FCC Test Report

Applicant Name:	:	Yeonhwa M Tech Co.,Ltd
FCC ID	:	VSODX-5400
Equipment Type	:	Digital 5W Portable Radio
Models Name	:	DX-5400, DX-5400R, MDP-5400R, VR-5400R, RCD-5400R, DX-5400L, MDP-5400L, VR-5400L, RCD-5400L, MDP-5400, VR-5400, RCD-5400
Report Number	:	TZ210302100-E
Date Of Receipt	:	March 26, 2021
Date Of Issue	:	April 22, 2021
Test By	:	Anna Hu (*Anna Hu*)
Supervised by	:	Hugo Chen *(Hugo Chen)*
Approved by	:	Andy Zhang *(Andy Zhang)*
Tested by	:	**Shenzhen Tongzhou Testing Co.,Ltd** 1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China

The test report apply only to the specific sample(s) tested under stated test conditions
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

REPORT REVISE RECORD

Revision	Description	Issued Data	Remark
Revision 00	Initial Test Report Release	April 22, 2021	Andy Zhang

CONTENT

1. TEST STANDARDS

The tests were performed according to following standards:
FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS
FCC Part 90: PRIVATE LAND MOBILE RADIO SERVICES.
ANSI/TIA-603-E-2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
ANSI C63.26-2015: IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

2. GENERAL INFORMATION

Models Name	DX-5400, DX-5400R, MDP-5400R, VR-5400R, RCD-5400R, DX-5400L, MDP-5400L, VR-5400L, RCD-5400L, MDP-5400, VR-5400, RCD-5400
Difference description	Shows in 2.1 of this reports.
Test Model	DX-5400
Applicant	Yeonhwa M Tech Co.,Ltd
Address	36, Jeonpa-ro, 44beon-gil, Manan-gu, Anyang-si, Gyeonggi-do, korea 14086
Manufacturer	Yeonhwa M Tech Co.,Ltd
Address	36, Jeonpa-ro, 44beon-gil, Manan-gu, Anyang-si, Gyeonggi-do, korea 14086
Equipment Type	Digital 5W Portable Radio
Trade Mark	X Radio, MAXON, Brecom, Raditel
Hardware version:	DXO54-R1
Software version:	V2.5.2.0
Extreme Temp. Tolerance	-10℃-+55℃
EUT Power Rating	DC 7.40 V by battery
Operating Frequency	406.1 MHz – 510 MHz
Channel Spacing	12.5 KHz
Modulation Type	FM, 4FSK
Emission Designation	FM VOICE:11K0F3E 4FSK VOICE:7K60F1E 4FSK DATA:7K60F1D
Antenna Type:	Detachable Antenna
Antenna gain:	0.0 dBi
Data of receipt	March 26, 2021
Date of test	March 26, 2021 to April 21, 2021
Deviation	None
Test Sample ID	TZ210302100-1#
Condition of Test Sample	Normal

2.1. Difference of Models

The difference shows in following table,other design are identical.

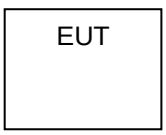
Derived Model	Brand name	Function	Difference description	Appearance
DX-5400R	X Radio	16-Channel Rotary Type	All the same except for the model name and appearance	
MDP-5400R	MAXON			
VR-5400R	Brecom			
RCD-5400R	Raditel			
DX-5400L	X Radio	LCD Type		
MDP-5400L	MAXON			
VR-5400L	Brecom			
RCD-5400L	Raditel			
DX-5400	X Radio	OLED Type		
MDP-5400	MAXON			
VR-5400	Brecom			
RCD-5400	Raditel			

2.2. EUT operation mode

Modulation	Channel separation	Frequency (MHz)	Operation Description
FM	12.5 KHz	406.125	Op1
	12.5 KHz	455.5	Op2
	12.5 KHz	509.975	Op3
4FSK	12.5 KHz	406.125	Op4
	12.5 KHz	455.5	Op5
	12.5 KHz	509.975	Op6

2.3. Block Diagram of Test Setup

Fig. 2-1 Configuration of Tested System



2.4. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for**FCC ID:VSODX-5400** filing to comply with FCC Part 2, FCC Part 90 of the FCC CFR 47 Rules.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Tongzhou Testing Co.,Ltd
1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2014) and CISPR Publication 22.

3.2. Test Facility

FCC
Designation Number: CN1275
Test Firm Registration Number: 167722
Shenzhen Tongzhou Testing Co.,Ltd has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA
Certificate Number: 5463.01
Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

IC
ISED#: 22033
CAB identifier: CN0099
Shenzhen Tongzhou Testing Co.,Ltd has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Test Description

Test Specification clause	Test case	Pass	Fail	NA	NP	Remark
§90.205 §2.1046(a)	RF Power Output	☒	☐	☐	☐	Pass
§90.205 §2.1046(a)	RF Power Output(Conducted Method)	☒	☐	☐	☐	Pass
§90.242(b)(8) §90.210 §2.1047	Modulation Characteristic	☒	☐	☐	☐	Pass
§90.209 §2.1049	99% Occupied Bandwidth	☒	☐	☐	☐	Pass
§90.210 §2.1049	Emission Mask	☒	☐	☐	☐	Pass
§90.213 §2.1055	Frequency Stability	☒	☐	☐	☐	Pass
§2.1051 §2.1053 §90.210	TX spurious emissions	☒	☐	☐	☐	Pass
§90.214	Transient frequency behavior	☒	☐	☐	☐	Pass

Note:
1. NA = Not Applicable; NP = Not Performed;

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Tongzhou Testing Co.,Ltd quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for Shenzhen Tongzhou Testing Co.,Ltd laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	3.10 dB	(1)
Radiated Emission	1~18GHz	3.70 dB	(1)
Radiated Emission	18-40GHz	3.90 dB	(1)
Conducted Disturbance	0.15~30MHz	1.63 dB	(1)
Conducted Power	9KHz~18GHz	0.61 dB	(1)
Spurious RF Conducted Emission	9KHz~40GHz	1.22 dB	(1)
Band Edge Compliance of RF Emission	9KHz~40GHz	1.22 dB	(1)
Occuiped Bandwidth	9KHz~40GHz	-	(1)
Frequency Error	9KHz~40GHz	1×10^{-7}	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

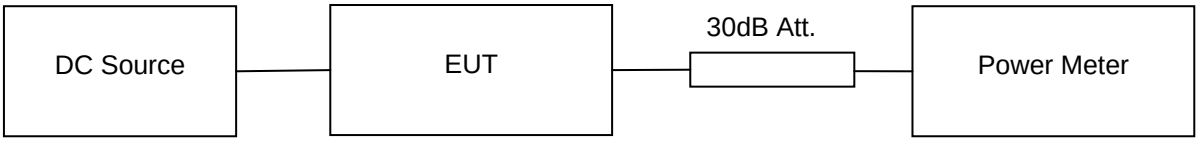
3.6. Equipments Used during the Test

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2021/1/4	2022/1/3
2	Signal Generator (SG B)	Keysight	N5182A	MY4620709	2021/1/4	2022/1/3
3	Signal Generator(SG C)	R&S	SML03	102924/0013	2021/1/4	2022/1/3
4	RF COMMUNICATION TEST SET(SG A)	HP	8921A	3430A01131	2021/1/4	2022/1/3
5	Loop Antenna	schwarzbeck	FMZB1519B	00023	2019/11/16	2022/11/15
6	Wideband Antenna	schwarzbeck	VULB 9163	958	2019/11/16	2022/11/15
7	Amplifier	schwarzbeck	BBV 9743	209	2021/1/4	2022/1/3
8	Amplifier	Tonscend	TSAMP-0518SE	--	2021/1/4	2022/1/3
9	Horn Antenna	schwarzbeck	9120D-1141	1574	2019/11/16	2022/11/15
10	EMI Test Receiver	R&S	ESCI	100849/003	2021/1/4	2022/1/3
11	Controller	MF	MF7802	N/A	N/A	N/A
12	Modulation Analyzer	HP	8901A	2976553	2021/1/4	2022/1/3
13	Climate Chamber	KRUOMR	KRM-1000	KRM16072901	2021/1/4	2022/1/3
14	Test Software	Tonscend	JS36-RSE	V1.0.2.0	--	--
15	Oscilloscope	Tektronix	TDS2024C	C044925	2021/1/4	2022/1/3
16	Power Sensor	Agilent	U2021XA	MY5365004	2021/1/4	2022/1/3
17	Power Meter	Agilent	U2531A	TW53323507	2021/1/4	2022/1/3

4. TEST CONDITIONS AND RESULTS

4.1. RF Power Output(Conducted Method)

TEST CONFIGURATION



TEST PROCEDURE

1) Connect the equipmet as illuastrated.
2) Set EUT working in continuous mode in low,middle,high frequency,read and record the peak power value.

TEST RESULTS

Modulation	Channel Separation	Test Frequency (MHz)	Reading(dBm)	
			High Power Level	Low Power Level
FM	12.5KHz	406.125	36.81	29.43
		455.5	36.57	29.52
		509.975	36.23	29.67
4FSK	12.5KHz	406.125	36.61	29.24
		455.5	36.47	29.85
		509.975	36.29	29.73
Rated Power			5W(36.99dBm)	1W(30dBm)
Result Power			Pass	Pass

The rated 5W for High Power and 1W for Low power.

4.2. Modulation Characteristics

TEST CONFIGURATION

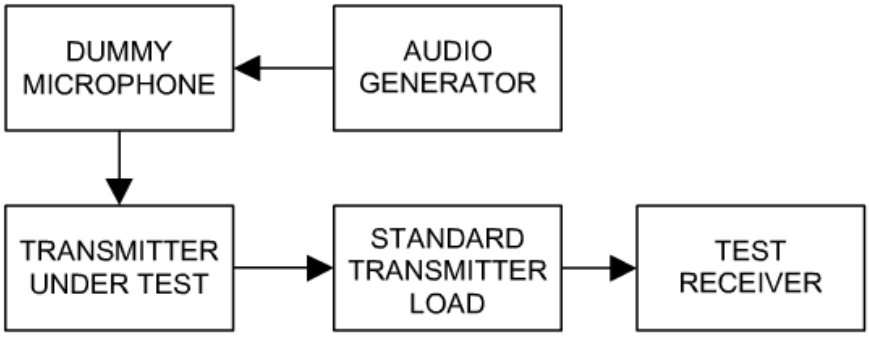


Figure 1: Modulation Limit&Audio Frequency Response

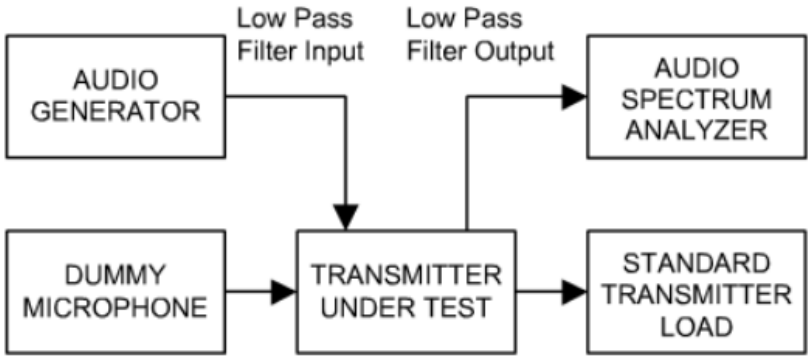


Figure 2: Audio Low Pass Filter Response

TEST PROCEDURE

Modulation limitations

1 Connect the equipment as illustrated.
2 Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
3 Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤0.25 Hz to ≥15,000 Hz. Turn the de-emphasis function off.
4 Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation, this level is as a reference (0dB) and vary the input level from –20 to +20dB.
5 Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level
6 Repeat step 4-5 with input frequency changing to 300Hz, 500Hz, 1000Hz, 1500Hz, 2000Hz, 2500Hz and 3000Hz in sequence.

Audio Frequency Response

1 Configure the EUT as shown in figure 1.
2 Adjust the audio input for 20% of rated system deviation at 1kHz using this level as a reference.
3 Vary the Audio frequency from 300Hz to 3 KHz. and record the frequency deviation.
4 Audio FrequencyResponse =$20\log_{10}$ (Deviationof test frequency/Deviation of 1 KHz reference).

Audio Low Pass Filter Frequency Response

1 Configure the EUT as shown in figure 2.
2 Connect the audio frequency generator as close as possible the input of the post litniter low pass filter within the transmitter under test.
3 Connect the audio spectrum analyzer to the output of the post limiter low pass filter within the transmitter under test.

4 Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.
5 Record the dB level of the 1000 Hz spectral line on the audio spectrum analyzer as $LEV_{REF.}$
6 Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass filter limit.
7 Record audio spectrum analyzer levels, at the test frequency in step 6).
8 Record the dB level on the audio spectrum analyzer as LEV_{RREQ}.
9 Calculate the audio frequency response at the test frequency as:
10 low pass filter response = LEV_{FREQ} –LEV_{REF}
11 Repeat steps 6) through 10) for all the desired test frequencies.

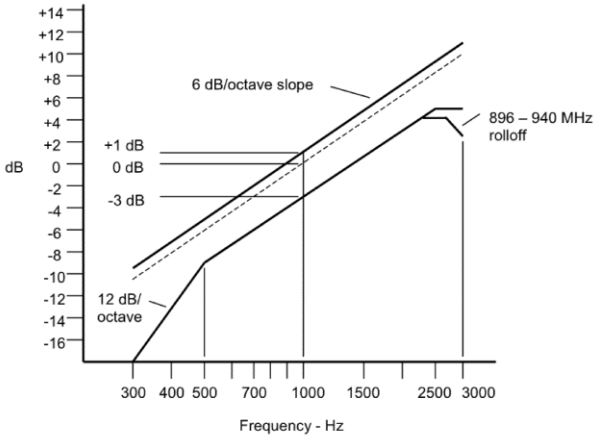
LIMIT

Modulation limitations

According to TIA/EIA 603 D, For FM transmitters, the sum of the highest modulating frequency in Hertz and the amount of the frequency deviation or swing in Hertz may not exceed 2800 Hz and the maximum deviation may not exceed 2.5 kHz.

Audio Frequency Response

According to TIA/EIA 603 D,



The audio frequency response from 300 Hz to 3000 Hz shall not vary more than+ 1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level. The exception is from 500 Hz to 3000 Hz, where an additional 6 dB per octave rol loff is allowed.

The following exceptions are also permissible:
a) An additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz range.
b) An additional 6 dB per octave rolloff is allowed from 2300 Hz to 2700 Hz, and an additional 12 dB per octave is allowed from 2700 Hz to 3000 Hz, in equipment operating in the 896 MHz to 940 MHz range, and all narrowband (12.5 kHz and 15 kHz channelization) equipment.

Audio Low Pass Filter Frequency Response

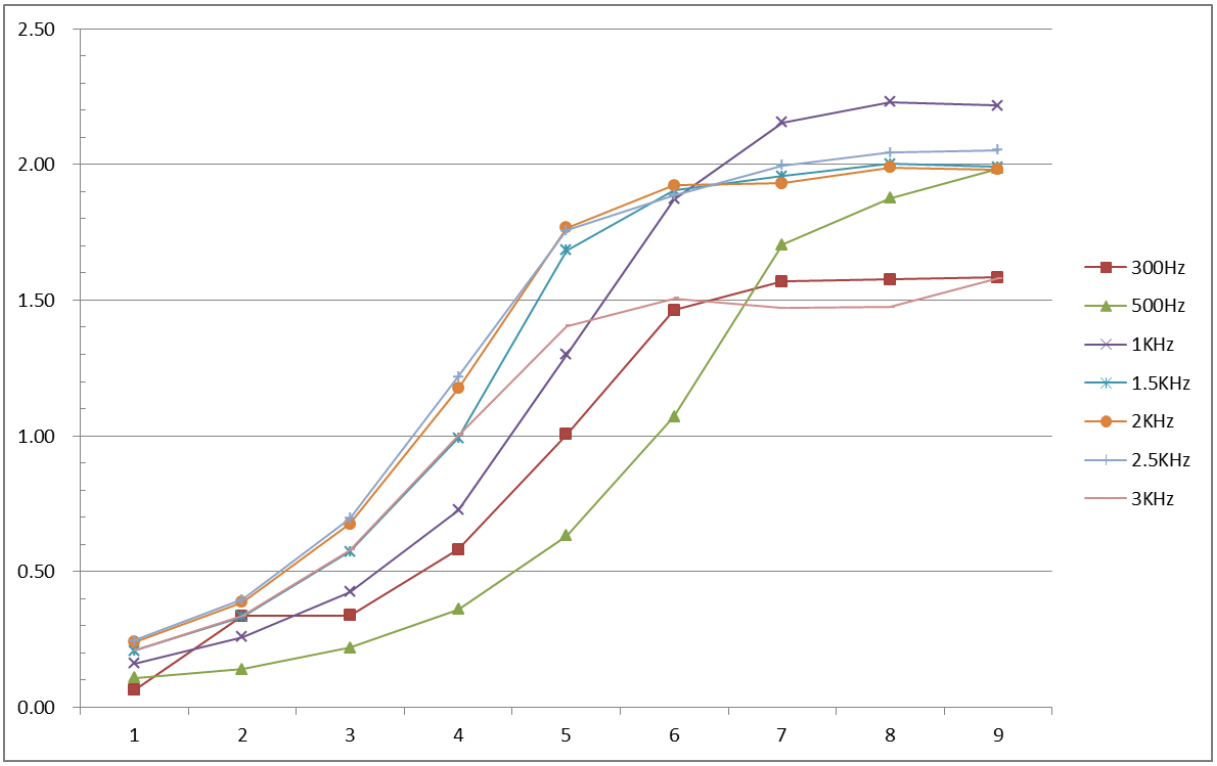
According to TIA/EIA 603 D,

Audio band	Minimum Attenuation Rel. to 1KHz Attenuation
3-20KHz	100* log10 (f/3) decibels
20-30KHz	82.5dB

