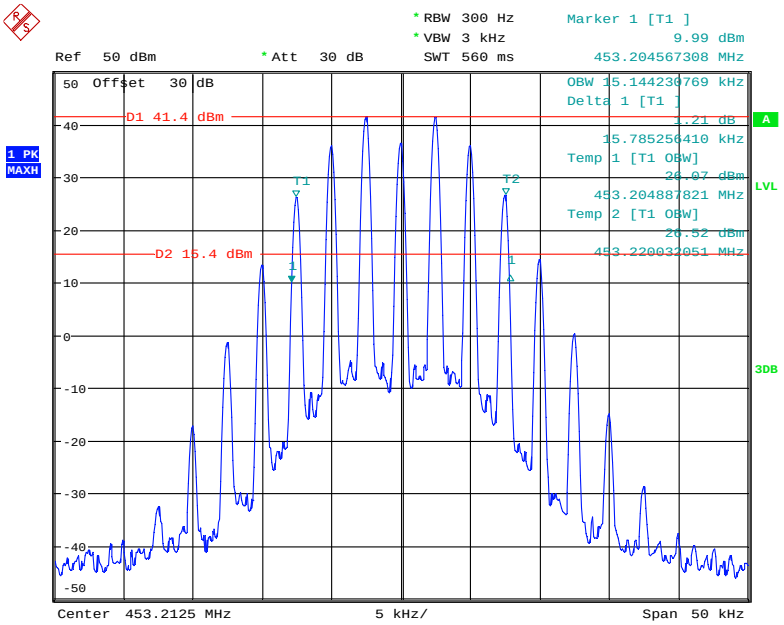
Analog Modulation 25k:

