TEST REPORT

For

Applicant :	**Xiamen Puxing Electronics Science & Technology Co., Ltd**
Address :	**FL3-4 No.11, XiangHong Road, Xiang'An District, Xiamen City, Fujian**
Product Name :	**DMR Mobile Radio**
Model Name :	**MD720**
Brand Name :	**PUXING**
FCC ID :	**AUJPXDZMD720V**
Report No. :	**MTE/DYY/A15111472**
Date of Issue :	**Nov. 27, 2015**

Issued by :	**Most Technology Service Co., Ltd.**
Address :	**No.5, 2nd Langshan Road, North District, Hi-tech Industrial Park, Nanshan, Shenzhen, Guangdong, China**
Tel :	**86-755-8602 6850**
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1. TEST STANDARDS

The tests were performed according to following standards:

FCC Part 90: PRIVATE LAND MOBILE RADIO SERVICES

TIA/EIA 603: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

47 CFR FCC Part 15 Subpart B - Unintentional Radiators
FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

2. SUMMARY

2.1 General Remarks

Data of receipt of test sample	:	Nov. 02, 2015
Testing commenced on	:	Nov. 05-24, 2015
Testing concluded on	:	Nov. 24, 2015

2.2 Equipment Under Test

Power supply system

Power supply voltage	:	○	120V/60 Hz	○	115V/60Hz
		●	13.8V DC	○	24V DC
		○	Other(specified in blank below)		

2.3 Short description of the Equipment under Test (EUT)

The Xiamen Puxing Electronics Science & Technology Co., Ltd's Model: MD720 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	DMR Mobile Radio	
Model Number	MD720	
FCC ID	AUJPXDZMD720V	
Rated Output Power	3 Watts(34.77dBm)/25 Watts(43.98dBm)	
Support data rate	4.8kbps	
Communication distance	≤24km	
Modulation Type	FM for Analog Voice	
	4FSK for Digital Voice/ Digital Data	
	4FSK for Digital Data	
	Analog	F3E for 12.5KHz Channel Separation
	Digital	F1E for 12.5KHz Channel Separation
		/
Channel Separation	Analog Voice	12.5 KHz
	Digital Voice/ Data	12.5 KHz
	Digital Data	12.5 KHz
Antenna Type	External	
Frequency Range	From 136MHz to 174MHz	
Maximum Output Power	Analog	43.58dBm for 12.5KHz Channel Separation
	Digital	43.67dBm for 12.5KHz Channel Separation

Note: The product has the same digital working characters when operating in both two digitized voice/data mode (4K00F1E). So only one set of test results for digital modulation modes are provided in this test report.

Test frequency list

Frequency Range (MHz)	Modulation Type	Channel Separation (KHz)	Test frequency (MHz)
136-174	Analog/FM	12.5	137.0125
			152.0125
			166.9880
	Digital/4FSK	12.5	137.0125
			152.0125
			166.9880

2.4 Short description of the Equipment under Test (EUT)

136-174MHz DMR Mobile Radio (MD720).
For more details, refer to the user's manual of the EUT.
Serial number: Nil

2.5 EUT operation mode

The EUT has been tested under typical operating condition.

2.6 EUT operation mode

The following peripheral devices and interface cables were connected during the measurement:
● - supplied by the manufacturer
○ - supplied by the lab

○	Power Cable	Length(m):	/
		Shield:	/
		Detachable:	/
○	Multimeter	Manufacturer:	/
		Model No:	/

2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: AUJPXDZMD720U filing to comply with the FCC Part 90 Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3. 1 TEST FACILITY

Test Site:	Most Technology Service Co., Ltd
Location:	No.5, Langshan 2nd Rd., North Hi-Tech Industrial park, Nanshan, Shenzhen, Guangdong, China
Description:	There is one 3m semi-anechoic an area test sites and two line conducted labs for final test. The Open Area Test Sites and the Line Conducted labs are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009 and CISPR 16 requirements. The FCC Registration Number is **490827.** The **IC** Registration Number is **7103A-1.**
Site Filing:	The site description is on file with the Federal Communications Commission, 7435 Oakland Mills Road, Columbia, MD 21046.
Instrument Tolerance:	All measuring equipment is in accord with ANSI C63.4:2009 and CISPR 16 requirements that meet industry regulatory agency and accreditation agency requirement.
Ground Plane:	Two conductive reference ground planes were used during the Line Conducted Emission, one in vertical and the other in horizontal. The dimensions of these ground planes are as below. The vertical ground plane was placed distancing 40 cm to the rear of the wooden test table on where the EUT and the support equipment were placed during test. The horizontal ground plane projected 50 cm beyond the footprint of the EUT system and distanced 80 cm to the wooden test table. For Radiated Emission Test, one horizontal conductive ground plane extended at least 1m beyond the periphery of the EUT and the largest measuring antenna, and covered the entire area between the EUT and the antenna.

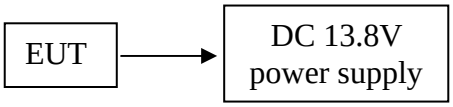
3.3 Environmental conditions

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

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

3.4 Configuration of Tested System

Configuration of Tested System



3.5 Measurement uncertainty

No.	Item	Uncertainty
1.	Uncertainty for Conducted Disturbance Test	1.25dB
2.	Uncertainty for Radiated Disturbance Test	3.15dB

3.6. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2015/07/11	2016/07/10
EMI Test Receiver	R&S	ESCI	103710	2015/07/09	2016/07/08
Spectrum Analyzer	Agilent	E4407B	E4407B MY45108355	2015/07/05	2016/07/04
Controller	EM Electronics	Controller EM 1000	N/A	2015/07/05	2016/07/05
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2015/07/11	2016/07/10
Horn Antenna	SCHWARZBECK	BBHA9170	1562	2015/07/11	2016/07/10
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2015/07/11	2016/07/10
LISN	R&S	ENV216	101316	2015/07/09	2016/07/08
LISN	SCHWARZBECK	NSLK8127	8127687	2015/07/09	2016/07/08
Microwave Preamplifier	HP	8349B	3155A00882	2015/07/09	2016/07/08
Amplifier	HP	8447D	3113A07663	2015/07/09	2016/07/08
Transient Limiter	Com-Power	LIT-153	532226	2015/07/09	2016/07/08
Radio Communication Tester	R&S	CMU200	3655A03522	2015/07/05	2016/07/04
Temperature /Humidity Meter	zhicheng	ZC1-2	22522	2015/07/09	2016/07/08
SIGNAL GENERATOR	HP	8647A	3200A00852	2015/07/09	2016/07/08
Wideband Peak Power Meter	Anritsu	ML2495A	220.23.35	2015/07/05	2016/07/04
Climate Chamber	ESPEC	EL-10KA	A20120523	2015/07/05	2016/07/04
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	/	2015/07/05	2016/07/04
High-Pass Filter	K&L	41H10-1375/U12750-O/O	/	2015/07/05	2016/07/04

3.7. General Technical Requirements and Summary of Test Results

FCC Rules	Description of Test	Test Result
§ 2.1091	Maximum Permissible Exposure	Complies
§ 90.205	Maximum Transmitter Power	Complies
§ 90.207	Modulation Characteristic	Complies
§ 90.209	Occupied Bandwidth	Complies
§ 90.210	Emission Mask	Complies
§ 90.213	Frequency Stability	Complies
§ 90.214	Transmitter Frequency Behaviour	Complies
§ 90.210	Transmitter Radiated Spurious Emission	Complies
§ 90.210	Spurious Emission On Antenna Port	Complies

4. TEST CONDITIONS AND RESULTS

4.1 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

According to 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 Maximum Permissible Exposure (MPE)

Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	**Electric Field Strength (E) (V/m)**	**Magnetic Field Strength (H) (A/m)**	**Power Density (S) (mW/cm²)**	**Averaging Time |E|, |H| or S (minutes)**
0.3- 3.0	614	1.63	(100)*	6
3.0 - 30	1842/f	4.89/f	(900/f²)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

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

MPE Calculation
Predication of MPE limit at a given distance

$S = PG/4\pi R^2$

Where: 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
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Result:

Frequency	The Max Target Conducted Output Power		Typical Antenna Gain		Distance	Power Density	Limit
MHz	**mW**	**dBm**	**dBi**	**numeric**	**cm**	**mW/cm²**	**mW/cm²**
166.9880	23280.9	43.67	0	1.0	80	0.2896	1.0

Note: The manufacturer does not specify an antenna to be used with this device, but a typical installation has a gain up to 0dBi.

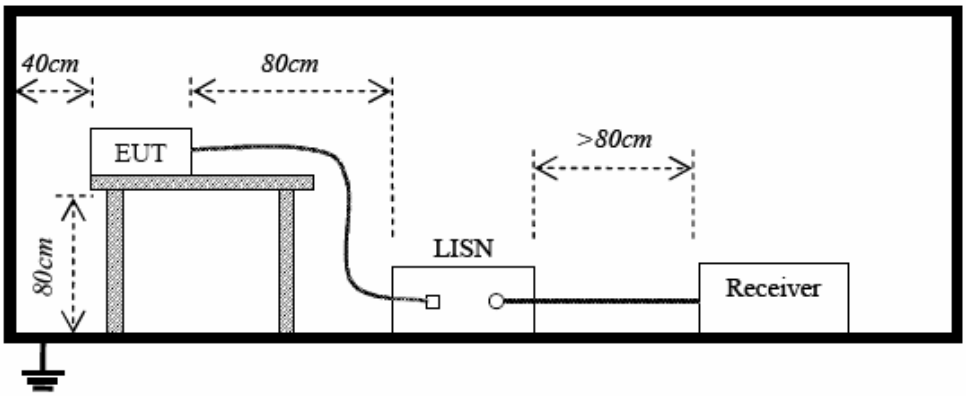
Radio Exposure Statement:

To comply with RF exposure requirements, a minimum separation distance of 80cm is required between antenna and all public persons.

Result: Compliant.

4.1 Conducted Emissions Test

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4.
2 Support equipment, if needed, was placed as per ANSI C63.4.
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
4 The EUT received DC13.8 V power from the DC power supply
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

Conducted Power Line Emission Limit

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following：

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15-0.50	79	66	66-65	56-46
0.50-5.00	73	60	56	46
5.00-30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

TEST RESULTS

Not applicable to equipment which is intend to be connected to the dc power supply.

4.2 Occupied Bandwidth and Emission Mask

PROVISIONS APPLICABLE

a). Occupied Bandwidth: The EUT was connected to the audio signal generator and the spectrum analyzer via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyzer.

(b). Emission Mask B: For transmitters that are equipped with an audio low-pass filter pursuant to §90.211(a), the power of any emission must be 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.

(c). 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) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd -2.88 kHz) dB.

(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.

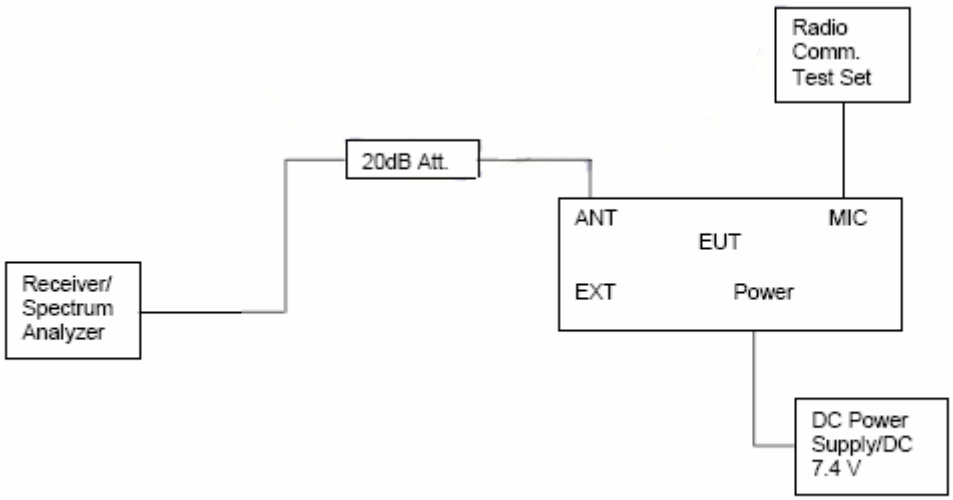
(d). Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emis-sion must be attenuated below the power (P) of the highest emission con-tained within the authorized band-width as follows

(1) On any frequency from the center of the authorized bandwidth f0to 3.0 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd¥3 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10log (P) or 65 dB, whichever is the lesser attenuation.

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. Rated system deviation is 2.5 kHz (12.5 kHz channel spacing)
2: Set EUT as normal operation.
3: Set SPA Center Frequency = fundamental frequency, RBW=300Hz, VBW= 3 KHz, span =50 KHz.
4: Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.
6: Set SPA Center Frequency=fundamental frequency, set =100Hz, VBW=1 KHz, span=50 KHz for 12.5 channel spacing and set =100Hz, VBW=1 KHz, span=50 KHz for 6.25 channel spacing

TEST RESULTS:

4.2.1 Occupied Bandwidth

High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency	99% Occupied Bandwidth	26dB Occupied Band width
FM	12.5KHz	Low	137.0125 MHz	5.20 KHz	5.30 KHz
		Middle	152.0125 MHz	5.20 KHz	5.40 KHz
		High	166.9880 MHz	5.10KHz	5.30 KHz
4FSK	12.5KHz	Low	137.0125 MHz	6.60 KHz	8.40 KHz
		Middle	152.0125 MHz	7.00 KHz	8.90 KHz
		High	166.9880 MHz	7.00 KHz	8.90 KHz
Limit		11.25KHz for 12.5KHz Channel Separation			
Test Results		Compliance			

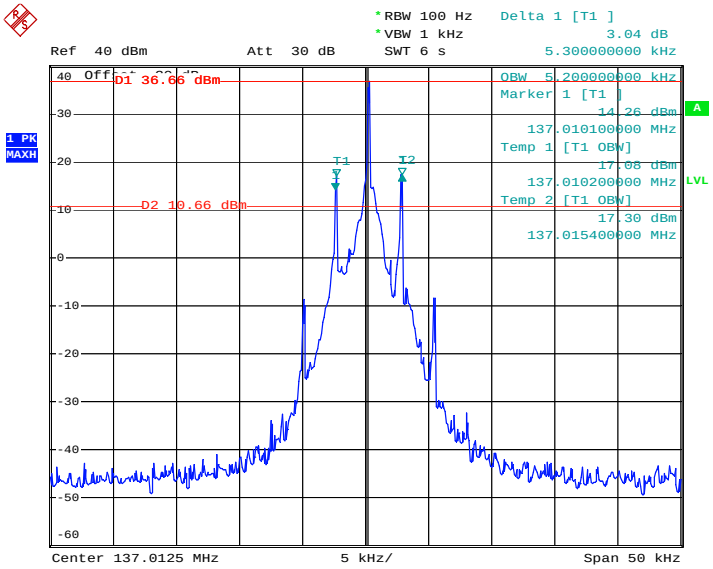
Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency	99% Occupied Bandwidth	26dB Occupied Band width
FM	12.5KHz	Low	137.0125 MHz	5.20 KHz	5.30 KHz
		Middle	152.0125 MHz	5.20 KHz	5.30 KHz
		High	166.9880 MHz	5.20 KHz	5.40 KHz
4FSK	12.5KHz	Low	137.0125 MHz	7.20 KHz	9.70 KHz
		Middle	152.0125 MHz	7.20 KHz	9.00 KHz
		High	166.9880 MHz	7.50 KHz	9.30 KHz
Limit		11.25KHz for 12.5KHz Channel Separation			
Test Results		Compliance			

Plots of 99% and 26dB Bandwidth Measurement

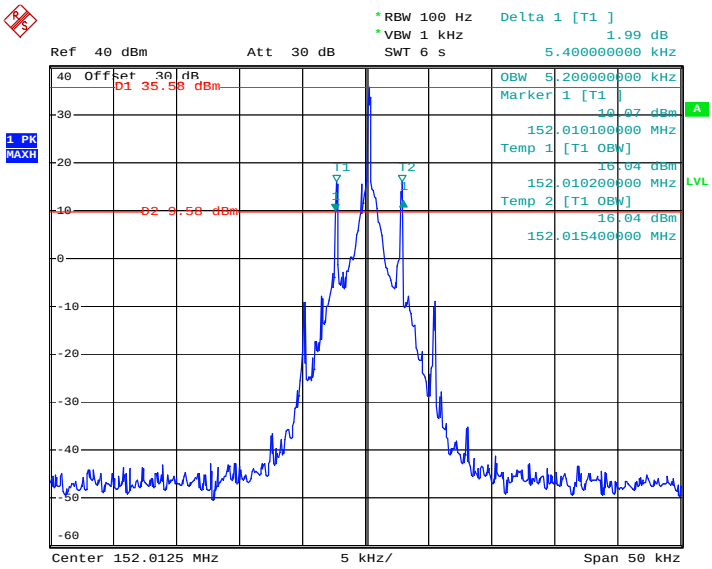
High Power

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5KHz	137.0125	5.20	5.30	11.25	Compliance



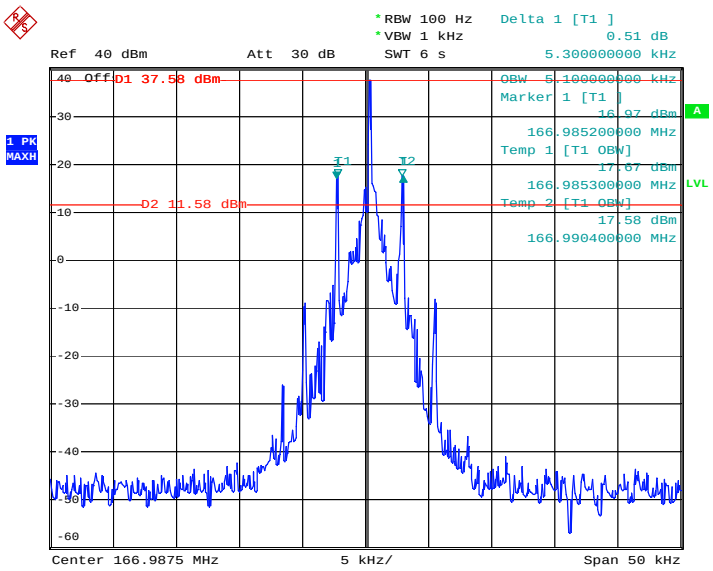
Date: 19.NOV.2015 16:25:06

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5KHz	152.0125	5.20	5.40	11.25	Compliance



Date: 19.NOV.2015 16:28:15

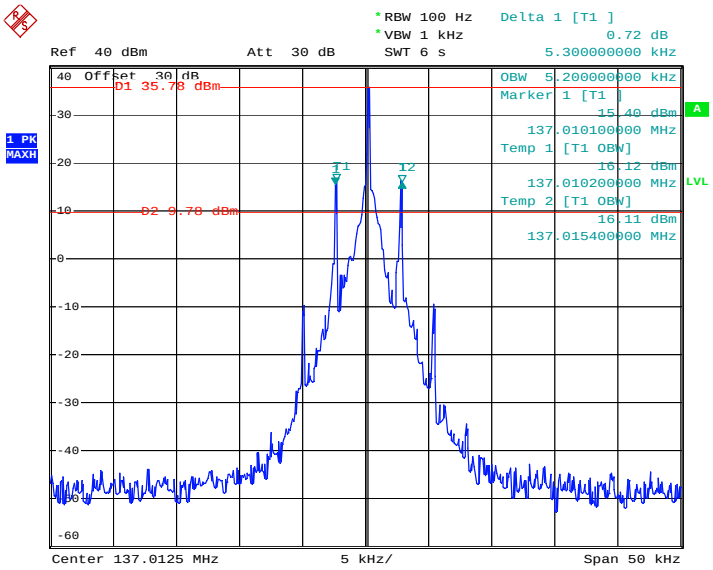
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5KHz	166.9880	5.10	5.30	11.25	Compliance



Date: 19.NOV.2015 16:30:42

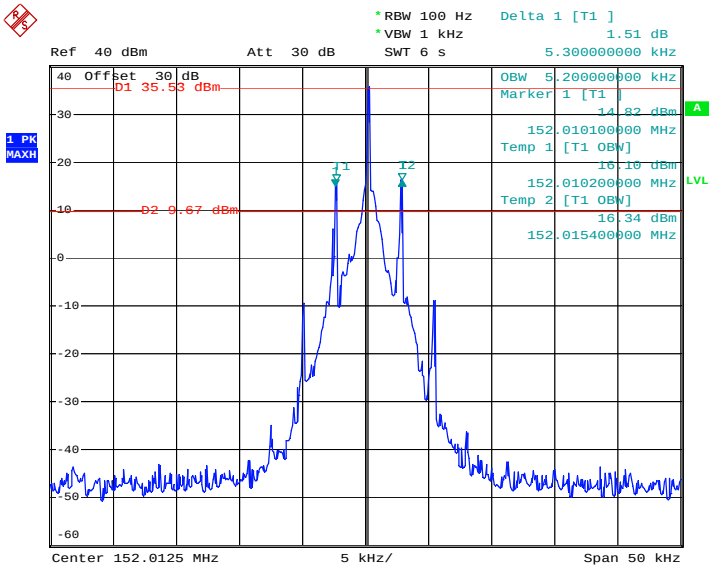
Low Power

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5KHz	137.0125	5.20	5.30	11.25	Compliance



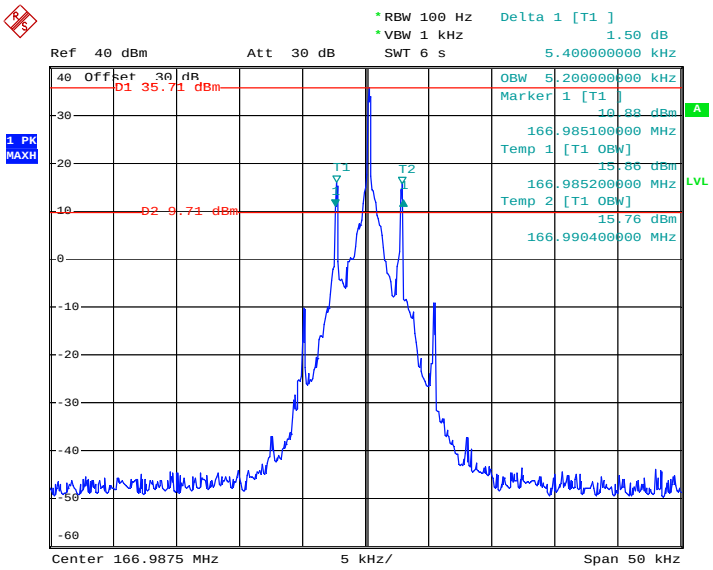
Date: 19.NOV.2015 16:23:17

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5KHz	152.0125	5.20	5.30	11.25	Compliance



Date: 19.NOV.2015 16:19:03

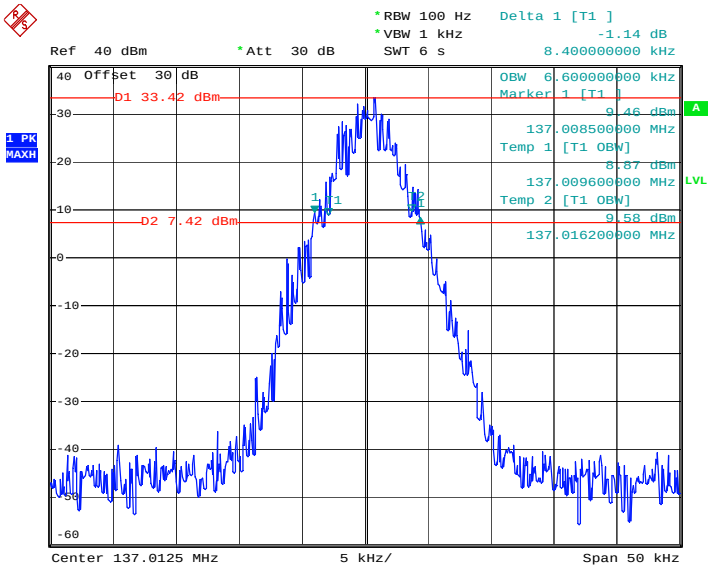
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5KHz	166.9880	5.20	5.40	11.25	Compliance



Date: 19.NOV.2015 16:21:31

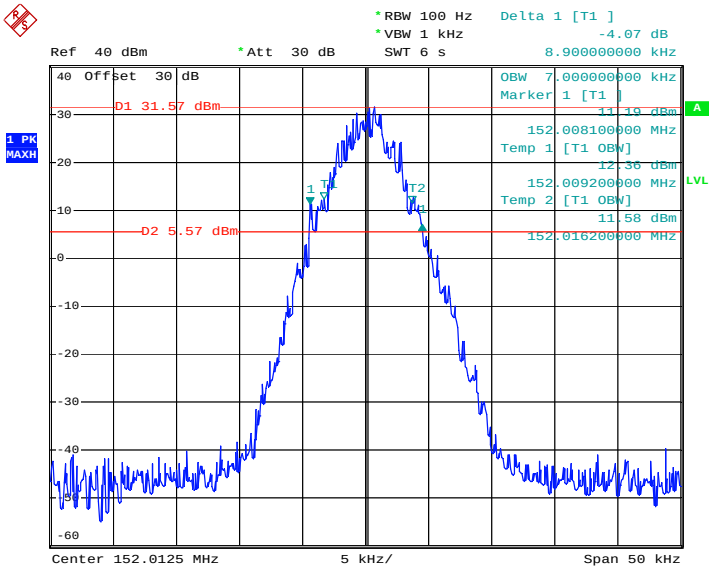
High Power

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4FSK	12.5KHz	137.0125	6.60	8.40	11.25	Compliance



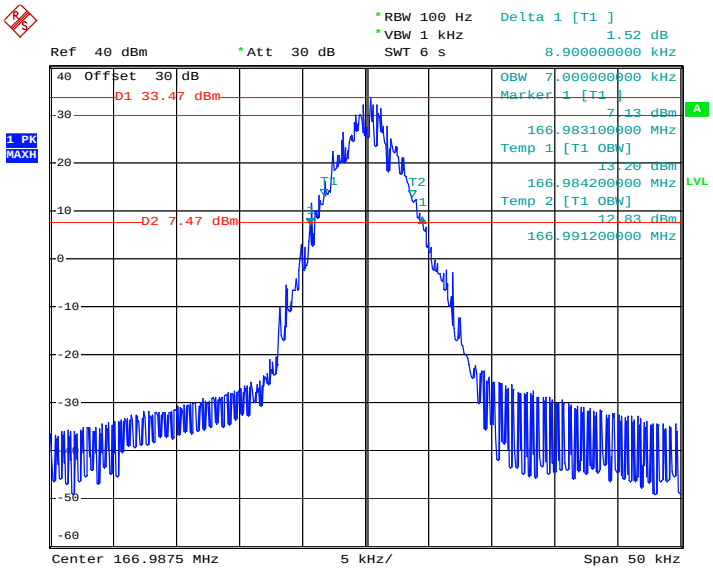
Date: 19.NOV.2015 13:05:44

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4FSK	12.5KHz	152.0125	7.00	8.90	11.25	Compliance