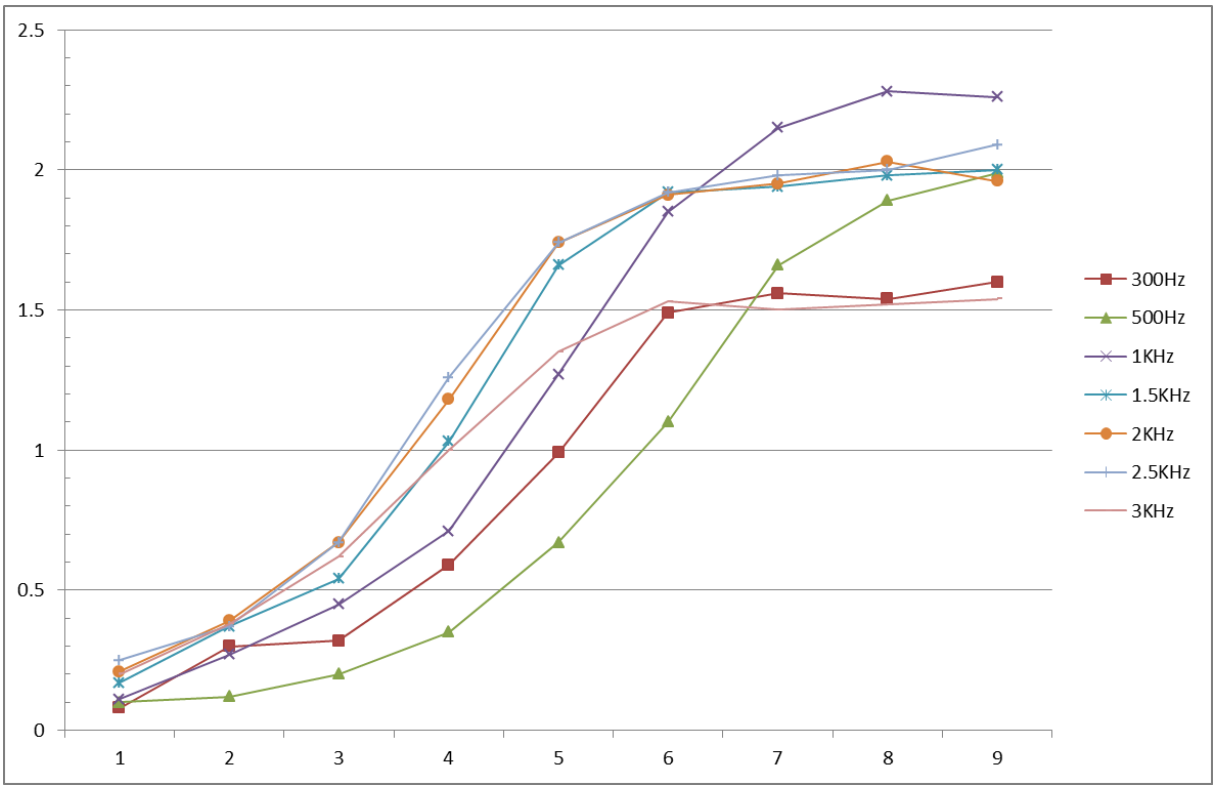
TEST RESULTS

4.2.1.1 Modulation Characteristics

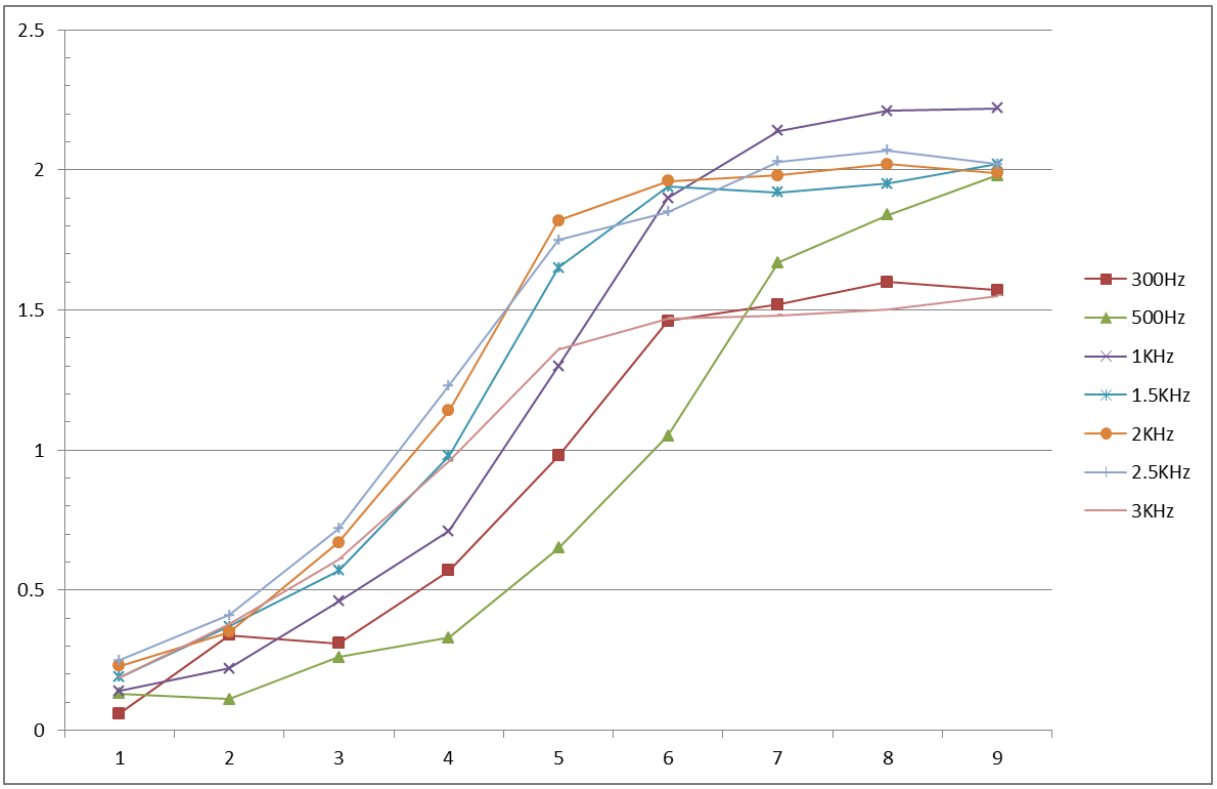
406.125MHz @ 12.5 KHz Channel Separation									
Modulation Input(dBC)	Peak Frequency Deviation (KHz)							Limit(KHz)	Result
	300Hz	500Hz	1KHz	1.5KHz	2KHz	2.5KHz	3KHz		
-20	0.06	0.11	0.16	0.21	0.24	0.25	0.21	2.5	Pass
-15	0.34	0.14	0.26	0.33	0.39	0.40	0.34	2.5	Pass
-10	0.34	0.22	0.42	0.57	0.67	0.70	0.58	2.5	Pass
-5	0.58	0.36	0.73	0.99	1.17	1.22	1.00	2.5	Pass
0	1.00	0.63	1.30	1.68	1.77	1.76	1.40	2.5	Pass
5	1.46	1.07	1.87	1.90	1.92	1.89	1.51	2.5	Pass
10	1.57	1.70	2.15	1.96	1.93	2.00	1.47	2.5	Pass
15	1.58	1.88	2.23	2.00	1.99	2.04	1.47	2.5	Pass
20	1.58	1.98	2.22	1.99	1.98	2.05	1.58	2.5	Pass



455.5MHz @ 12.5 KHz Channel Separation									
Modulation Input(dBC)	Peak Frequency Deviation (KHz)							Limit(KHz)	Result
	300Hz	500Hz	1KHz	1.5KHz	2KHz	2.5KHz	3KHz		
-20	0.08	0.1	0.11	0.17	0.21	0.25	0.2	2.5	Pass
-15	0.3	0.12	0.27	0.37	0.39	0.37	0.38	2.5	Pass
-10	0.32	0.2	0.45	0.54	0.67	0.67	0.62	2.5	Pass
-5	0.59	0.35	0.71	1.03	1.18	1.26	1	2.5	Pass
0	0.99	0.67	1.27	1.66	1.74	1.74	1.35	2.5	Pass
5	1.49	1.1	1.85	1.92	1.91	1.92	1.53	2.5	Pass
10	1.56	1.66	2.15	1.94	1.95	1.98	1.5	2.5	Pass
15	1.54	1.89	2.28	1.98	2.03	2	1.52	2.5	Pass
20	1.6	1.99	2.26	2	1.96	2.09	1.54	2.5	Pass

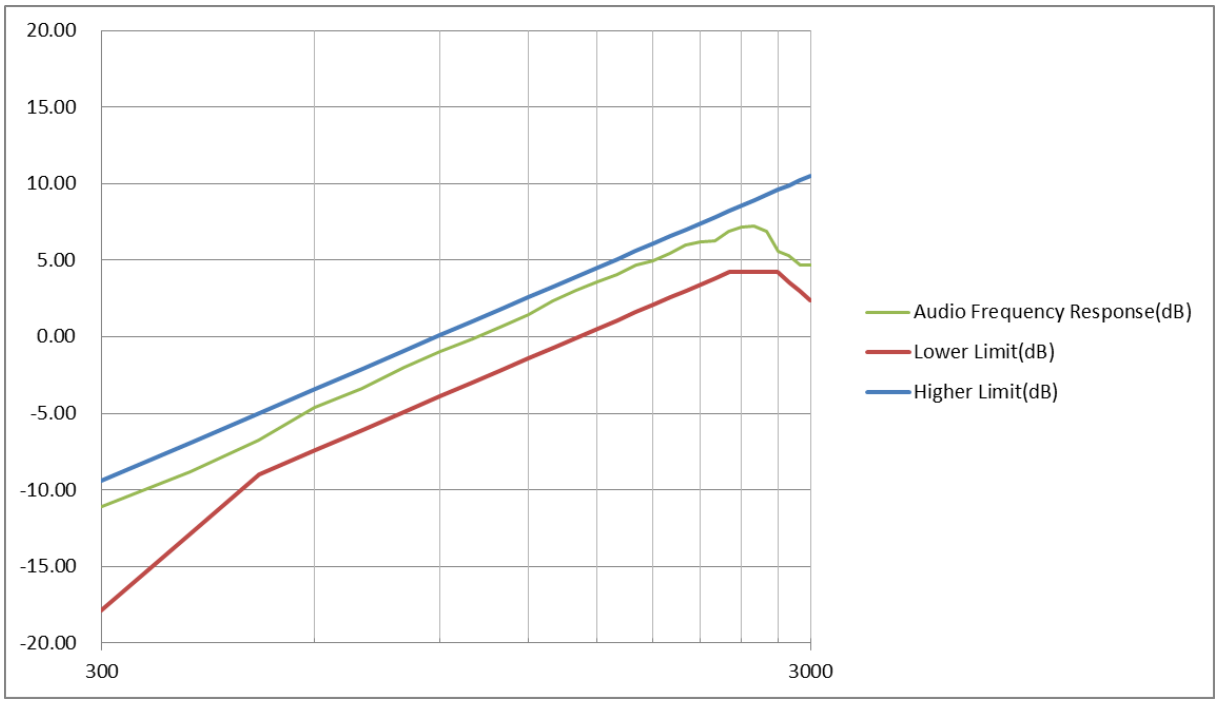


509.975MHz @ 12.5 KHz Channel Separation									
Modulation Input(dBC)	Peak Frequency Deviation (KHz)							Limit(KHz)	Result
	300Hz	500Hz	1KHz	1.5KHz	2KHz	2.5KHz	3KHz		
-20	0.06	0.13	0.14	0.19	0.23	0.25	0.19	2.5	Pass
-15	0.34	0.11	0.22	0.37	0.35	0.41	0.38	2.5	Pass
-10	0.31	0.26	0.46	0.57	0.67	0.72	0.61	2.5	Pass
-5	0.57	0.33	0.71	0.98	1.14	1.23	0.96	2.5	Pass
0	0.98	0.65	1.3	1.65	1.82	1.75	1.36	2.5	Pass
5	1.46	1.05	1.9	1.94	1.96	1.85	1.47	2.5	Pass
10	1.52	1.67	2.14	1.92	1.98	2.03	1.48	2.5	Pass
15	1.6	1.84	2.21	1.95	2.02	2.07	1.5	2.5	Pass
20	1.57	1.98	2.22	2.02	1.99	2.02	1.55	2.5	Pass

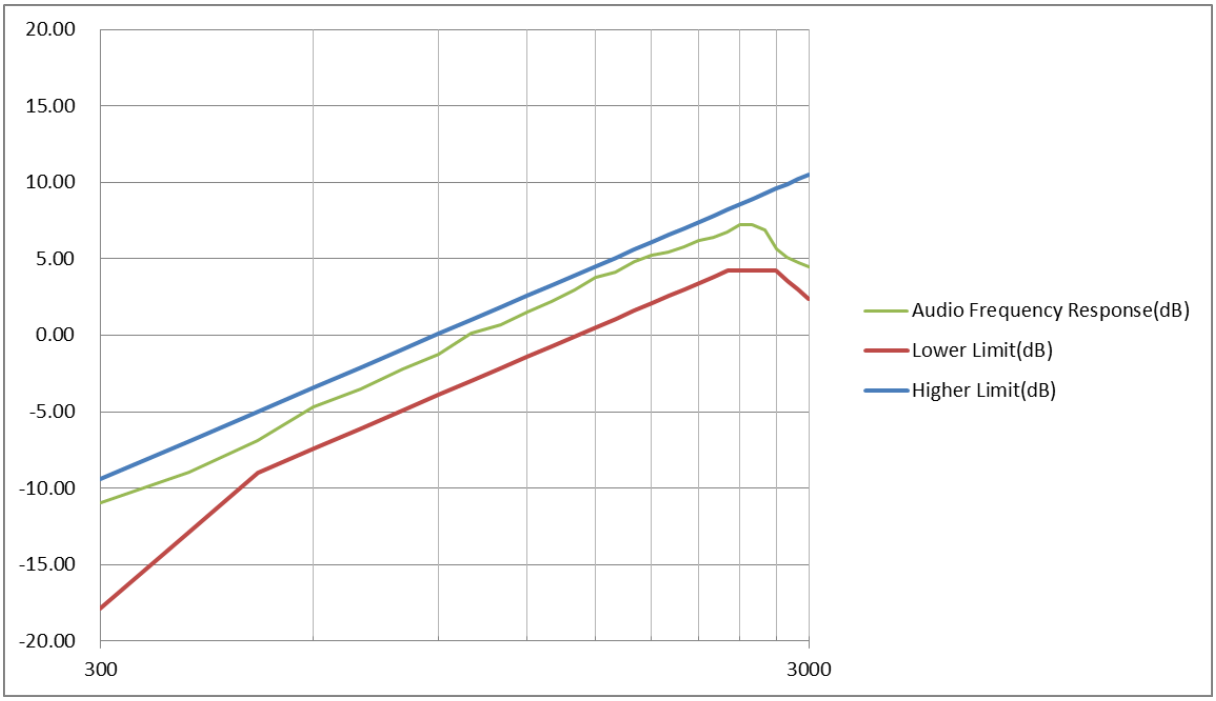


4.5.3 Audio Frequency Response

406.1250MHz@ 12.5 KHz Channel Separation			
Frequency(Hz)	Lower Limit(dB)	Audio Frequency Response(dB)	Higher Limit(dB)
300	-17.84	-11.09	-9.42
400	-12.86	-8.83	-6.93
500	-9.00	-6.74	-5.00
600	-7.42	-4.60	-3.42
700	-6.09	-3.39	-2.09
800	-4.93	-2.02	-0.93
900	-3.91	-0.97	0.09
1000	-3	-0.12	1.00
1100	-2.17	0.69	1.83
1200	-1.42	1.46	2.58
1300	-0.73	2.34	3.27
1400	-0.09	3.01	3.91
1500	0.51	3.58	4.51
1600	1.07	4.04	5.07
1700	1.59	4.69	5.59
1800	2.09	4.99	6.09
1900	2.56	5.43	6.56
2000	3.00	5.98	7.00
2100	3.42	6.20	7.42
2200	3.83	6.26	7.83
2300	4.21	6.88	8.21
2400	4.21	7.18	8.58
2500	4.21	7.21	8.93
2600	4.21	6.86	9.27
2700	4.21	5.58	9.60
2800	3.58	5.29	9.91
2900	2.97	4.72	10.22
3000	2.39	4.71	10.51

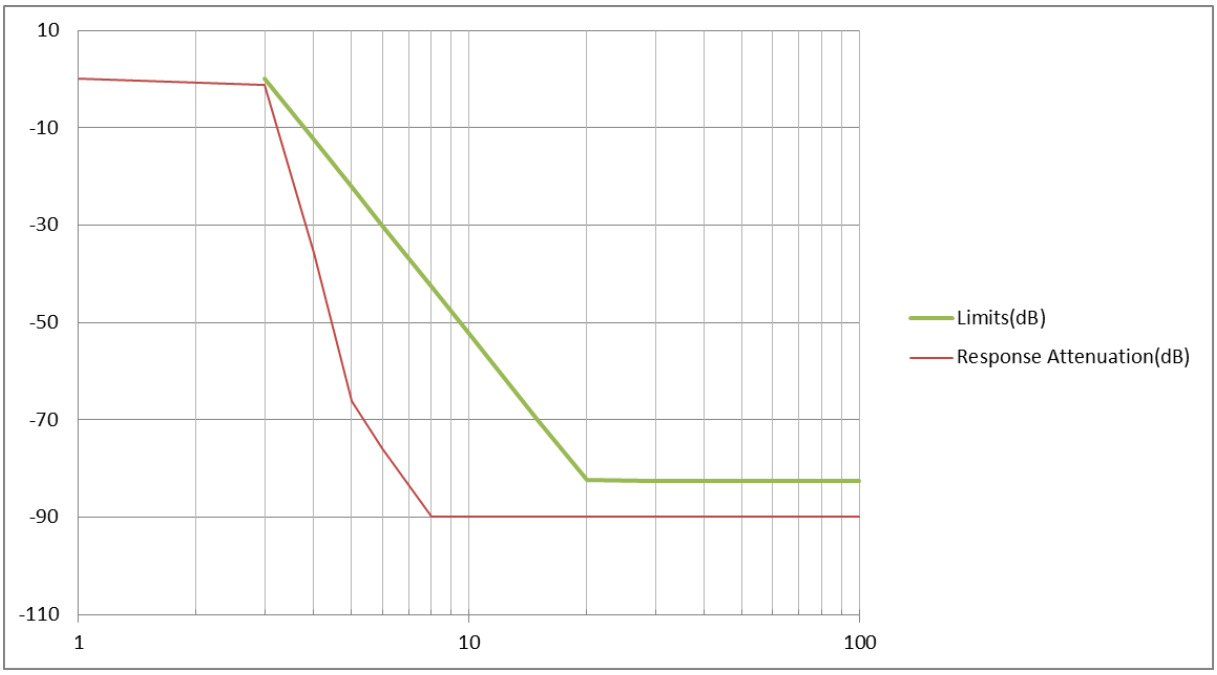


509.975000MHz@ 12.5 KHz Channel Separation			
Frequency(Hz)	Lower Limit(dB)	Audio Frequency Response(dB)	Higher Limit(dB)
300	-17.84	-10.92	-9.42
400	-12.86	-8.92	-6.93
500	-9.00	-6.88	-5.00
600	-7.42	-4.67	-3.42
700	-6.09	-3.49	-2.09
800	-4.93	-2.20	-0.93
900	-3.91	-1.24	0.09
1000	-3	0.13	1.00
1100	-2.17	0.69	1.83
1200	-1.42	1.50	2.58
1300	-0.73	2.23	3.27
1400	-0.09	2.94	3.91
1500	0.51	3.76	4.51
1600	1.07	4.11	5.07
1700	1.59	4.81	5.59
1800	2.09	5.22	6.09
1900	2.56	5.44	6.56
2000	3.00	5.76	7.00
2100	3.42	6.19	7.42
2200	3.83	6.40	7.83
2300	4.21	6.72	8.21
2400	4.21	7.26	8.58
2500	4.21	7.24	8.93
2600	4.21	6.88	9.27
2700	4.21	5.63	9.60
2800	3.58	5.09	9.91
2900	2.97	4.77	10.22
3000	2.39	4.47	10.51

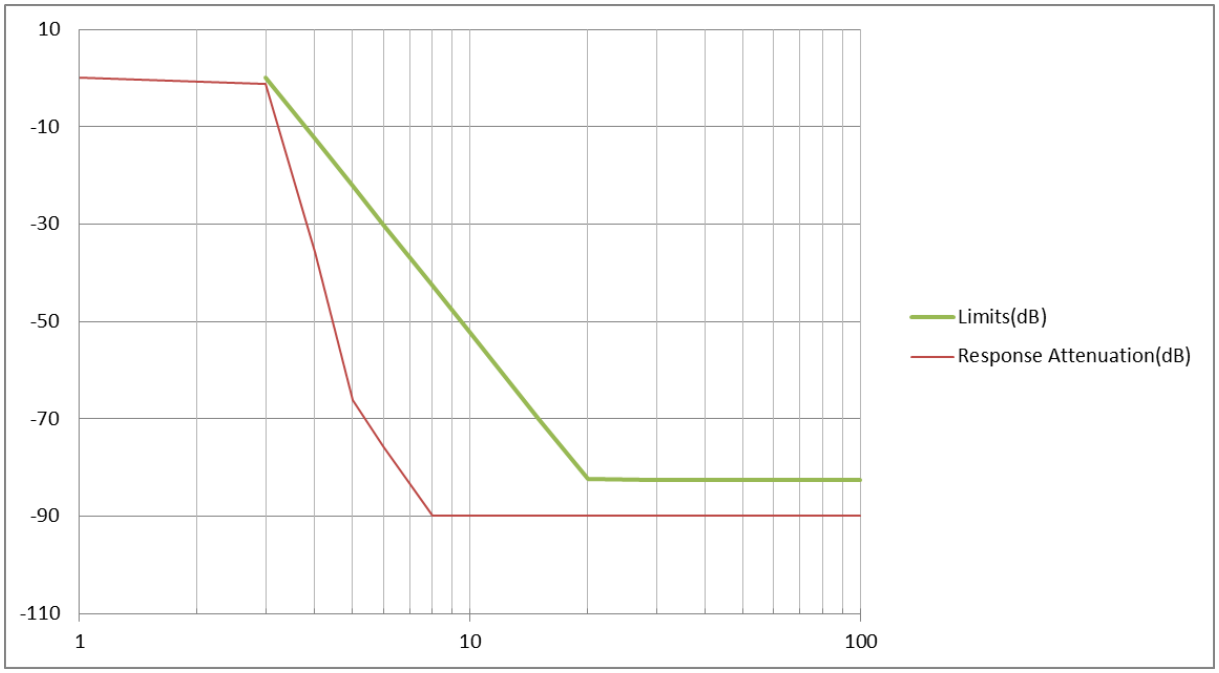


4.5.3 Audio Low Pass Filter Frequency Response

406.1250MHz@ 12.5 KHz Channel Separation		
Audio Frequency (KHz)	dB relative to 1 KHz	Limits
1	0	0
3	-1.2	0
4	-35.8	-12.5
5	-66.2	-22.2
6	-75.8	-30.1
8	-89.9	-42.6
10	-89.9	-52.3
15	-89.9	-69.9
20	-89.9	-82.4
30	-89.9	-82.5
40	-89.9	-82.5
50	-89.9	-82.5
60	-89.9	-82.5
70	-89.9	-82.5
80	-89.9	-82.5
90	-89.9	-82.5
100	-89.9	-82.5