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



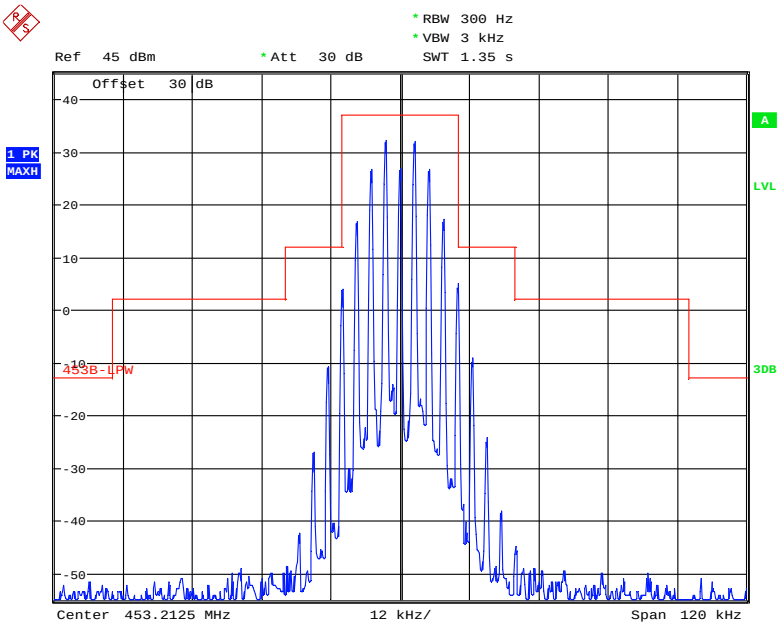
Date: 25.SEP.2017 23:29:28

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



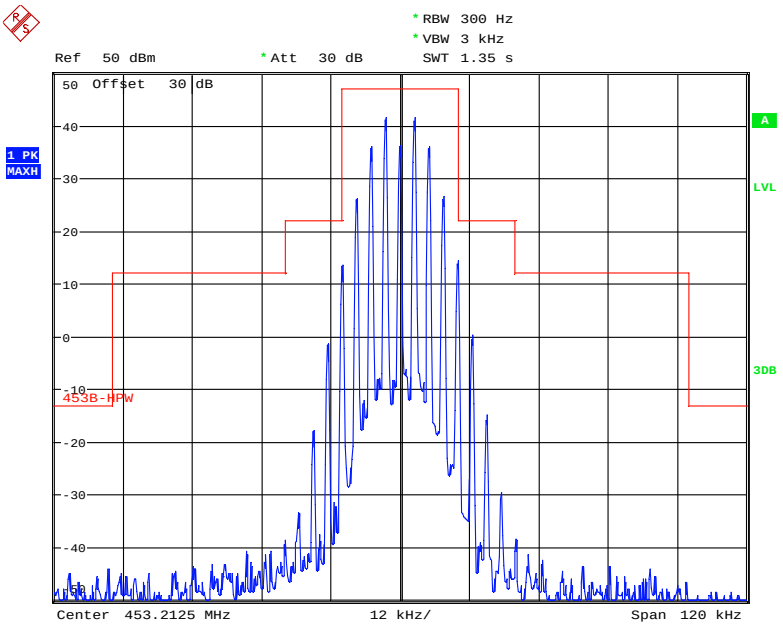
Date: 25.SEP.2017 23:28:53

Frequency 453.2125 MHz: Emission Mask B,FCC Part 74.462, Low Power



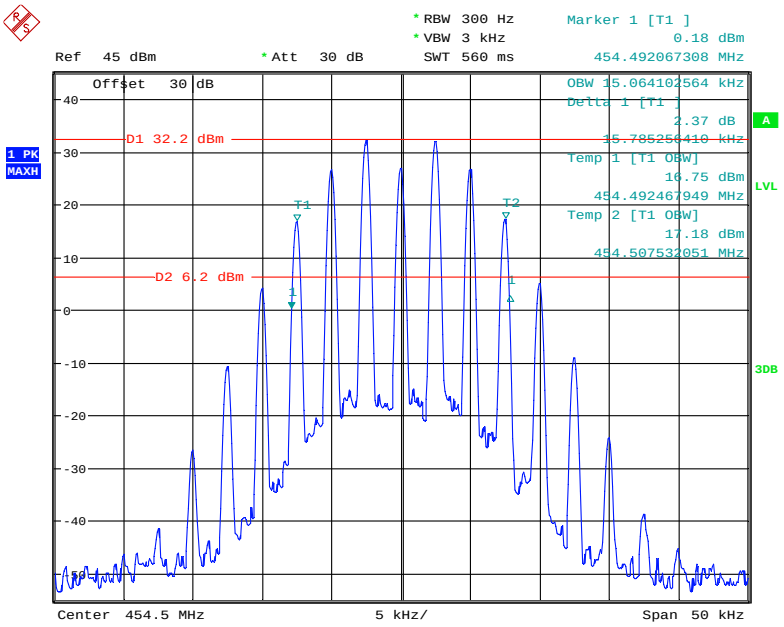
Date: 25.SEP.2017 23:25:12

Frequency 453.2125 MHz: Emission Mask B, FCC Part 74.462, High Power



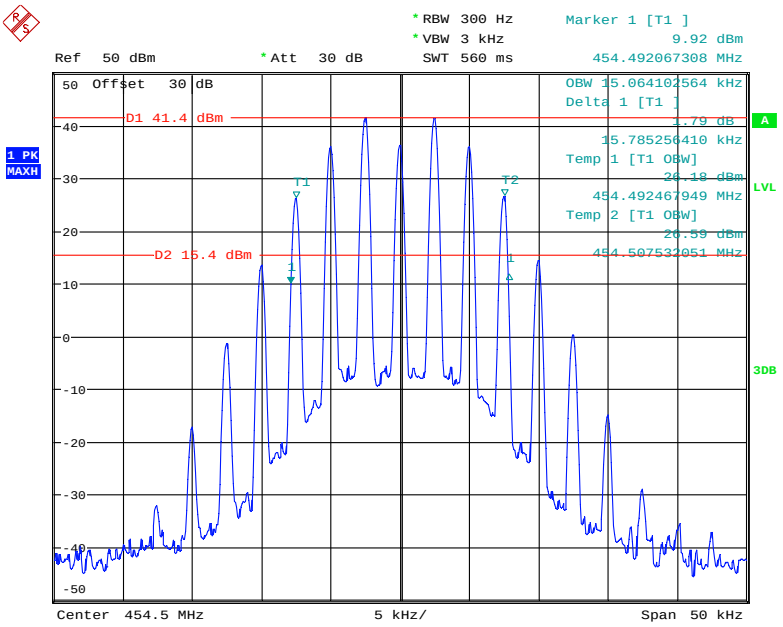
Date: 25.SEP.2017 23:24:52

Frequency 454.5 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



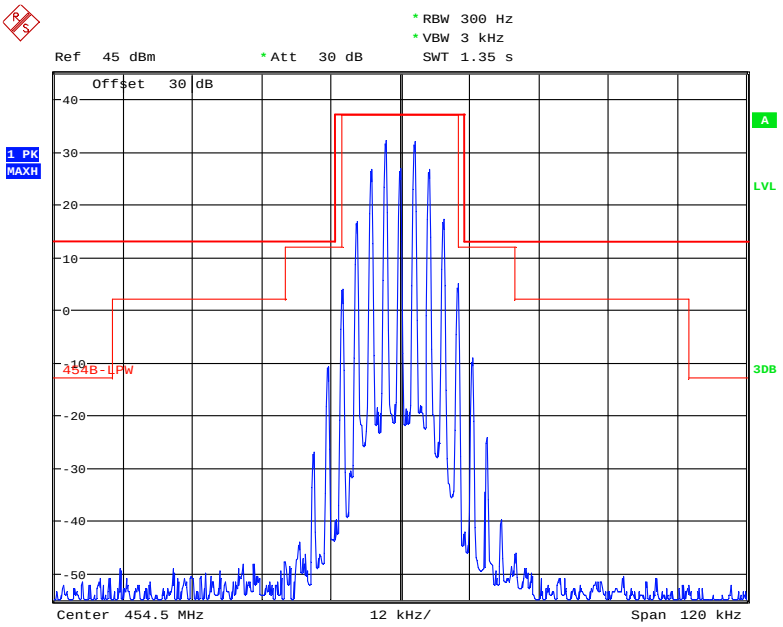
Date: 25.SEP.2017 23:27:40

Frequency 454.5 MHz: 99% Occupied & 26 dB Bandwidth, High Power



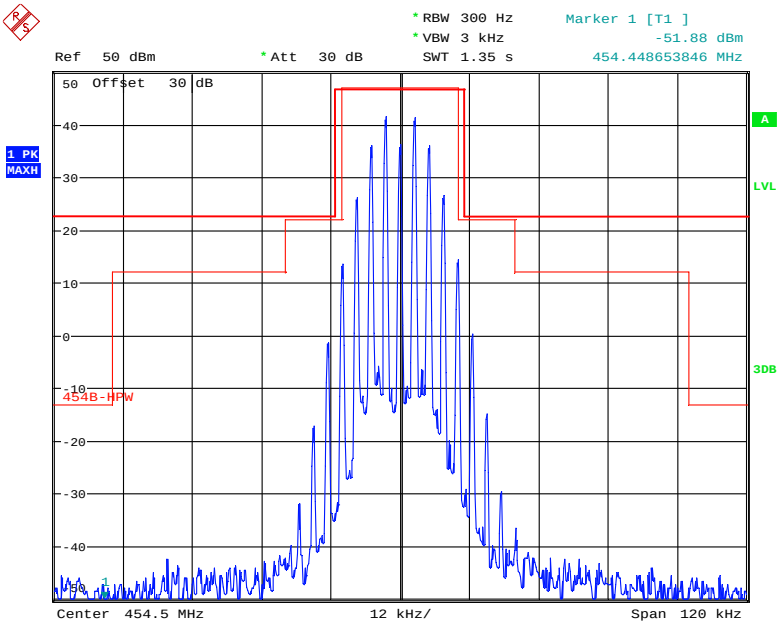
Date: 25.SEP.2017 23:28:20

Frequency 454.5 MHz: Emission Mask ,FCC part 22.359, Low Power



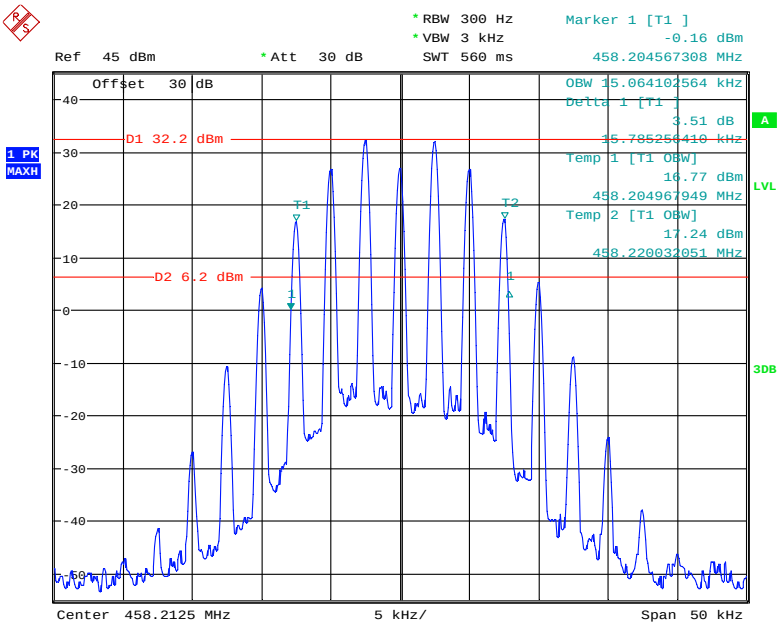
Date: 25.SEP.2017 23:26:45