Date: 8.DEC.2015 09:48:06

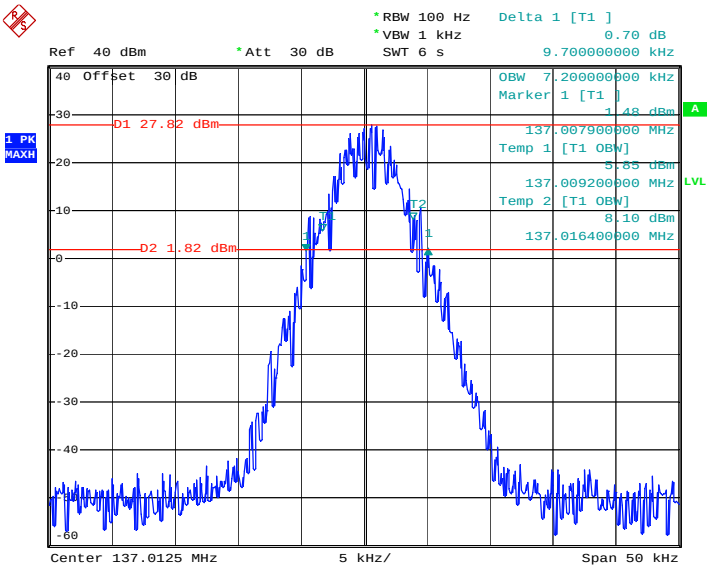
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4FSK	12.5KHz	166.9875	7.00	8.90	11.25	Compliance



Date: 8.DEC.2015 09:51:37

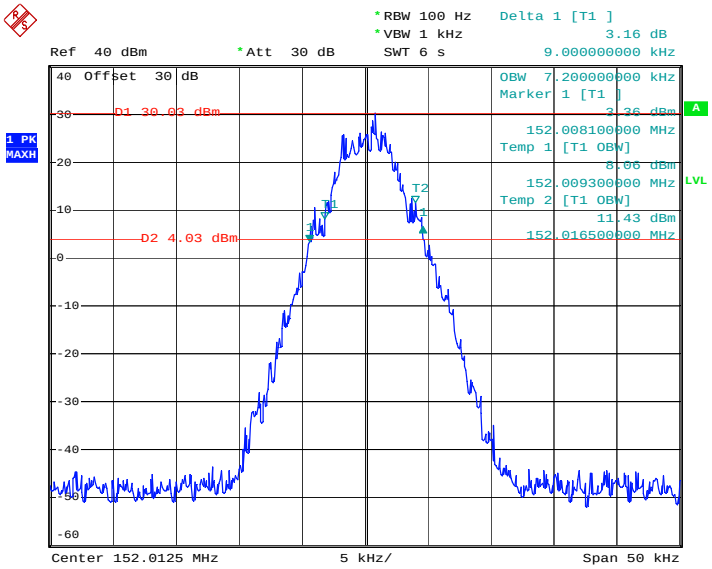
Low Power

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4FSK	12.5KHz	137.0125	7.20	9.70	11.25	Compliance



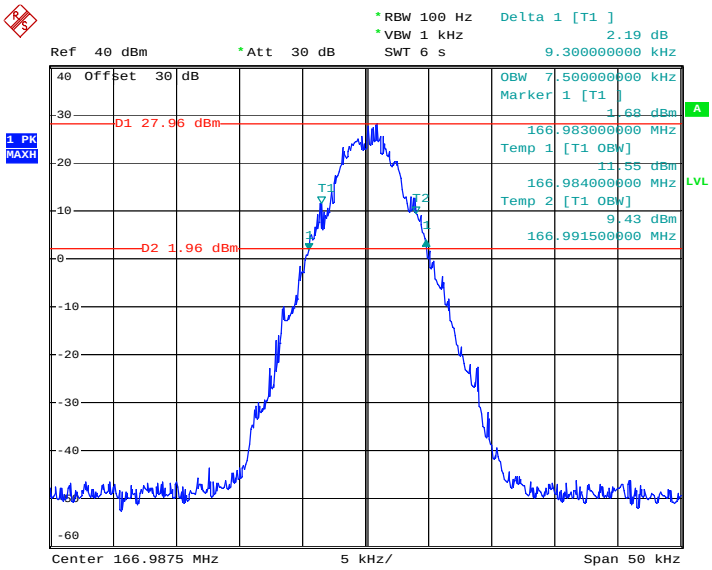
Date: 19.NOV.2015 13:20:28

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4FSK	12.5KHz	152.0125	7.20	9.00	11.25	Compliance



Date: 19.NOV.2015 13:18:06

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4FSK	12.5KHz	166.9875	7.50	9.30	11.25	Compliance



Date: 19.NOV.2015 13:15:15

4.3 Emission Mask

High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency	FCC Applicable Mask	RBW
FM	12.5KHz	Low	137.0125 MHz	B	100Hz
		Middle	152.0125 MHz	D	100Hz
		High	166.9875 MHz	D	100Hz
4FSK	12.5KHz	Low	137.0125 MHz	B	100Hz
		Middle	152.0125 MHz	D	100Hz
		High	166.9875 MHz	D	100Hz
Test Results		Compliance			

Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency	FCC Applicable Mask	RBW
FM	12.5KHz	Low	137.0125 MHz	B	100Hz
		Middle	152.0125 MHz	D	100Hz
		High	166.9875 MHz	D	100Hz
4FSK	12.5KHz	Low	137.0125 MHz	B	100Hz
		Middle	152.0125 MHz	D	100Hz
		High	166.9875 MHz	D	100Hz
Test Results		Compliance			

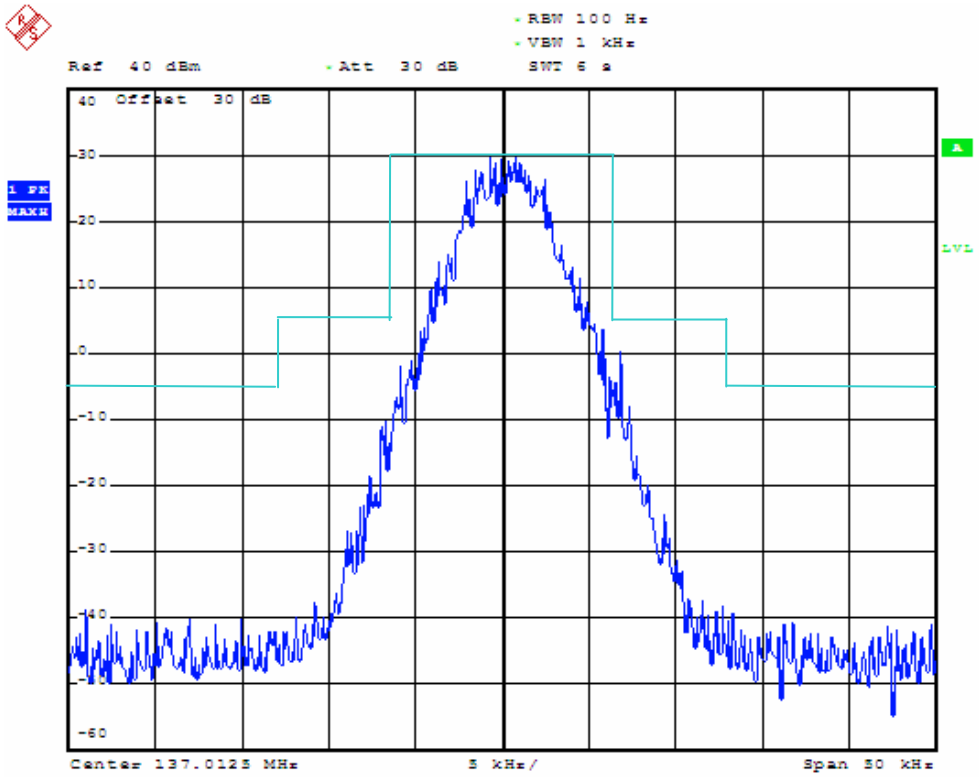
Referred as the attached plot hereinafter

Note: The blue curve represents unmodulated signal.

The blue curve represents modulated signal.

High power

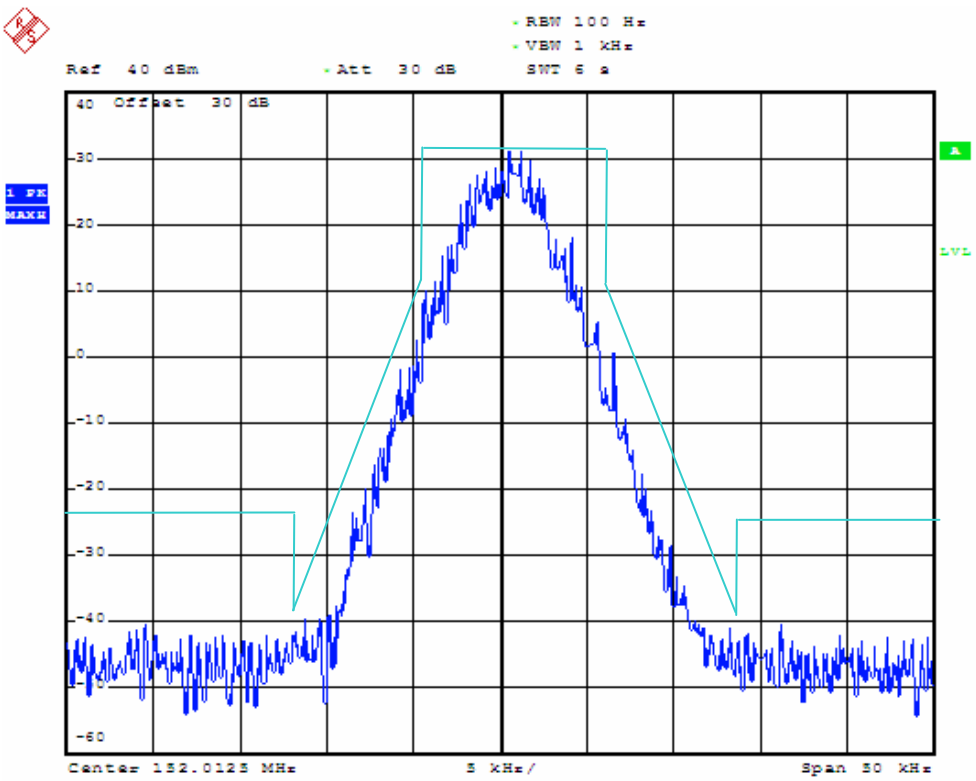
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4FSK	12.5KHz	137.0125	B	100Hz	/	Compliance



Date: 19.NOV.2015 16:42:00

High power

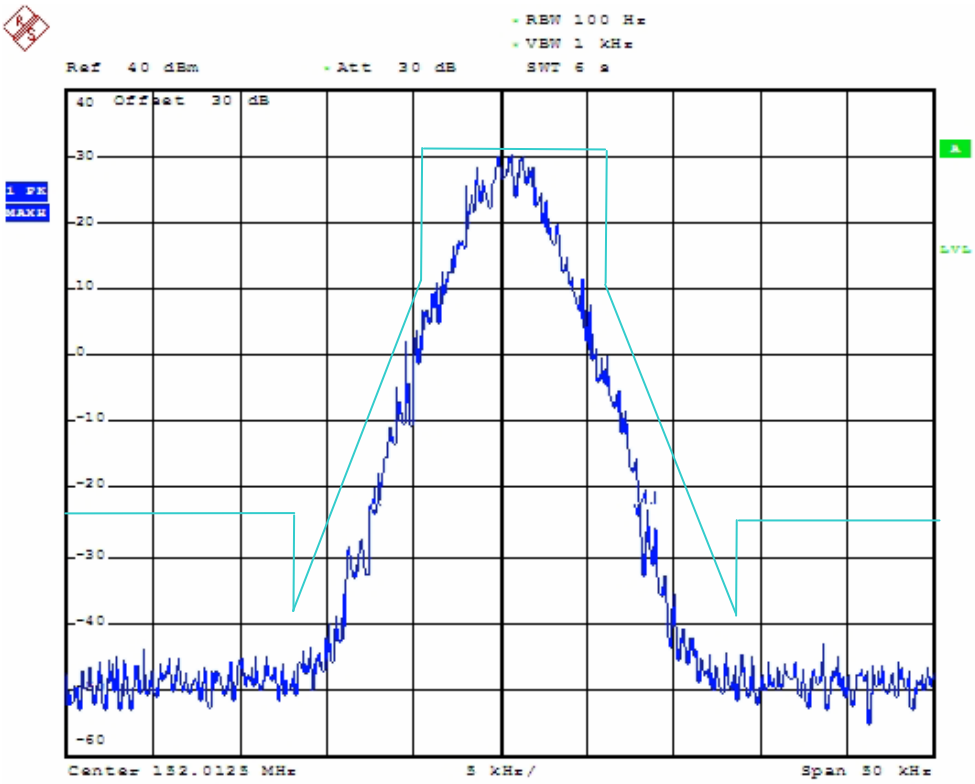
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4FSK	12.5KHz	152.0125	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:40:33

High power

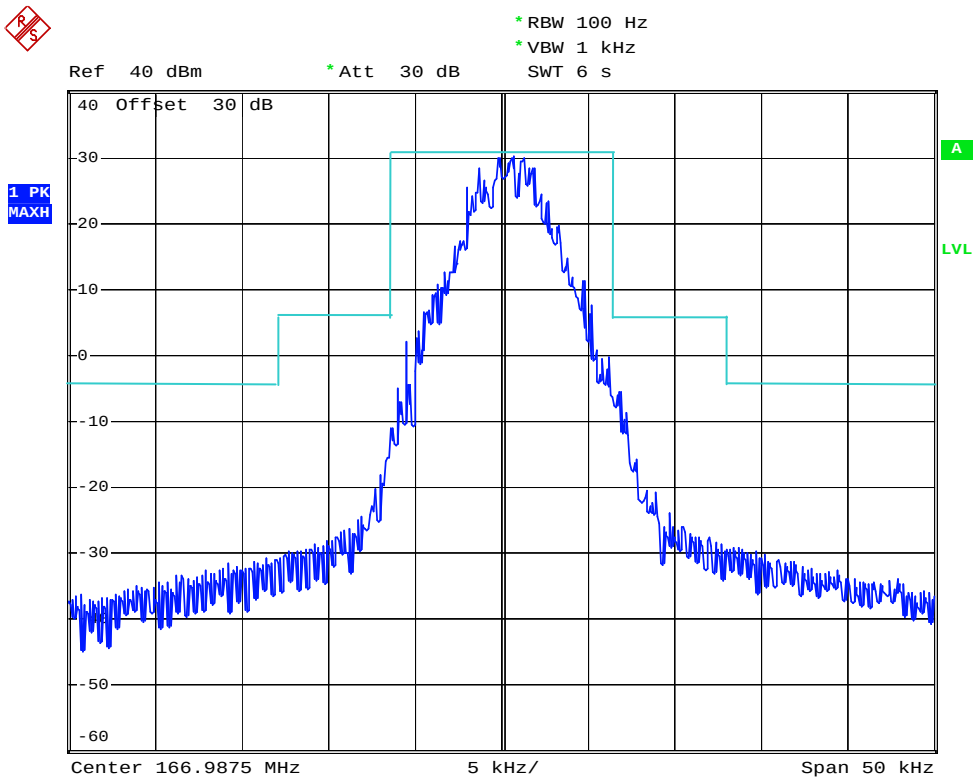
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4FSK	12.5KHz	166.9875	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:38:51

Low power

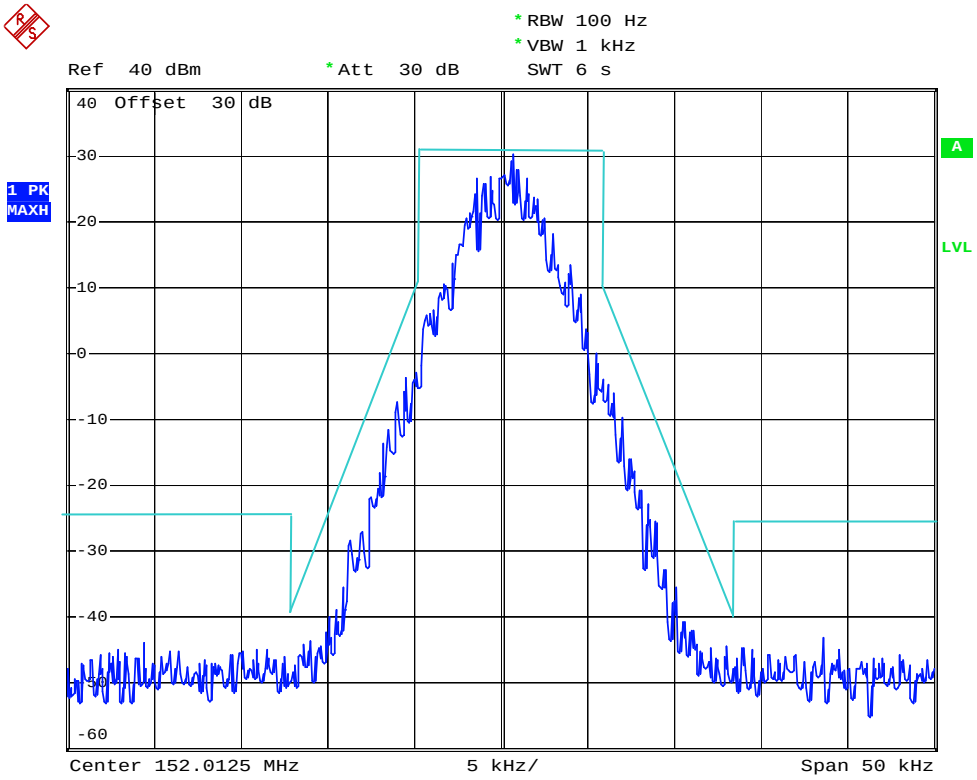
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4FSK	12.5KHz	137.0125	B	100Hz	/	Compliance



Date: 19.NOV.2015 16:38:51

Low power

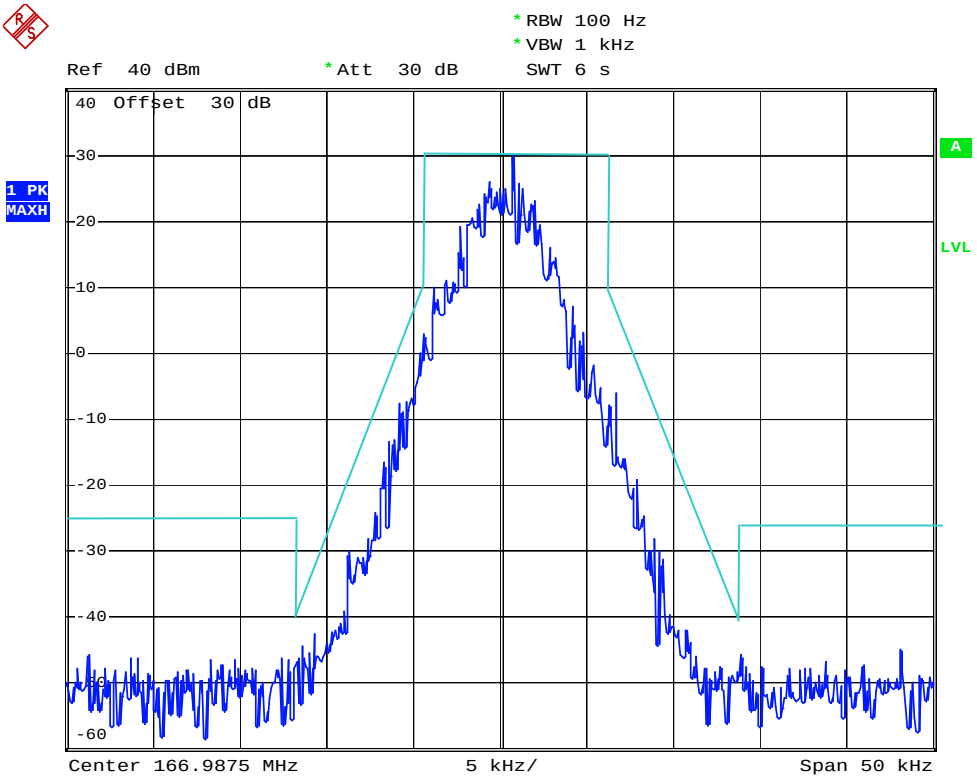
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4FSK	12.5KHz	152.0125	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:44:46

Low power

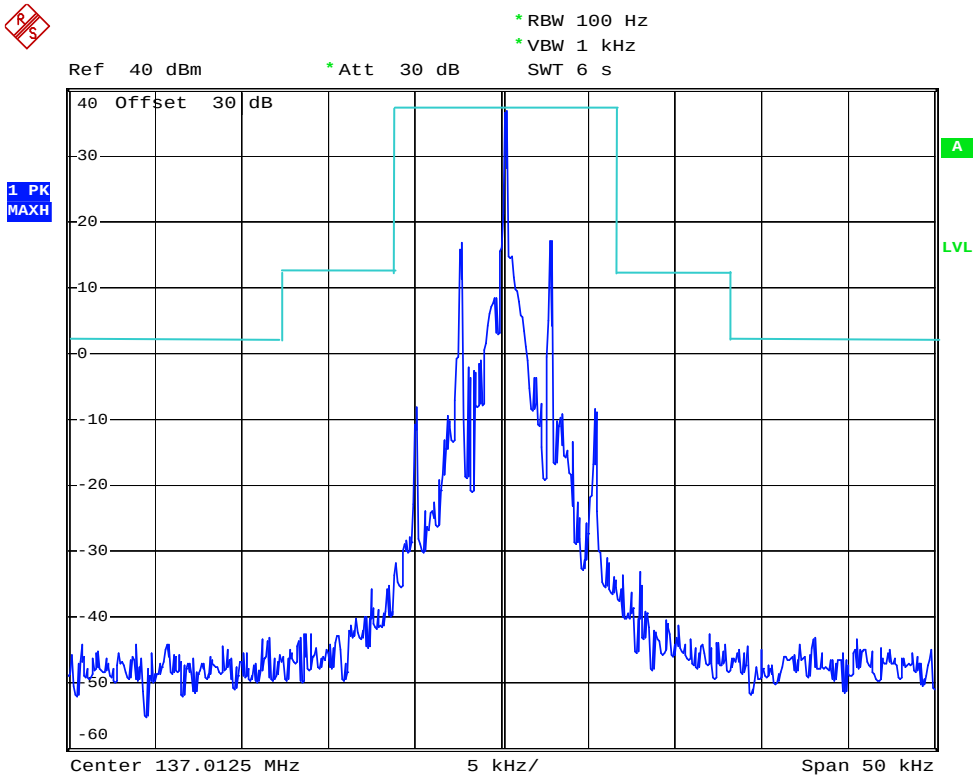
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4FSK	12.5KHz	166.9875	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:46:24

High power

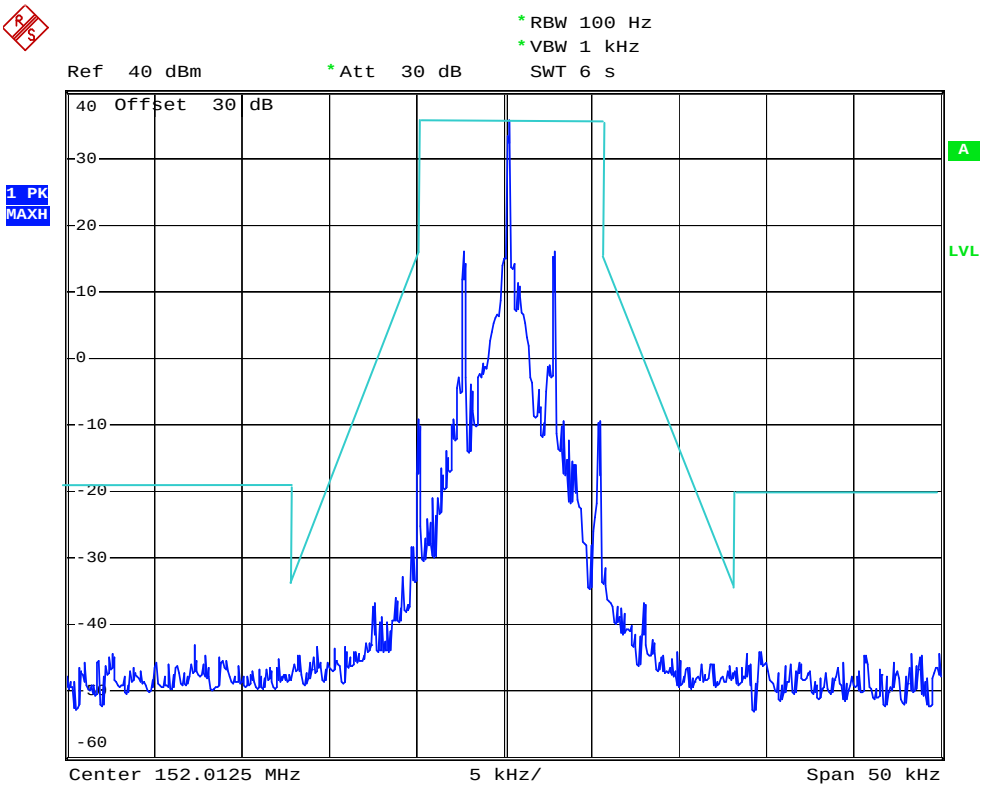
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5KHz	137.0125	B	100Hz	/	Compliance