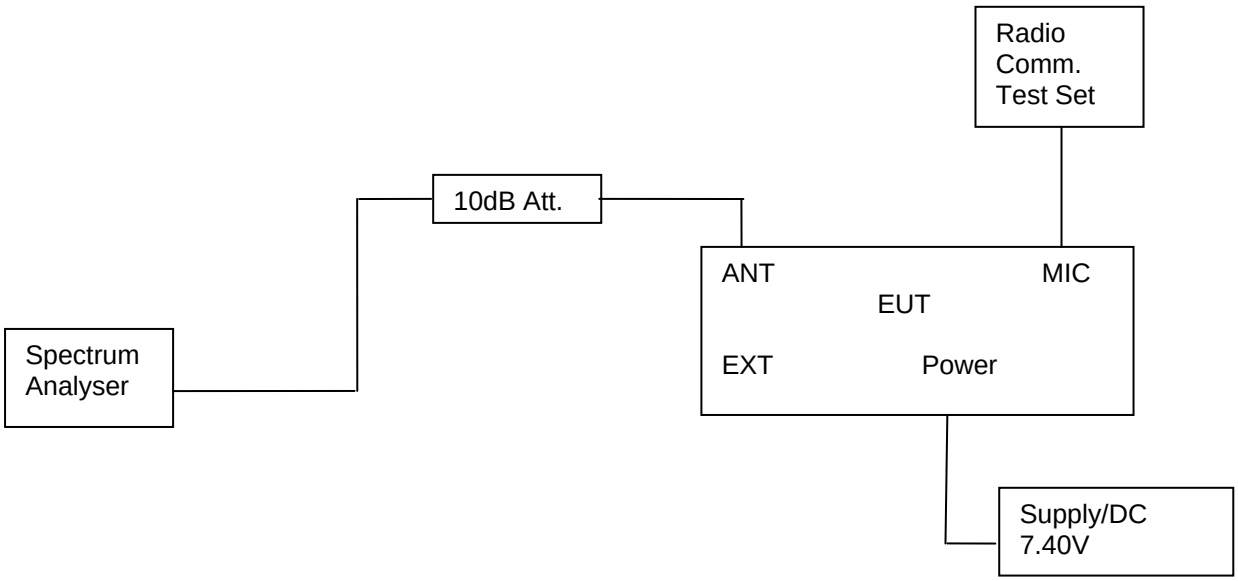


509.9750MHz@ 12.5 KHz Channel Separation		
Audio Frequency (KHz)	dB relative to 1 KHz	Limits
1	0	0
3	-1.2	0
4	-35.7	-12.5
5	-66.1	-22.2
6	-75.7	-30.1
8	-89.9	-42.6
10	-89.9	-52.3
15	-89.9	-69.9
20	-89.9	-82.4
30	-89.9	-82.5
40	-89.9	-82.5
50	-89.9	-82.5
60	-89.9	-82.5
70	-89.9	-82.5
80	-89.9	-82.5
90	-89.9	-82.5
100	-89.9	-82.5



4.3. Occupied Bandwidth and Emission Mask

TEST CONFIGURATION



TEST PROCEDURE

1 The EUT was modulated by 2.5 KHz Sine wave audio signal;the level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation.
2 Set EUT work at continuous transmitting.
3 Set SPA Centre Frequency = fundamental frequency, RBW=300Hz, VBW= 1 KHz, span =100 KHz.
4 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.

LIMIT

Standard Channel Spacing/Bandwidth

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25[2]		
25-50	20	20
72-76	20	20
150-174	[1]7.5	[1 3]20/11.25/6
216-220[5]	6.25	20/11.25/6
220-222	5	4
406-512[2]	[1]6.25	[136]20/11.25/6
806-809/851-854	12.5	20
809-824/854-869	25	[6]20
896-901/935-940	12.5	13.6
902-928[4]		
929-930	25	20
1427-1432[5]	12.5	12.5
[3]2450-2483.5[2]		
Above 2500[2]		

[1]For stations authorized on or after August 18, 1995.

[2]Bandwidths for radiolocation stations in the 420-450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis.

[3]Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be

authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of §90.203(j)(3).

[4]The maximum authorized bandwidth shall be 12 MHz for non-multilateration LMS operations in the band 909.75-921.75 MHz and 2 MHz in the band 902.00-904.00 MHz. The maximum authorized bandwidth for multilateration LMS operations shall be 5.75 MHz in the 904.00-909.75 MHz band; 2 MHz in the 919.75-921.75 MHz band; 5.75 MHz in the 921.75-927.25 MHz band and its associated 927.25-927.50 MHz narrowband forward link; and 8.00 MHz if the 919.75-921.75 MHz and 921.75-927.25 MHz bands and their associated 927.25-927.50 MHz and 927.50-927.75 MHz narrowband forward links are aggregated.

[5]See §90.259.

[6]Operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the Adjacent Channel Power limits of §90.221.

(6)(i) Beginning January 1, 2011, no new applications for the 150-174 MHz and/or 421-512 MHz bands will be acceptable for filing if the applicant utilizes channels with an authorized bandwidth exceeding 11.25 kHz, unless specified elsewhere or the operations meet the efficiency standards of §90.203(j)(3).

(ii) Beginning January 1, 2011, no modification applications for stations in the 150-174 MHz and/or 421-512 MHz bands that increase the station's authorized interference contour, will be acceptable for filing if the applicant utilizes channels with an authorized bandwidth exceeding 11.25 kHz, unless specified elsewhere or the operations meet the efficiency standards of §90.203(j)(3). See §90.187(b)(2)(iii) and (iv) for interference contour designations and calculations. Applications submitted pursuant to this paragraph must comply with frequency coordination requirements of §90.175.

(7) Economic Area (EA)-based licensees in frequencies 817-824/862-869 MHz (813.5-824/858.5-869 MHz in the counties listed in §90.614(c)) may exceed the standard channel spacing and authorized bandwidth listed in paragraph (b)(5) of this section in any National Public Safety Planning Advisory Committee Region when all 800 MHz public safety licensees in the Region have completed band reconfiguration consistent with this part. In any National Public Safety Planning Advisory Committee Region where the 800 MHz band reconfiguration is incomplete, EA-based licensees in frequencies 817-821/862-866 MHz (813.5-821/858.5-866 MHz in the counties listed in §90.614(c)) may exceed the standard channel spacing and authorized bandwidth listed in paragraph (b)(5) of this section. Upon all 800 MHz public safety licensees in a National Public Safety Planning Advisory Committee Region completing band reconfiguration, EA-based 800 MHz SMR licensees in the 821-824/866-869 MHz band may exceed the channel spacing and authorized bandwidth in paragraph (b)(5) of this section. Licensees authorized to exceed the standard channel spacing and authorized bandwidth under this paragraph must provide at least 30 days written notice prior to initiating such service in the bands listed herein to every 800 MHz public safety licensee with a base station in an affected National Public Safety Planning Advisory Committee Region, and every 800 MHz public safety licensee with a base station within 113 kilometers (70 miles) of an affected National Public Safety Planning Advisory Committee Region. Such notice shall include the estimated date upon which the EA-based 800 MHz SMR licensee intends to begin operations that exceed the channel spacing and authorized bandwidth in paragraph (b)(5) of this section.

Applicable Emission Masks

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25[1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174[2]	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512[2 5]	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854[6]	B	H
809-824/854-869[3 5]	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925[4]		
All other bands	B	C

[1]Equipment using single sideband J3E emission must meet the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.

[2]Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.

[3]Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of §90.691 of this chapter.

[4]DSRCS Roadside Units equipment in the 5850-5925 MHz band is governed under subpart M of this part.

[5]Equipment may alternatively meet the Adjacent Channel Power limits of §90.221

TEST RESULTS

Type	Frequency(MHz)	Channel Spacing(KHz)	Power Mode(W)	Occuipied Channel Bandwidth(KHz)	26dB Bandwidth(KHz)	Limit(KHz)	Conclusion
Analog	406.125	12.5	5	5.186	10.09	11.25	Pass
Analog	455.5	12.5	5	5.228	10.11	11.25	Pass
Analog	509.975	12.5	5	5.213	10.11	11.25	Pass
Analog	406.125	12.5	1	5.185	10.09	11.25	Pass
Analog	455.5	12.5	1	5.225	10.11	11.25	Pass
Analog	509.975	12.5	1	5.214	10.11	11.25	Pass
Digital	406.125	12.5	5	7.562	9.276	11.25	Pass
Digital	455.5	12.5	5	7.576	9.665	11.25	Pass
Digital	509.975	12.5	5	7.429	9.334	11.25	Pass
Digital	406.125	12.5	1	7.693	9.361	11.25	Pass
Digital	455.5	12.5	1	7.622	9.364	11.25	Pass
Digital	509.975	12.5	1	7.440	9.877	11.25	Pass

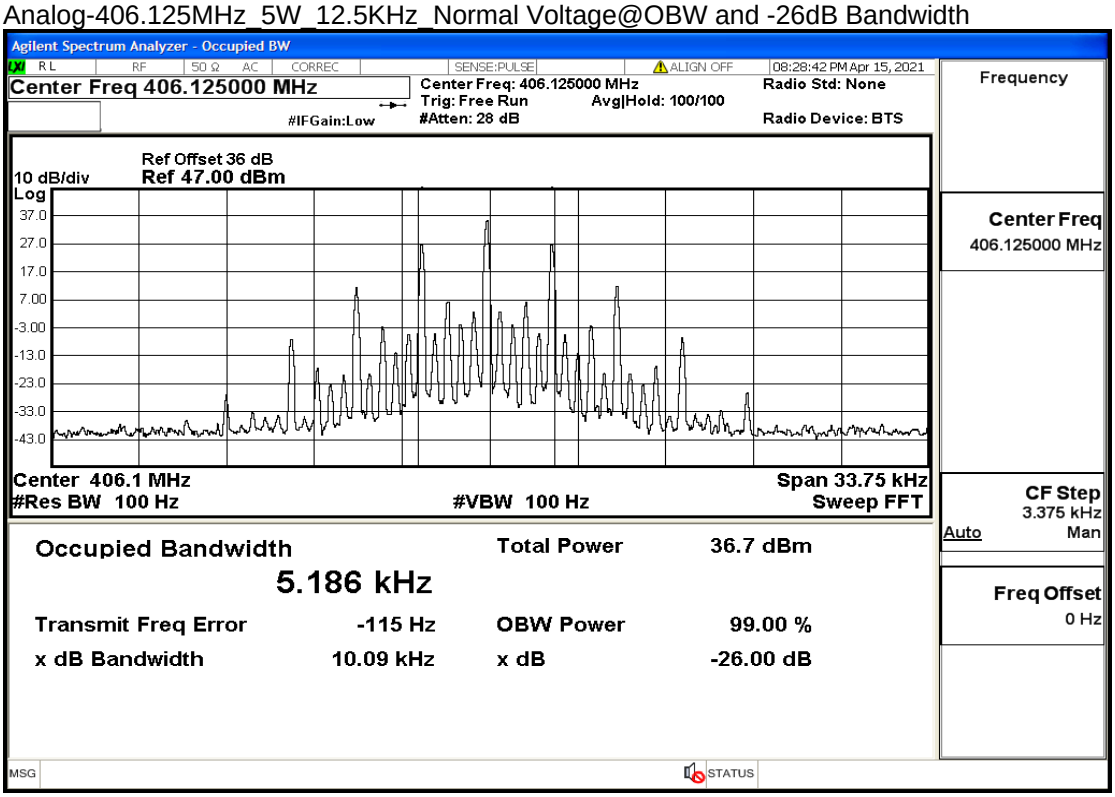
Note:
1. *All measured including cable loss and atten.*
2. *Please refer to following test plots;*

Type	Frequency(MHz)	Nominal Power(W)	Channel Spacing(KHz)	Emission Mask Type	Conclusion
Analog	406.125	5	12.5	D	Pass
Analog	455.5	5	12.5	D	Pass
Analog	509.975	5	12.5	D	Pass
Analog	406.125	1	12.5	D	Pass
Analog	455.5	1	12.5	D	Pass
Analog	509.975	1	12.5	D	Pass
Digital	406.125	5	12.5	D	Pass
Digital	455.5	5	12.5	D	Pass
Digital	509.975	5	12.5	D	Pass
Digital	406.125	1	12.5	D	Pass
Digital	455.5	1	12.5	D	Pass
Digital	509.975	1	12.5	D	Pass

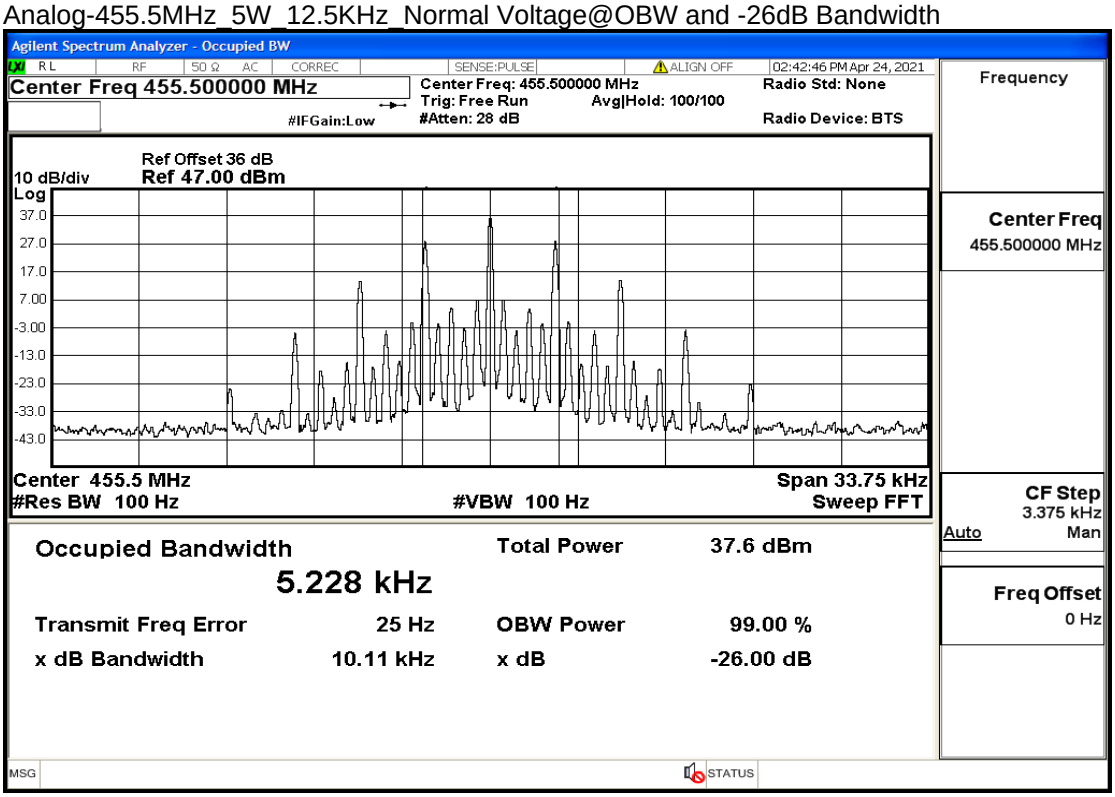
Note:

1. *All measured including cable loss and atten.*
2. *Please refer to following test plots;*

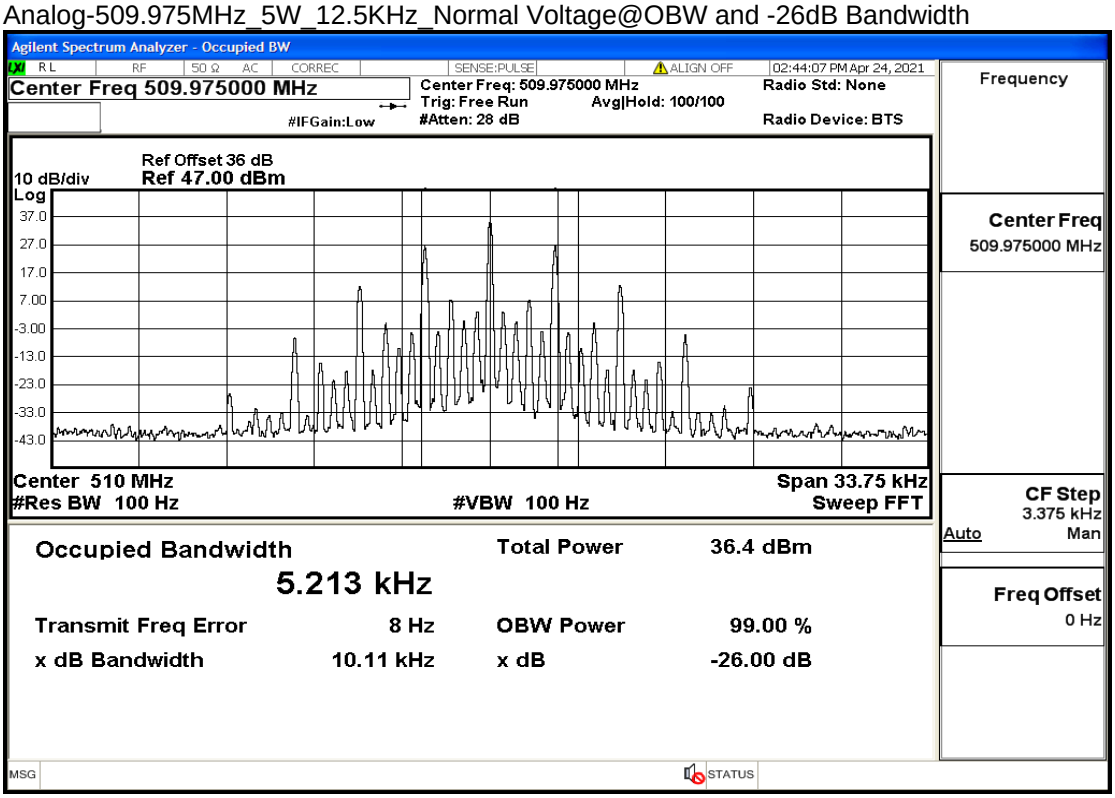
Analog-406.125MHz_5W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