Frequency 454.5 MHz: Emission Mask ,FCC part 22.359, High Power



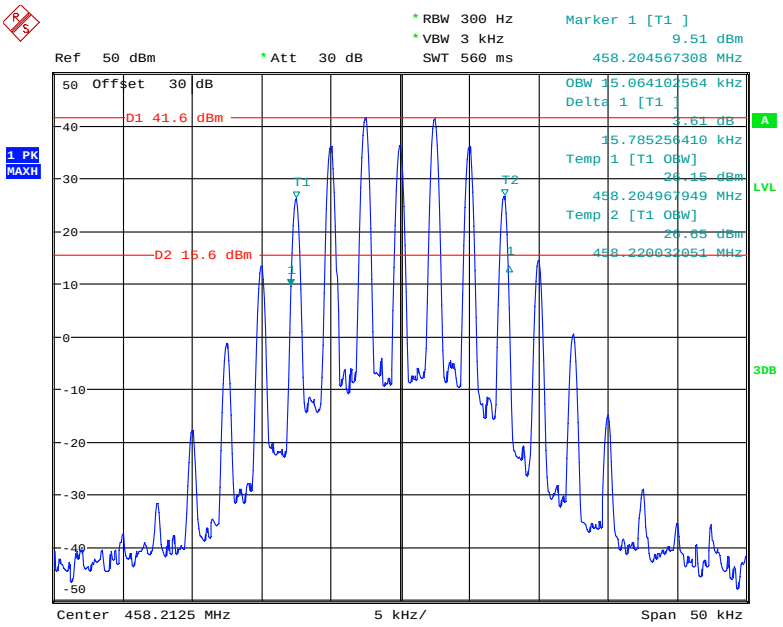
Date: 25.SEP.2017 23:26:24

Frequency 458.2125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



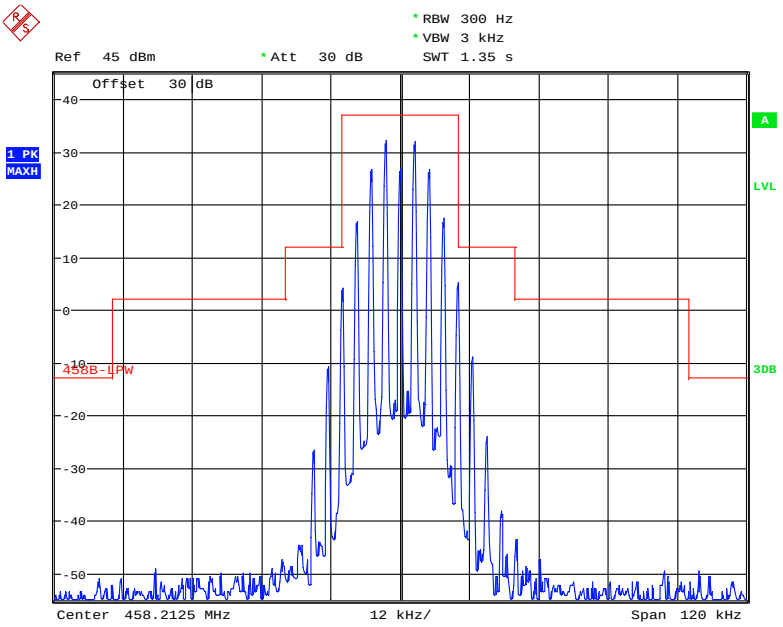
Date: 25.SEP.2017 23:30:01

Frequency 458.2125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



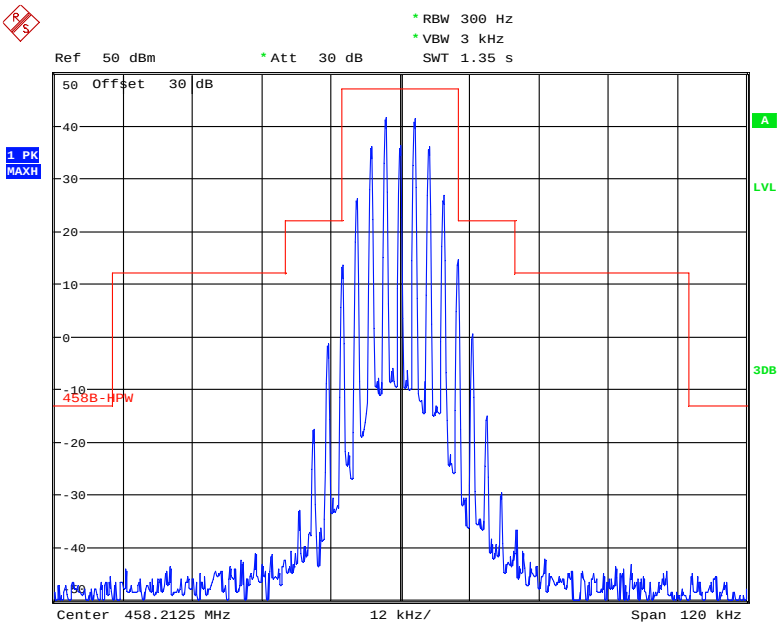
Date: 25.SEP.2017 23:30:31

Frequency 458.2125 MHz: Emission Mask B,FCC part 80.211(f), Low Power



Date: 25.SEP.2017 23:25:42

Frequency 458.2125 MHz: Emission Mask B, FCC part 80.211(f), High Power



Date: 25.SEP.2017 23:26:00

FCC §2.1051 & §22.861 & §74.462 & § 80.211 - 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 that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) 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

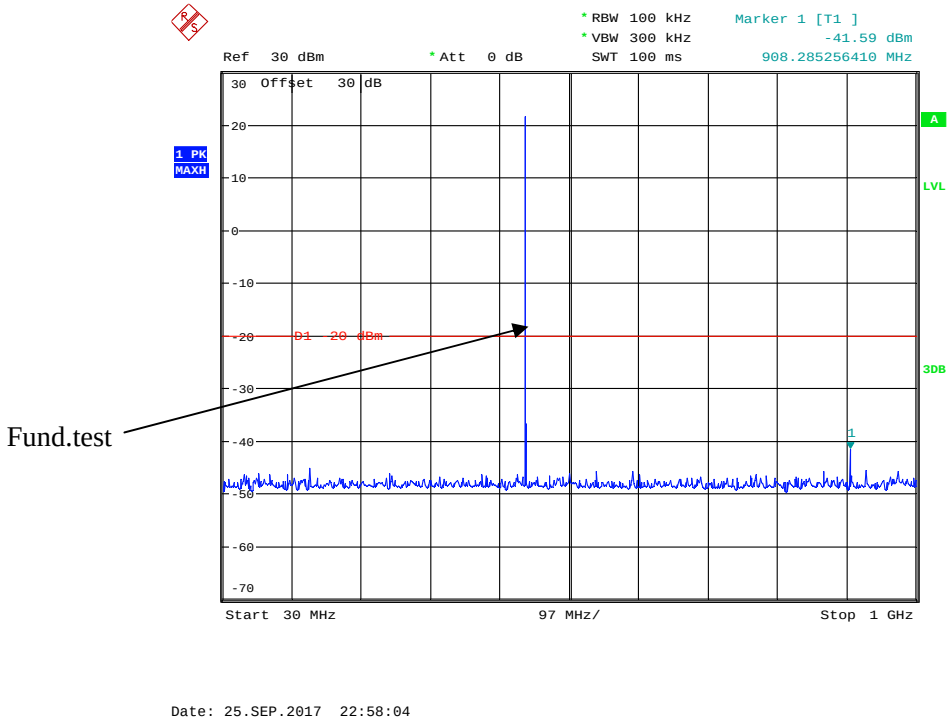
Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.5 kPa

The testing was performed by Dylan Li on 2017-09-25.