Date: 19.NOV.2015 16:34:10

High power

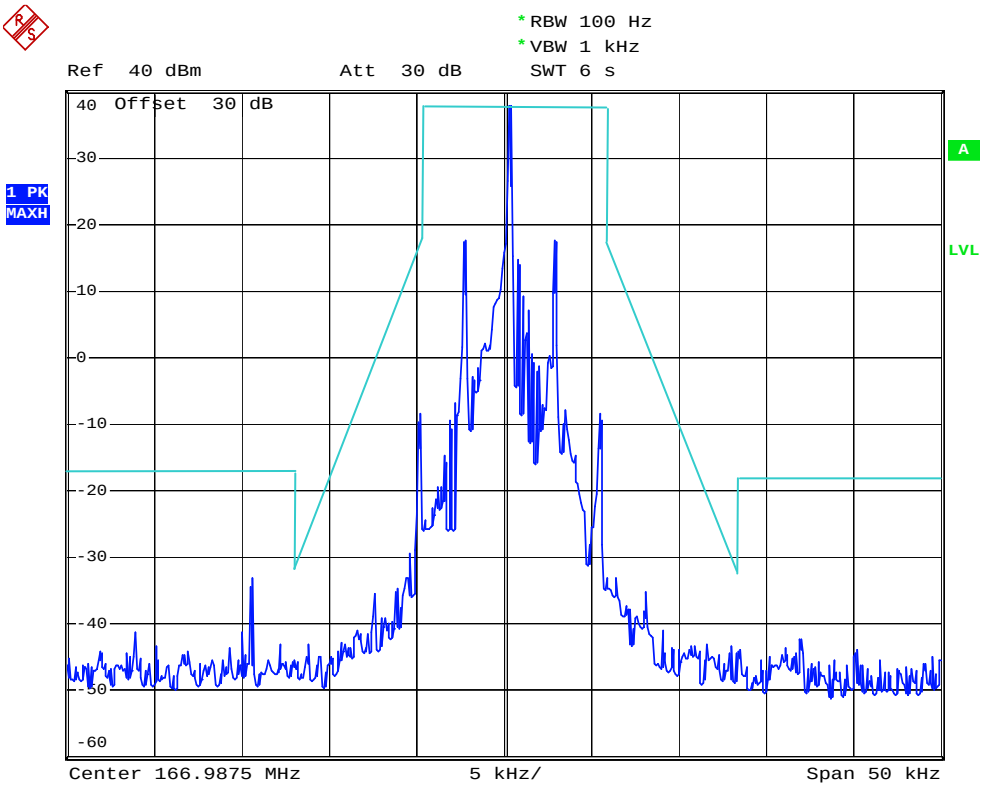
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5KHz	152.0125	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:33:07

High power

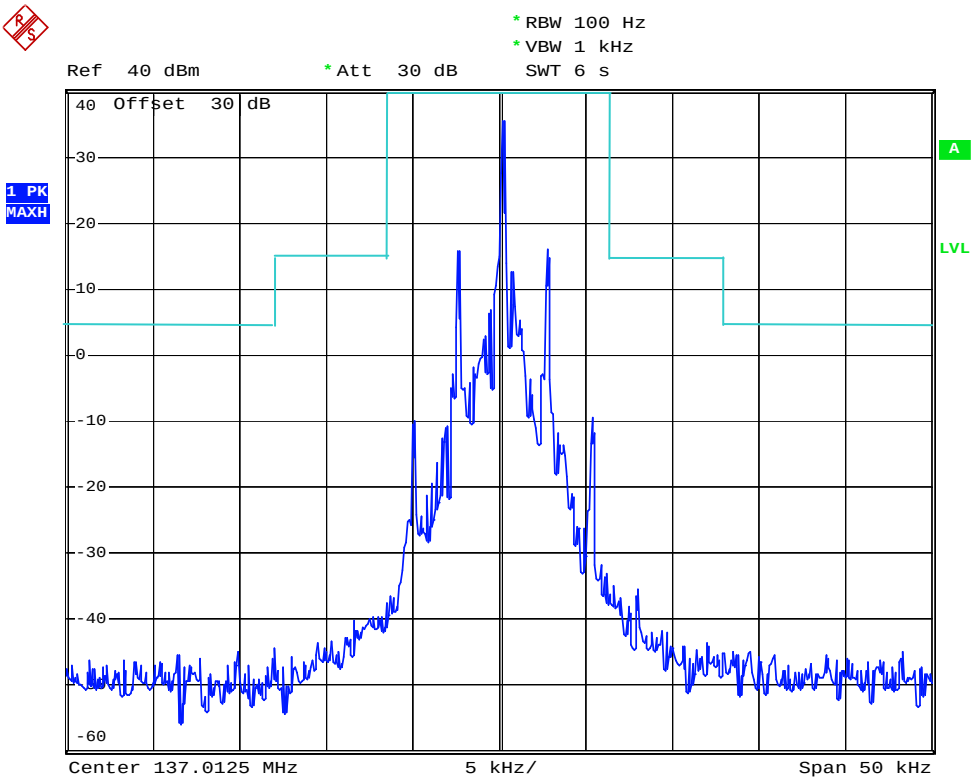
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5KHz	166.9875	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:31:53

Low power

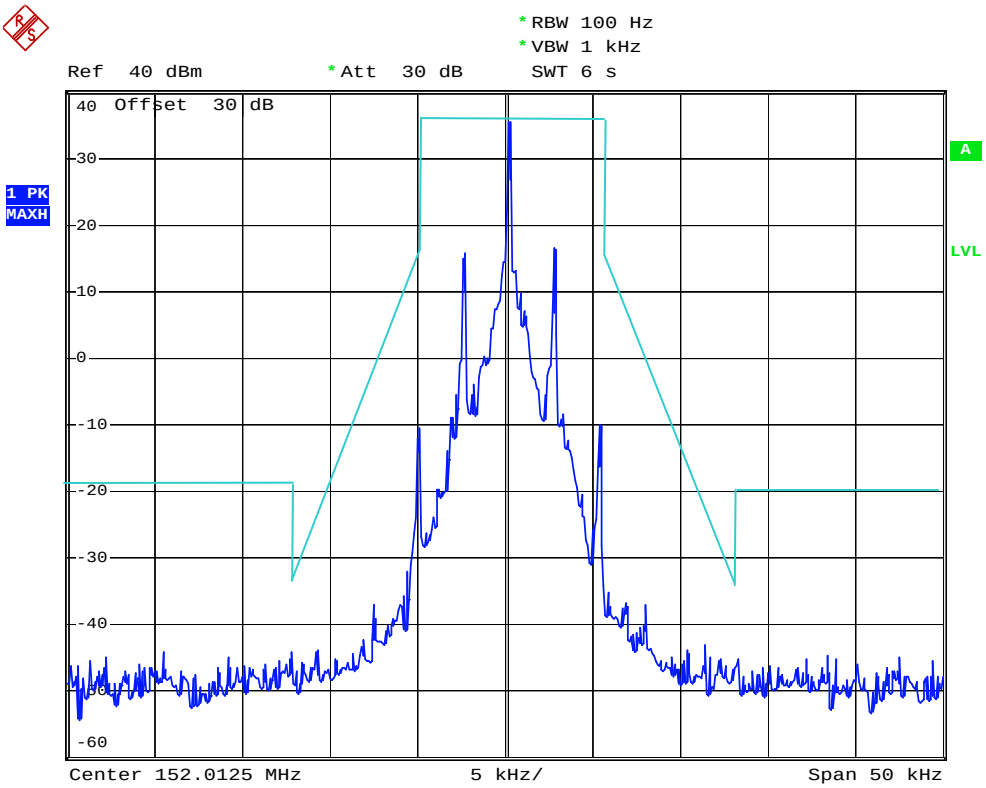
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5KHz	137.0125	B	100Hz	/	Compliance



Date: 19.NOV.2015 16:35:01

Low power

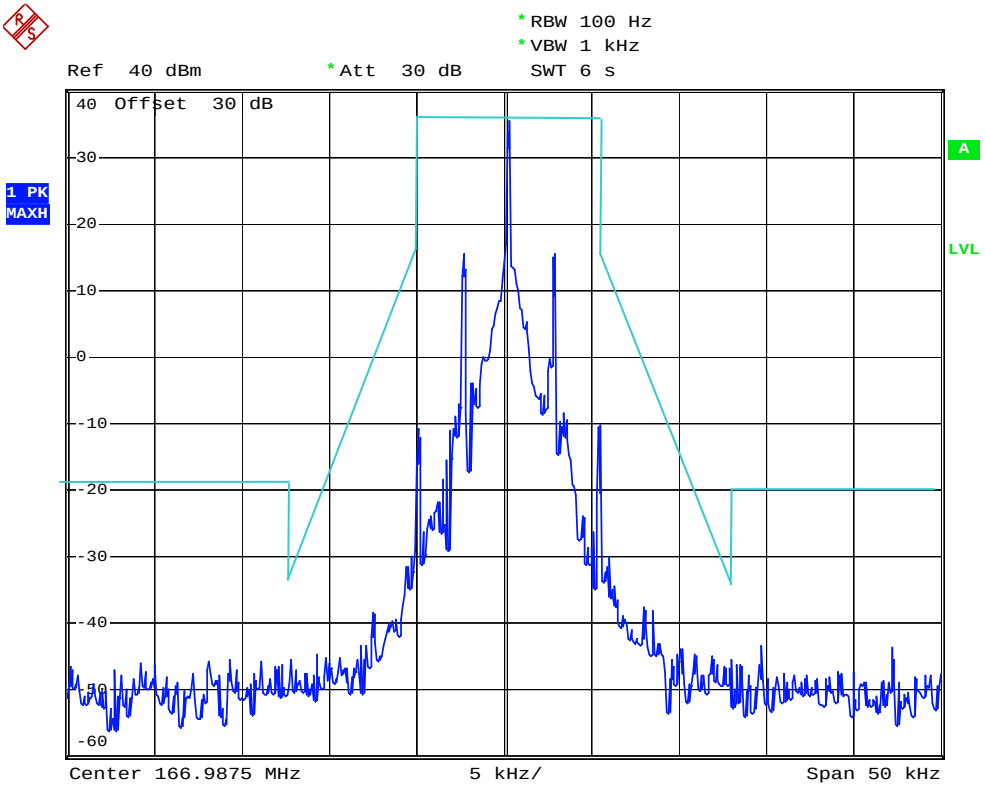
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5KHz	152.0125	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:36:07

Low power

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5KHz	166.9875	D	100Hz	/	Compliance



Date: 19.NOV.2015 16:37:04

4.3. Radiated Spurious Emission Test

TEST APPLICABLE

According to the TIA/EIA 603 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:

1 On any frequency removed from the center of the authorized bandwidth fo to 5.625 KHz removed from fo: Zero dB

2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) fo of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB

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

For transmitters designed to transmit with 6.25 KHz channel separation and equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as following:

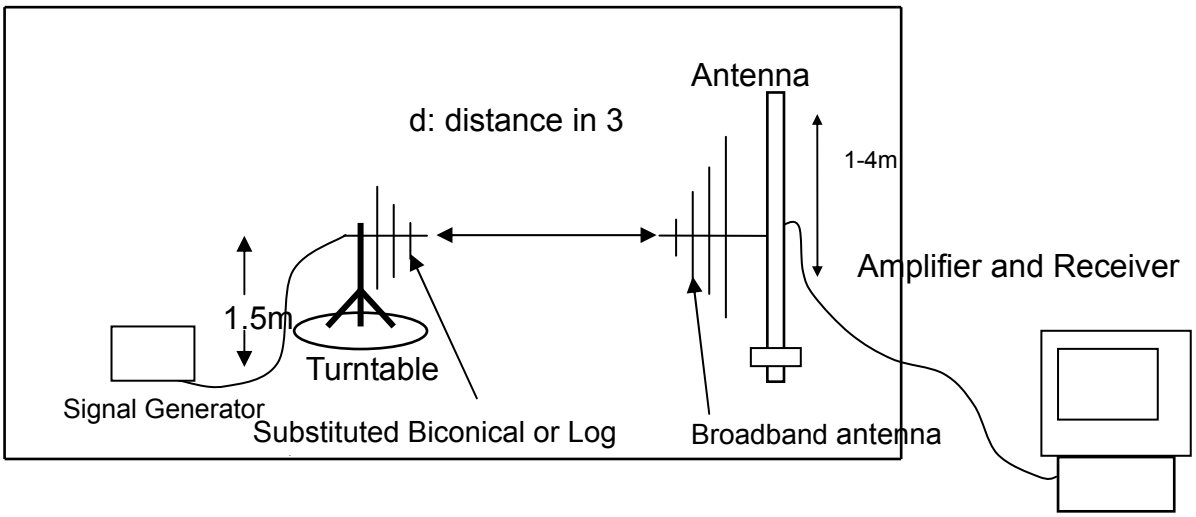
1 On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.

2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd−3 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

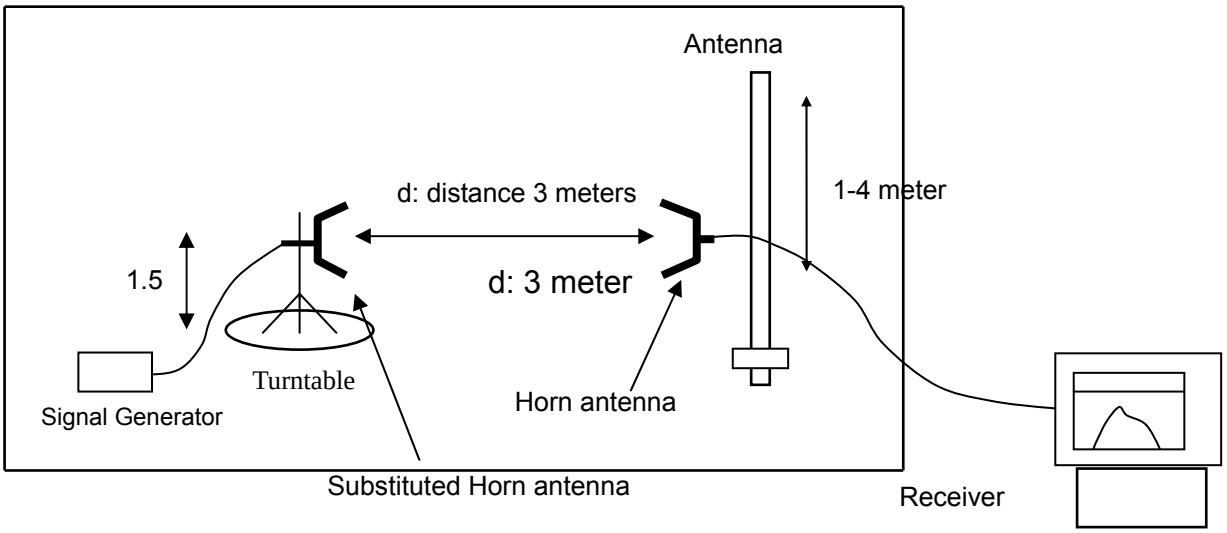
3 On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

TEST CONFIGURATION

Below 1GHz:



Above 1GHz:



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 RESULTS

Note: 1. In general, the worse case attenuation requirement shown above was applied.

2. The measurement frequency range from 30 MHz to 5 GHz.

3. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.

Modulation		4FSK		Channel Separation		12.5KHz		
Test Channel		Low Channel		Test Frequency		137.0125 MHz		
Frequency (MHz)	E-Field Level (dBuv/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method(dBm)	Limit (dBm)	Margin (dB)
436.52	53.02	Peak	H	110	232	-44.29	-20	24.29
2141.67	48.49	Peak	H	125	146	-49.17	-20	29.17
3654.67	46.75	Peak	H	120	47	-51.62	-20	31.62
…			H					
443.56	48.12	Peak	V	100	271	-49.45	-20	29.45
2216.41	47.87	Peak	V	130	24	-49.67	-20	29.67
3428.34	44.83	Peak	V	120	155	-52.73	-20	32.73
…	…	/	V	/	/	/	/	/

Modulation		4FSK		Channel Separation		12.5KHz		
Test Channel		Middle Channel		Test Frequency		152.0125 MHz		
Frequency (MHz)	E-Field Level (dBuv/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method(dBm)	Limit (dBm)	Margin (dB)
447.42	52.27	Peak	H	110	241	-45.24	-20	25.24
2216.43	49.55	Peak	H	125	142	-48.35	-20	28.35
3468.71	45.48	Peak	H	120	44	-52.12	-20	32.12
…			H					
447.52	47.86	Peak	V	105	277	-49.78	-20	29.78
2234.13	47.40	Peak	V	125	38	-50.16	-20	30.16
3420.38	44.79	Peak	V	125	147	-52.48	-20	32.48
…	…	/	V	/	/	/	/	/

Modulation		4FSK		Channel Separation		12.5KHz		
Test Channel		High Channel		Test Frequency		166.9880 MHz		
Frequency (MHz)	E-Field Level (dBuv/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method(dBm)	Limit (dBm)	Margin (dB)
435.37	51.96	Peak	H	105	251	-45.69	-20	25.69
2519.75	49.67	Peak	H	120	137	-47.85	-20	27.85
3345.46	44.04	Peak	H	125	149	-53.02	-20	33.02
…			H					
441.28	48.16	Peak	V	110	273	-49.27	-20	29.27
2522.19	48.67	Peak	V	130	29	-51.06	-20	31.06
3358.54	45.24	Peak	V	110	139	-52.36	-20	32.36
…	…	/	V	/	/	/	/	/

Modulation		FM		Channel Separation		12.5KHz		
Test Channel		Low Channel		Test Frequency		137.0125 MHz		
Frequency (MHz)	E-Field Level (dBuv/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method(dBm)	Limit (dBm)	Margin (dB)
462.28	52.17	Peak	H	115	310	-45.13	-20	25.13
2348.67	49.49	Peak	H	120	187	-48.15	-20	28.15
3514.36	45.19	Peak	H	120	41	-52.48	-20	32.48
…			H					
455.73	47.69	Peak	V	105	261	-50.14	-20	30.14
2338.16	48.27	Peak	V	130	88	-49.23	-20	29.23
3525.22	45.27	Peak	V	120	16	-51.96	-20	31.96
…	…	/	V	/	/	/	/	/

Modulation		FM		Channel Separation		12.5KHz		
Test Channel		Middle Channel		Test Frequency		152.0125 MHz		
Frequency (MHz)	E-Field Level (dBuv/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method(dBm)	Limit (dBm)	Margin (dB)
457.54	51.67	Peak	H	110	298	-45.63	-20	25.63
2340.42	48.72	Peak	H	125	172	-48.75	-20	28.75
3565.26	44.96	Peak	H	120	48	-52.38	-20	32.38
…			H					
453.53	48.35	Peak	V	105	270	-49.28	-20	29.28
2336.14	46.81	Peak	V	125	75	-50.75	-20	30.75
3526.33	45.48	Peak	V	125	21	-52.18	-20	32.18
…	…	/	V	/	/	/	/	/

Modulation		FM		Channel Separation		12.5KHz		
Test Channel		High Channel		Test Frequency		166.9880 MHz		
Frequency (MHz)	E-Field Level (dBuv/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method(dBm)	Limit (dBm)	Margin (dB)
461.27	49.76	Peak	H	105	301	-47.93	-20	27.93
2328.96	50.73	Peak	H	120	190	-46.44	-20	26.44
3546.18	45.18	Peak	H	125	46	-52.47	-20	32.47
…			H					
457.36	47.75	Peak	V	110	264	-49.86	-20	29.86
2332.28	46.94	Peak	V	130	74	-50.48	-20	30.48
3562.62	44.74	Peak	V	110	20	-52.69	-20	32.69
…	…	/	V	/	/	/	/	/

4.4. Spurious Emission On Antenna Port

TEST APPLICABLE

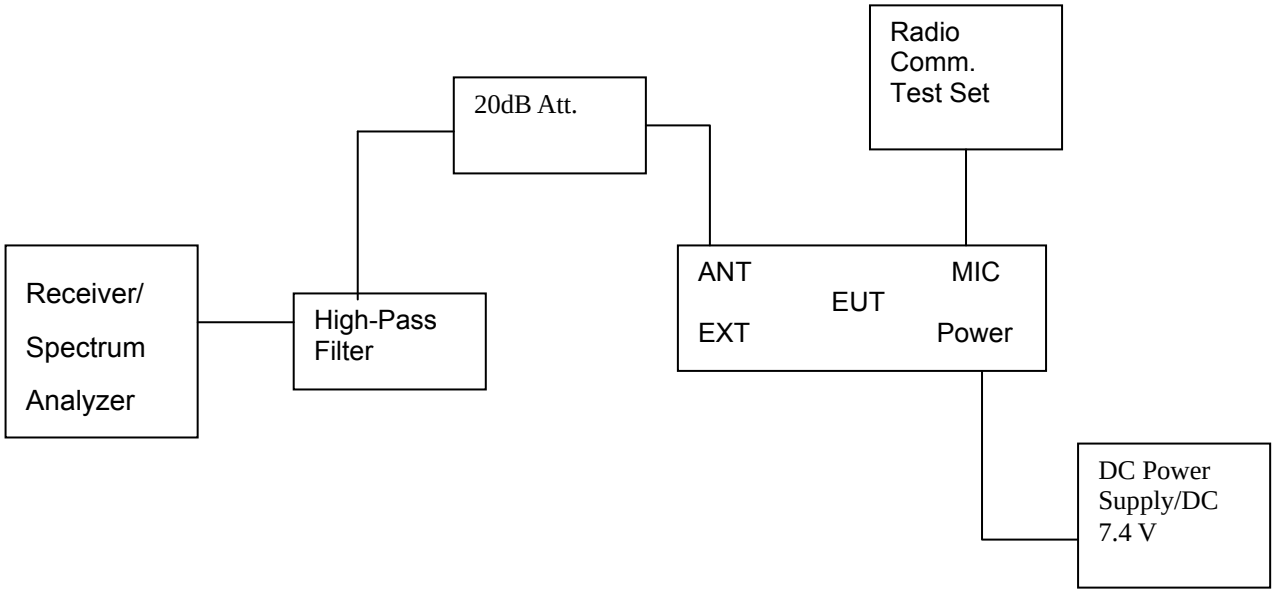
The same as Section 4.3

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 to 100 kHz. Sufficient scans were taken to show any out of band emission up to 10th. Harmonic for the lower and the highest frequency range. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz,while set RBW=1MHz.VBW=3MHz from the 1GHz to 10th Harmonic.

The audio input was set to 0 to get the unmodulated carrier, the resulting picture is print out for each channel separation.

TEST CONFIGURATION



TEST RESULTS:

Note: 1. In general, the worse case attenuation requirement shown above was applied.

2. The measurement frequency range from 30 MHz to 5 GHz.

High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz	
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)
Analog/FM	12.5KHz	Low	137.0125	596.00	-35.95	2920.00	-34.23
		Middle	152.0125	839.00	-35.78	2970.00	-34.28
		High	166.9875	844.00	-34.97	2950.00	-34.93
Digtal/4FSK	12.5KHz	Low	137.0125	880.00	-36.01	2960.00	-34.72
		Middle	152.0125	594.00	-36.02	2990.00	-32.77
		High	166.9875	606.00	-35.29	2930.00	-34.77
Limit		-20dBm for 12.5KHz Channel Separation					
Test Results		Compliance					

Low power:

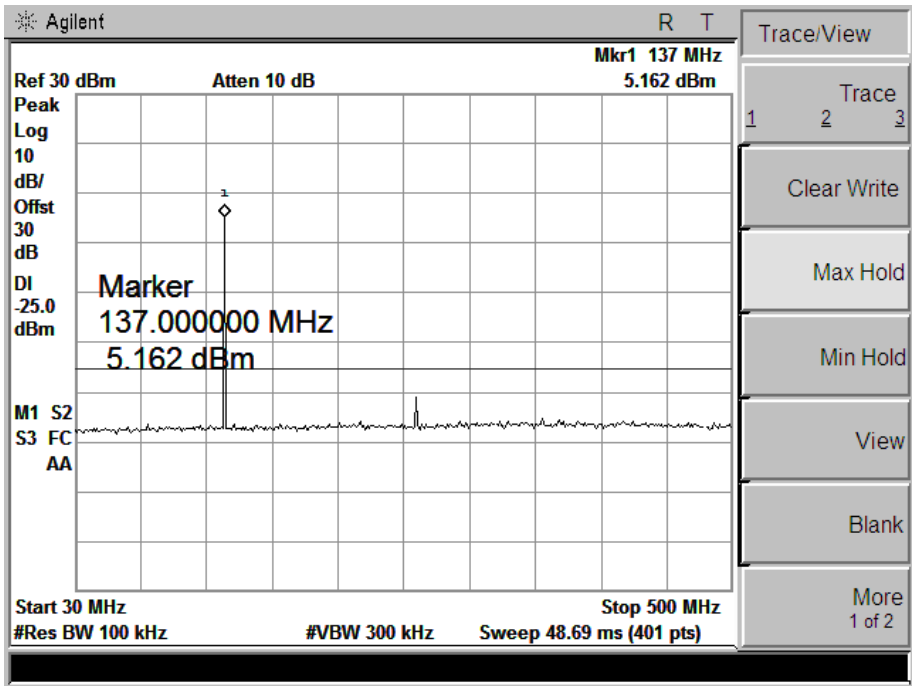
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz	
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)
Analog/FM	12.5KHz	Low	137.0125	609.00	-35.08	2050.00	-34.43
		Middle	152.0125	733.00	-35.29	2900.00	-34.19
		High	166.9875	553.00	-34.81	2730.00	-33.3
Digtal/4FSK	12.5KHz	Low	137.0125	756.00	-36.08	2980.00	-33.84
		Middle	152.0125	584.00	-35.29	2970.00	-34.03
		High	166.9875	608.00	-35.41	2950.00	-34.62
Limit		-20dBm for 12.5KHz Channel Separation					
Test Results		Compliance					

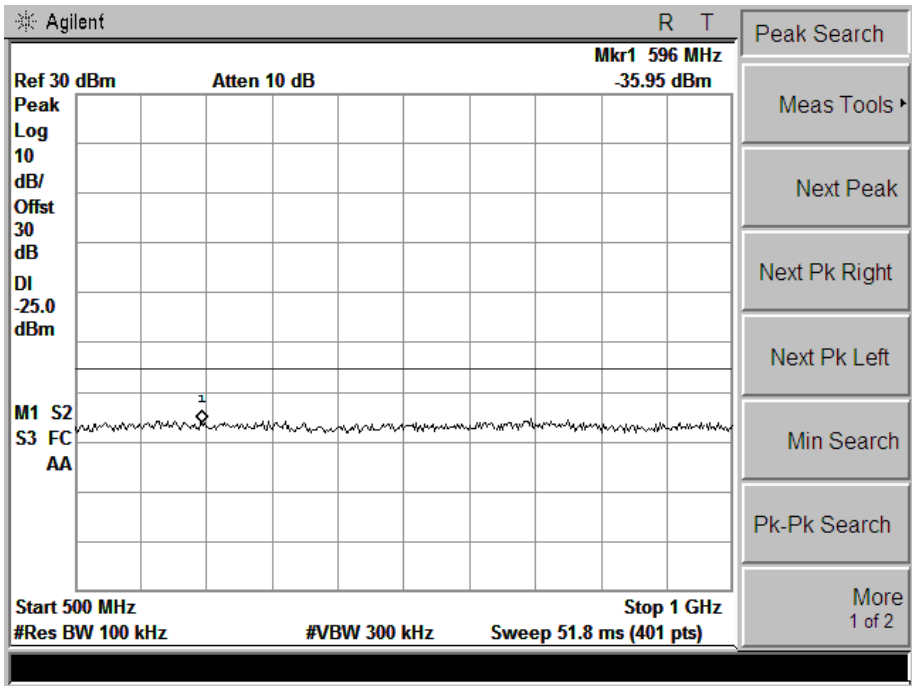
Plots of Spurious Emission on Antenna Port Measurement

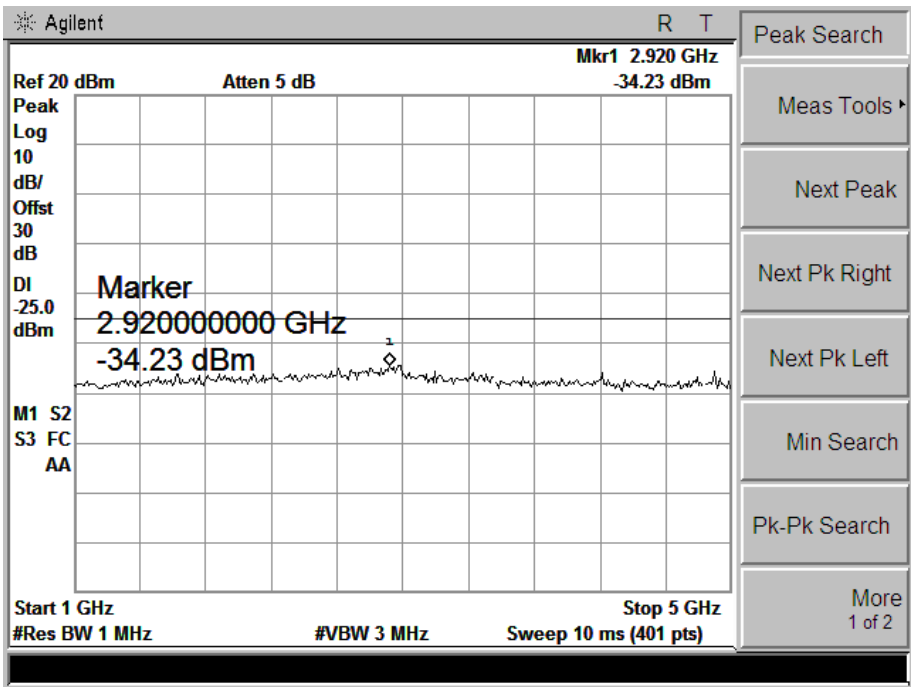
See next pages.