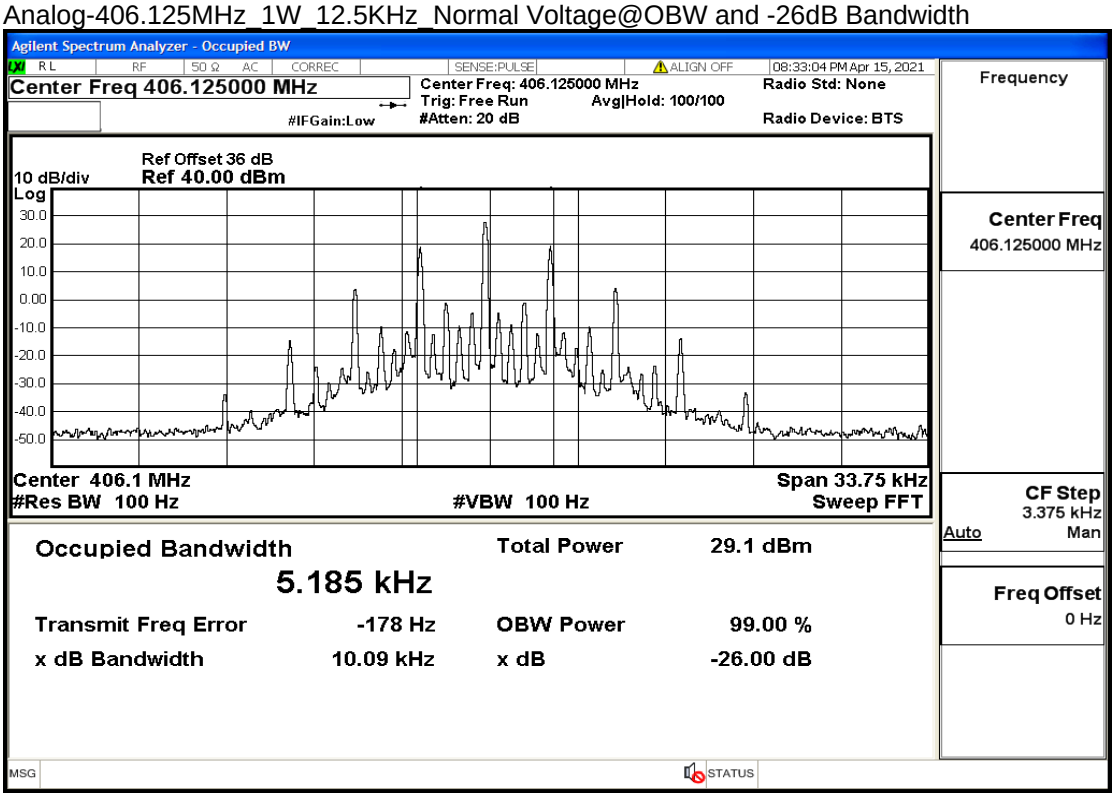
Analog-455.5MHz_5W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



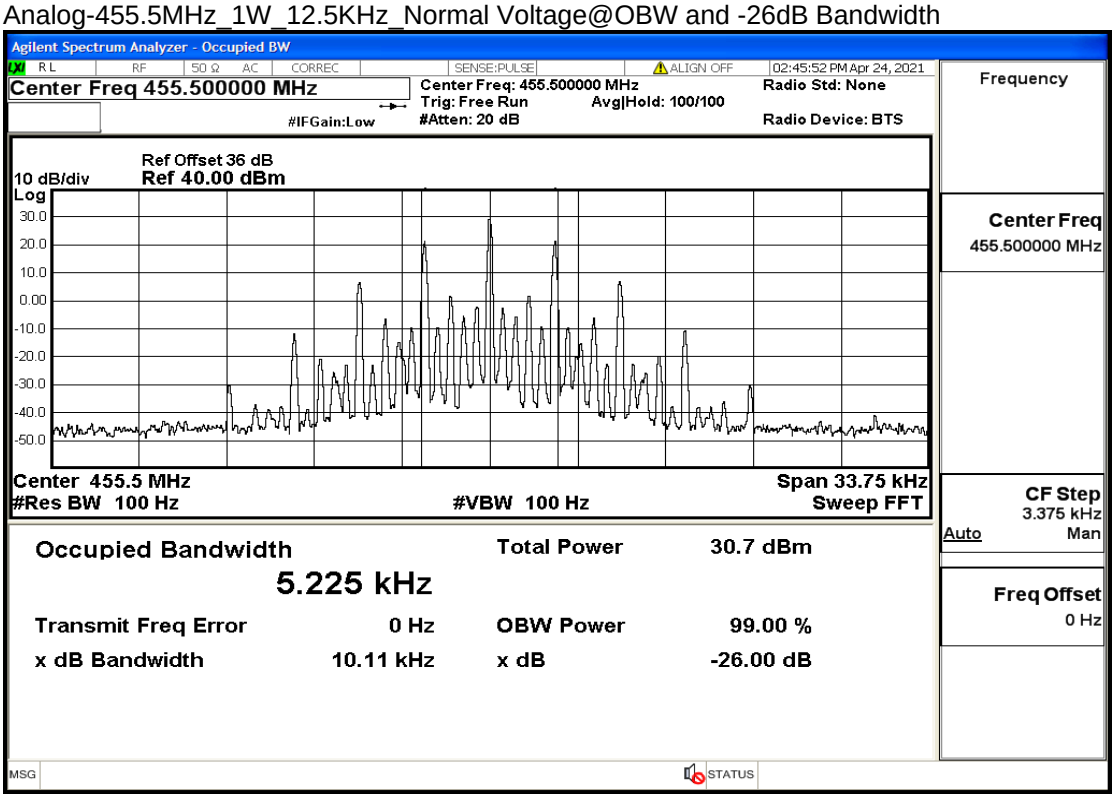
Analog-509.975MHz_5W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



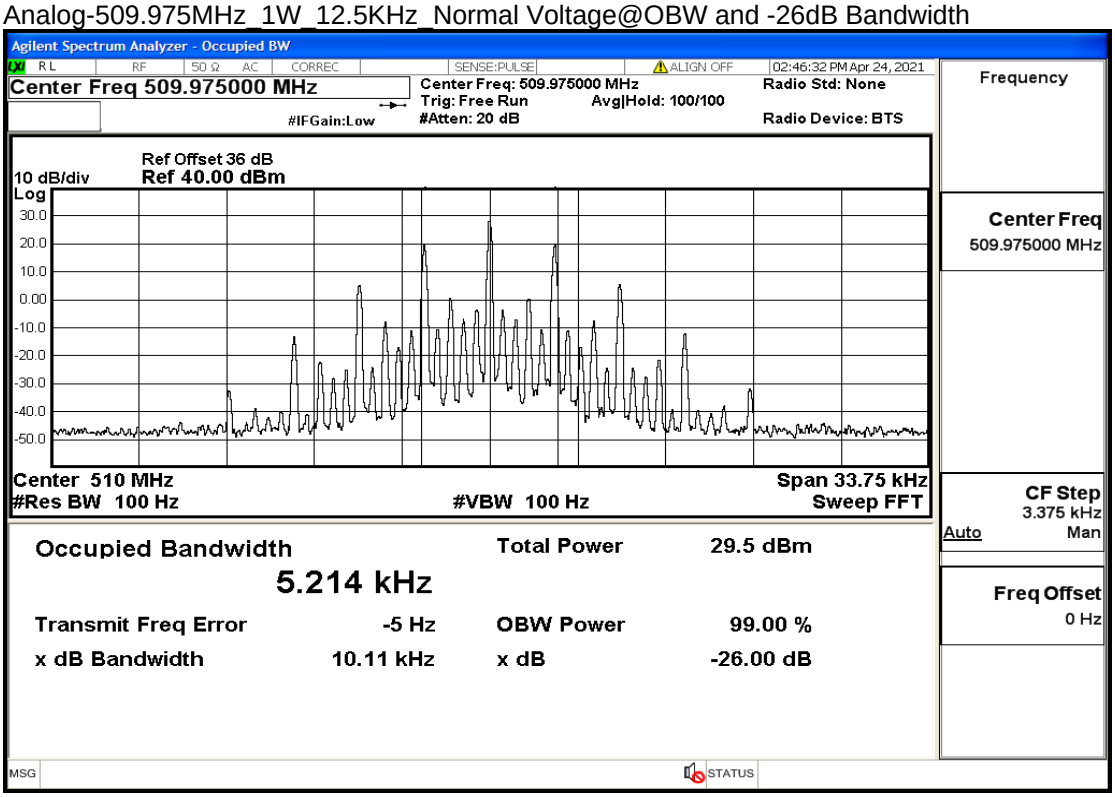
Analog-406.125MHz_1W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



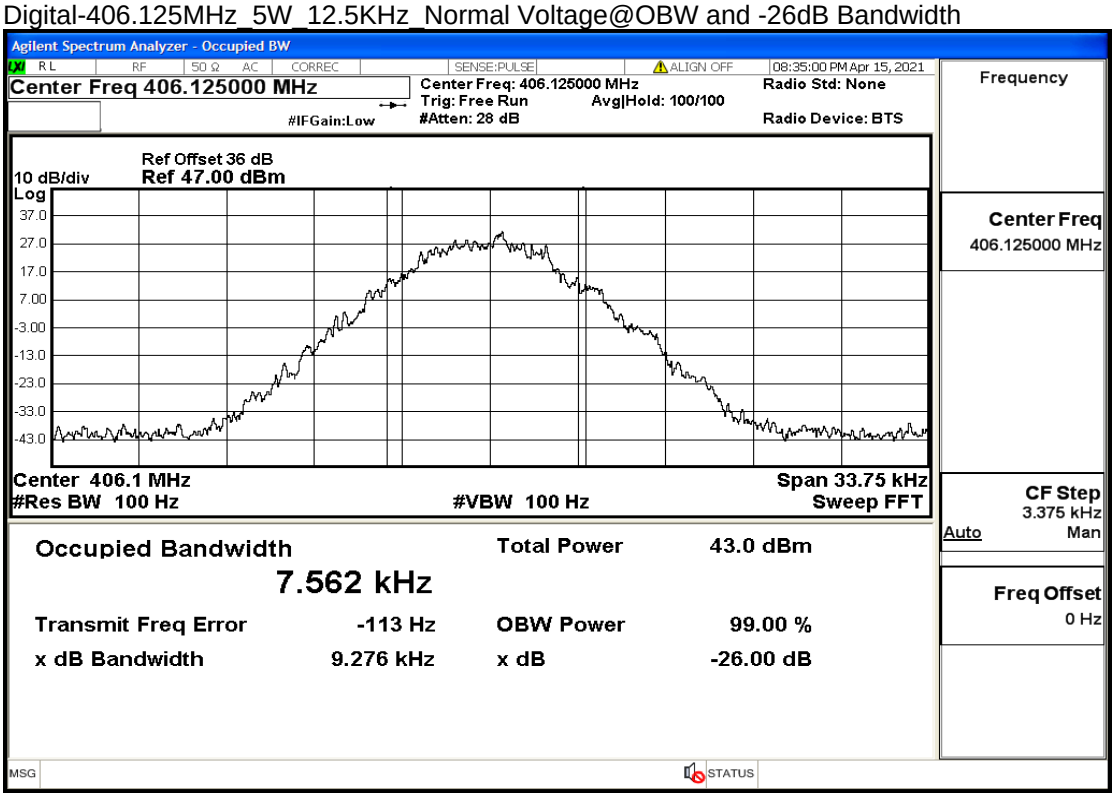
Analog-455.5MHz_1W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



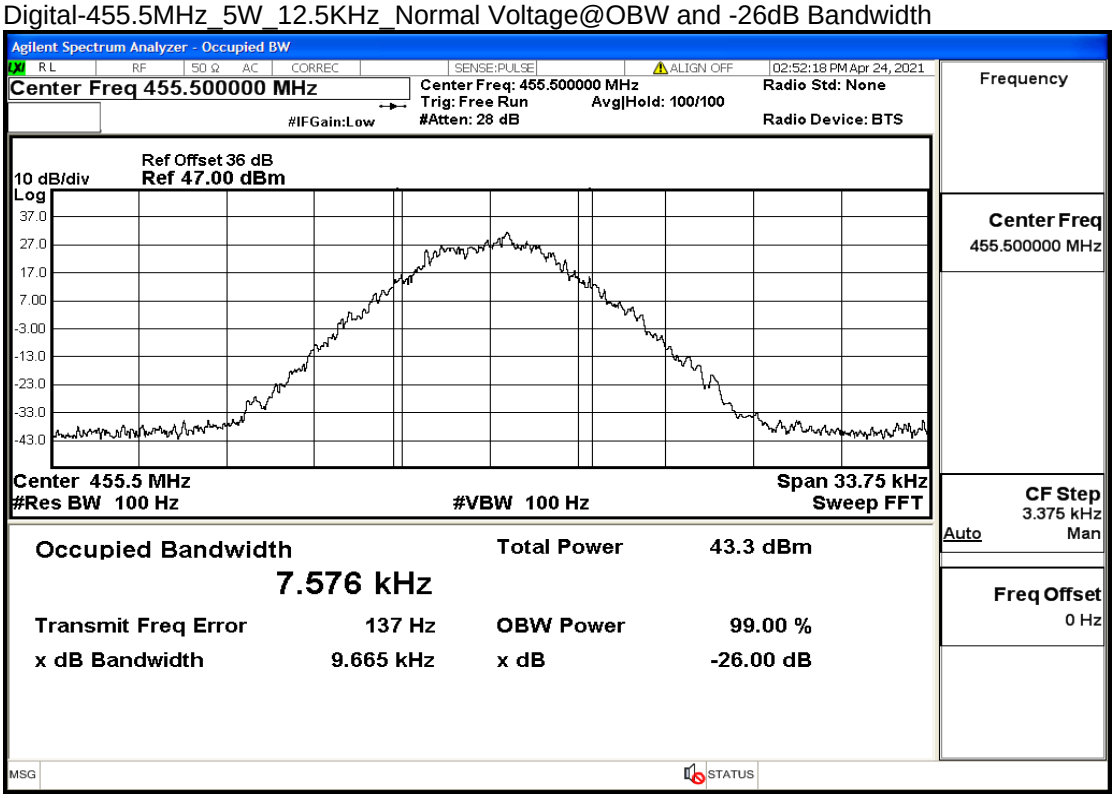
Analog-509.975MHz_1W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



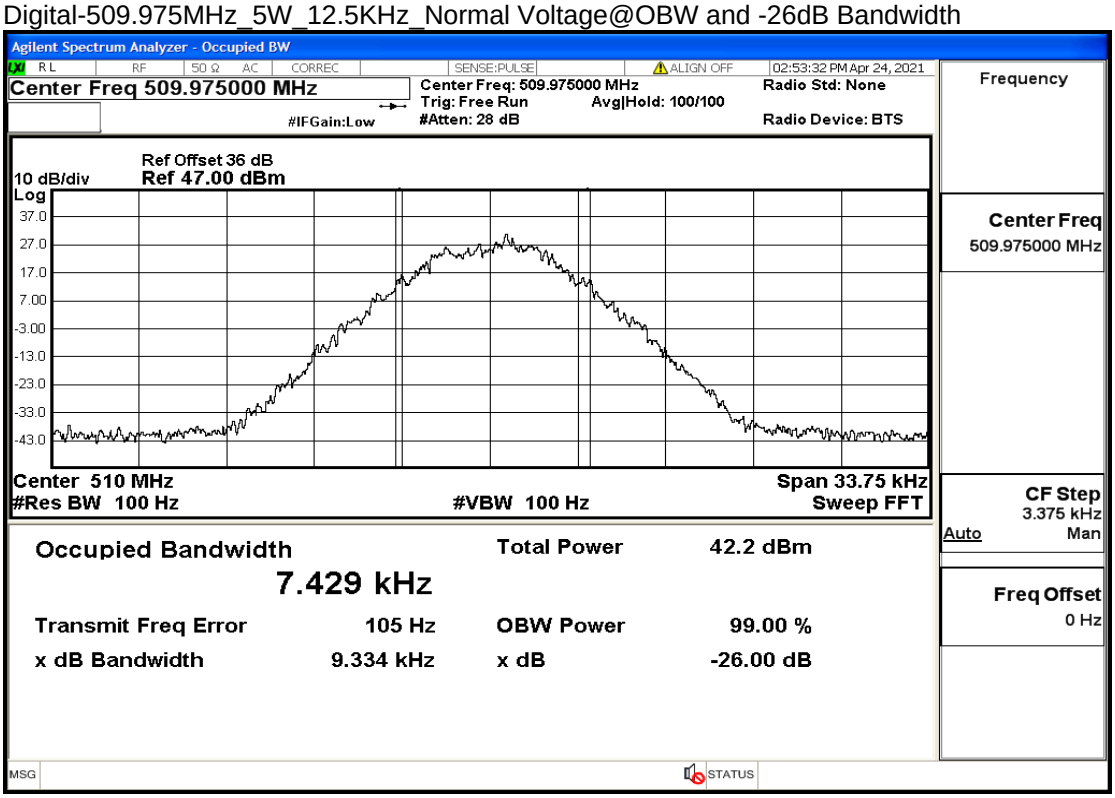
Digital-406.125MHz_5W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



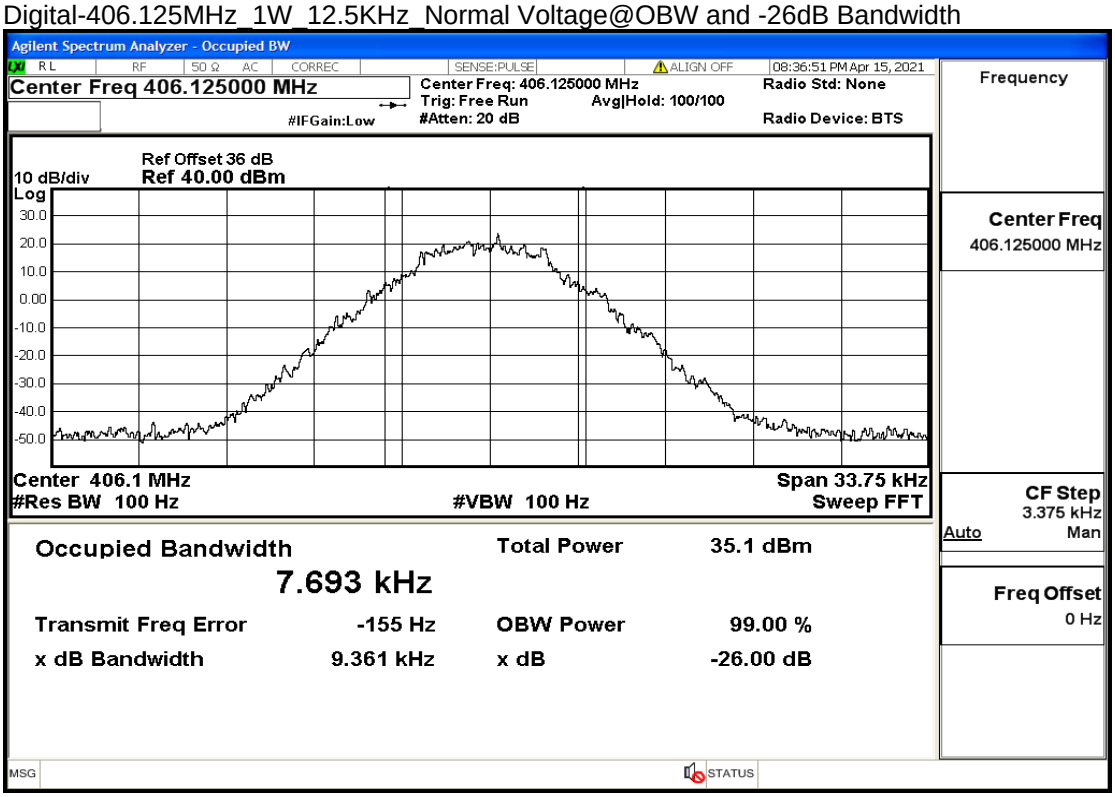
Digital-455.5MHz_5W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