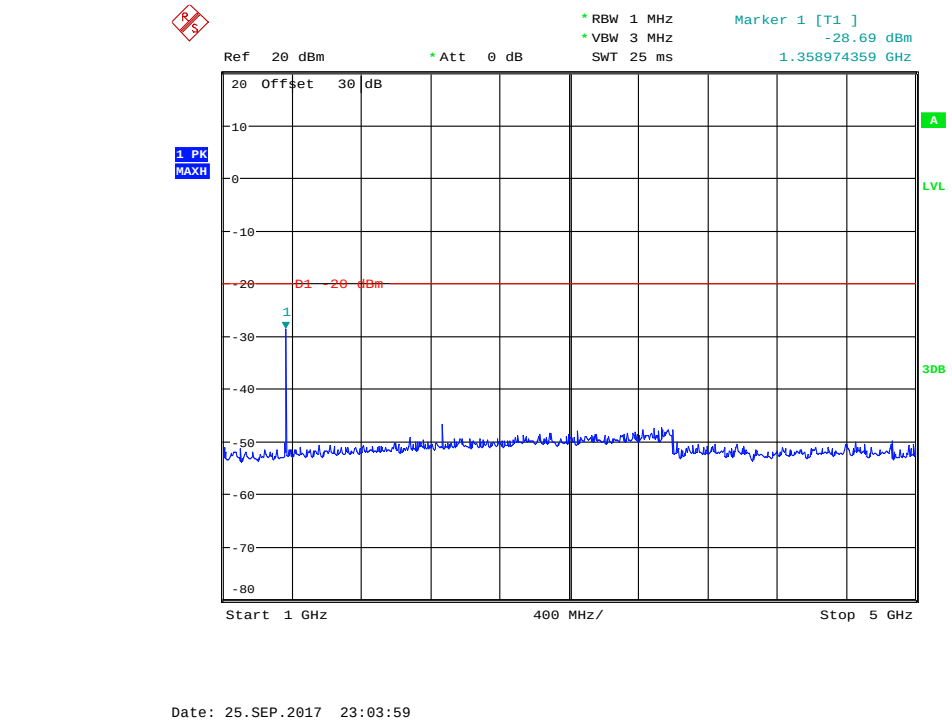
Test Mode: Transmitting, please refer to the following plots.

Digital Modulation:

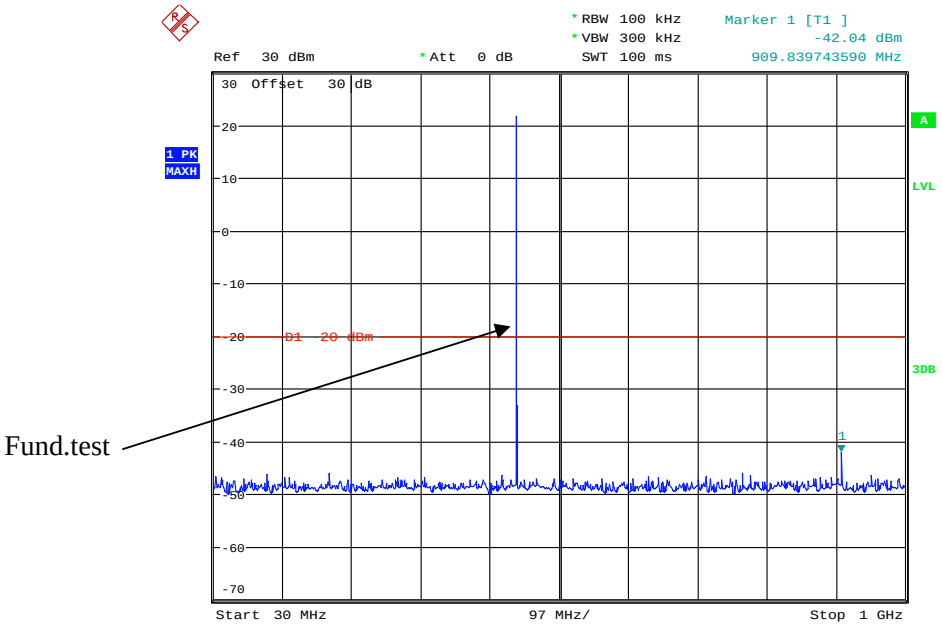
30MHz – 1 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz



1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz

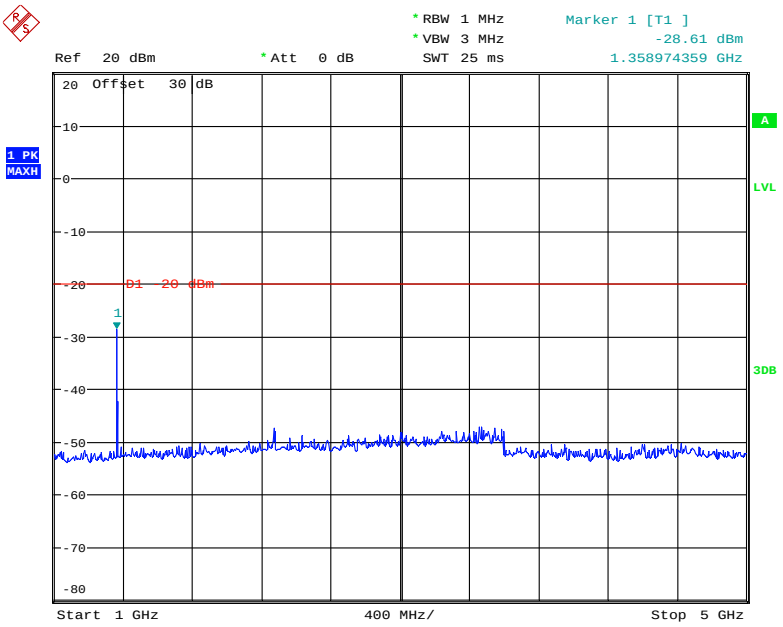


30MHz – 1 GHz, Channel Spacing 12.5 kHz, 454.5 MHz



Date: 25.SEP.2017 22:59:01

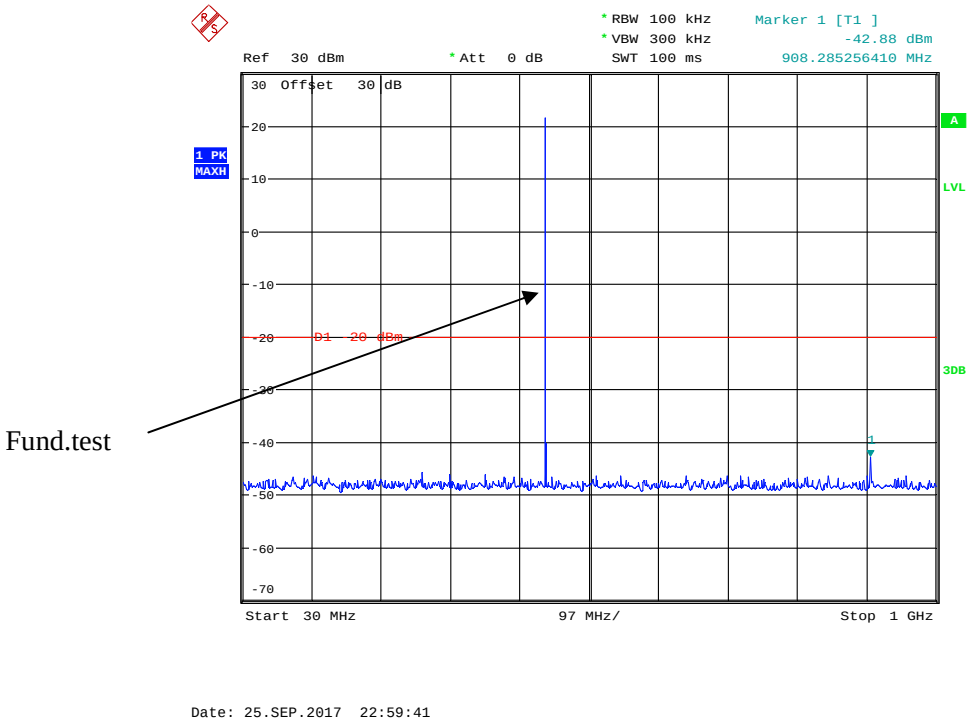
1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 454.5 MHz