High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
FM	12.5KHz	Low	137.0125	596.00	-35.95	2920.00	-34.23	-20dBm
Test Results		Compliance						

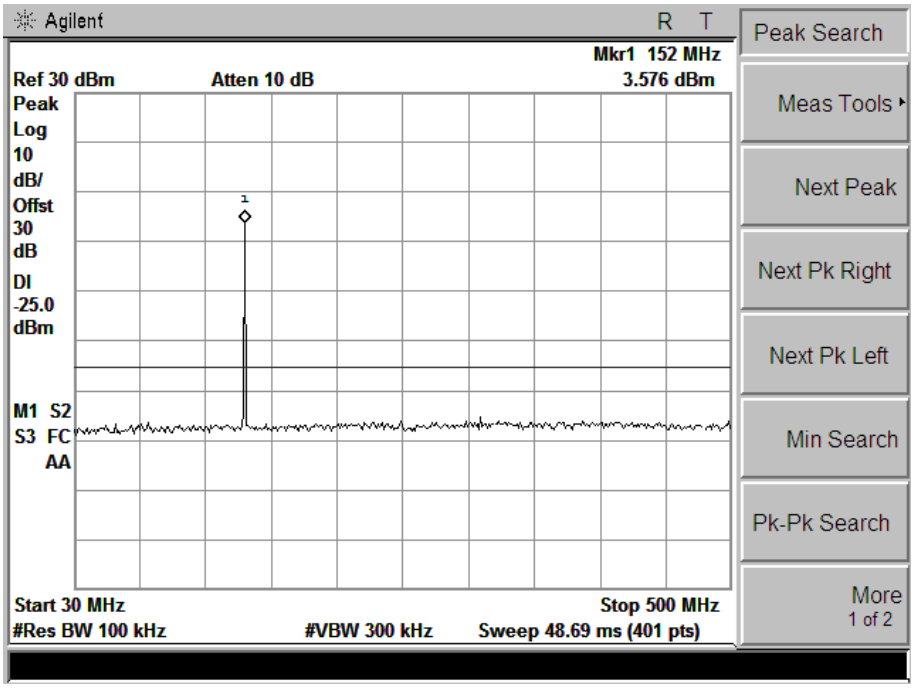


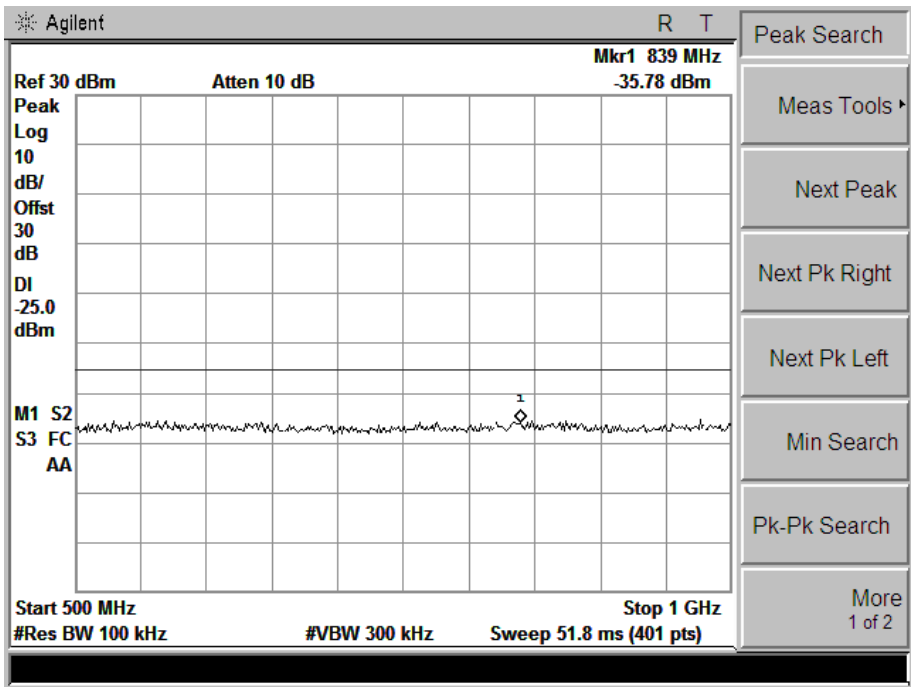


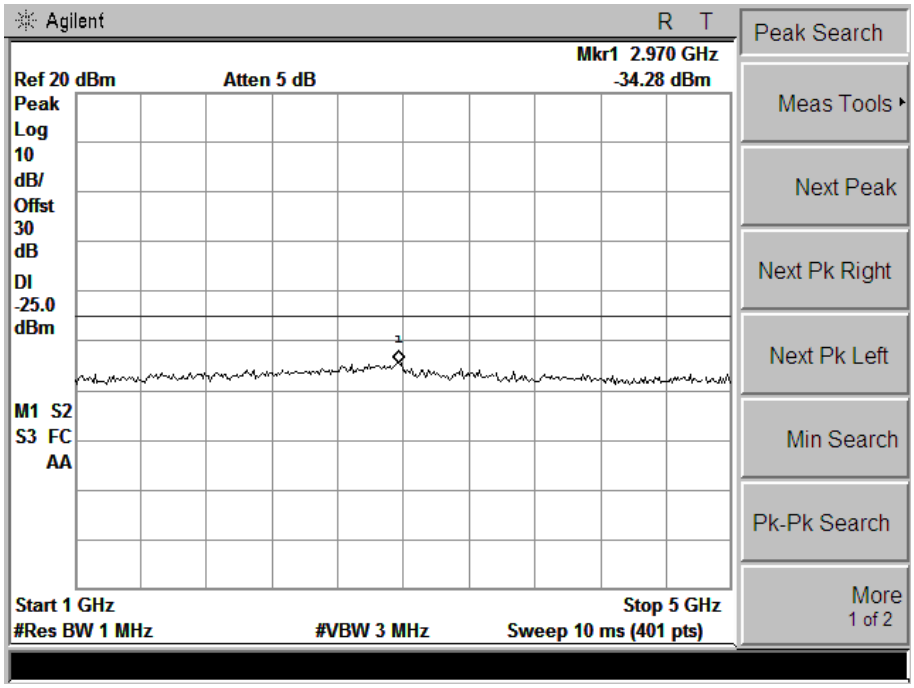


High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
FM	12.5KHz	Middle	152.0125	839.00	-35.78	2970.00	-34.28	-20dBm
Test Results		Compliance						

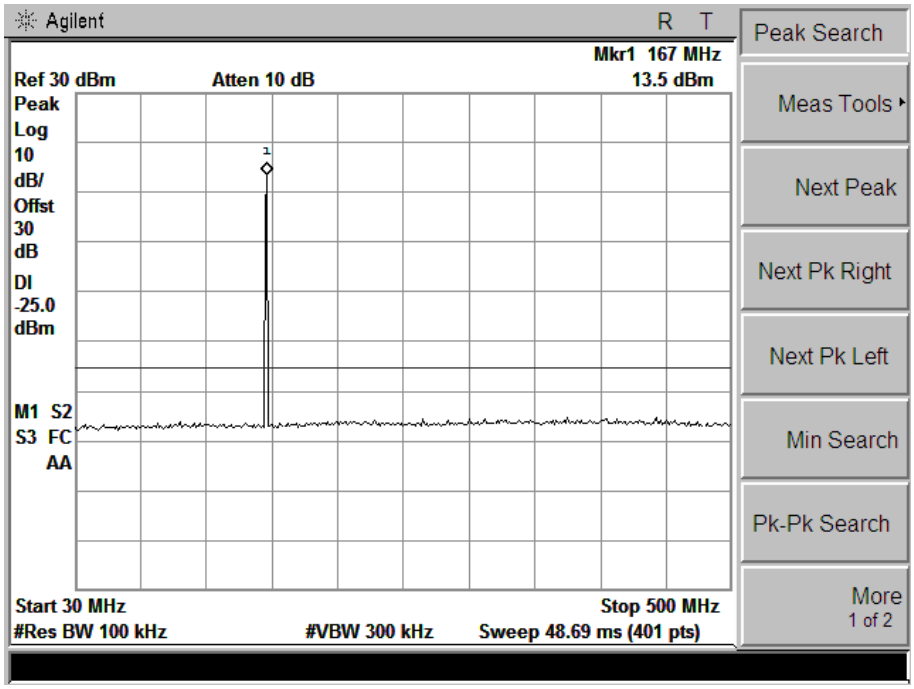


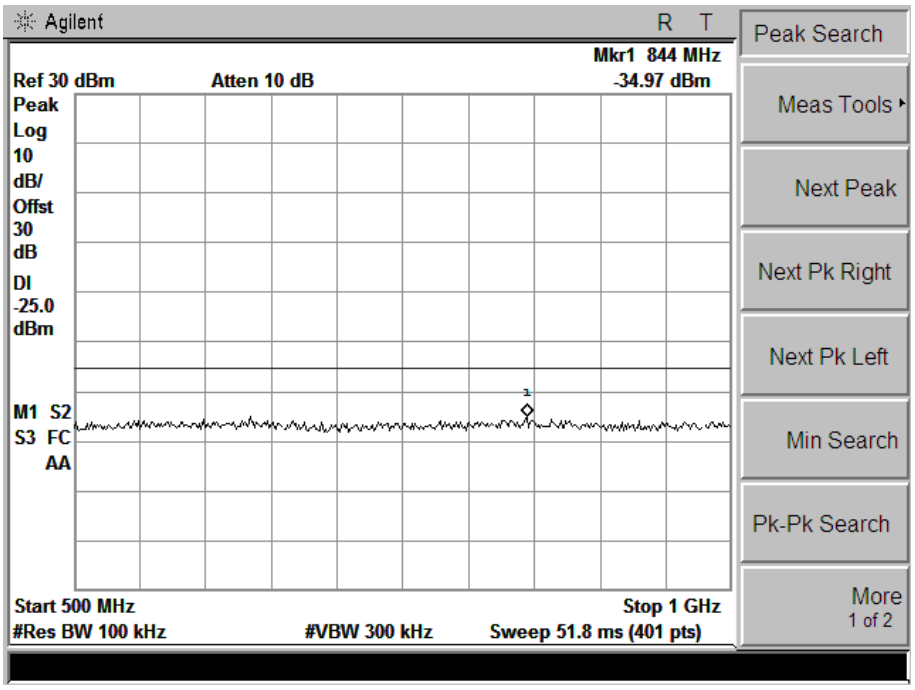

Agilent
R T
Mkr1 839 MHz
Ref 30 dBm
Atten 10 dB
-35.78 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
M1 S2
S3 FC
AA
Start 500 MHz
Stop 1 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 51.8 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

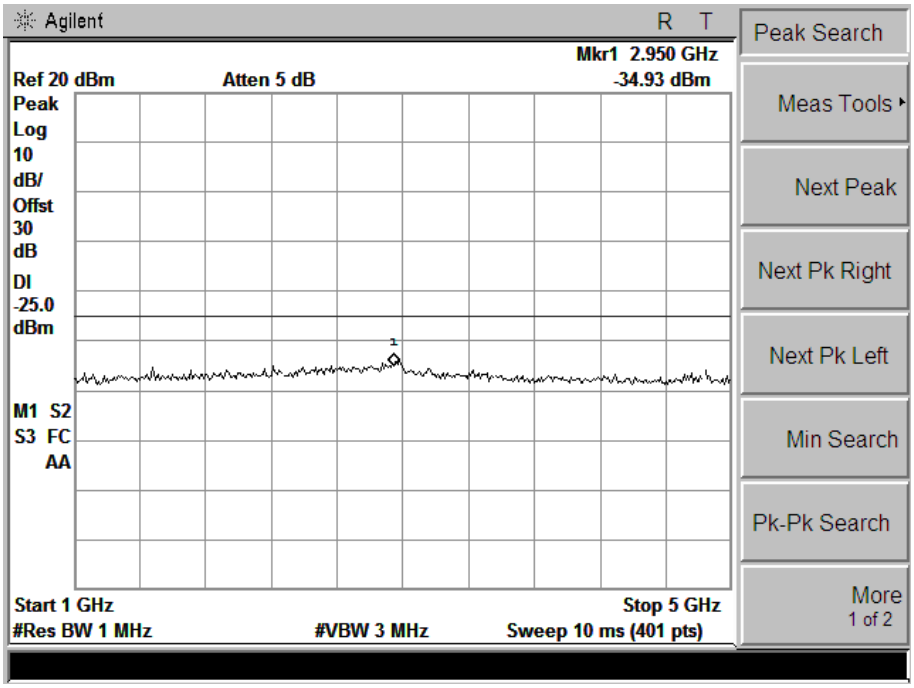

Agilent
R T
Mkr1 2.970 GHz
Ref 20 dBm
Atten 5 dB
-34.28 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
M1 S2
S3 FC
AA
Start 1 GHz
Stop 5 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 10 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
FM	12.5KHz	High	166.9875	844.00	-34.97	2950.00	-34.93	-20dBm
Test Results		Compliance						

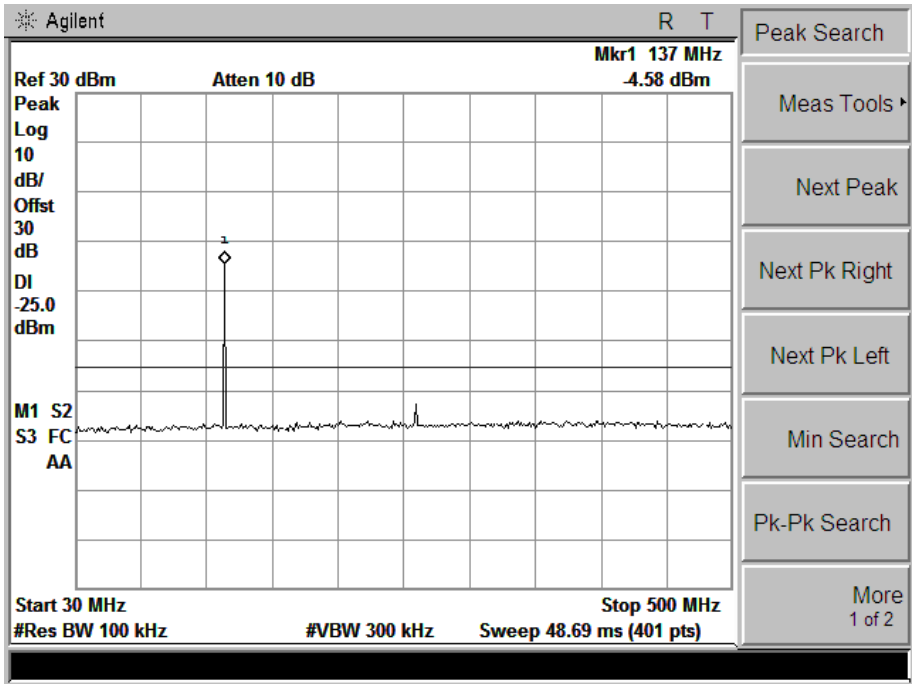


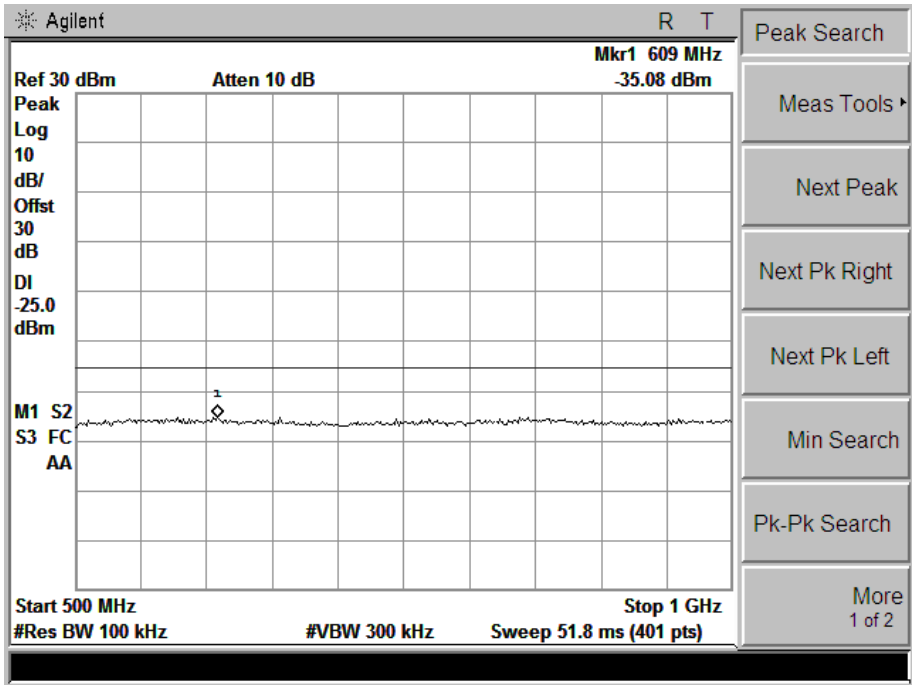


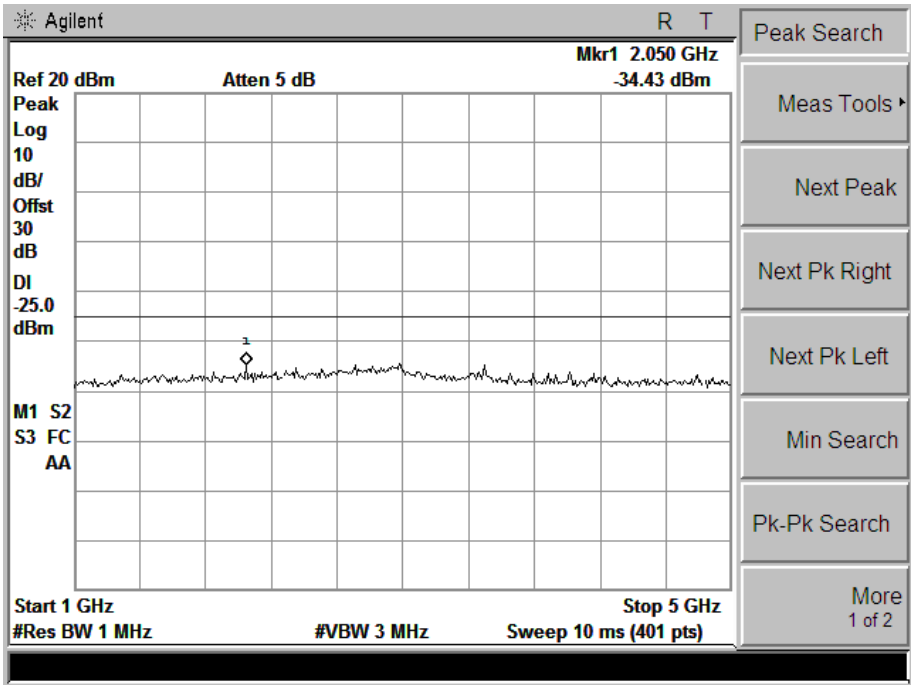


Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
FM	12.5KHz	Low	137.0125	609.00	-35.08	2050.00	-34.43	-20dBm
Test Results		Compliance						

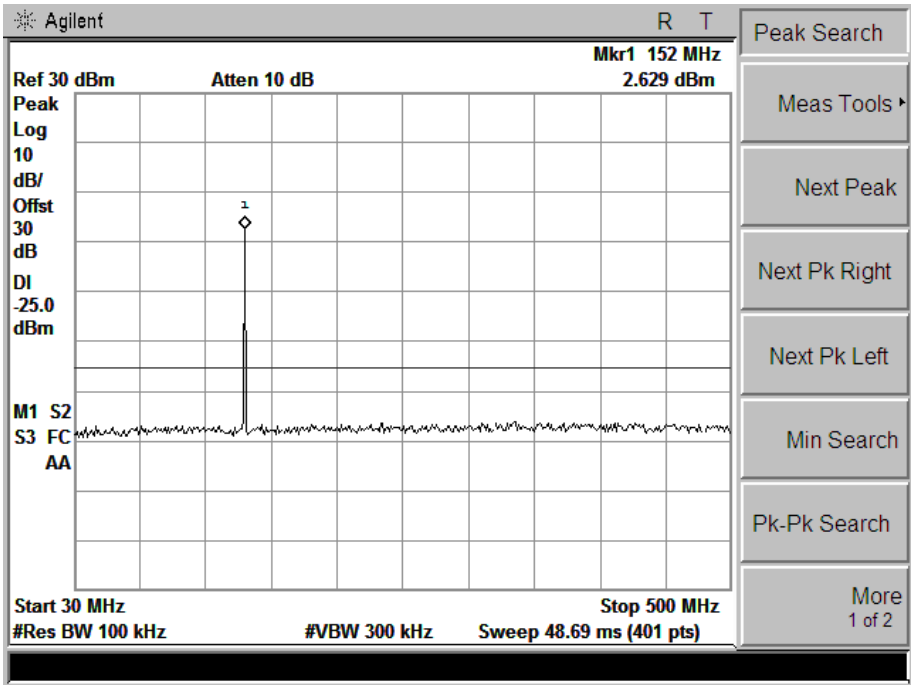


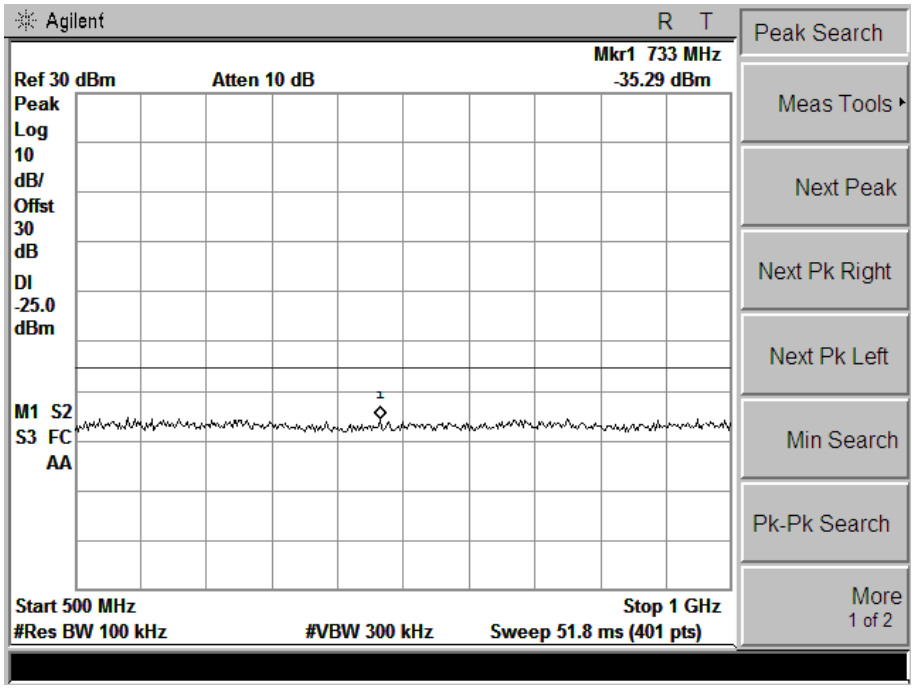

Agilent
R T
Peak Search
Mkr1 609 MHz
Ref 30 dBm
Atten 10 dB
-35.08 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
M1 S2
S3 FC
AA
Min Search
Pk-Pk Search
Start 500 MHz
Stop 1 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 51.8 ms (401 pts)
More
1 of 2