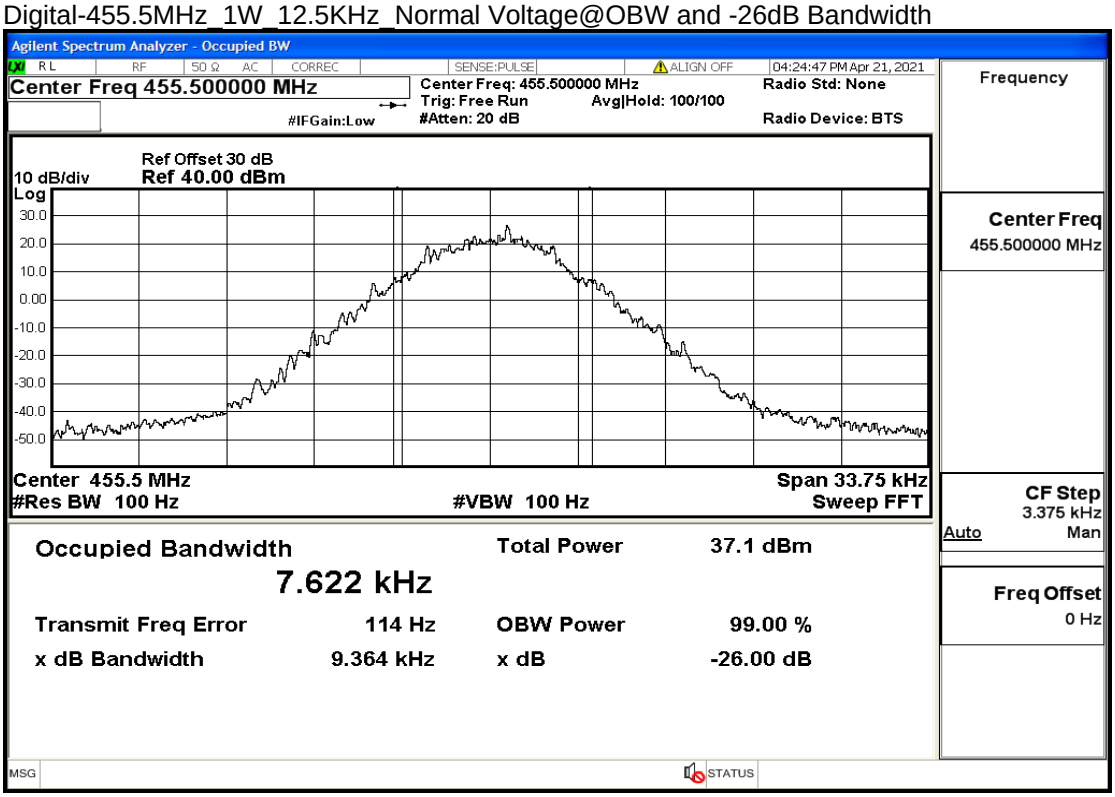
Digital-509.975MHz_5W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



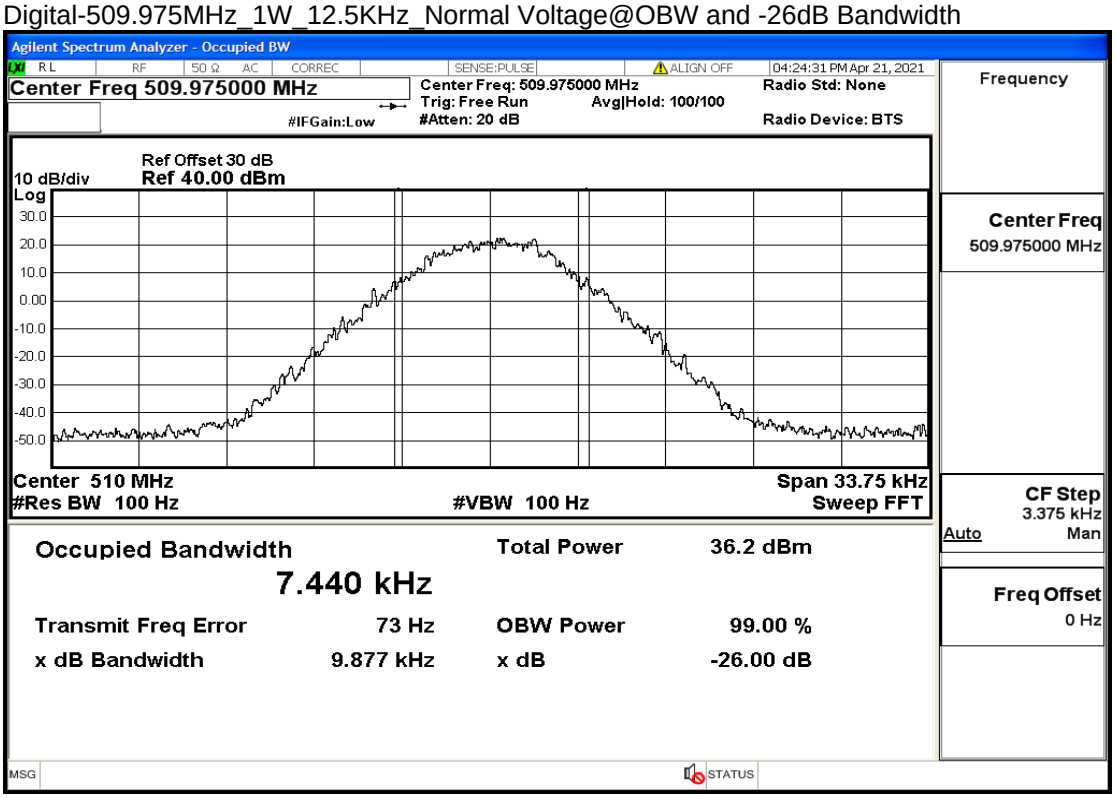
Digital-406.125MHz_1W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



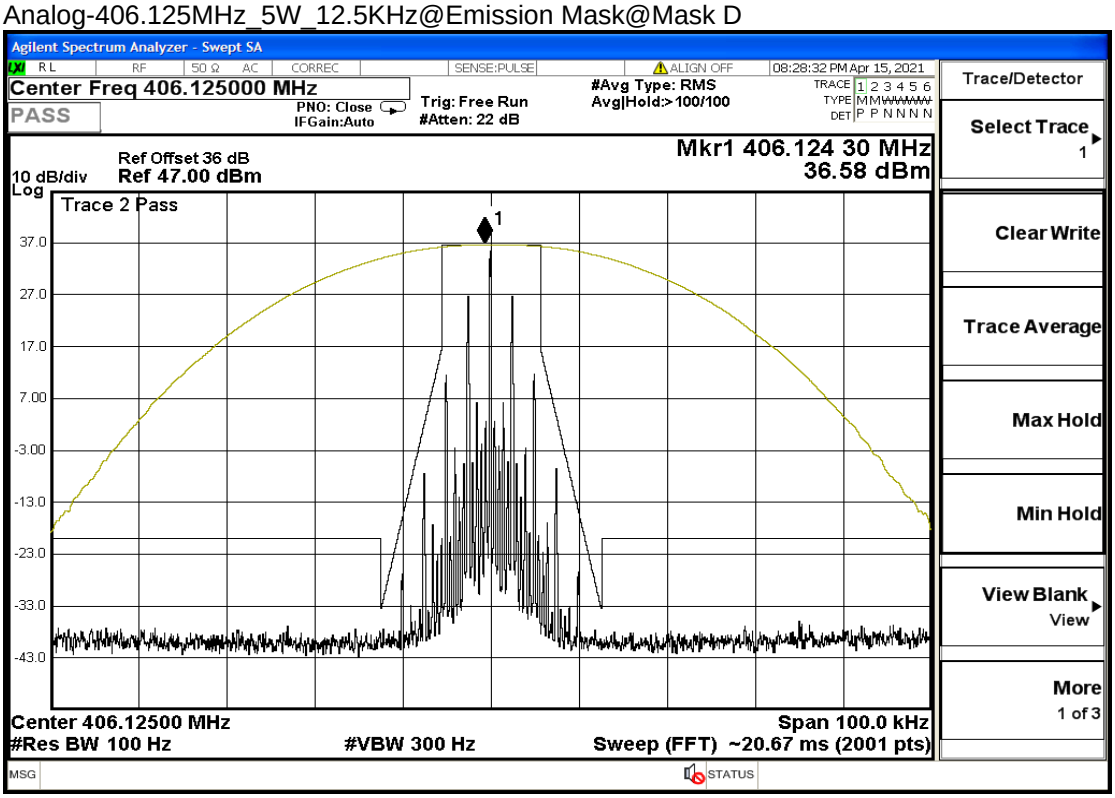
Digital-455.5MHz_1W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



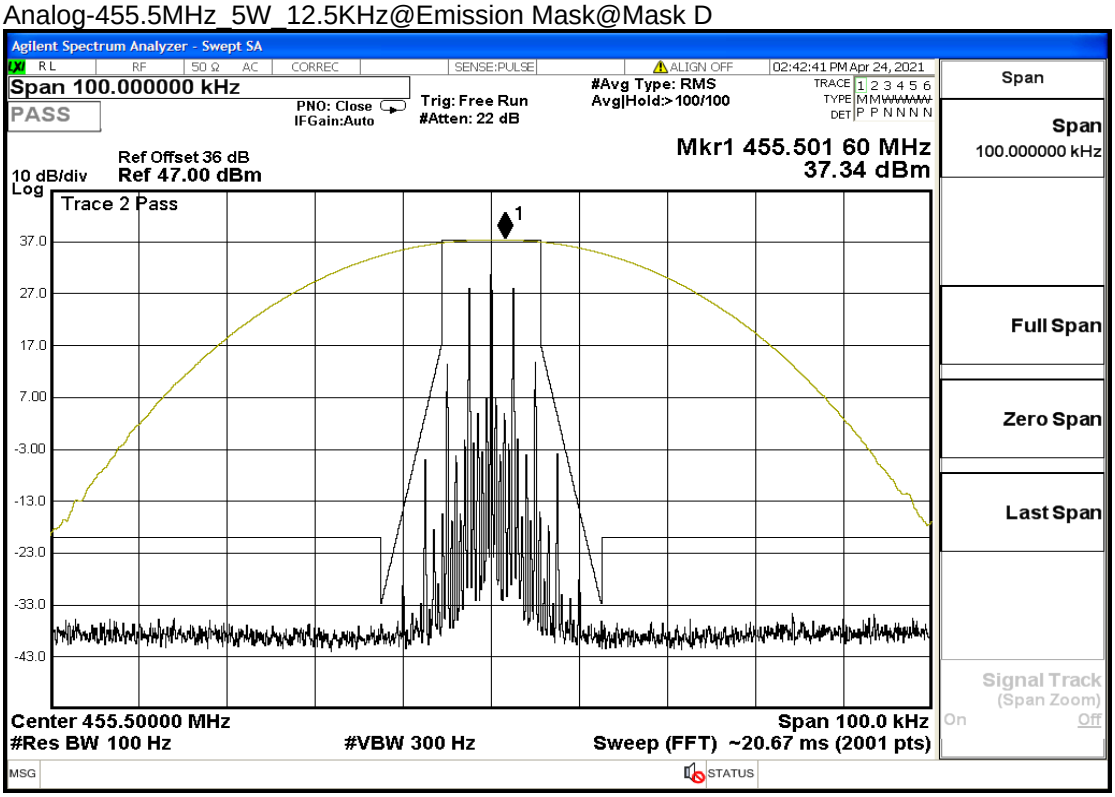
Digital-509.975MHz_1W_12.5KHz_Normal Voltage@OBW and -26dB Bandwidth



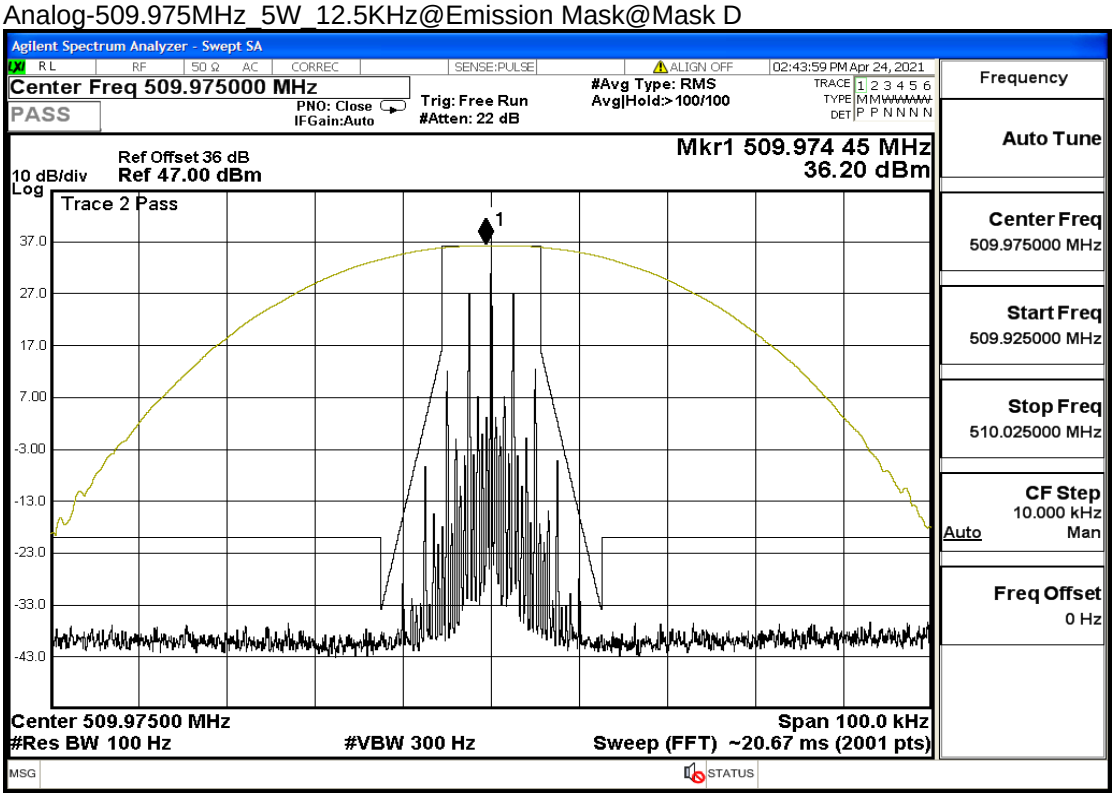
Analog-406.125MHz_5W_12.5KHz@Emission Mask@Mask D



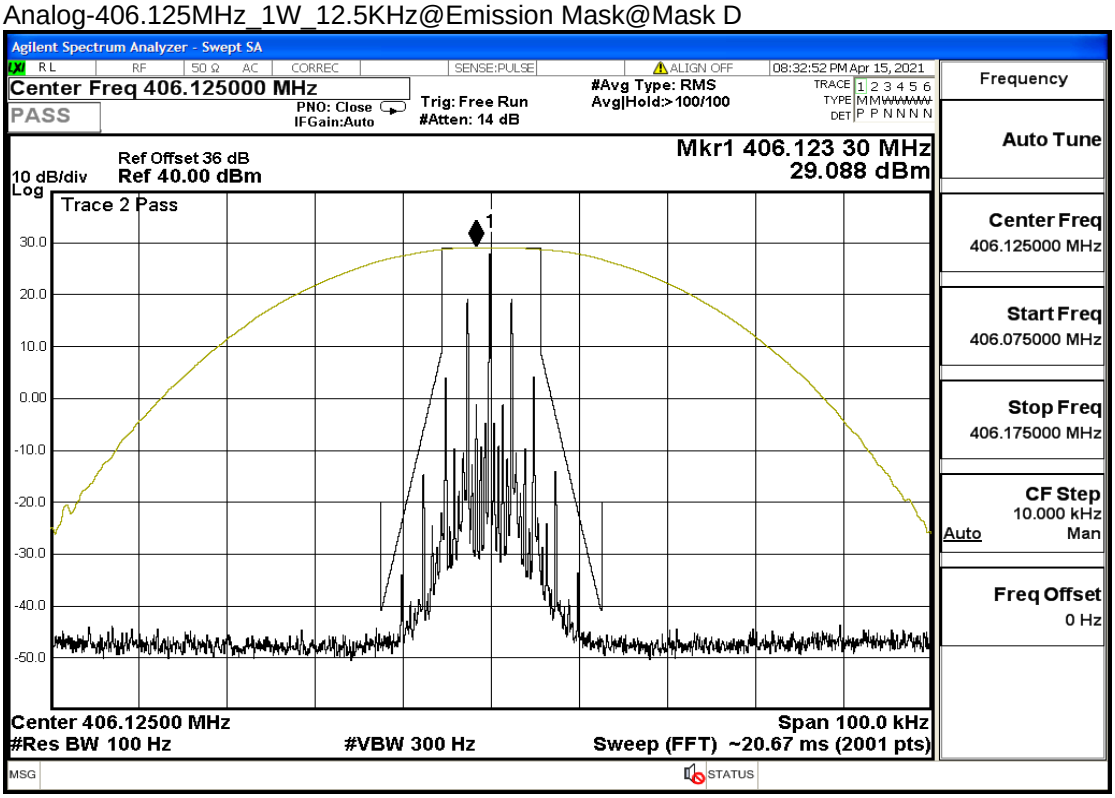
Analog-455.5MHz_5W_12.5KHz@Emission Mask@Mask D



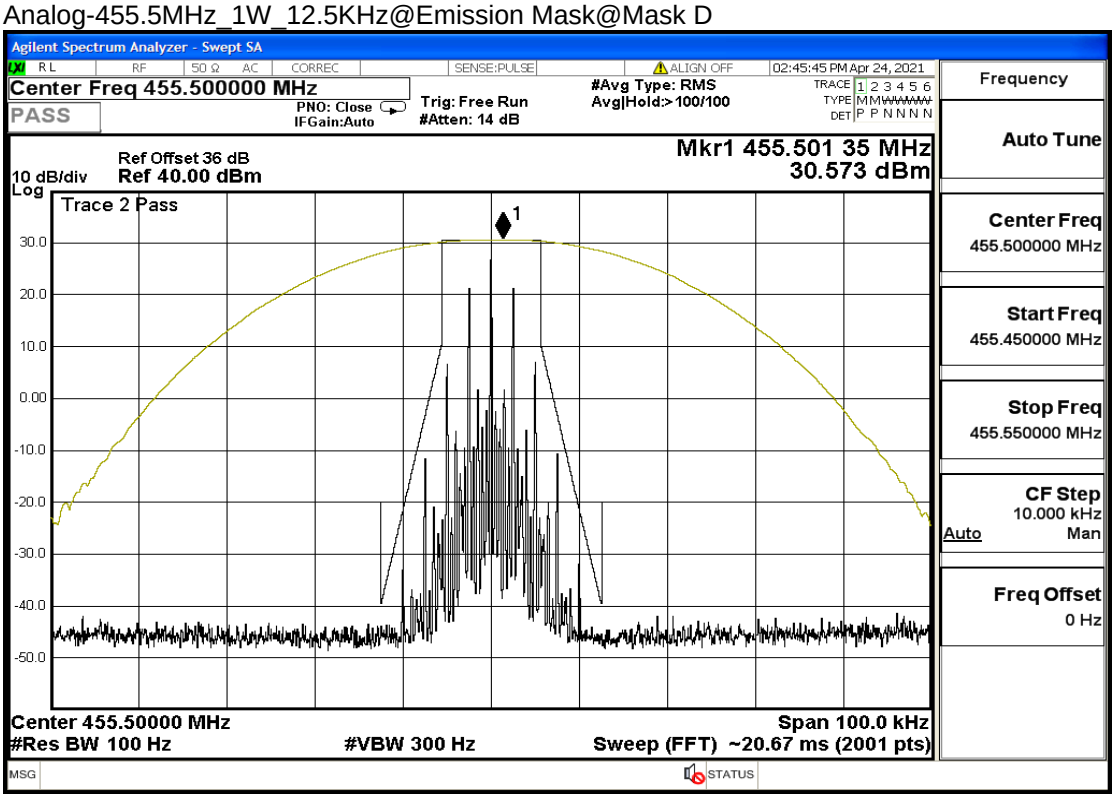
Analog-509.975MHz_5W_12.5KHz@Emission Mask@Mask D