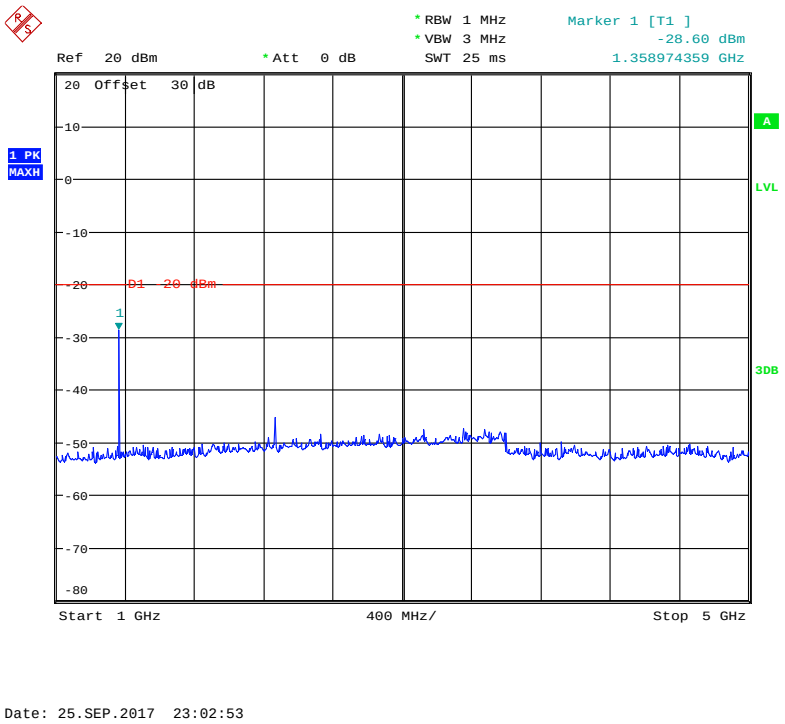
Date: 25.SEP.2017 23:03:35

Analog Modulation:

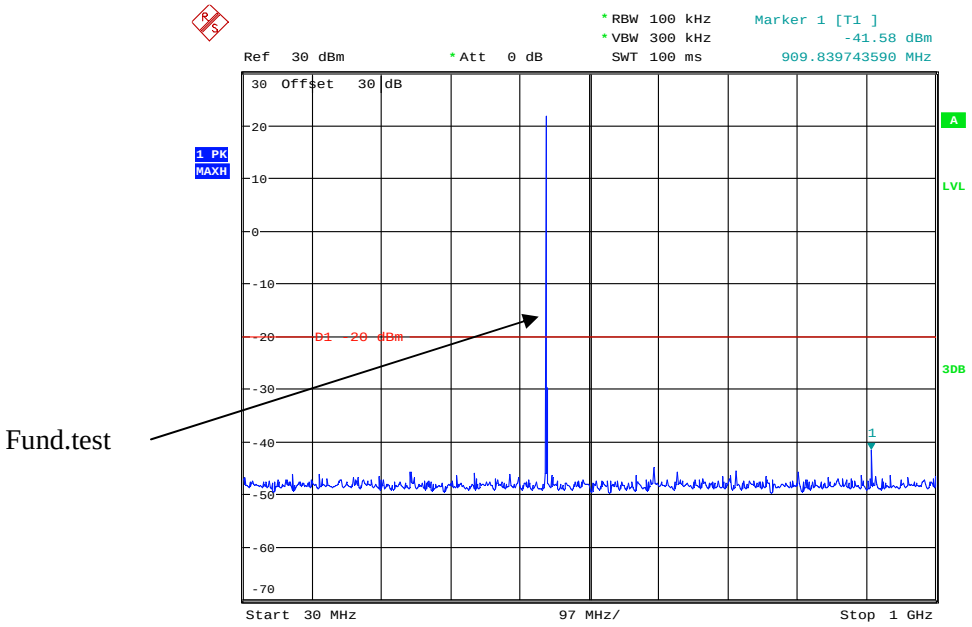
30MHz – 1 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz