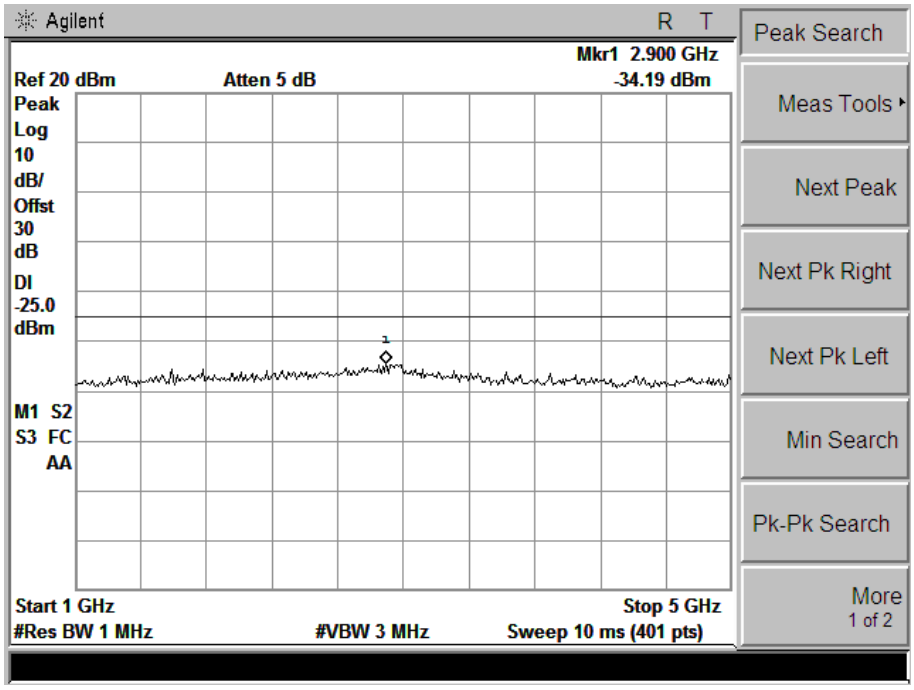

Agilent
R T
Peak Search
Mkr1 2.050 GHz
Ref 20 dBm
Atten 5 dB
-34.43 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
M1 S2
S3 FC
AA
Min Search
Pk-Pk Search
Start 1 GHz
Stop 5 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 10 ms (401 pts)
More
1 of 2

Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
FM	12.5KHz	Middle	152.0125	733.00	-35.29	2900.00	-34.19	-20dBm
Test Results		Compliance						

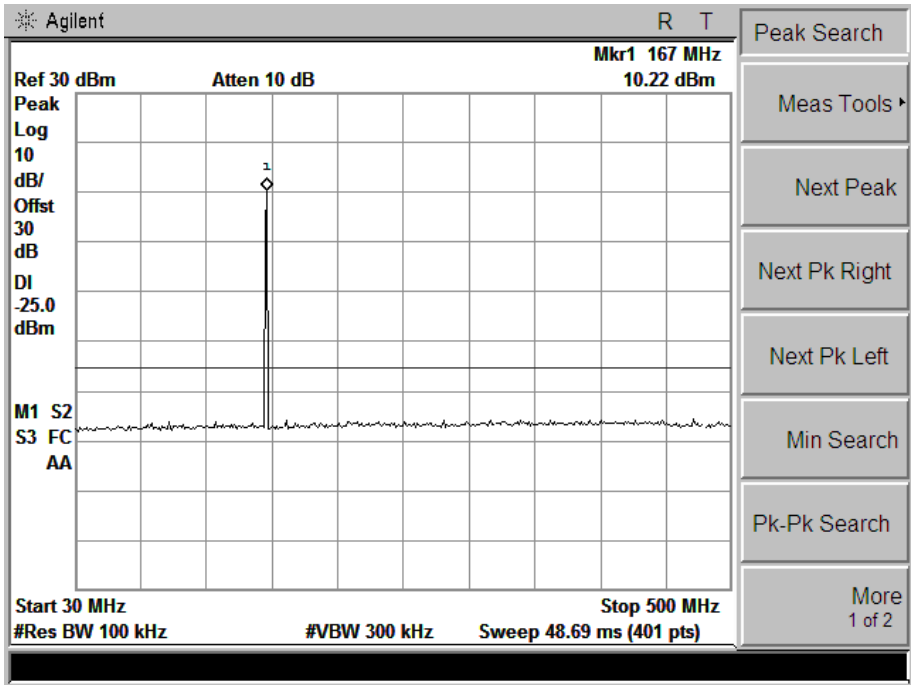


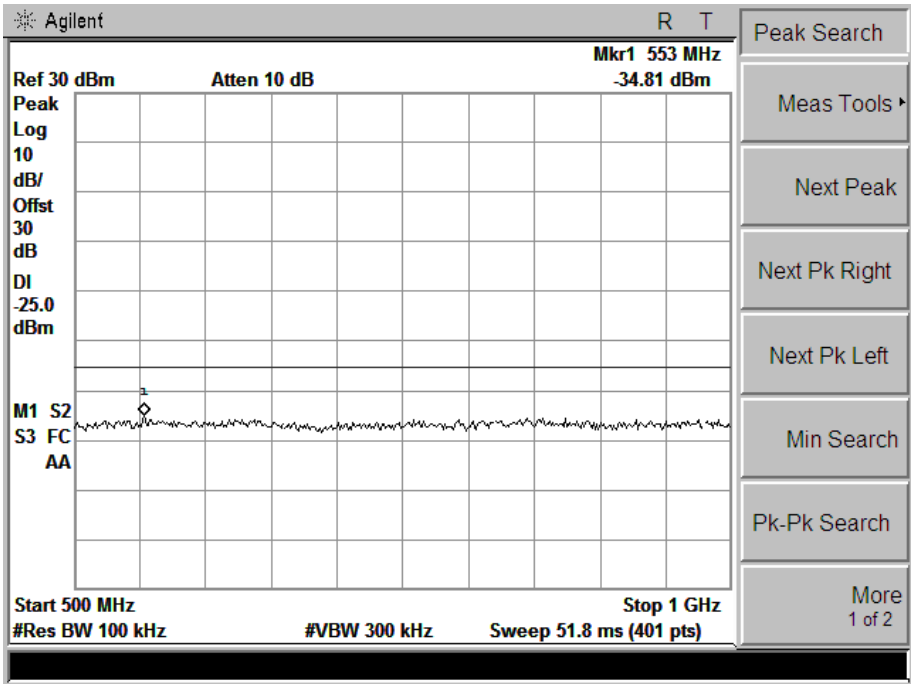


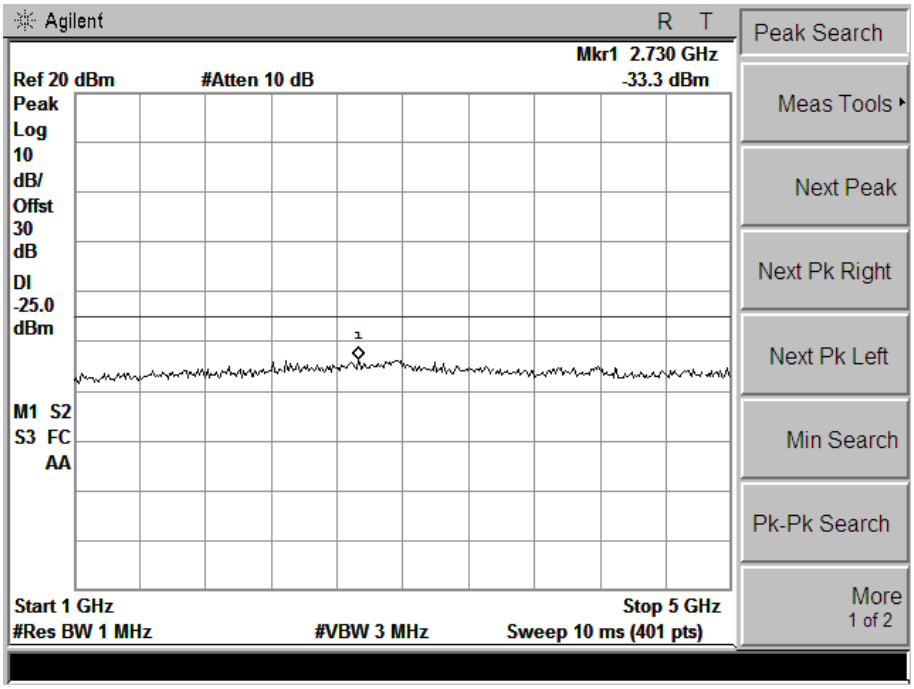


Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
FM	12.5KHz	High	166.9875	553.00	-34.81	2730.00	-33.3	-20dBm
Test Results		Compliance						

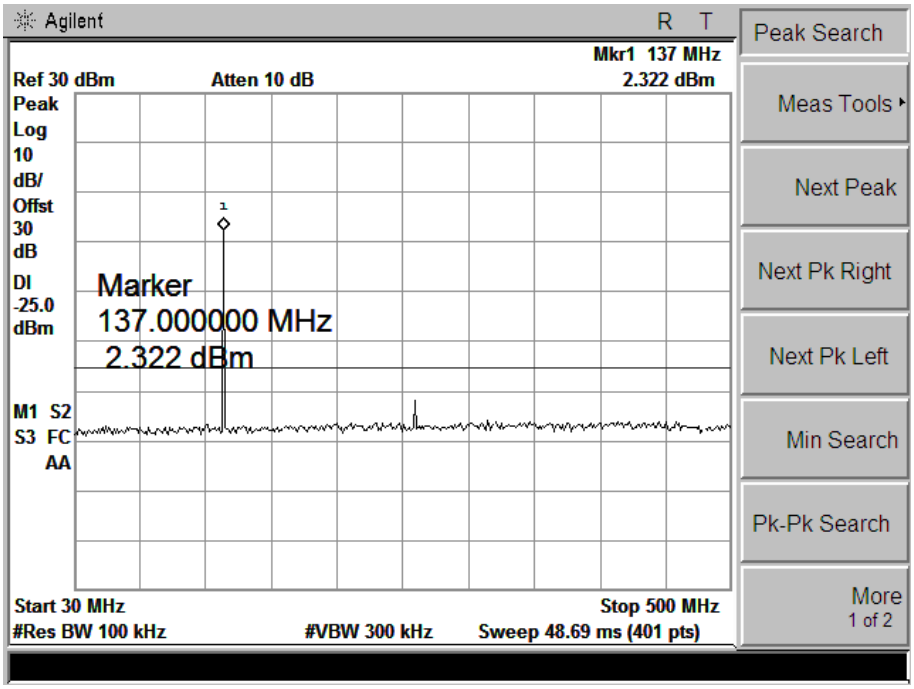


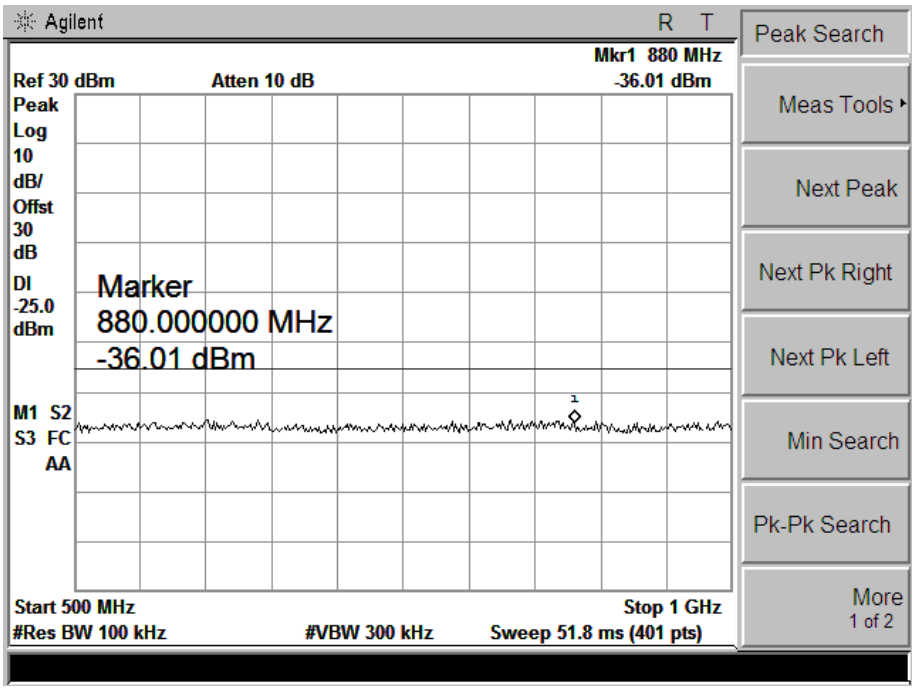

Agilent
R T
Mkr1 553 MHz
Ref 30 dBm
Atten 10 dB
-34.81 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
M1 S2
S3 FC
AA
Start 500 MHz
Stop 1 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 51.8 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

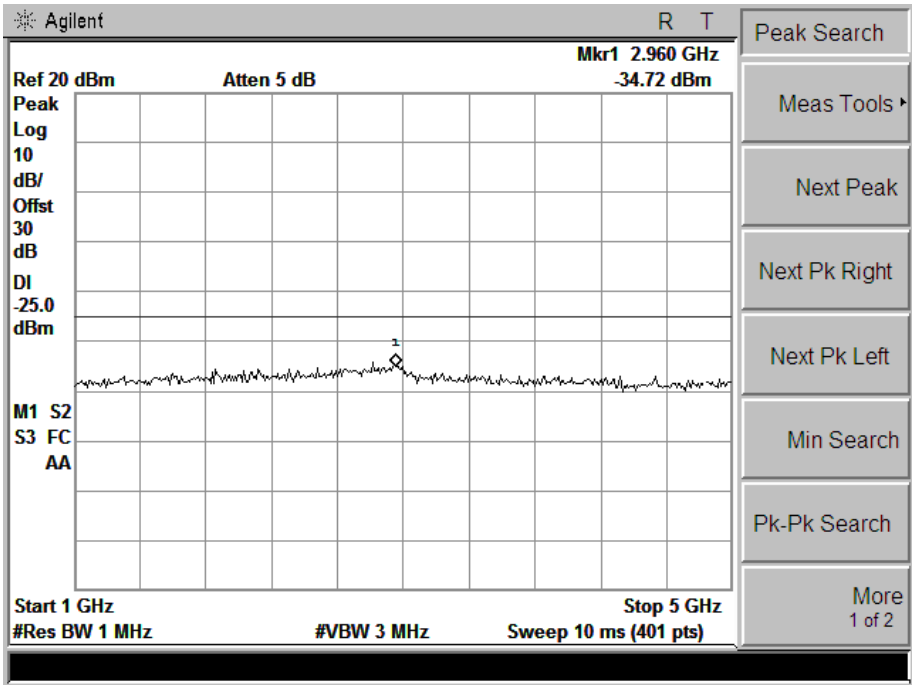

Agilent
R T
Mkr1 2.730 GHz
Ref 20 dBm
#Atten 10 dB
-33.3 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
M1 S2
S3 FC
AA
Start 1 GHz
Stop 5 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 10 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
4FSK	12.5KHz	Low	137.0125	880.00	-36.01	2960.00	-34.72	-20dBm
Test Results		Compliance						

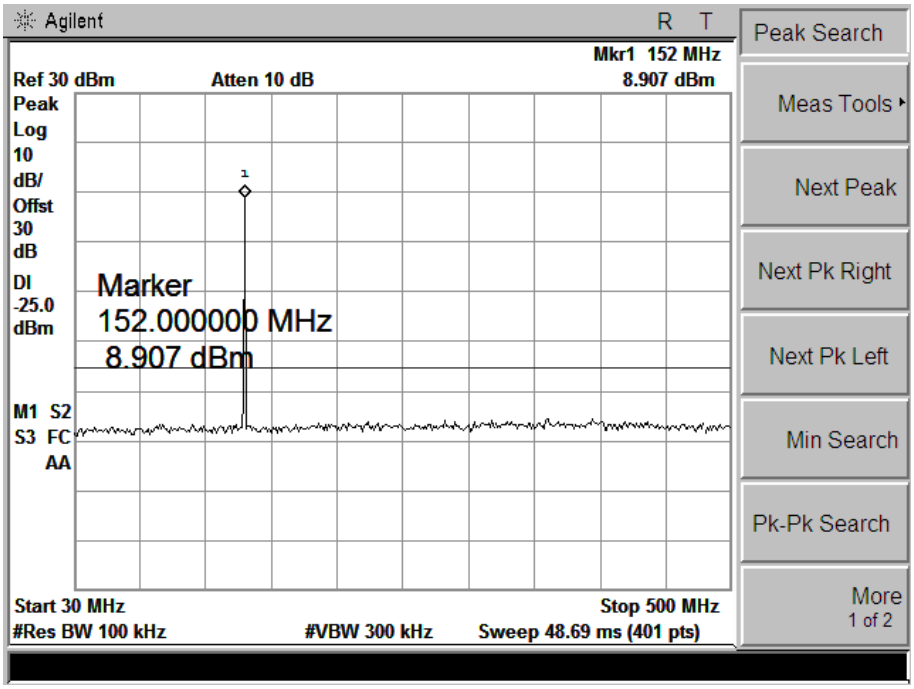


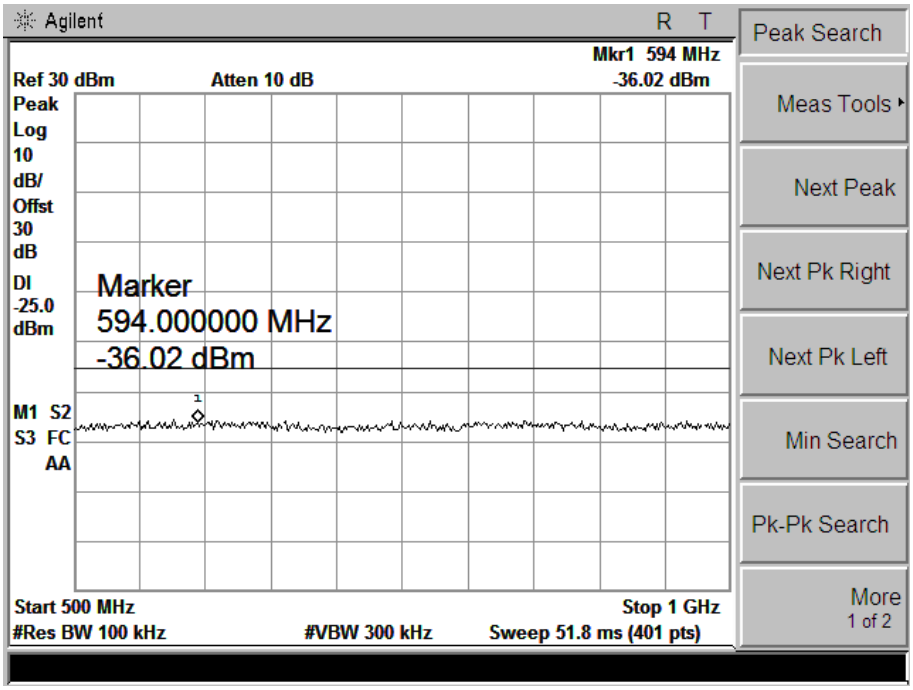


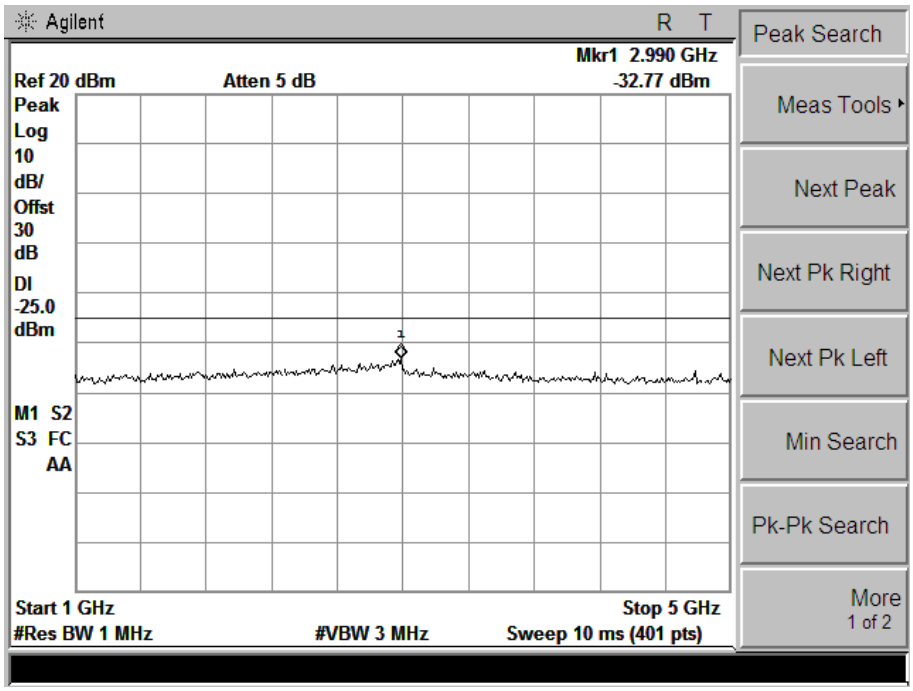


High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
4FSK	12.5KHz	Middle	152.0125	594.00	-36.02	2990.00	-32.77	-20dBm
Test Results		Compliance						

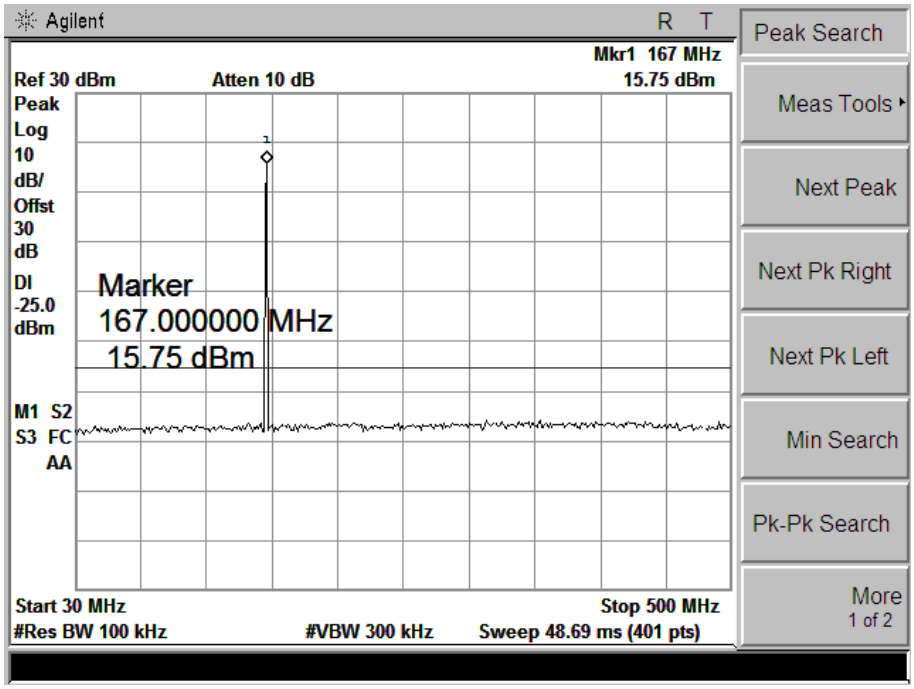


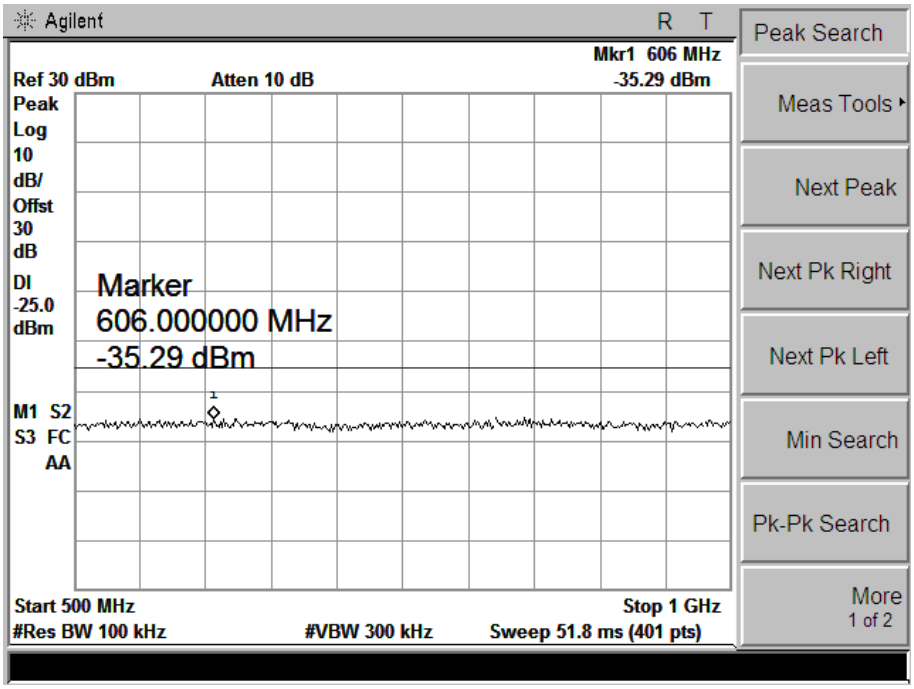

Agilent
R T
Mkr1 594 MHz
Ref 30 dBm
Atten 10 dB
-36.02 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
Marker
594.000000 MHz
-36.02 dBm
M1 S2
S3 FC
AA
Start 500 MHz
Stop 1 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 51.8 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

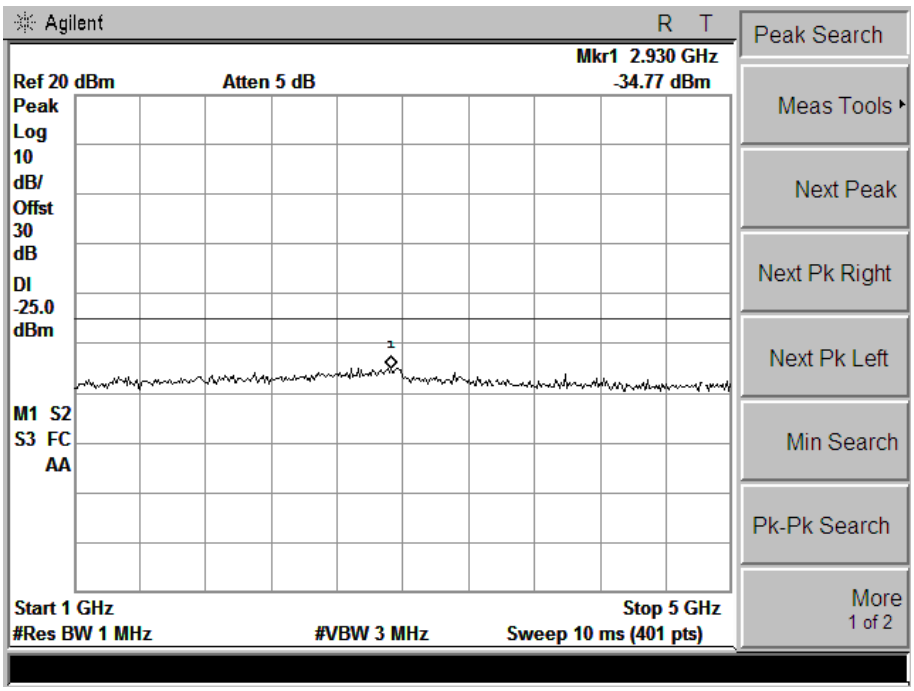

Agilent
R T
Mkr1 2.990 GHz
Ref 20 dBm
Atten 5 dB
-32.77 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
M1 S2
S3 FC
AA
Start 1 GHz
Stop 5 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 10 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