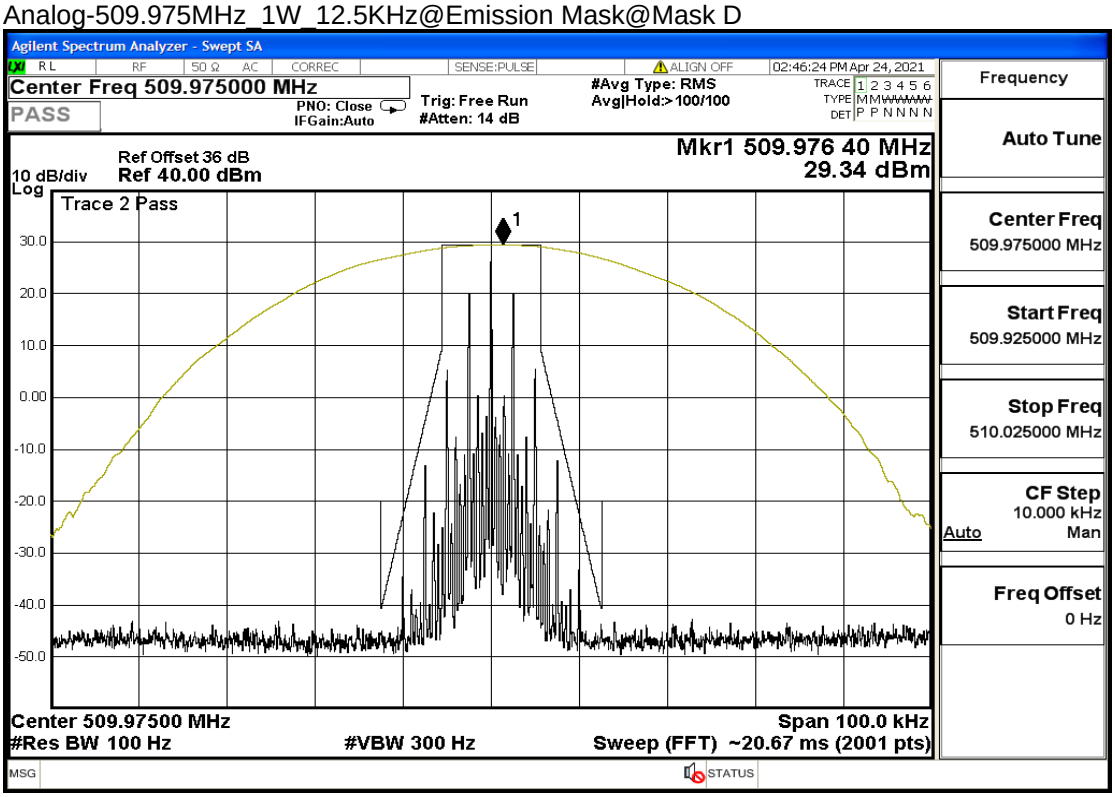
Analog-406.125MHz_1W_12.5KHz@Emission Mask@Mask D



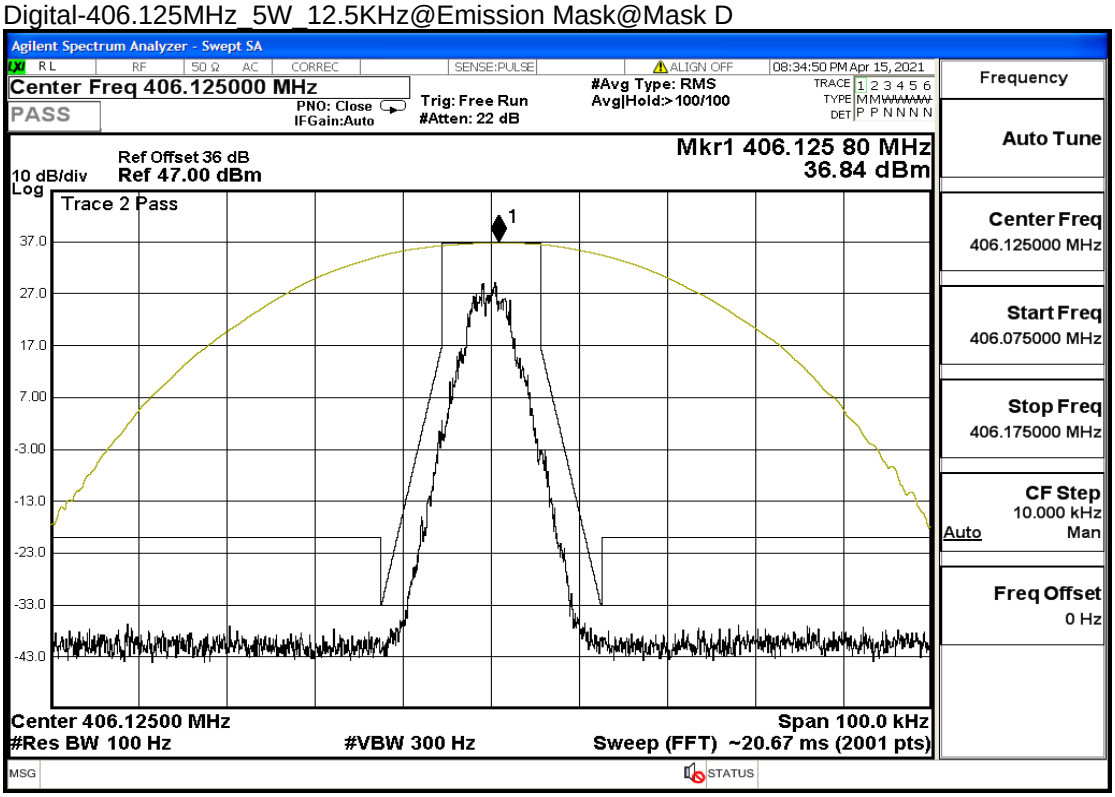
Analog-455.5MHz_1W_12.5KHz@Emission Mask@Mask D



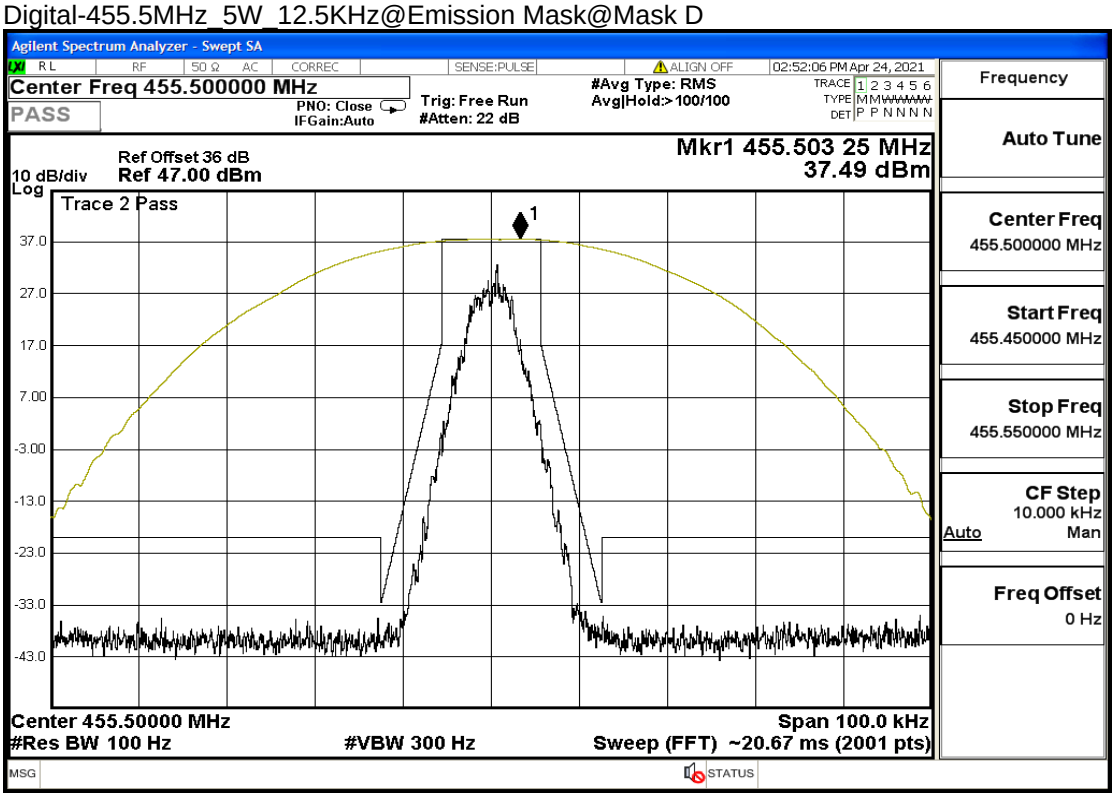
Analog-509.975MHz_1W_12.5KHz@Emission Mask@Mask D



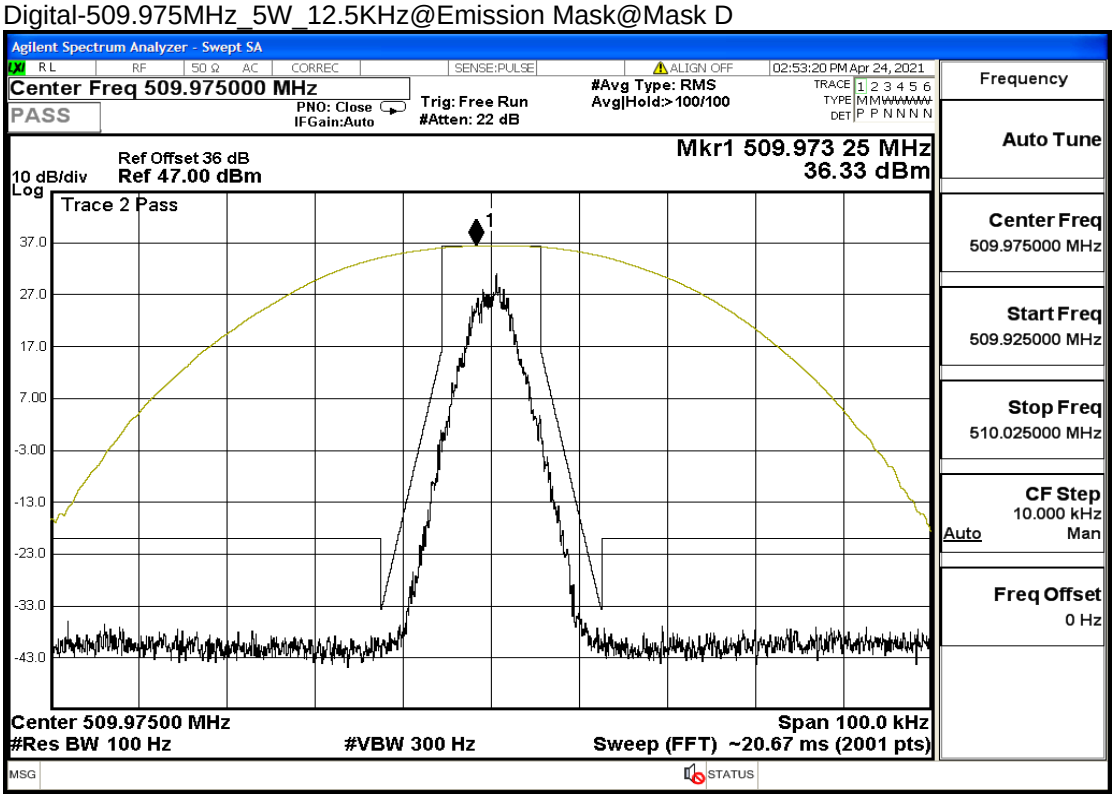
Digital-406.125MHz_5W_12.5KHz@Emission Mask@Mask D



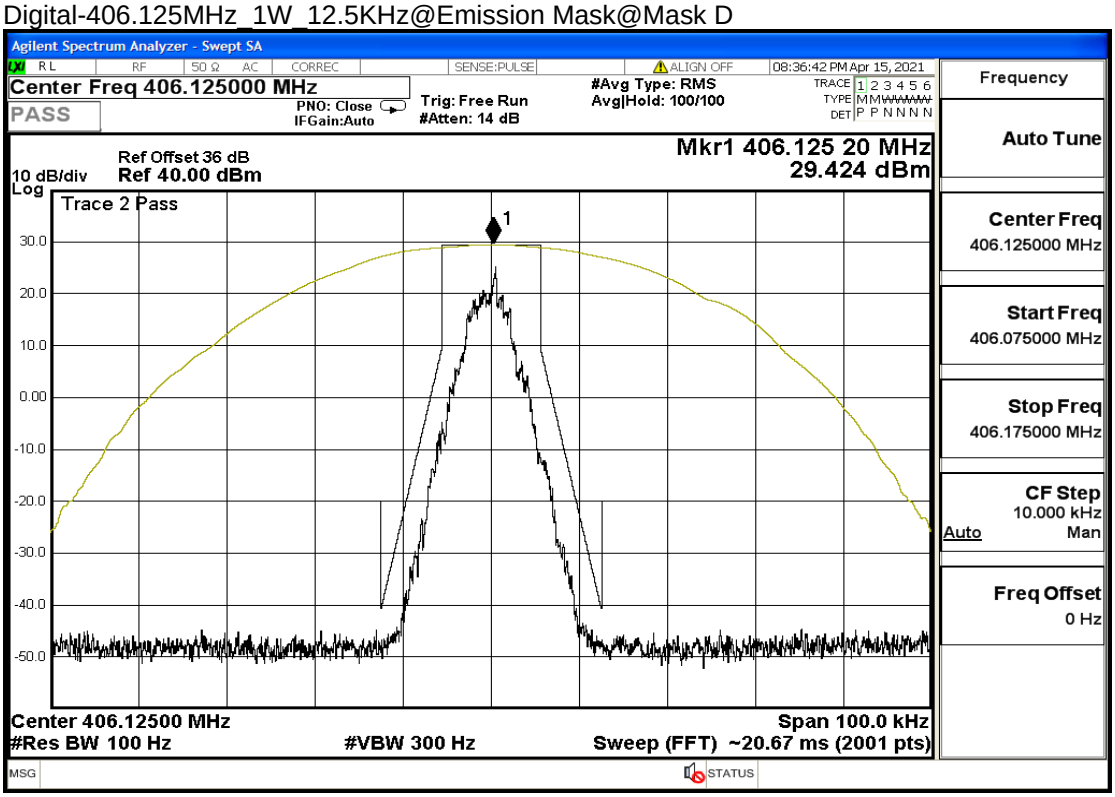
Digital-455.5MHz_5W_12.5KHz@Emission Mask@Mask D



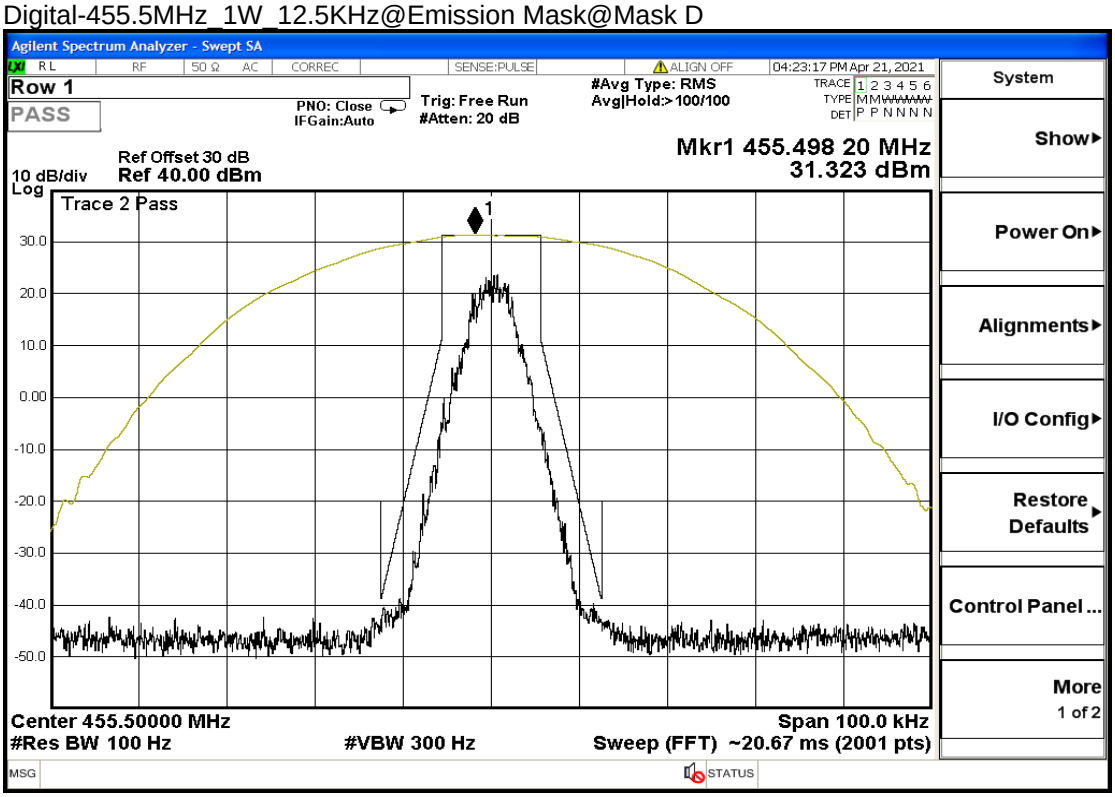
Digital-509.975MHz_5W_12.5KHz@Emission Mask@Mask D



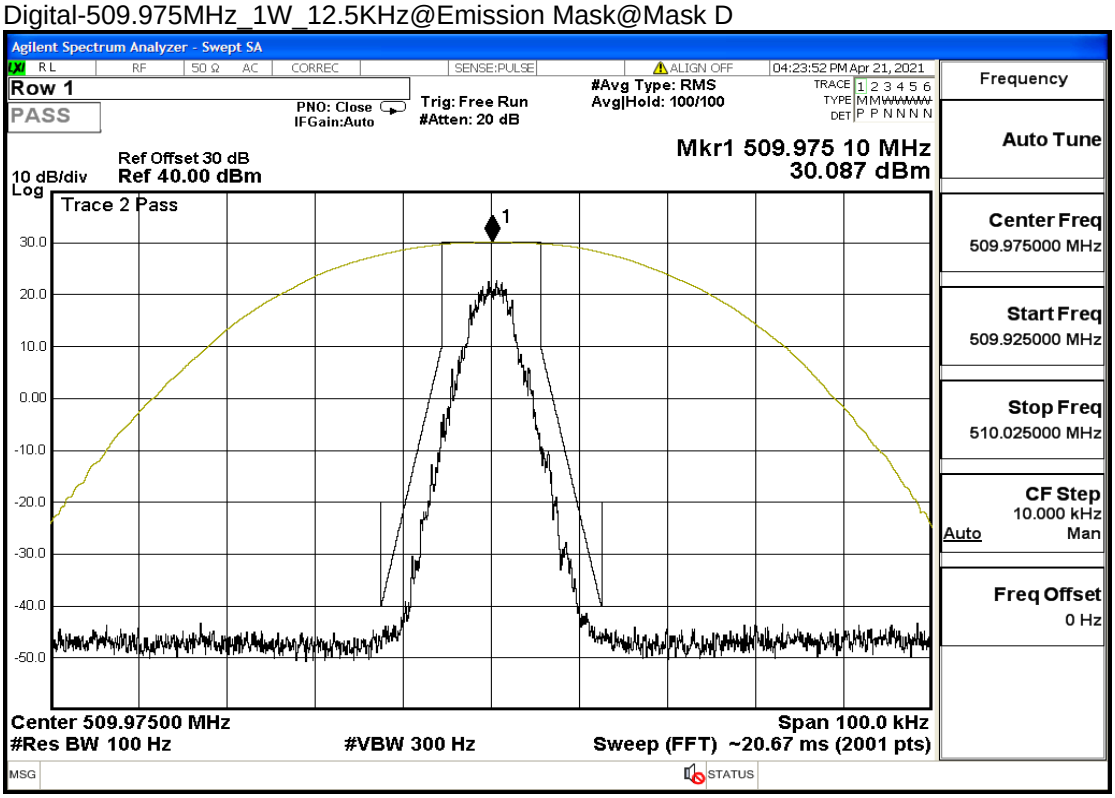
Digital-406.125MHz_1W_12.5KHz@Emission Mask@Mask D