1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz

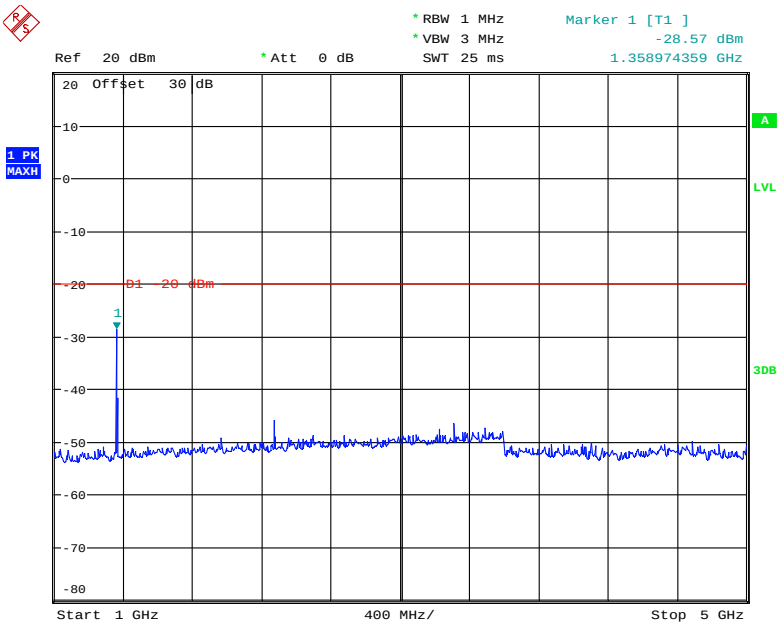


30MHz – 1 GHz, Channel Spacing 12.5 kHz, 454.5 MHz



Date: 25.SEP.2017 23:00:21

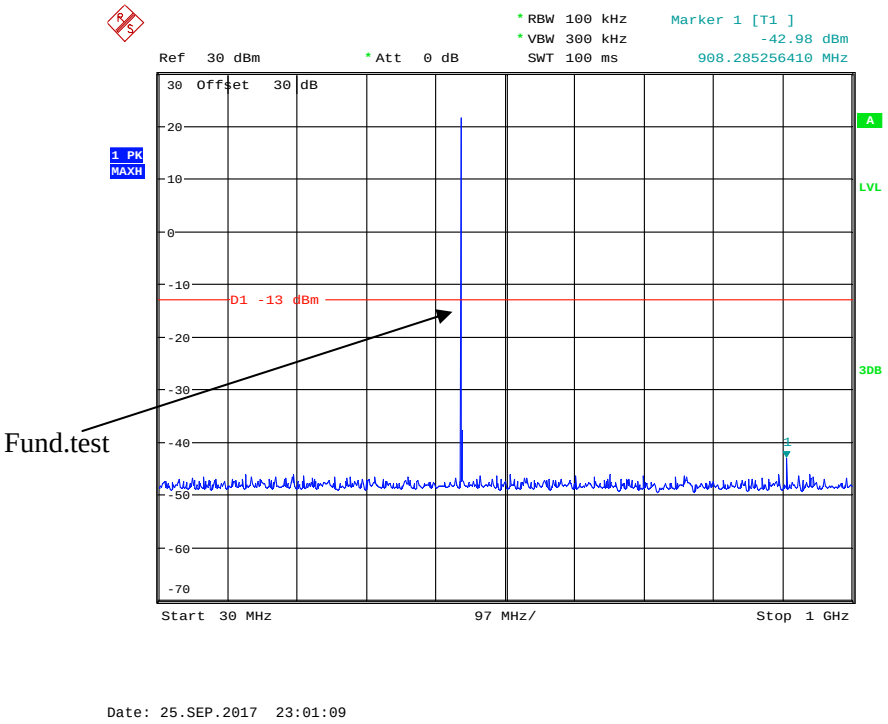
1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 454.5 MHz



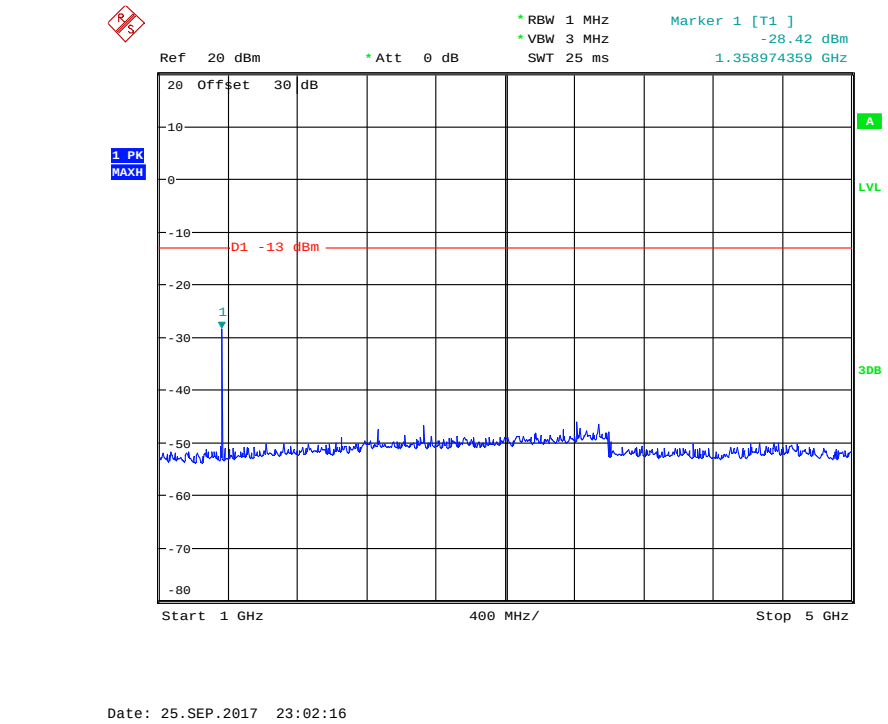
Date: 25.SEP.2017 23:03:22

Analog Modulation:

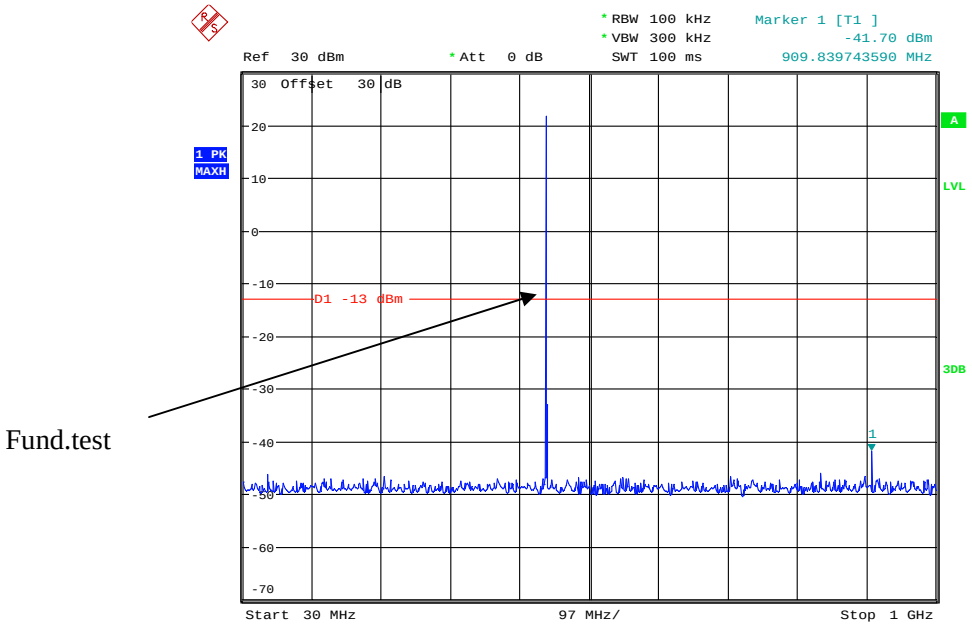
30MHz – 1 GHz, Channel Spacing 25 kHz, 453.2125 MHz