High power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
4FSK	12.5KHz	High	166.9875	606.00	-35.29	2930.00	-34.77	-20dBm
Test Results		Compliance						

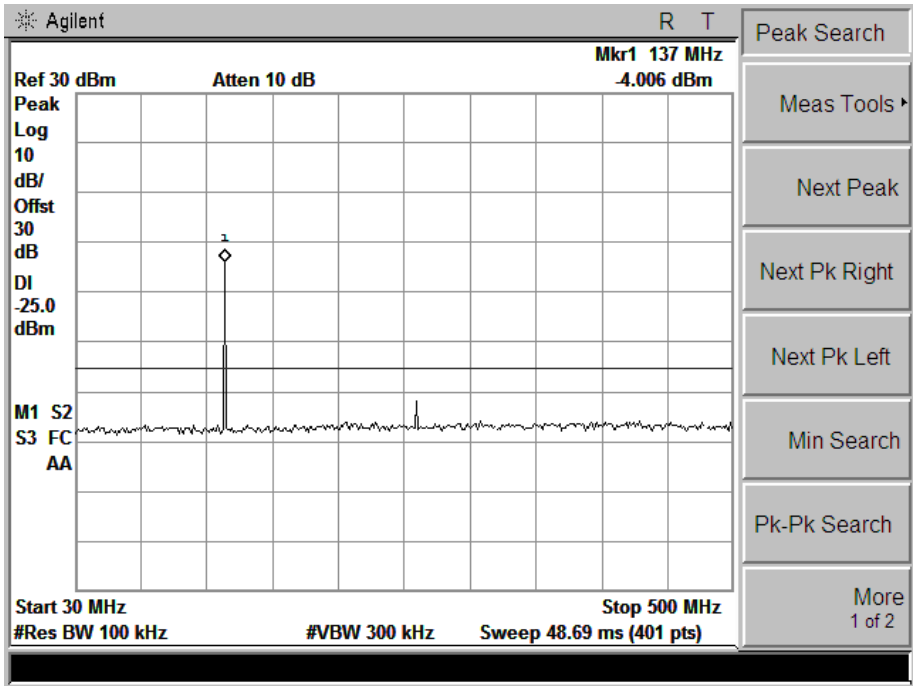


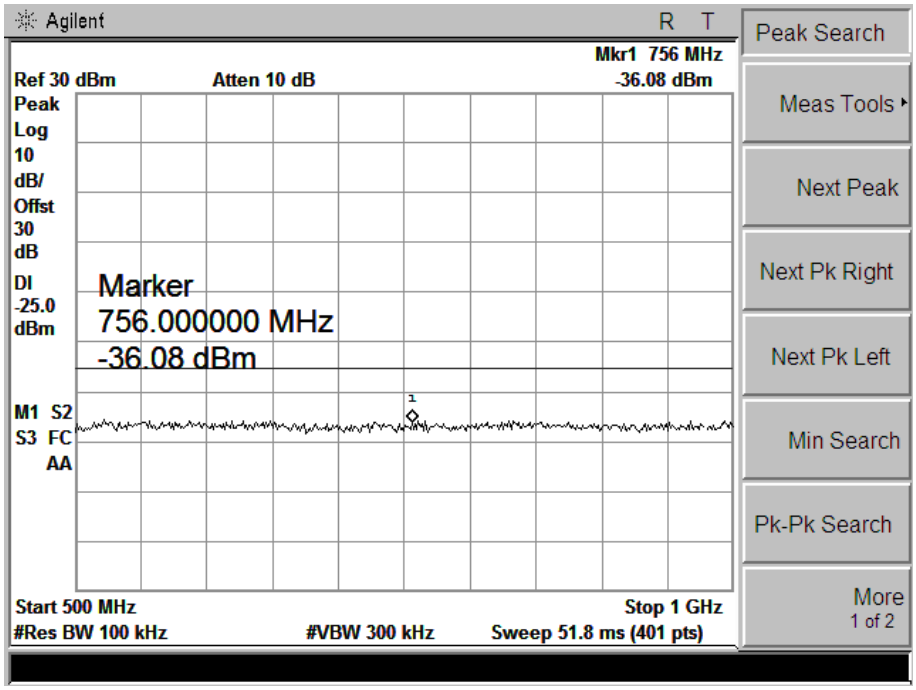


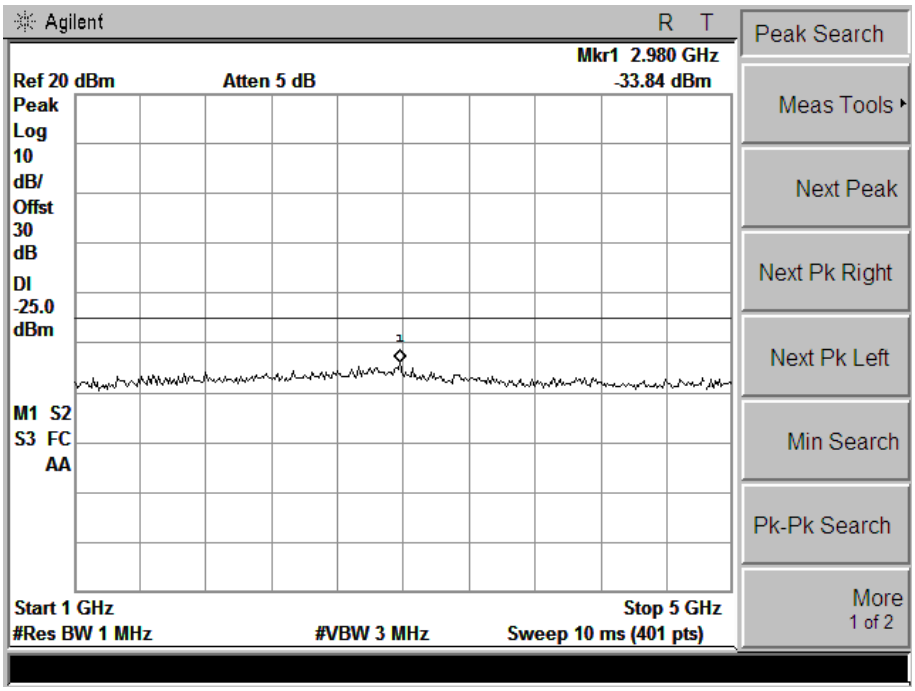


Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
4FSK	12.5KHz	Low	137.0125	756.00	-36.08	2980.00	-33.84	-20dBm
Test Results		Compliance						

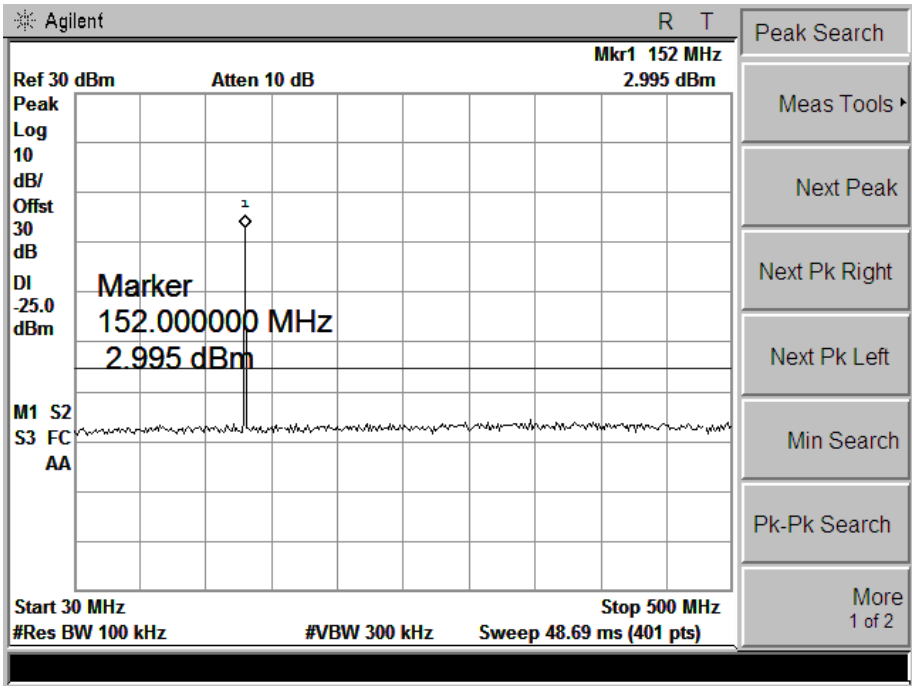


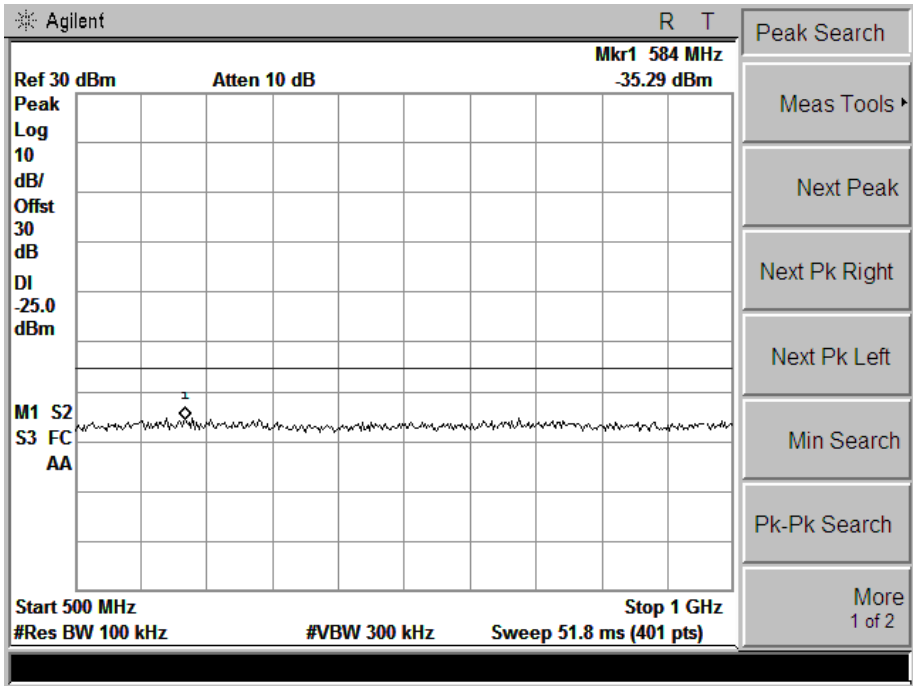

Agilent
R T
Mkr1 756 MHz
Ref 30 dBm
Atten 10 dB
-36.08 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
Marker
756.000000 MHz
-36.08 dBm
M1 S2
S3 FC
AA
Start 500 MHz
Stop 1 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 51.8 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

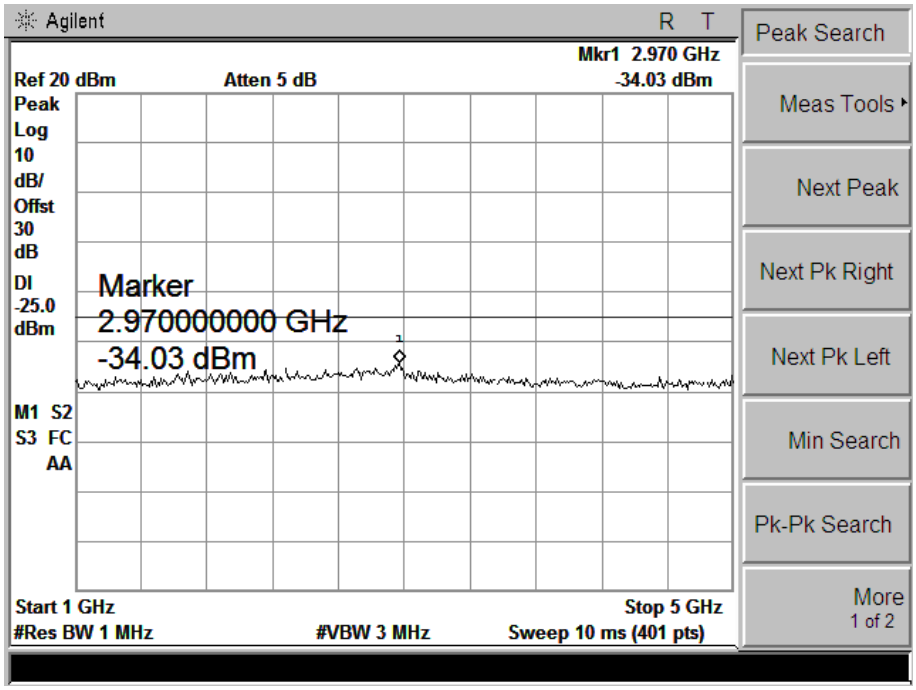

Agilent
R T
Mkr1 2.980 GHz
Ref 20 dBm
Atten 5 dB
-33.84 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
M1 S2
S3 FC
AA
Start 1 GHz
Stop 5 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 10 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
4FSK	12.5KHz	Middle	152.0125	584.00	-35.29	2970.00	-34.03	-20dBm
Test Results		Compliance						

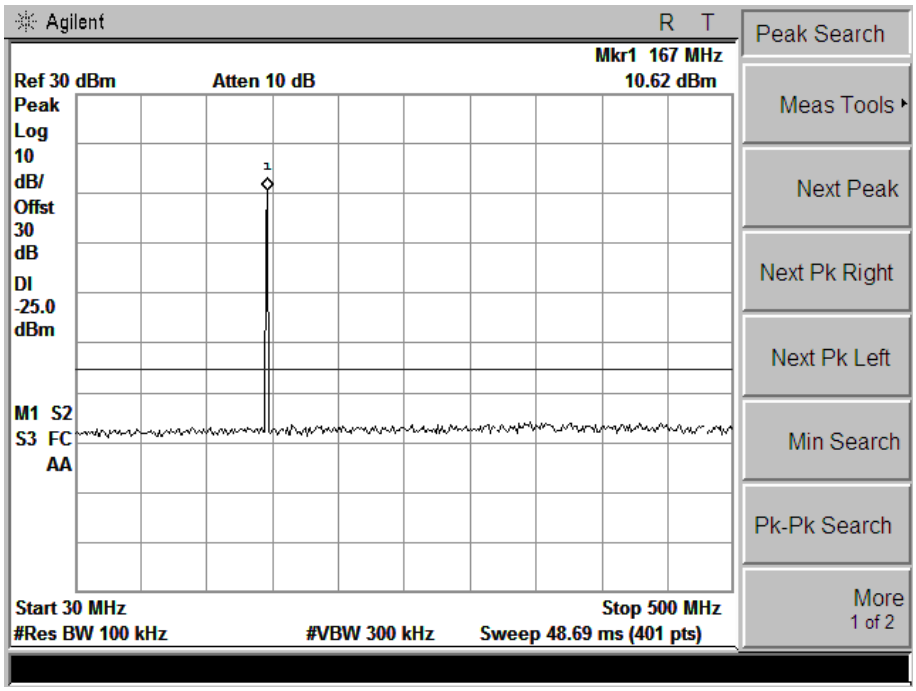


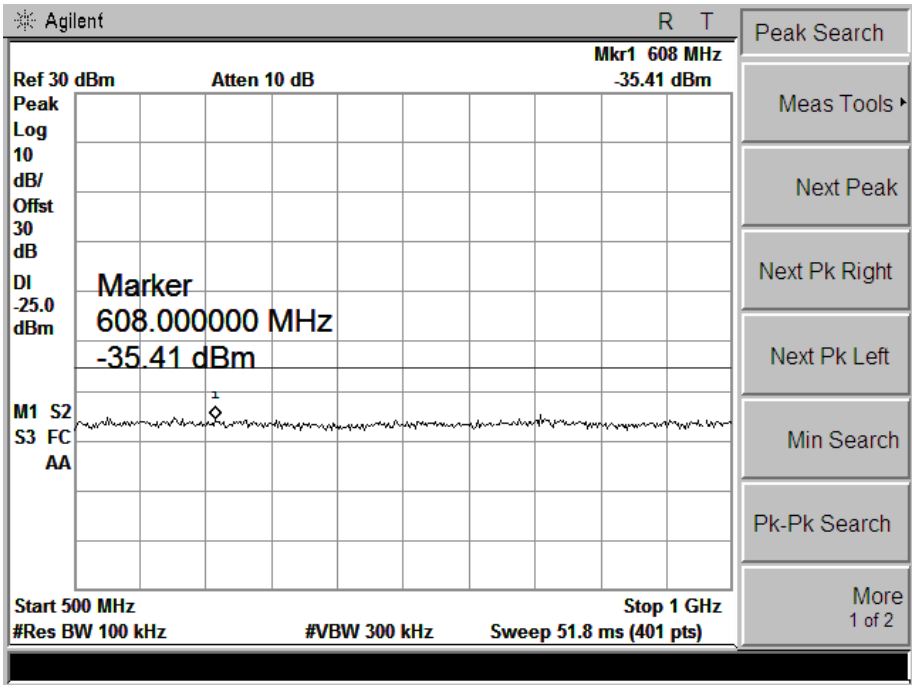


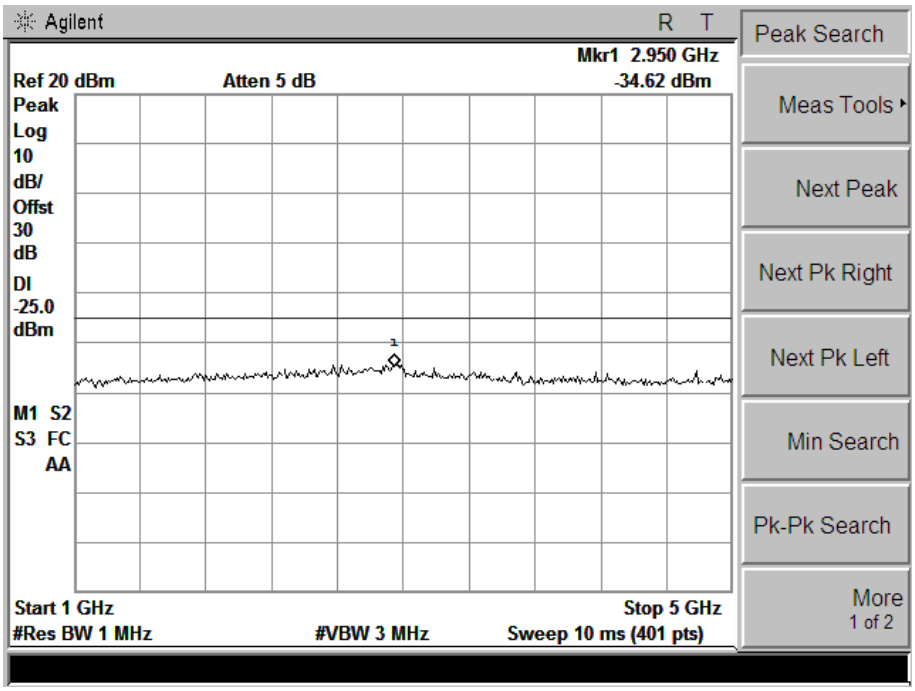


Low power:

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC limit
				Frequency (MHz)	Results (dBm)	Frequency (MHz)	Results (dBm)	
4FSK	12.5KHz	High	166.9875	608.00	-35.41	2950.00	-34.62	-20dBm
Test Results		Compliance						




Agilent
R T
Mkr1 608 MHz
Ref 30 dBm
Atten 10 dB
-35.41 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
Marker
608.000000 MHz
-35.41 dBm
M1 S2
S3 FC
AA
Start 500 MHz
Stop 1 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 51.8 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


Agilent
R T
Mkr1 2.950 GHz
Ref 20 dBm
Atten 5 dB
-34.62 dBm
Peak
Log
10
dB/
Offst
30
dB
Dl
-25.0
dBm
M1 S2
S3 FC
AA
Start 1 GHz
Stop 5 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 10 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

4.5. Modulation Characteristics

TEST APPLICABLE

According toCFR47 section 2.1047(a), for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

TEST PROCEDURE

Modulation Limit

1 Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1 KHz using this level as a reference (0dB) and vary the input level from –20 to +20dB. Record the frequency deviation obtained as a function of the input level.

2 Repeat step 1 with input frequency changing to 300, 1004, 1500 and 2500Hz in sequence.

Audio Frequency Response

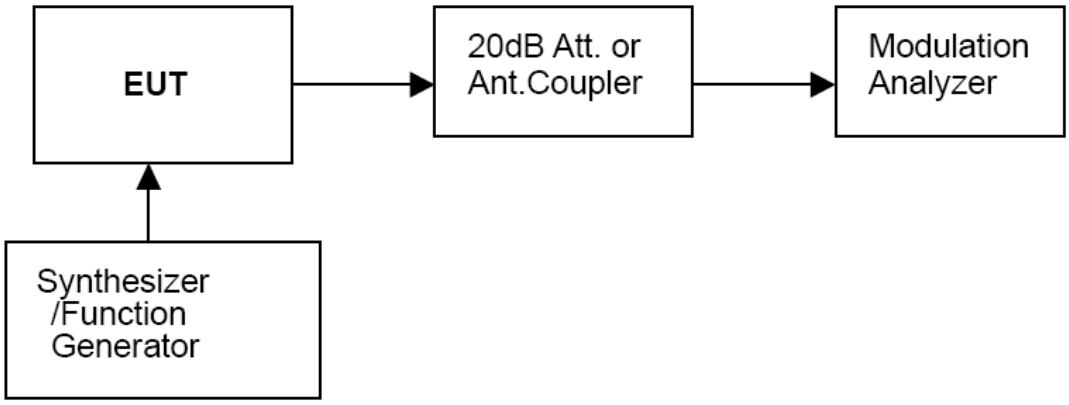
1 Configure the EUT as shown in figure 1.

2 Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0dB).

3 Vary the Audio frequency from 100 Hz to 3 KHz and record the frequency deviation.

4 Audio Frequency Response =20log10 (Deviation of test frequency/Deviation of 1 KHz reference).

TEST CONFIGURATION

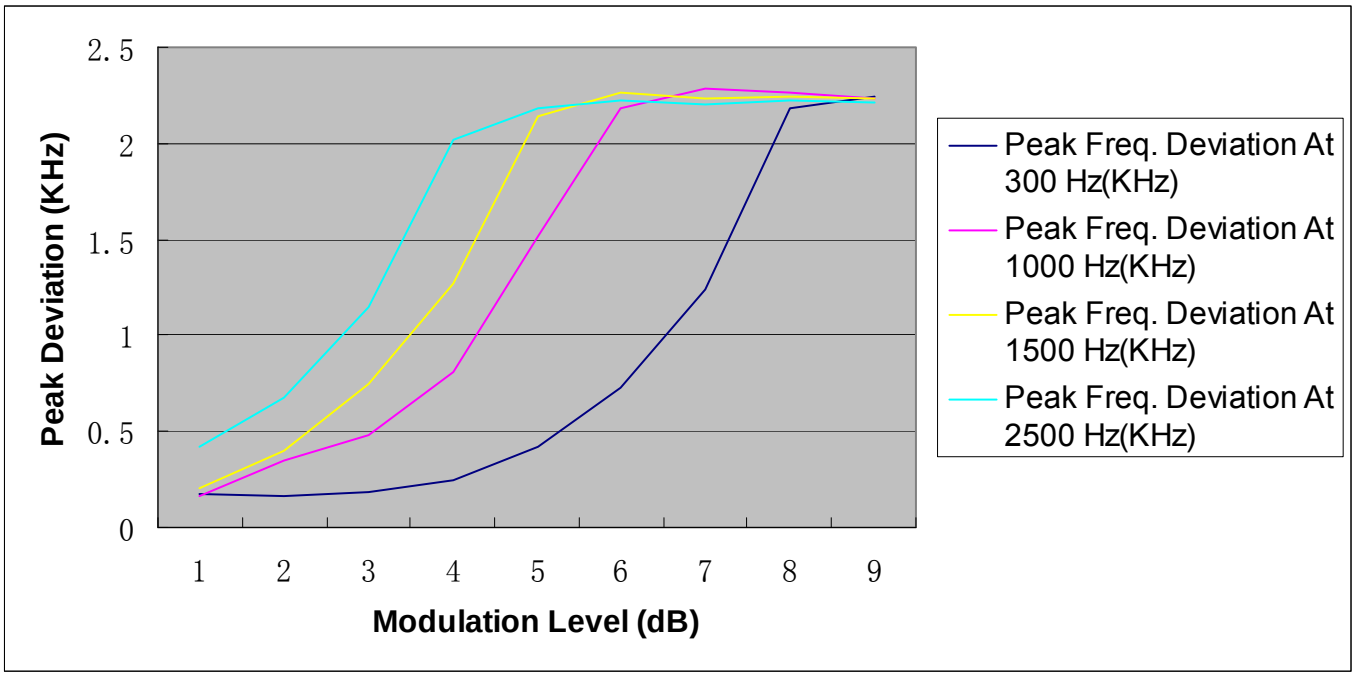


TEST RESULTS

Modulation Type: FM

12.5 KHz Channel Separation

Modulation Level(dB)	Peak Freq. Deviation At 300 Hz(KHz)	Peak Freq. Deviation At 1000 Hz(KHz)	Peak Freq. Deviation At 1500 Hz(KHz)	Peak Freq. Deviation At 2500 Hz(KHz)	Limit (KHz)
-20	0.17	0.16	0.21	0.42	2.5
-15	0.17	0.35	0.40	0.68	2.5
-10	0.18	0.48	0.75	1.15	2.5
-5	0.25	0.81	1.27	2.02	2.5
0	0.42	1.52	2.14	2.18	2.5
+5	0.73	2.18	2.26	2.22	2.5
+10	1.24	2.28	2.23	2.20	2.5
15	2.18	2.26	2.24	2.22	2.5
+20	2.24	2.23	2.23	2.21	2.5



Modulation type: 4FSK

Channel bandwidth: 12.5 kHz

It is not applicable for devices which operate with the digitized voice/data modulation type.

b). Audio Frequency Response:

Rule Part No.: Part 2.1407(a) (b)

Method of Measurement:

The audio frequency response was measured in accordance with TIA/EIA Specification 603 with no exception.