Digital-455.5MHz_1W_12.5KHz@Emission Mask@Mask D



Digital-509.975MHz_1W_12.5KHz@Emission Mask@Mask D



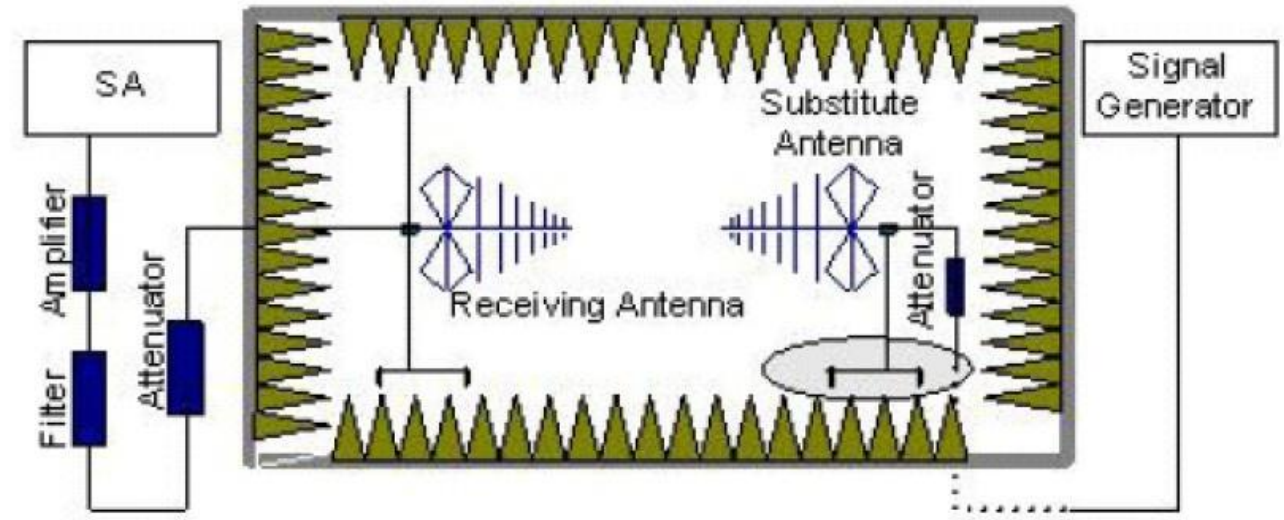
4.4. Field Strength Spurious Emissions

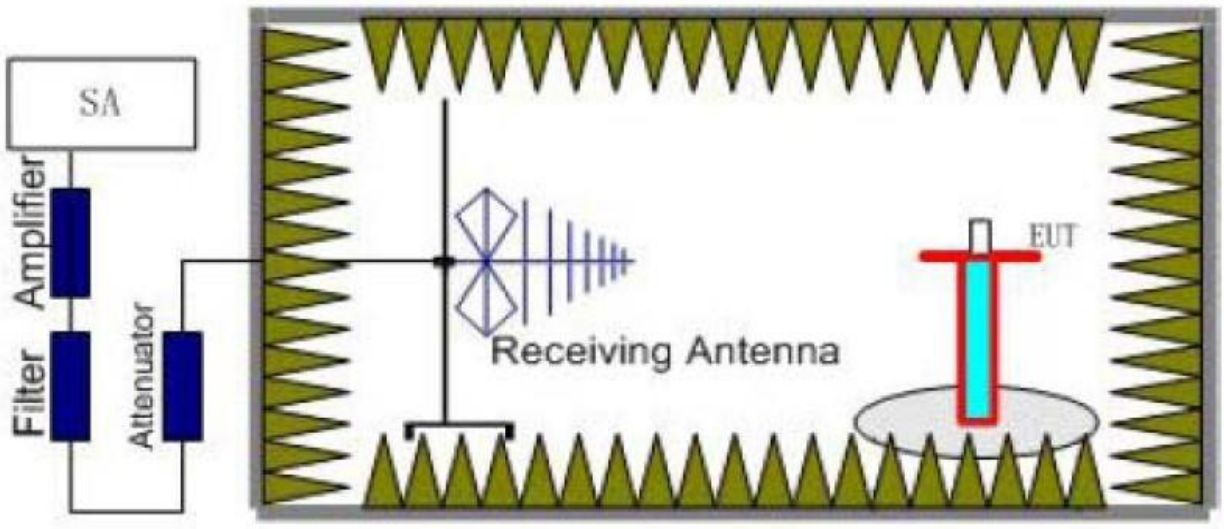
TEST APPLICABLE

According to the TIA/EIA 603D test method, andaccording to §95.635, the power of each unwanted emission shall be less than TransmittedPower as specified below:

1 At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.
2 At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.
3. At least 43 + 10 $\log_{10}$ (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

TEST CONFIGURATION





TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in six channels were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyser or receiver. The level of the spurious emissions can be calculated

through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyser or receiver.

3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz for above 1GHz and RBW=100KHz,VBW=300KHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna.In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest isconnected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.
   The measurement results are obtained as described below:
   Power(EIRP)=P_{Mea}- P_{Ag} - P_{cl}+ G_a

It can omit power amplifier if signal generator level meets requirement;

This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

Subrange (GHz)	RBW	VBW	Sweep time (s)
0.00009~0.15	1KHz	3KHz	30
0.00015~0.03	10KHz	30KHz	10
0.03~1	100KHz	300KHz	10
1~5	1 MHz	3 MHz	5

TEST LIMIT

According to §90.210 d) (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

TEST RESULTS

Note : only the high power mode result in test report.

Note:

1. In general, the worst case attenuation requirement shown above was applied.
2. The measurement frequency range from 9KHz to 5 GHz.
3. EIRP for measure frequency above 1 GHz and ERP for below 1 GHz.
4. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.

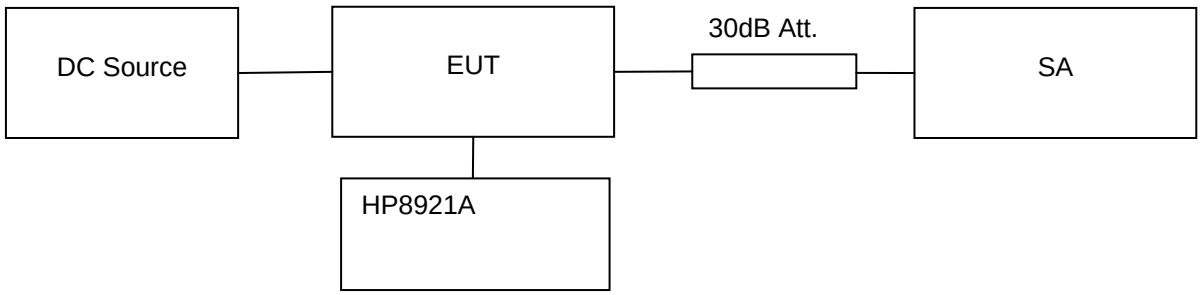
Test Frequency: 406.1250MHz				Channel Separation:12.5KHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Values (dBm)	Limit (dBm)	Polarization
812.25	-49.34	0.61	7.31	2.15	-44.79	-20.00	H
1218.38	-44.05	0.74	7.73	0.00	-37.06	-20.00	H
1624.50	-52.83	0.82	8.16	0.00	-45.49	-20.00	H
…	…	…	…	…	…	…	H
812.25	-38.80	0.61	7.31	2.15	-34.25	-20.00	V
1218.38	-43.65	0.74	7.73	0.00	-36.66	-20.00	V
1624.50	-52.13	0.5	7.09	0.00	-45.54	-20.00	V
…	…	…	…	…	…	…	V

Test Frequency: 455.5000MHz				Channel Separation:12.5KHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Values (dBm)	Limit (dBm)	Polarization
911.00	-49.96	0.66	7.41	2.15	-45.36	-20.00	H
1366.50	-45.17	0.77	7.89	0.00	-38.05	-20.00	H
1822.00	-50.92	0.86	8.37	0.00	-43.41	-20.00	H
…	…	…	…	…	…	…	H
911.00	-40.71	0.66	7.41	2.15	-36.11	-20.00	V
1366.50	-44.84	0.77	7.89	0.00	-37.72	-20.00	V
1822.00	-54.21	0.5	7.09	0.00	-47.62	-20.00	V
…	…	…	…	…	…	…	V

Test Frequency: 509.975000MHz				Channel Separation:12.5KHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Values (dBm)	Limit (dBm)	Polarization
1019.95	-49.57	0.7	7.52	0.00	-42.75	-20.00	H
1529.93	-45.32	0.81	8.06	0.00	-38.07	-20.00	H
2039.90	-51.05	0.91	8.6	0.00	-43.36	-20.00	H
…	…	…	…	…	…	…	H
1019.95	-42.91	0.7	7.52	0.00	-36.09	-20.00	V
1529.93	-44.71	0.81	8.06	0.00	-37.46	-20.00	V
2039.90	-51.54	0.5	7.09	0.00	-44.95	-20.00	V
…	…	…	…	…	…	…	V

4.5. Conducted sprious emission result(at antenna terminal):

TEST CONFIGURATION



TEST PROCEDURE

3) Connect the equipmet as illuastrated.
4) Set EUT working in continuous mode in low,middle,high frequency,read and record the peak power value.

TEST LIMIT

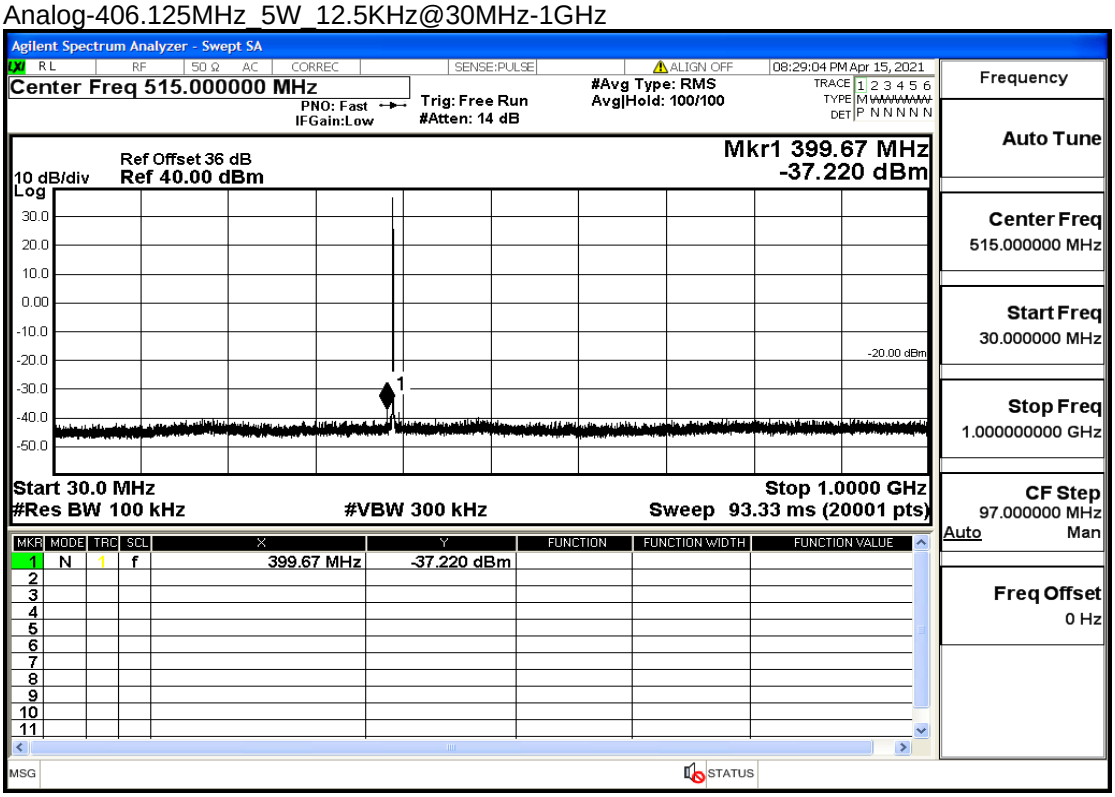
According to §90.210 d) (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