1 GHz – 5 GHz, Channel Spacing 25 kHz, 453.2125 MHz

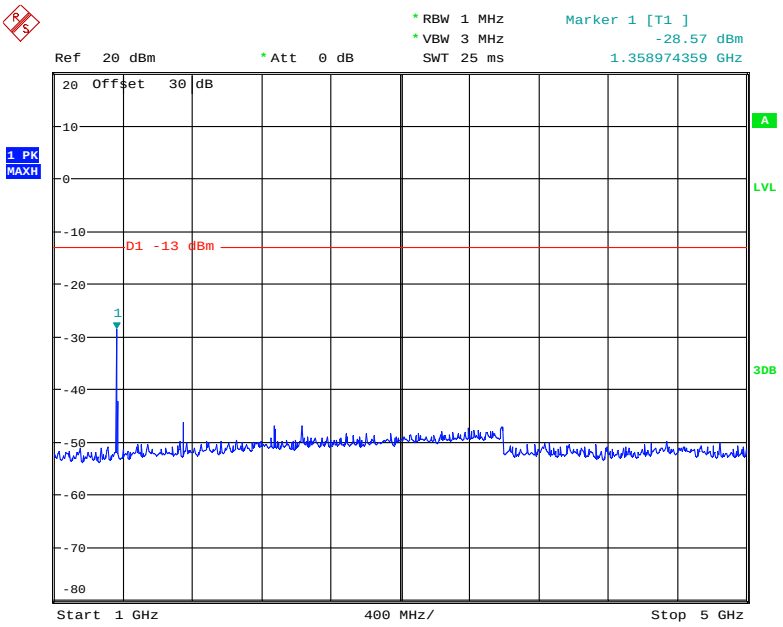


30MHz – 1 GHz, Channel Spacing 25 kHz, 454.5 MHz



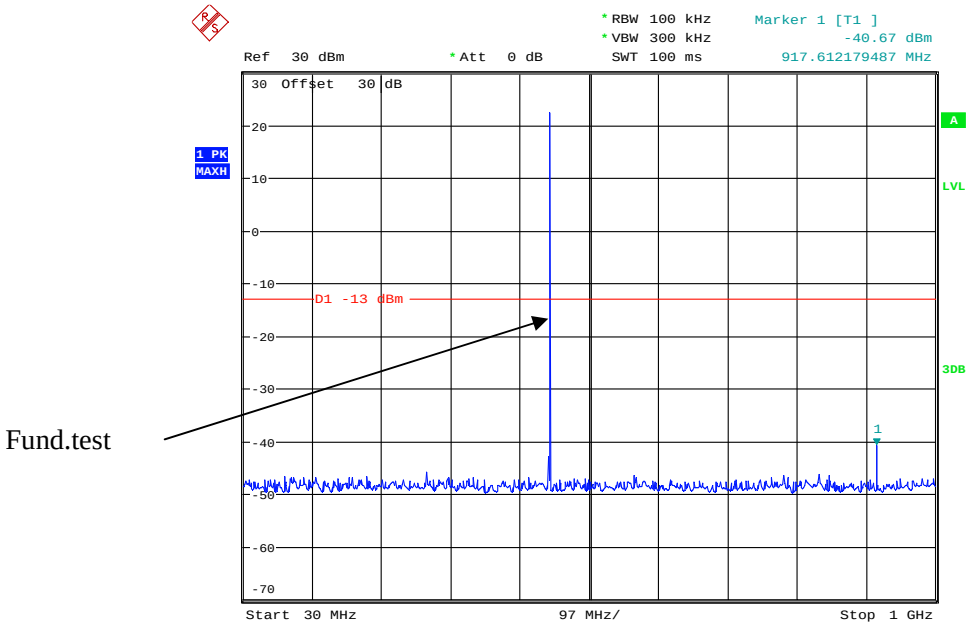
Date: 25.SEP.2017 23:00:49

1 GHz – 5 GHz, Channel Spacing 25 kHz, 454.5 MHz



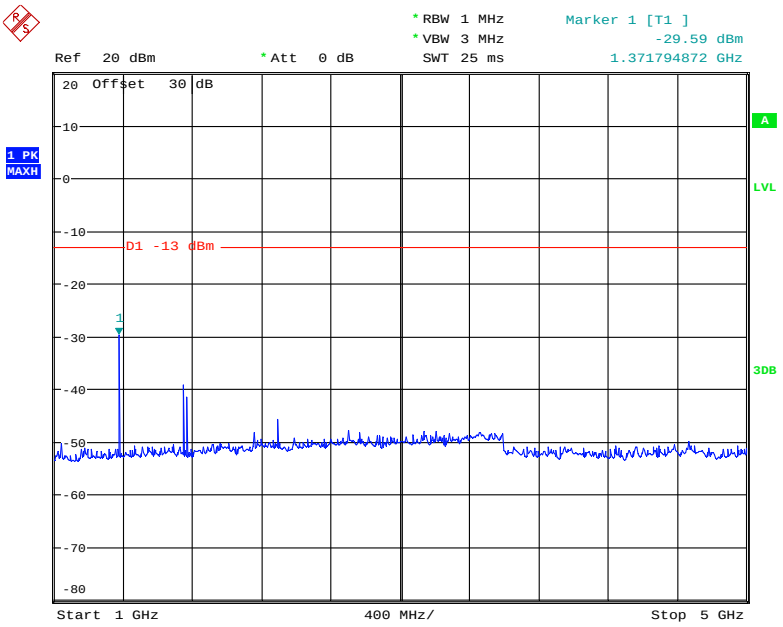
Date: 25.SEP.2017 23:02:32

30MHz – 1 GHz, Channel Spacing 25 kHz, 458.2125 MHz



Date: 25.SEP.2017 23:01:23

1 GHz – 5 GHz, Channel Spacing 25 kHz, 458.2125 MHz



Date: 25.SEP.2017 23:02:02

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

Applicable Standard

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

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:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Dylan Li on 2017-09-11.

Test Mode: Transmitting

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 453.2125MHz-25 kHz										
906.425	50.24	88	2.1	V	-45.8	0.7	0	-46.5	-13	33.5
906.425	49.85	262	2.2	H	-46.2	0.7	0	-46.9	-13	33.9
1359.64	44.11	165	2.1	H	-63.8	1.60	8.30	-57.10	-13	41.10
1359.64	46.50	109	1.5	V	-61.7	1.60	8.30	-55.00	-13	42.00
1812.85	43.16	172	1.5	H	-63.3	1.30	8.50	-56.10	-13	43.10
1812.85	44.73	13	1.9	V	-61.3	1.30	8.50	-54.10	-13	41.10
Analog 454.5MHz-25 kHz										
909	52.16	227	1.5	V	-43.8	0.7	0	-44.5	-13	31.5
909	51.27	41	2.0	H	-44.7	0.7	0	-45.4	-13	32.4
1363.50	48.77	337	1.7	H	-59.2	1.60	8.30	-52.50	-13	39.50
1363.50	46.30	239	1.4	V	-61.9	1.60	8.30	-55.20	-13	42.20
1818.00	44.46	265	2.2	H	-62.0	1.30	8.50	-54.80	-13	41.80
1818.00	43.75	142	1.5	V	-62.3	1.30	8.50	-55.10	-13	42.10
Analog 458.2125MHz-25 kHz										
916.425	52.14	327	1.2	V	-43.9	0.7	0	-44.6	-13	31.6
916.425	50.29	177	1.6	H	-45.7	0.7	0	-46.4	-13	33.4
1374.64	46.56	206	2.1	H	-61.4	1.60	8.30	-54.70	-13	41.70
1374.64	46.02	117	1.7	V	-62.2	1.60	8.30	-55.50	-13	42.50
1832.85	43.57	42	1.1	H	-62.9	1.30	8.50	-55.70	-13	42.70
1832.85	43.96	267	1.8	V	-62.1	1.30	8.50	-54.90	-13	41.90
Analog 453.2125MHz-12.5 kHz										
906.425	49.68	157	1.5	V	-46.3	0.7	0	-47.0	-20	27.0
906.425	48.67	220	2.2	H	-47.3	0.7	0	-48.0	-20	28.0
1359.64	47.90	88	1.7	H	-60.1	1.60	8.30	-53.40	-20	33.40
1359.64	45.86	114	1.3	V	-62.4	1.60	8.30	-55.70	-20	35.70
1812.85	43.44	347	1.6	H	-63.0	1.30	8.50	-55.80	-20	35.80
1812.85	43.69	266	2.4	V	-62.4	1.30	8.50	-55.20	-20	35.20
Analog 454.5MHz-12.5 kHz										
909	51.84	252	2.2	V	-44.2	0.7	0	-44.9	-20	24.9
909	50.95	61	1.8	H	-45.1	0.7	0	-45.8	-20	25.8
1363.50	45.55	8	2.2	H	-62.4	1.60	8.30	-55.70	-20	35.70
1363.50	44.81	127	1.6	V	-63.4	1.60	8.30	-56.70	-20	36.70
1818.00	44.12	321	2.2	H	-62.3	1.30	8.50	-55.10	-20	35.10
1818.00	43.14	208	2.3	V	-62.9	1.30	8.50	-55.70	-20	35.70