A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 300-3000Hz shall be submitted and Audio Post Limiter Low Pass Filter Response from 3.0 KHz to 50KHz.However, the audio frequency response should test from 100Hz to 5.0 KHz according to FCC Part 90.

Modulation Type: FM

The audio frequency response curve is show below and Test Audio Level (1 KHz and 20% maximum deviation) is 2.90mv for 12.5 KHz channel separation.

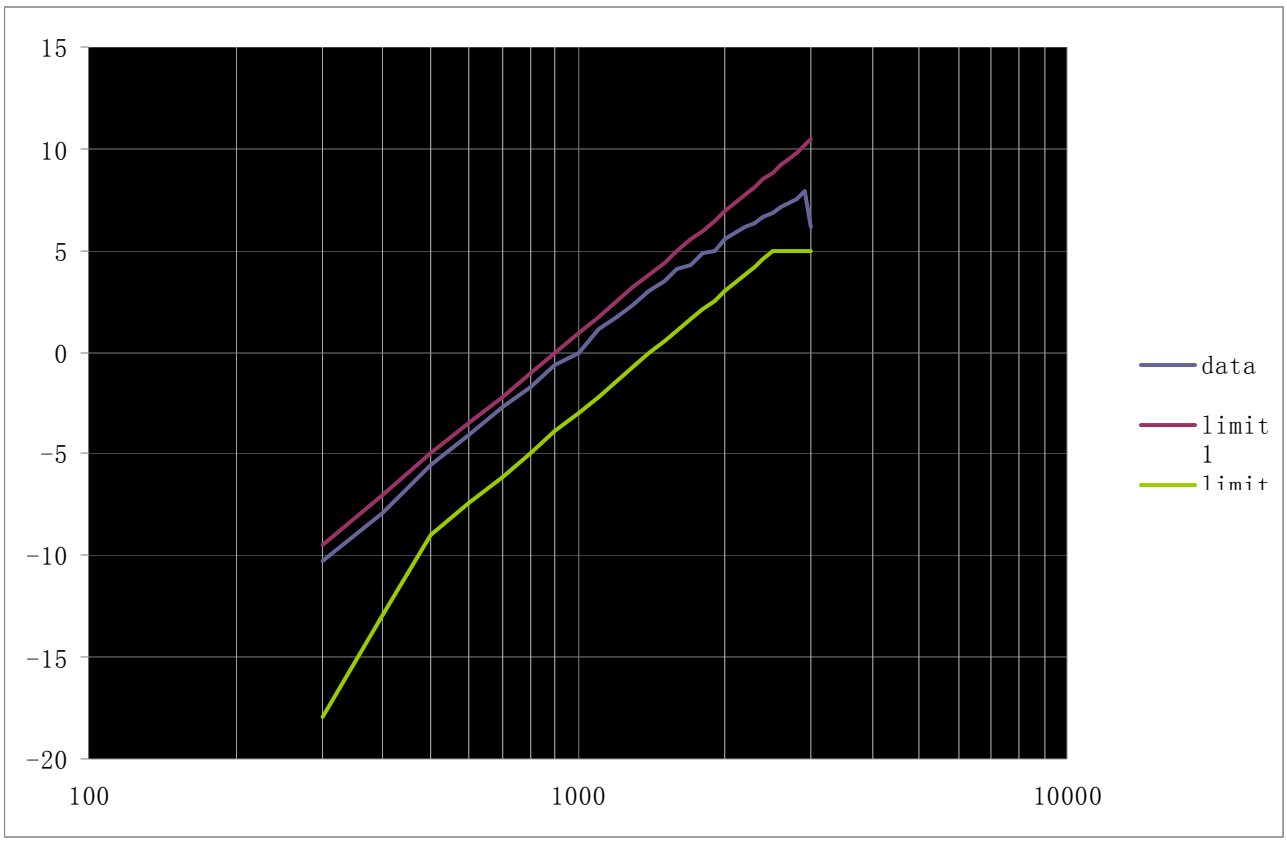
Note:

1 Not applicable to new standard. However, tests are conducted under FCC's recommendation.

1 Not applicable to new standard. However, tests are conducted under FCC's recommendation.

12.5 KHz Channel Separation

Frequency (KHz)	Frequency Deviation (KHz)	1KHz Reference Deviation (KHz)	Audio Frequency Response (dB)
0.1	0.04	0.51	-20.18
0.2	0.05	0.51	-20.22
0.3	0.15	0.51	-10.23
0.4	0.28	0.51	-7.87
0.5	0.27	0.51	-5.55
0.6	0.32	0.51	-4.07
0.7	0.36	0.51	-2.73
0.8	0.37	0.51	-1.73
0.9	0.44	0.51	-0.62
1.0	0.51	0.51	0.00
1.2	0.53	0.51	1.73
1.4	0.67	0.51	3.00
1.6	0.77	0.51	4.05
1.8	0.89	0.51	4.90
2.0	0.92	0.51	5.56
2.1	1.01	0.51	5.85
2.2	1.03	0.51	6.14
2.3	1.07	0.51	6.38
2.4	1.16	0.51	6.62
2.5	1.18	0.51	6.87
2.6	1.21	0.51	7.18
2.7	1.22	0.51	7.36
2.8	1.21	0.51	7.53
2.9	1.24	0.51	7.91
3.0	1.26	0.51	6.12
3.5	0.05	0.51	-20.15
4.0	0.04	0.51	-22.13
4.5	0.03	0.51	-24.61
5.0	0.03	0.51	-24.61



Modulation type: 4FSK

Channel bandwidth:12.5 kHz

It is not applicable for devices which operate with the digitized voice/data modulation type.

4.6. Frequency Stability Measurement

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 +50℃ 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.

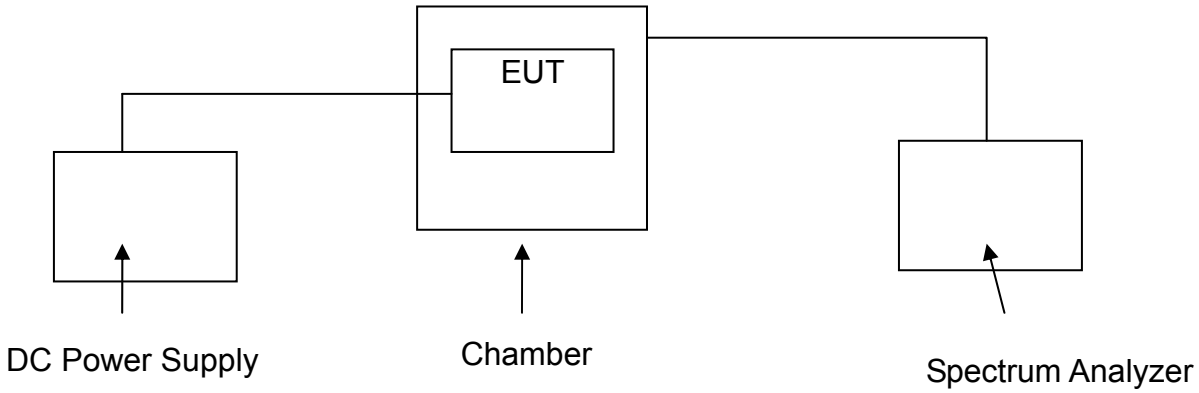
3 Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and tested end point voltage.

4 According to §90.213, the frequency stability limit is 2.5 ppm for 12.5 KHz channel separation and 1.0 ppm for 6.25KHz channel separation.

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 Spectrum Analyzer ESI 26. 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 SETUP BLOCK DIAGRAM



TEST LIMITS

According to 90.213, Transmitters used must have minimum frequency stability as specified in the following table.

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3] 100	100	200
25–50	20	20	50
72–76	5	.....	50
150–174	[5,11] 5	[6] 5	[4,6] 50
216–220	1.0	.....	1.0
220–222 [12]	0.1	1.5	1.5
421–512	[7,11,14] 2.5	[8] 5	[8] 5
806–809	[14] 1.0	1.5	1.5
809–824	[14] 1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	[14] 0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928 [13]	2.5	2.5	2.5
929–930	1.5	.....	.....
935–940	0.1	1.5	1.5
1427–1435	[9] 300	300	300
Above 2450 [10]	.....	.....	.....

Modulation Type	Channel separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(℃)	137.0125 (MHz)	152.0125 (MHz)	166.9880 (MHz)
Analog/FM	12.5KHz	DC 13.8	-30	-0.73	-0.72	-0.73
			-20	-0.72	-0.70	-0.71
			10	-0.67	-0.69	-0.70
			0	-0.54	-0.54	-0.55
			10	-0.47	-0.45	-0.43
			20	-0.23	-0.25	-0.24
			30	-0.37	-0.36	-0.35
			40	-0.41	-0.43	-0.42
			50	-0.53	-0.47	-0.55
		6.25 (End Point)	25	-0.35	-0.33	-0.34
		6.29 (85% Rated)	20	-0.33	-0.34	-0.33
		8.51 (115% Rated)	20	-0.32	-0.33	-0.31
Limit				2.50	2.50	2.50
Conclusion			Complies			

Modulation Type	Channel separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(℃)	137.0125 (MHz)	152.0125 (MHz)	166.9880 (MHz)
Digital/4FSK	12.5KHz	DC 13.8	-30	-0.61	-0.63	-0.62
			-20	-0.62	-0.64	-0.65
			10	-0.56	-0.55	-0.53
			0	-0.46	-0.53	-0.48
			10	-0.41	-0.47	-0.38
			20	-0.18	-0.17	-0.20
			30	-0.32	-0.35	-0.33
			40	-0.41	-0.40	-0.42
			50	-0.44	-0.46	-0.53
		6.25 (End Point)	25	-0.61	-0.64	-0.66
		6.29 (85% Rated)	20	-0.34	-0.31	-0.32
		8.51 (115% Rated)	20	-0.23	-0.23	-0.22
Limit				2.50	2.50	2.50
Conclusion			Complies			

4.7. Conducted Output Power

TEST APPLICABLE

Per FCC «2.1046 and «90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

Typical transmitter output powers are 110 watts for base and/or fixed stations (paging transmitters excepted), and 30 watts for mobile stations. Higher powers may be certified, but it should be noted that mobile stations are normally only licensed up to 30 watts. See the SRSP relevant to the operating frequency for equipment power limits.

TEST PROCEDURE

Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted bellow:

f the power output is adjustable, measurements shall be made for the highest and lowest power levels.

The EUT connect to the Receiver through 40 dB attenuator.

Measurement with Spectrum Analyzer FSP40 or Aglient E4407B conducted, external power supply with 12.50 V stabilized supply voltage.

TEST CONFIGURATION

<table>
<tr><td colspan="4"></td><td rowspan="3">Spectrum Analyzer/Receiver</td></tr>
<tr><td rowspan="2">EUT</td><td></td><td rowspan="2">Attenuator</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="4"></td></tr>
</table>

The EUT was directly connected to a RF Communication

Test set by a 20 dB attenuator

TEST LIMITS

TABLE 2—450-470 MHZ—MAXIMUM ERP/REFERENCE HAAT FOR A SPECIFIC SERVICE AREA RADIUS

	Service area radius (km)									
	3	8	13	16	24	32	40[4]	48[4]	64[4]	80[4]
Maximum ERP (w)[1]	2	100	2500	2500	2500	2500	2500	2500	2500	2500
Up to reference HAAT (m)[3]	15	15	15	27	63	125	250	410	950	2700

1: Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig. 29 (See §73.699, Fig. 10 b).

2: Maximum ERP of 500 watts allowed. Signal strength at the service area contour may be less than 39 dBu.

3: When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation: $ERPallow = ERPmax \times (HAATref / HAATactual)^2$.

4: Applications for this service area radius may be granted upon specific request with justification and must include a technical demonstration that the signal strength at the edge of the service area does not exceed 39 dBu.

TEST RESULTS

High Power

Frequency Range (MHz)	Modulation Type	Channel Separation (KHz)	Test Channel	Maximum Output Power Test Results (dBm)
136-174	Analog/FM	12.5	Low	43.58
			Middle	43.27
			High	43.04
136-174	Digital/4FSK	12.5	Low	43.00
			Middle	43.59
			High	43.67
Limit	The limit is dependent upon the station's antenna HAAT and required service area.			
Test Results	Compliance			

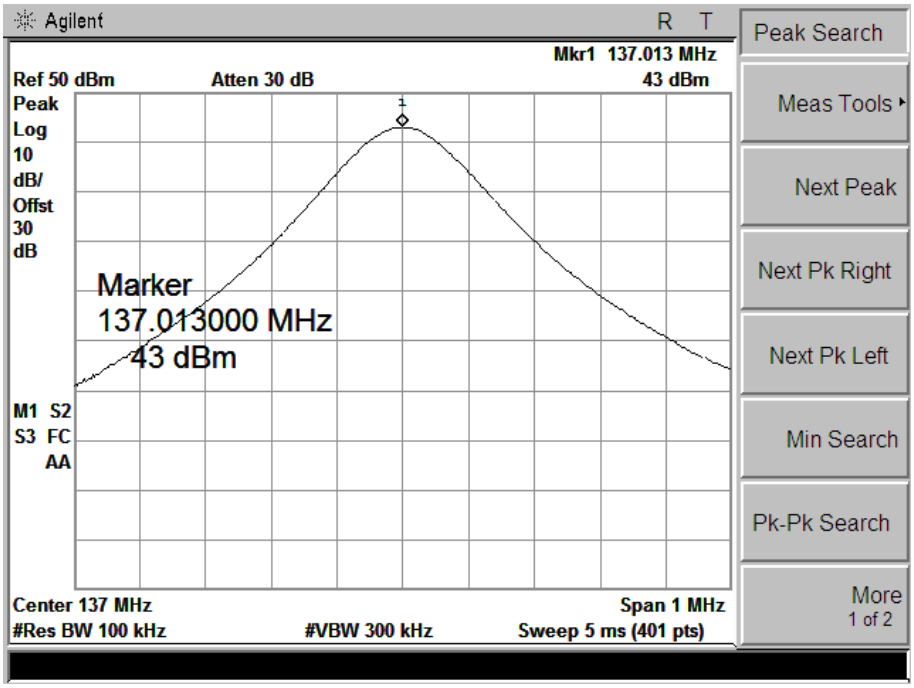
Low Power

Frequency Range (MHz)	Modulation Type	Channel Separation (KHz)	Test Channel	Maximum Output Power Test Results (dBm)
136-174	Analog/FM	12.5	Low	34.61
			Middle	34.63
			High	34.37
136-174	Digital/4FSK	12.5	Low	34.51
			Middle	34.40
			High	34.04
Limit	The limit is dependent upon the station's antenna HAAT and required service area.			
Test Results	Compliance			

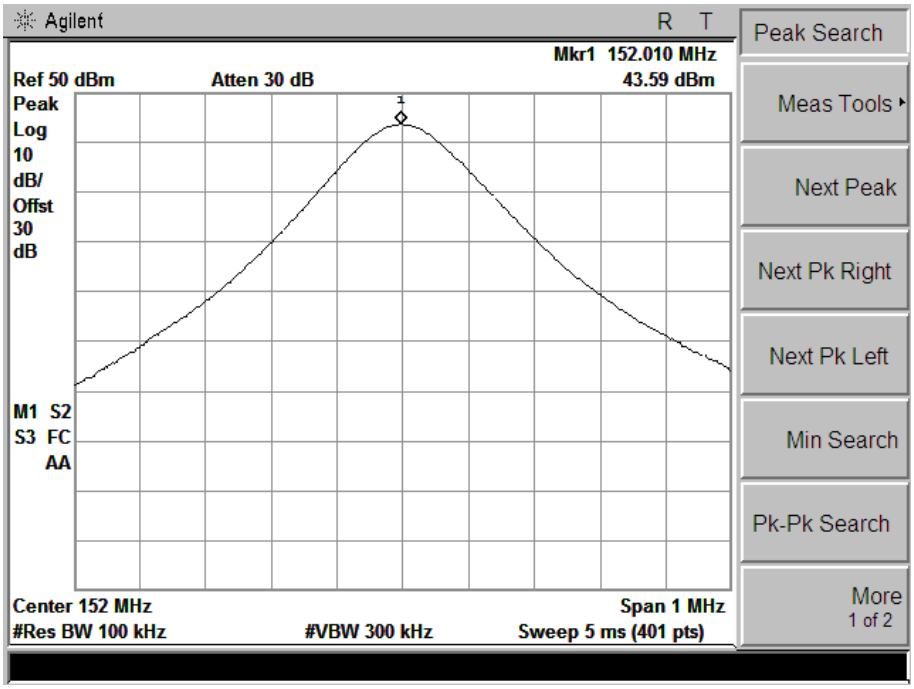
Plots of Maximum Transmitter Power Measurement

High Power:

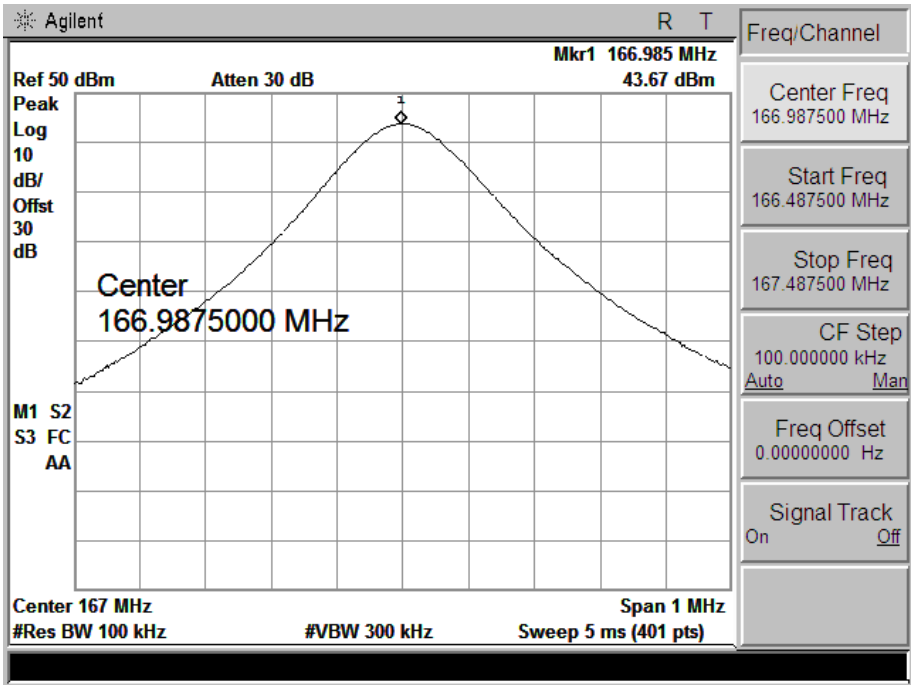
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
4FSK	12.5 KHz	137.0125	25	43.00	Varies	Compliance



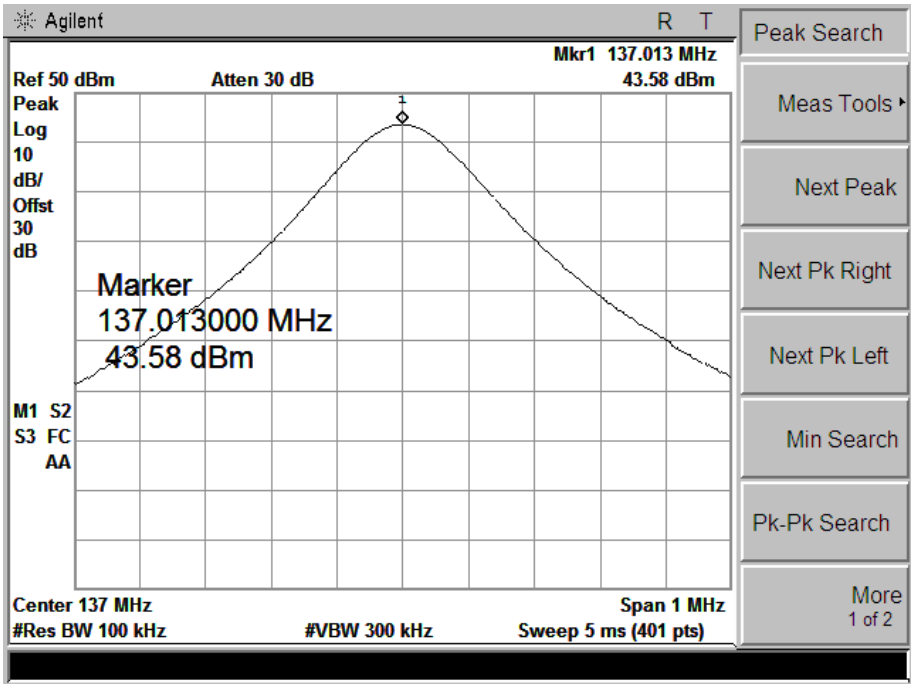
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
4FSK	12.5KHz	152.0125	25	43.59	Varies	Compliance



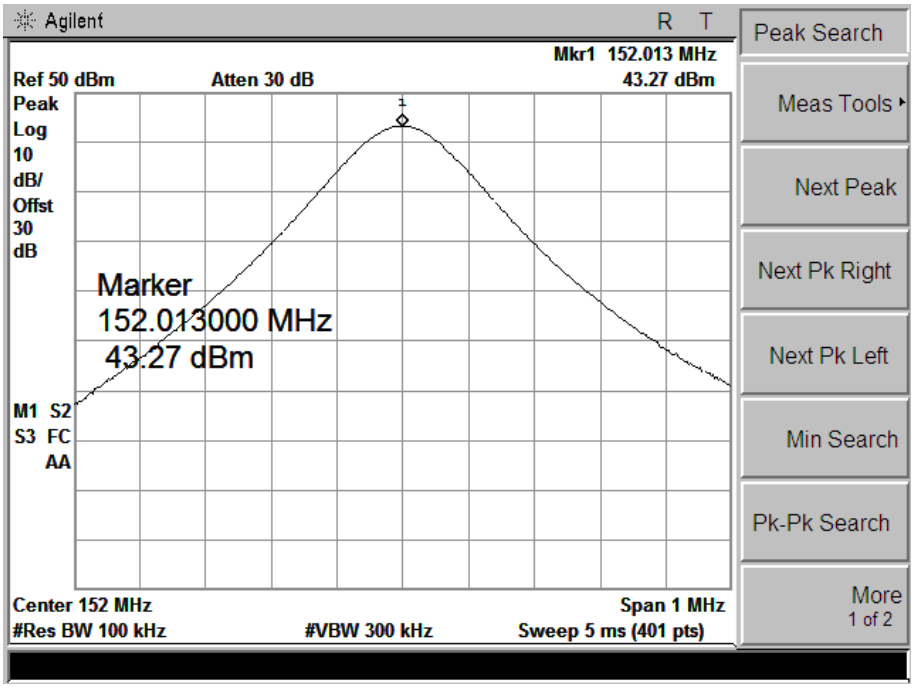
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
4FSK	12.5 KHz	166.9875	25	43.67	Varies	Compliance



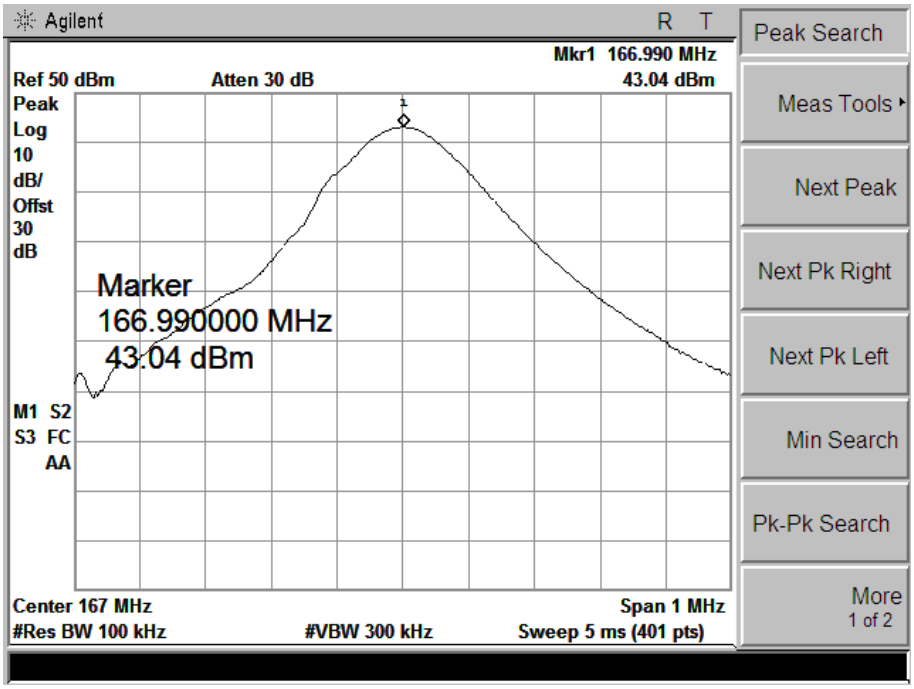
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
FM	12.5KHz	137.0125	25	43.58	Varies	Compliance



Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
FM	12.5KHz	152.0125	25	43.27	Varies	Compliance