TEST RESULTS

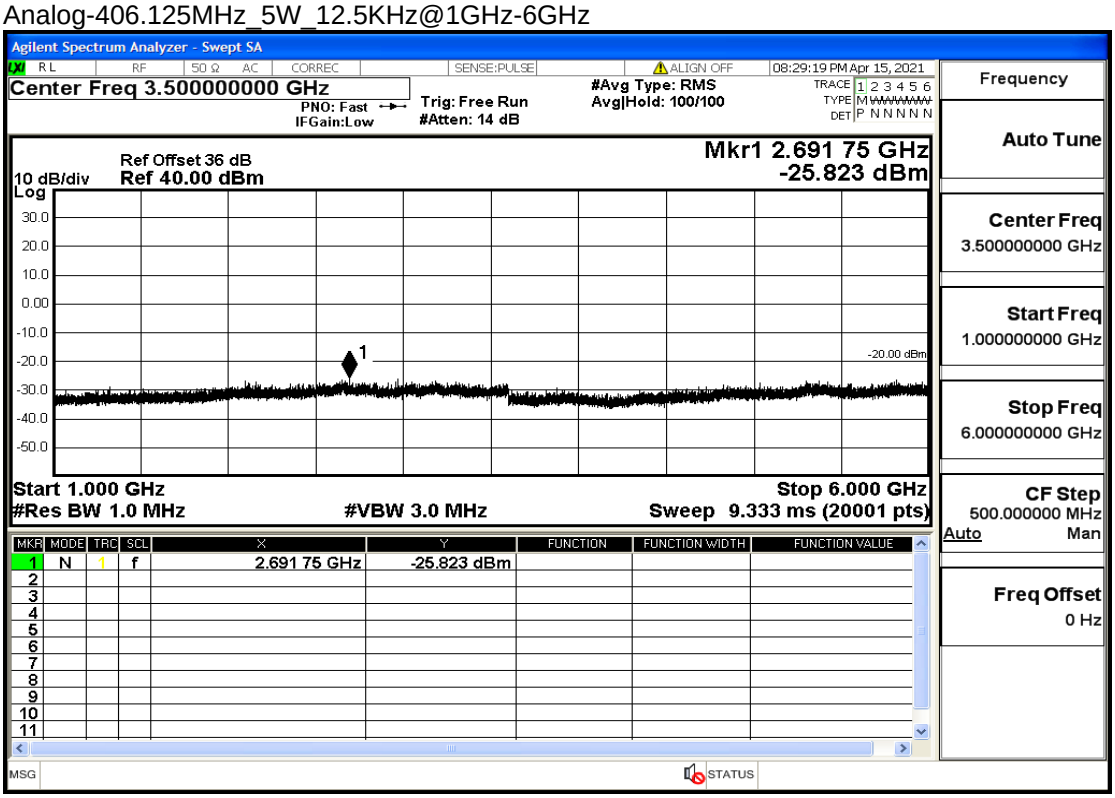
Pass

Note:list the worst result in this item

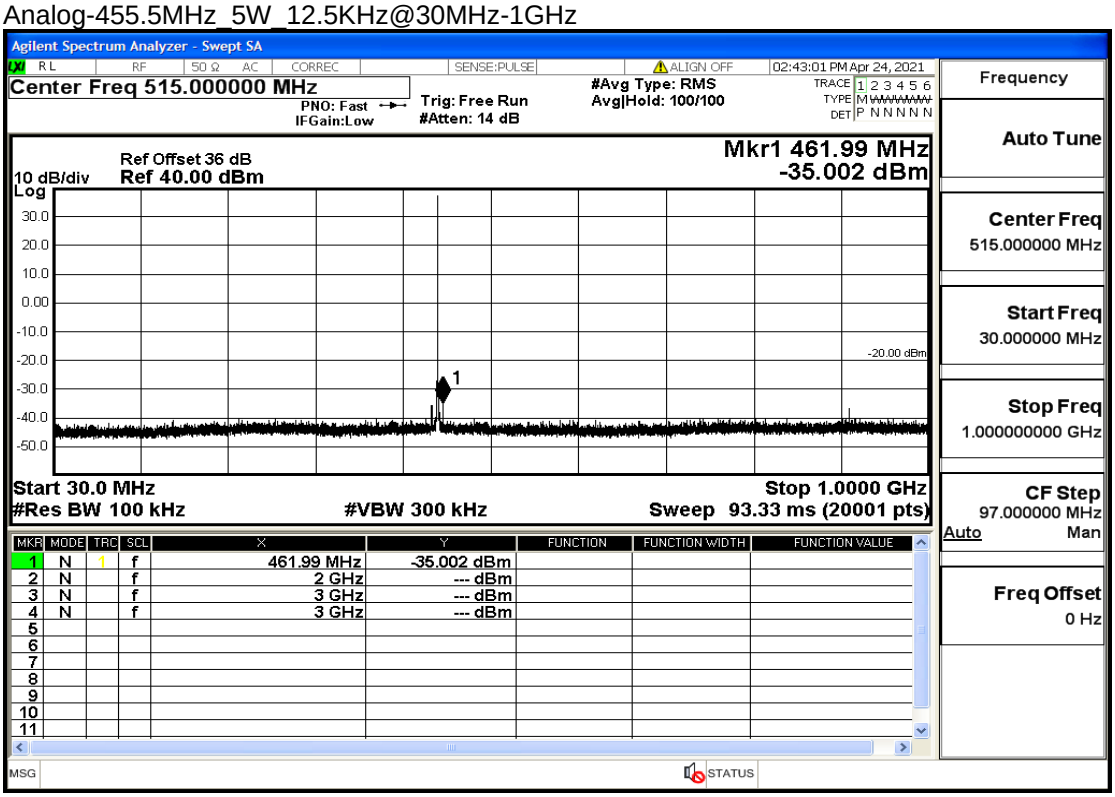
Analog-406.125MHz_5W_12.5KHz@30MHz-1GHz



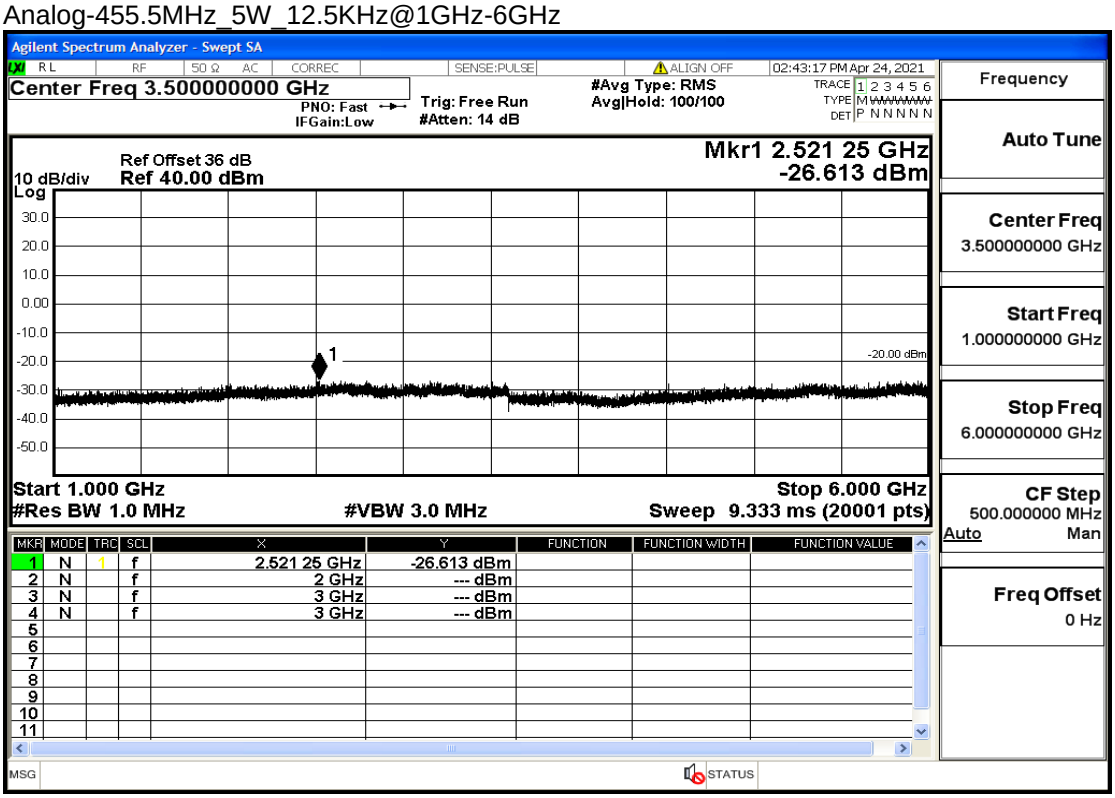
Analog-406.125MHz_5W_12.5KHz@1GHz-6GHz



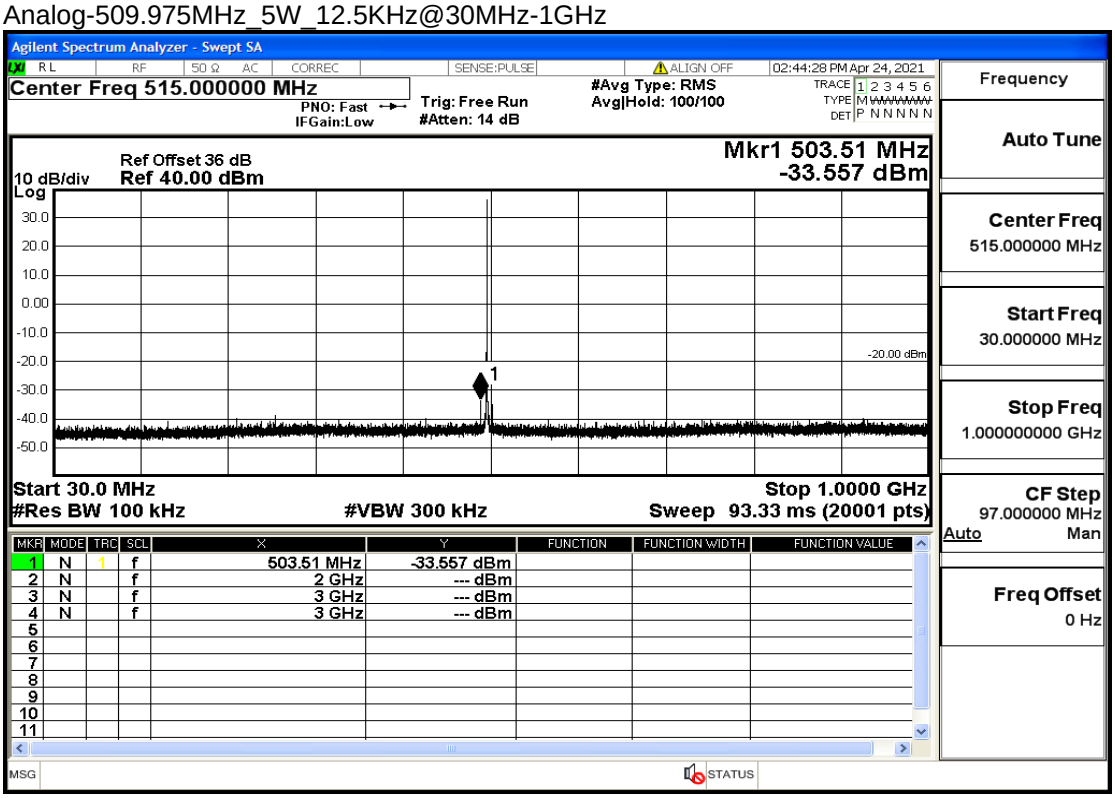
Analog-455.5MHz_5W_12.5KHz@30MHz-1GHz



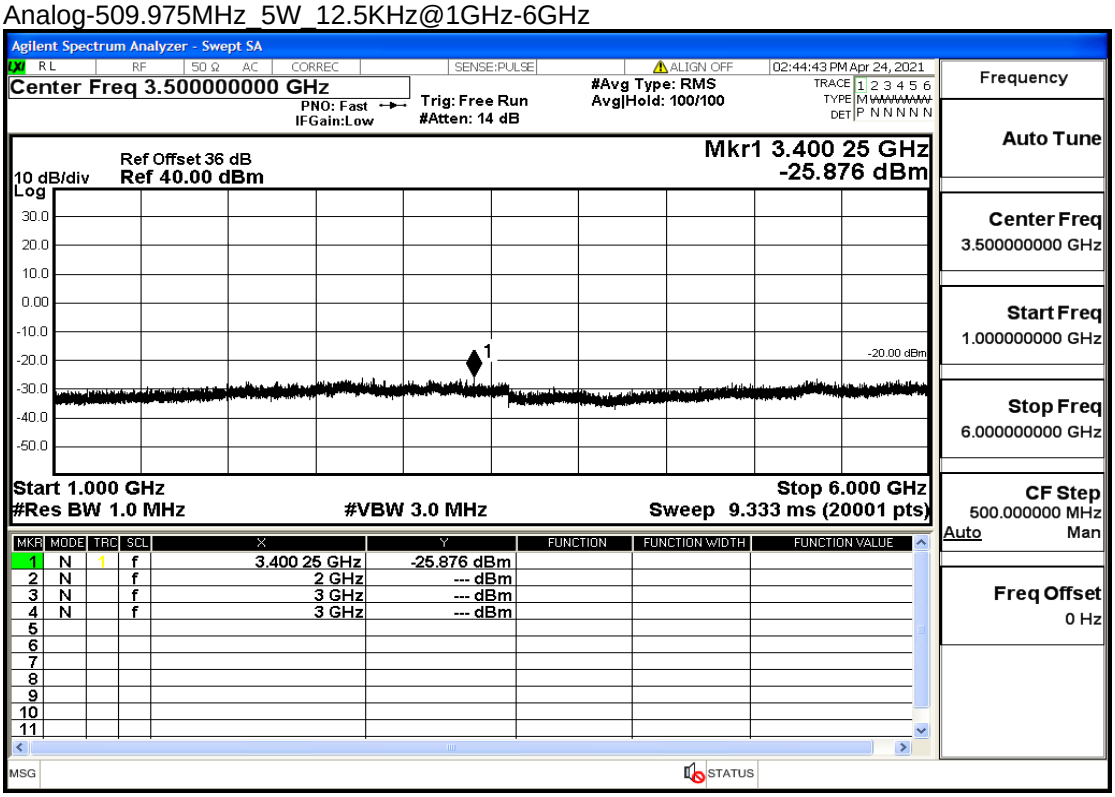
Analog-455.5MHz_5W_12.5KHz@1GHz-6GHz



Analog-509.975MHz_5W_12.5KHz@30MHz-1GHz

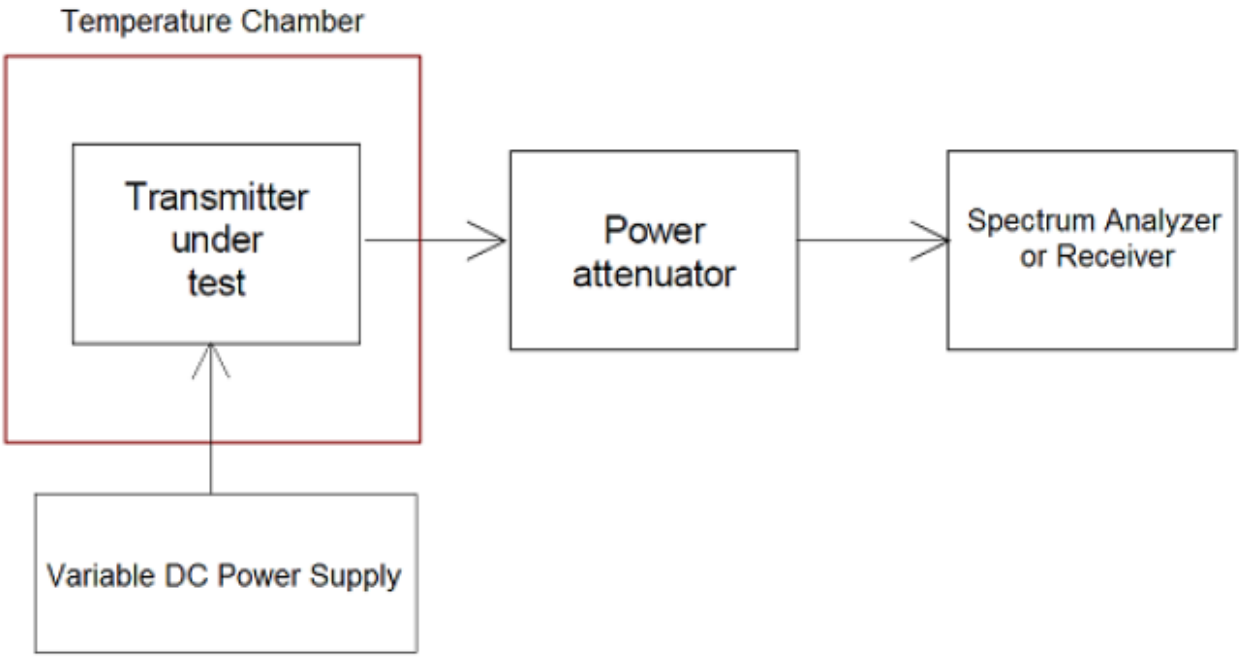


Analog-509.975MHz_5W_12.5KHz@1GHz-6GHz



4.6. Frequency Stability

TEST CONFIGURATION



TEST PROCEDURE

The EUT was set in the climate chamber and connected to an external DC power supply. The RF output was directly connected to frequency meter. The coupling loss of the additional cables was recorded and taken in account for all the measurements. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply and the voltage was adjusted in the required ranges. The result was recorded.

TEST APPLICABLE

1 According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30℃ to +60℃centigrade.
2 According to FCC Part 2 Section 2.1055 (a) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
3 Vary primary supply voltage from 85 to 115 percent of the nominal value; if manufacturer declares extreme voltage within 85 to 115 percent of the nominal value, measured at extreme voltage declared by manufacturer.

LIMIT

According to §95.621, Each GMRS transmitter for mobile station, small base station and control station operation must be maintained within a frequency tolerance of 0.0005%. Each GMRS transmitter for base station (except small base), mobile relay station or fixed station operation must be maintained within a frequency tolerance of 0.00025%.
According to §95.625,Each FRS unit must be maintained within a frequency tolerance of 0.00025%.

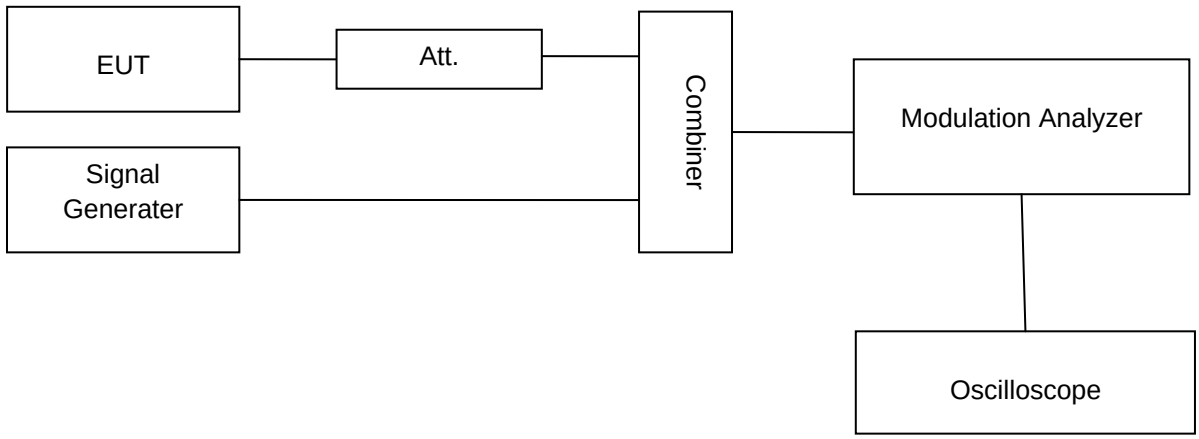
TEST RESULTS

Test conditions		Frequency error (ppm)		
Voltage Condition	Temp(℃)	406.125 MHz	455.5000MHz	509.975MHz
NV	-30	0.49	0.06	0.16
	-20	0.09	0.16	0.41
	-10	0.35	0.30	0.13
	0	0.22	0.40	0.41
	10	0.40	0.11	0.39
	20	0.15	0.43	0.34
	30	0.35	0.42	0.08
	40	0.39	0.25	0.32
	50	0.28	0.33	0.08
	60	0.07	0.42	0.10
LV	20	0.02	0.10	0.33
HV	20	0.39	0.28	0.00
Limit(ppm)		2.50	2.50	2.50
Result		PASS	PASS	PASS

NV: Normal Voltage 7.4V
LV: Low Voltage 6.9V
HV: High Voltage 8.4V

4.7. Transient Frequency Behavior

TEST CONFIGURATION



TEST PROCEDURE

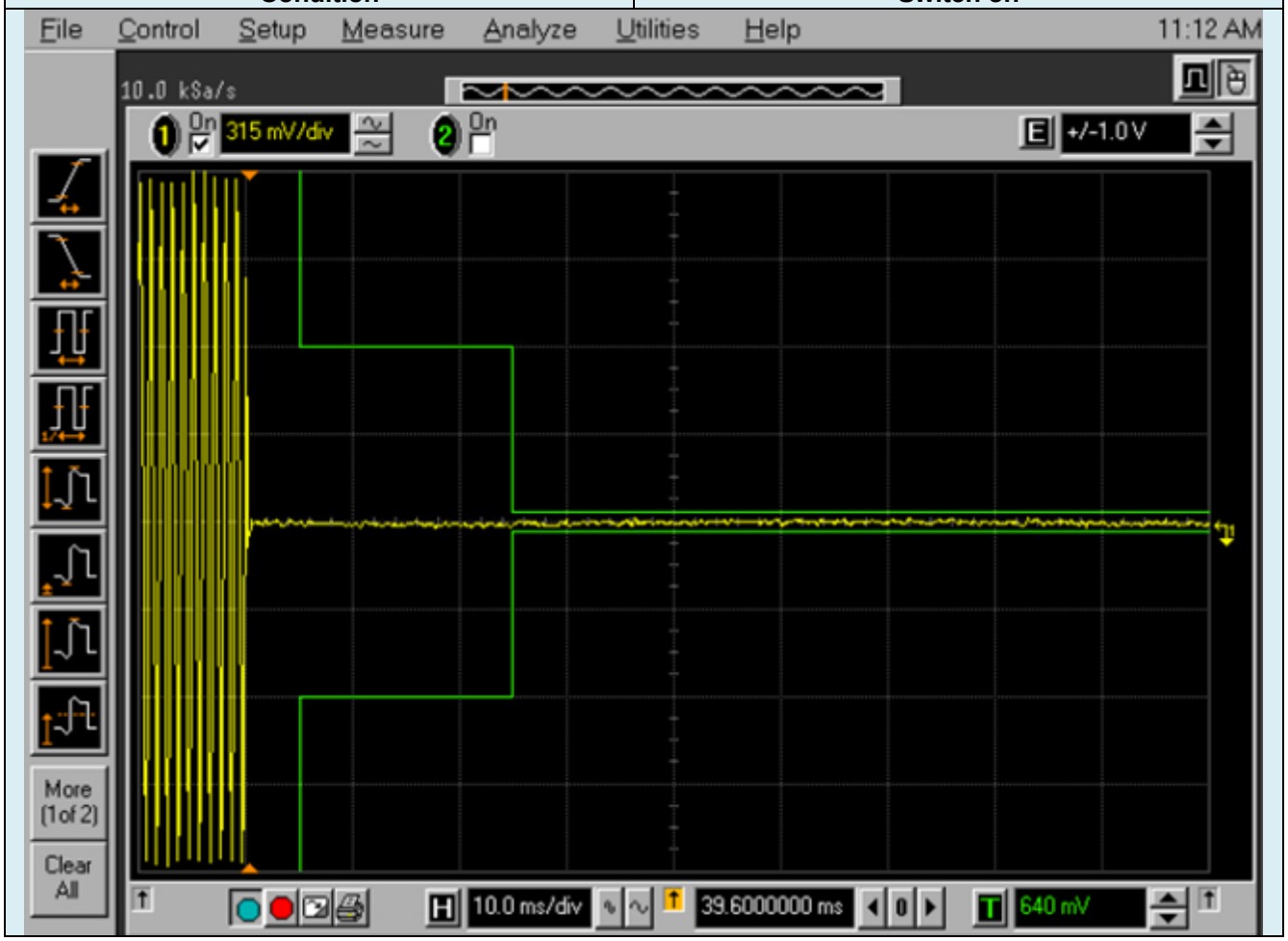
1. Connect the EUT and test equipment as shown on the following block diagram.
2. Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
3. Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at ±12.5 kHz deviation and set its output level to -100dBm.
4. Turn on the transmitter.
5. 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 P0.
6. Turn off the transmitter.
7. Adjust the RF level of the signal generator to provide RF power equal to P0. This signal generator RF level shall be maintained throughout the rest of the measurement.
8. Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
9. Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at ±4 divisions
10. 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.
11. 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 ton. The trace should be maintained within the allowed divisions during the period t_1 and t_2.
12. 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.

LIMIT

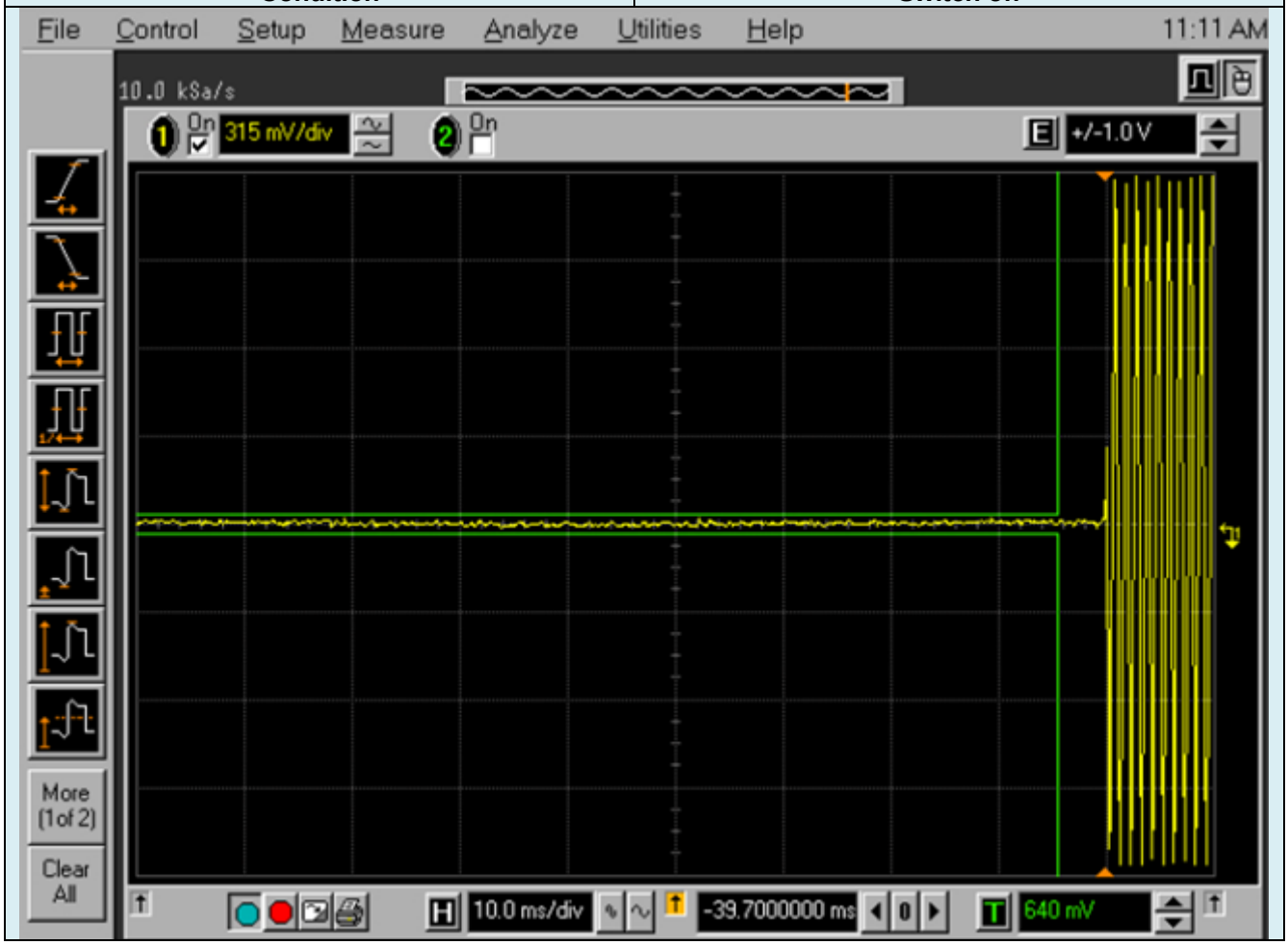
Time intervals	Maximum frequency difference	Requirement
		421 to 512 MHz
t1	±25.0KHz	5.0 ms
t2	±12.5KHz	20.0 ms
t3	±25.0KHz	5.0 ms

TEST RESULTS

Test Frequency: 455.5000MHz	Channel Separation:12.5KHz
Condition	Switch on



Test Frequency: 455.5000MHz	Channel Separation:12.5KHz
Condition	Switch off



.....End of Report.....