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 (dB)			
Digital 453.2125MHz-12.5 kHz										
906.425	51.86	224	2.3	V	-44.1	0.7	0	-44.8	-20	24.8
906.425	49.68	220	2.4	H	-46.3	0.7	0	-47.0	-20	27.0
1359.64	45.77	321	2.5	H	-62.2	1.60	8.30	-55.50	-20	35.50
1359.64	46.00	74	2.1	V	-62.2	1.60	8.30	-55.50	-20	35.50
1812.85	45.45	337	1.6	H	-61.0	1.30	8.50	-53.80	-20	33.80
1812.85	43.81	172	2.1	V	-62.2	1.30	8.50	-55.00	-20	35.00
Digital 454.5MHz-12.5 kHz										
909	51.22	157	1.1	V	-44.8	0.7	0	-45.5	-20	25.5
909	49.87	290	1.4	H	-46.1	0.7	0	-46.8	-20	26.8
1363.50	46.92	344	1.2	H	-61.0	1.60	8.30	-54.30	-20	34.30
1363.50	47.10	226	1.8	V	-61.1	1.60	8.30	-54.40	-20	34.40
1818.00	43.95	232	1.3	H	-62.5	1.30	8.50	-55.30	-20	35.30
1818.00	43.21	269	2.0	V	-62.8	1.30	8.50	-55.60	-20	35.60

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

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

Applicable Standard

FCC §2.1055, § 22.355, §74.464, § 80.209

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:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Dylan Li on 2017-09-26.

Test Mode: Transmitting

Digital Modulation, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm,12.5 kHz			
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	453.21246	-0.08826
40	13.6	453.21241	-0.19858
30	13.6	453.21237	-0.28684
20	13.6	453.21241	-0.19858
10	13.6	453.21245	-0.11032
0	13.6	453.21239	-0.24271
-10	13.6	453.21240	-0.22065
-20	13.6	453.21237	-0.28684
-30	13.6	453.21241	-0.19858
Frequency Stability versus Input Voltage			
20	11.0	453.21244	-0.13239
20	15.6	453.21253	0.06619

Digital Modulation, Reference Frequency: 454.5 MHz, Limit: ±2.5 ppm,12.5 kHz			
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	454.49997	-0.06601
40	13.6	454.49992	-0.17602
30	13.6	454.49994	-0.13201
20	13.6	454.49987	-0.28603
10	13.6	454.49983	-0.37404
0	13.6	454.49995	-0.11001
-10	13.6	454.49985	-0.33003
-20	13.6	454.49990	-0.22002
-30	13.6	454.49988	-0.26403
Frequency Stability versus Input Voltage			
20	11.0	454.49990	-0.22002
20	15.6	454.49983	-0.37404

Digital Modulation, Reference Frequency: 458.2125 MHz, Limit: ±2.5 ppm,12.5 kHz			
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	458.21240	-0.21824
40	13.6	458.21241	-0.19642
30	13.6	458.21239	-0.24006
20	13.6	458.21244	-0.13094
10	13.6	458.21236	-0.30554
0	13.6	458.21235	-0.32736
-10	13.6	458.21241	-0.19642
-20	13.6	458.21236	-0.30554
-30	13.6	458.21243	-0.15277
Frequency Stability versus Input Voltage			
20	11.0	458.21241	-0.19642
20	15.6	458.21247	-0.06547

Analog Modulation, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm,12.5 kHz			
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	453.21245	-0.11032
40	13.6	453.21241	-0.19858
30	13.6	453.21238	-0.26478
20	13.6	453.21240	-0.22065
10	13.6	453.21244	-0.13239
0	13.6	453.21241	-0.19858
-10	13.6	453.21247	-0.06619
-20	13.6	453.21239	-0.24271
-30	13.6	453.21244	-0.13239
Frequency Stability versus Input Voltage			
20	11.0	453.21245	-0.11032
20	15.6	453.21239	-0.24271

Analog Modulation, Reference Frequency: 454.5 MHz, Limit: ±2.5 ppm,12.5 kHz			
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	454.49981	-0.41804
40	13.6	454.49989	-0.24202
30	13.6	454.49986	-0.30803
20	13.6	454.49990	-0.22002
10	13.6	454.49993	-0.15402
0	13.6	454.49991	-0.19802
-10	13.6	454.49989	-0.24202
-20	13.6	454.49991	-0.19802
-30	13.6	454.49986	-0.30803
Frequency Stability versus Input Voltage			
20	11.0	454.49992	-0.17602
20	15.6	454.49985	-0.33003

Analog Modulation, Reference Frequency: 458.2125 MHz, Limit: ±2.5 ppm,12.5 kHz			
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	458.21241	-0.19642
40	13.6	458.21240	-0.21824
30	13.6	458.21239	-0.24006
20	13.6	458.21237	-0.28371
10	13.6	458.21233	-0.37101
0	13.6	458.21245	-0.10912
-10	13.6	458.21243	-0.15277
-20	13.6	458.21246	-0.08730
-30	13.6	458.21242	-0.17459
Frequency Stability versus Input Voltage			
20	11.0	458.21239	-0.24006
20	15.6	458.21243	-0.15277

Analog Modulation, Reference Frequency: 453.2125 MHz, Limit: ±5.0 ppm, 25 kHz			
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	453.21239	-0.24271
40	13.6	453.21235	-0.33097
30	13.6	453.21242	-0.17652
20	13.6	453.21241	-0.19858
10	13.6	453.21238	-0.26478
0	13.6	453.21244	-0.13239
-10	13.6	453.21241	-0.19858
-20	13.6	453.21240	-0.22065
-30	13.6	453.21237	-0.28684
Frequency Stability versus Input Voltage			
20	11.0	453.21240	-0.22065
20	15.6	453.21244	-0.13239

Analog Modulation, Reference Frequency: 454.5 MHz, Limit: ±5.0 ppm, 25 kHz			
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	454.49989	-0.24202
40	13.6	454.49986	-0.30803
30	13.6	454.49990	-0.22002
20	13.6	454.49986	-0.30803
10	13.6	454.49983	-0.37404
0	13.6	454.49987	-0.28603
-10	13.6	454.49982	-0.39604
-20	13.6	454.49989	-0.24202
-30	13.6	454.49984	-0.35204
Frequency Stability versus Input Voltage			
20	11.0	454.49992	-0.17602
20	15.6	454.49985	-0.33003

Analog Modulation, Reference Frequency: 458.2125 MHz, Limit: ±5.0 ppm, 25 kHz			
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	458.21239	-0.24006
40	13.6	458.21247	-0.06547
30	13.6	458.21240	-0.21824
20	13.6	458.21245	-0.10912
10	13.6	458.21243	-0.15277
0	13.6	458.21241	-0.19642
-10	13.6	458.21234	-0.34918
-20	13.6	458.21238	-0.26189
-30	13.6	458.21236	-0.30554
Frequency Stability versus Input Voltage			
20	11.0	458.21242	-0.17459
20	15.6	458.21237	-0.28371

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