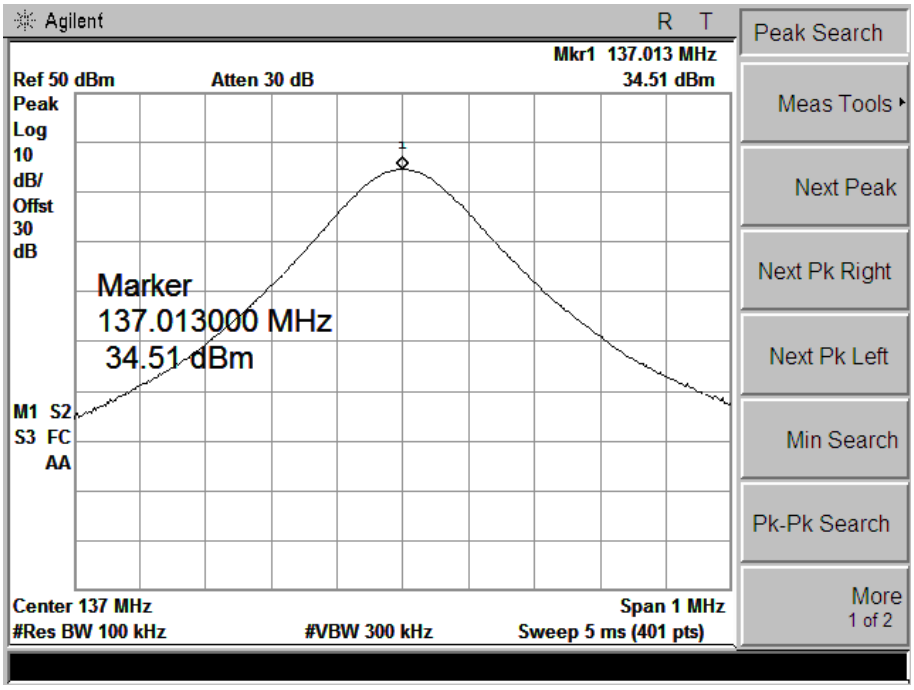


Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
FM	12.5KHz	166.9875	25	43.04	Varies	Compliance

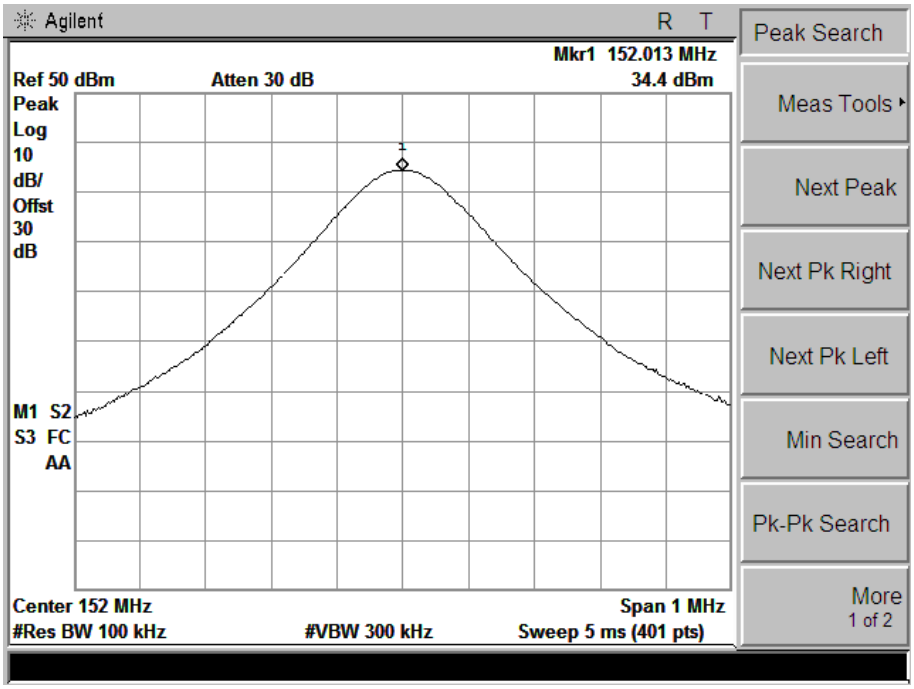


Low Power:

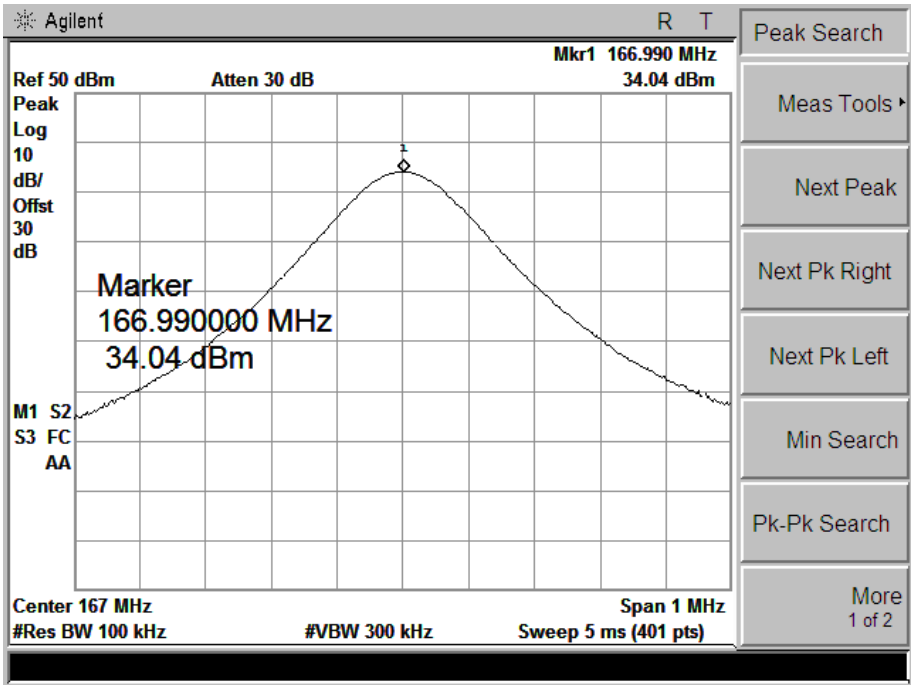
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
4FSK	12.5 KHz	137.0125	3	34.51	Varies	Compliance



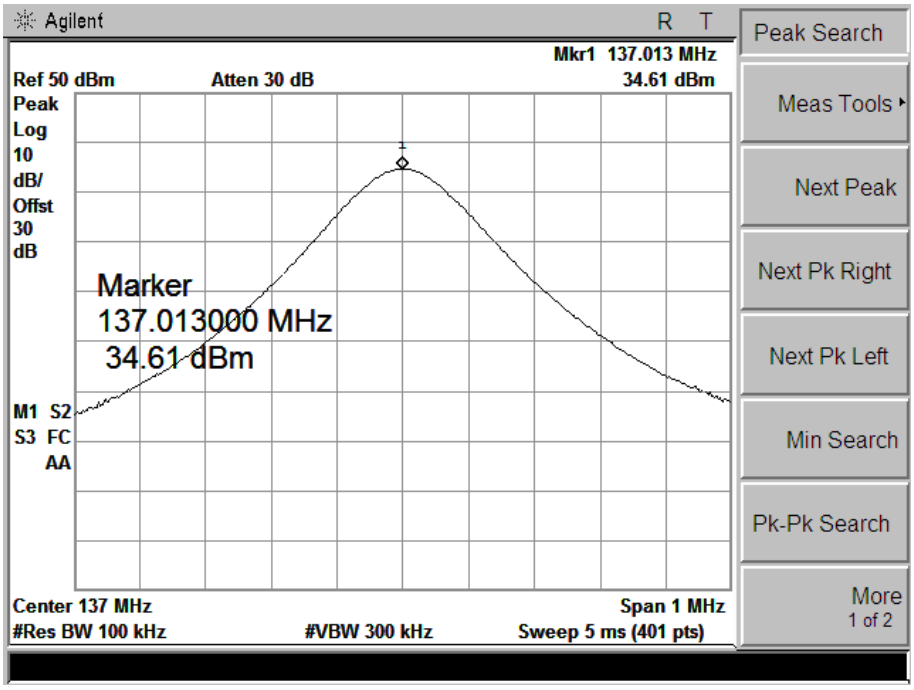
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
4FSK	12.5KHz	152.0125	3	34.40	Varies	Compliance



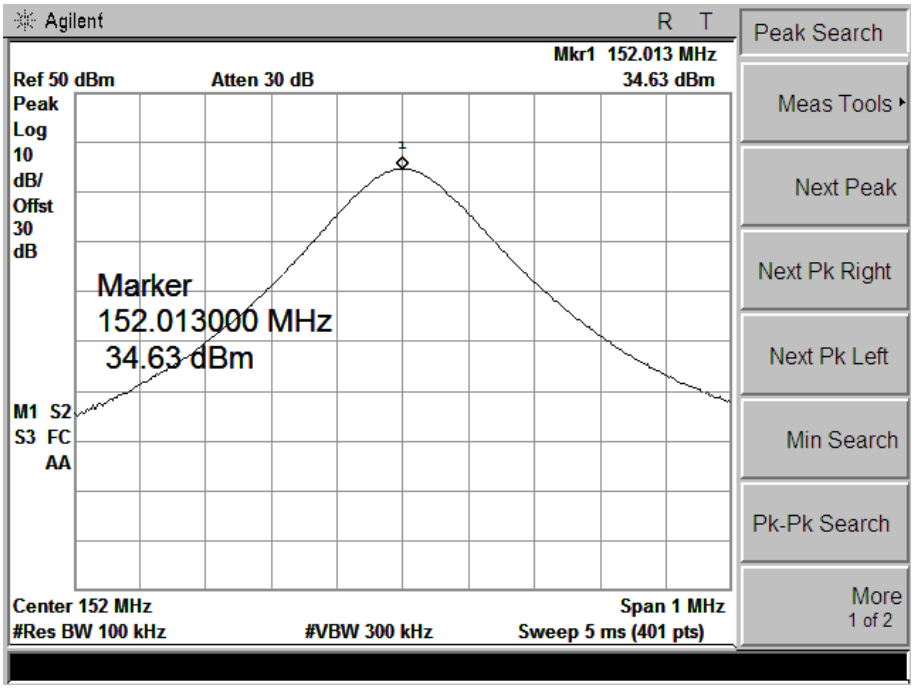
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
4FSK	12.5 KHz	166.9875	3	34.04	Varies	Compliance



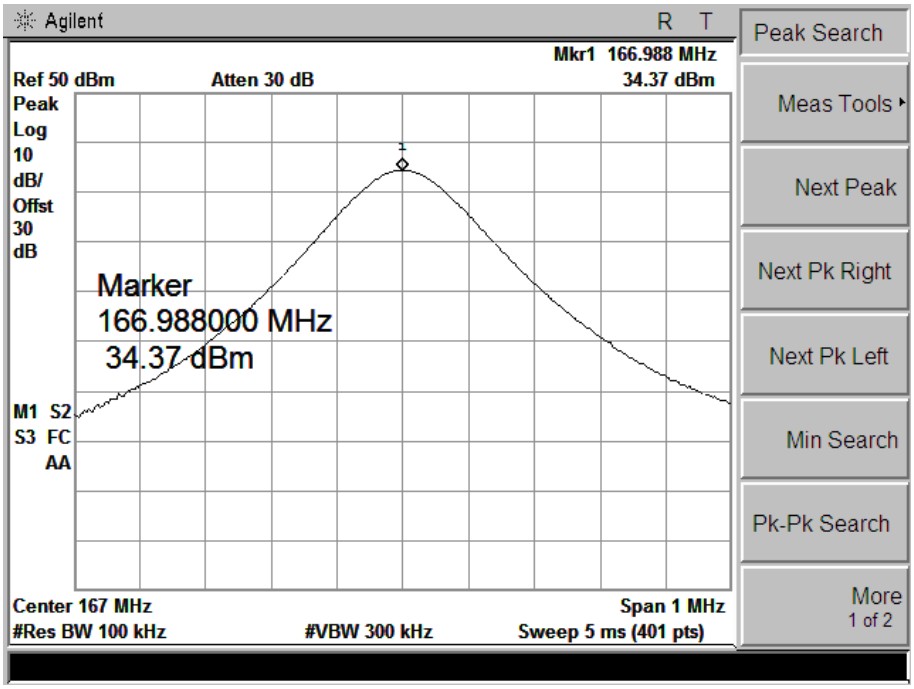
Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
FM	12.5KHz	137.0125	3	34.61	Varies	Compliance



Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
FM	12.5KHz	152.0125	3	34.63	Varies	Compliance



Modulation	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Type Results
FM	12.5KHz	166.9875	3	34.37	Varies	Compliance



4.8. Transmitter Frequency Behavior

TEST APPLICABLE

Section 90.214

Transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

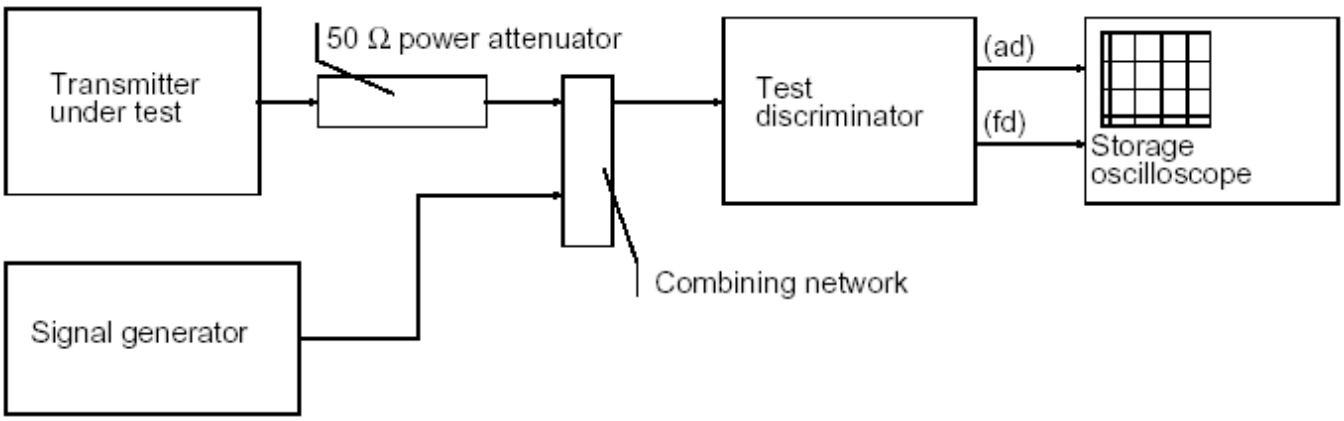
Time intervals [1, 2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 KHz Channels			
t_1 [4]	± 25.0 KHz	5.0 ms	10.0 ms
t_2	± 12.5 KHz	20.0 ms	25.0 ms
t_3 [4]	± 25.0 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 KHz Channels			
t_1 [4]	± 12.5 KHz	5.0 ms	10.0 ms
t_2	± 6.25 KHz	20.0 ms	25.0 ms
t_3 [4]	± 12.5 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 KHz Channels			
t_1 [4]	±6.25 KHz	5.0 ms	10.0 ms
t_2	±3.125 KHz	20.0 ms	25.0 ms
t_3 [4]	±6.25 KHz	5.0 ms	10.0 ms

1. t_{on} is the instant when a 1 KHz test signal is completely suppressed, including any capture time due to phasing.
   t_1 is the time period immediately following t_{on}.
   t_2 is the time period immediately following t_1.
   t_3 is the time period from the instant when the transmitter is turned off until t_{off}.
   t_{off} is the instant when the 1 KHz test signal starts to rise.
2. During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in § 90.213.
3. Difference between the actual transmitter frequency and the assigned transmitter frequency.
4. If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

TEST PROCEDURE

TIA/EIA-603 2.2.19

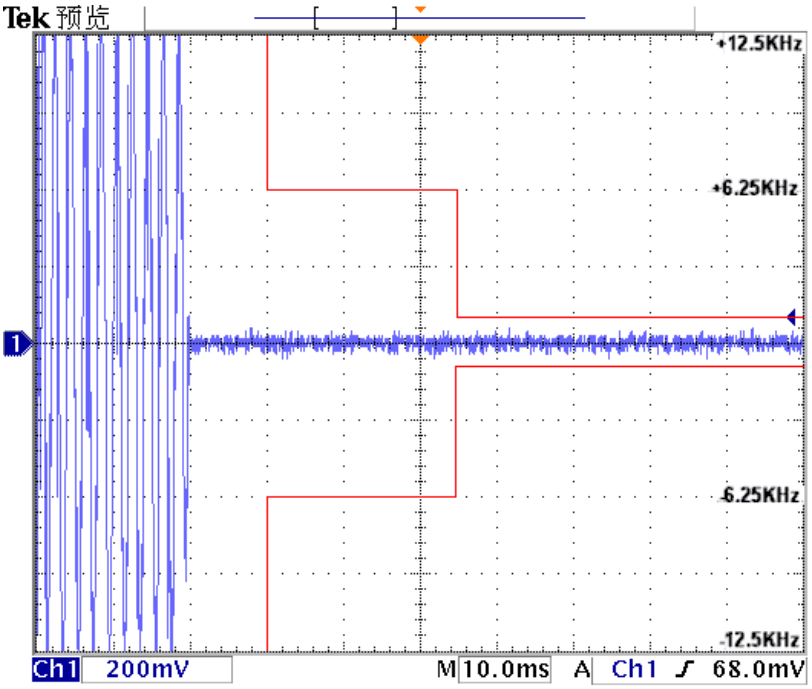
TEST CONFIGURATION



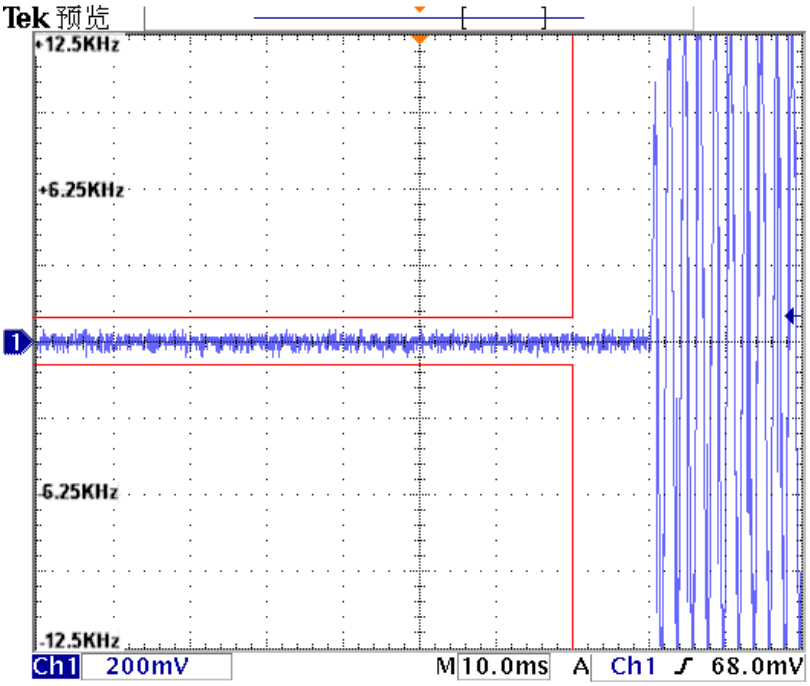
TEST RESULTS

Modulation Type: FM

Transmitter Frequency Behavior @ 12.5 KHz Channel Separation------Off – On

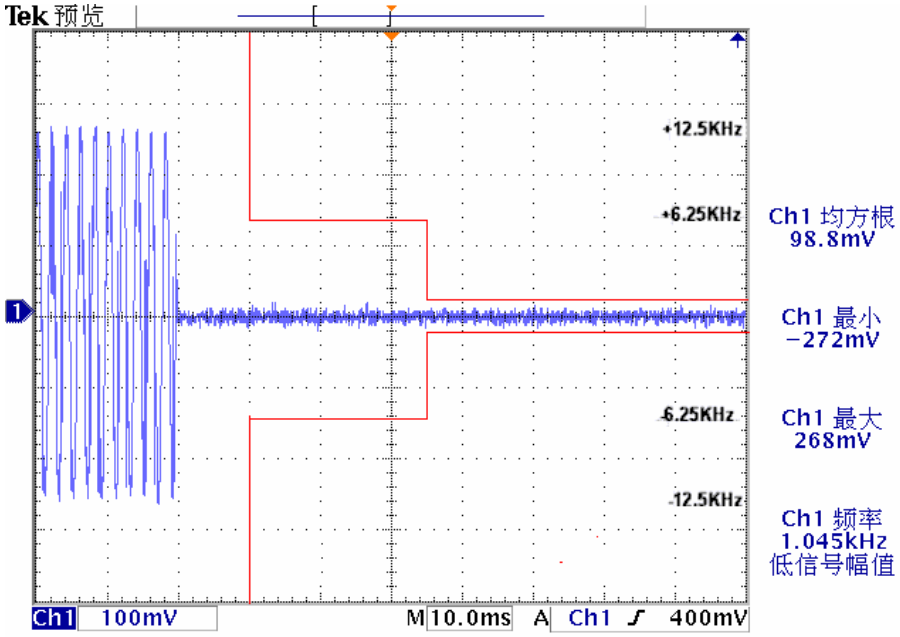


Transmitter Frequency Behavior @ 12.5 KHz Channel Separation------Off – On

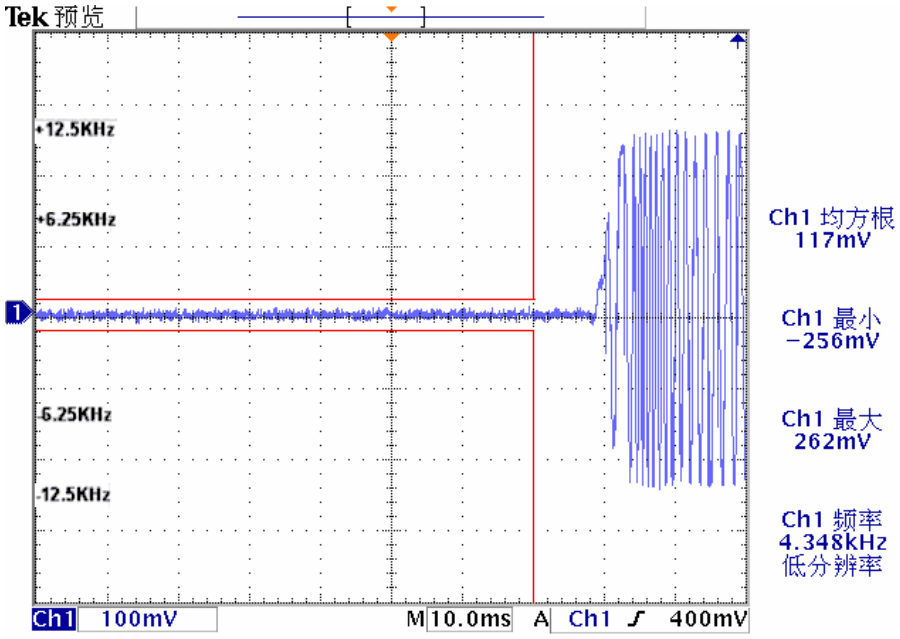


Modulation Type: 4FSK

Transmitter Frequency Behavior @ 12.5 KHz Channel Separation------Off – On

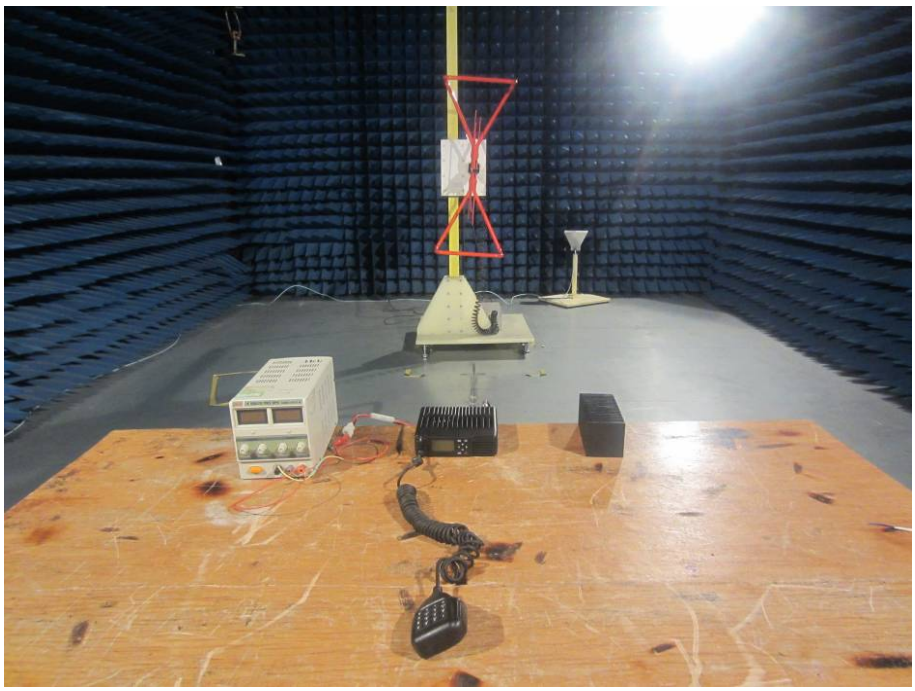


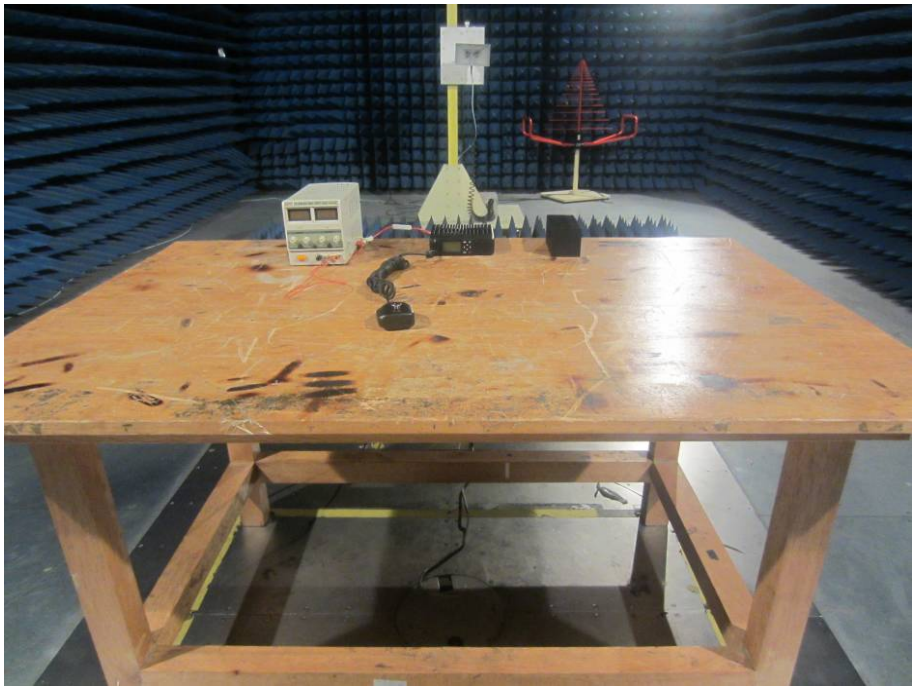
Transmitter Frequency Behavior @ 12.5 KHz Channel Separation------Off – On



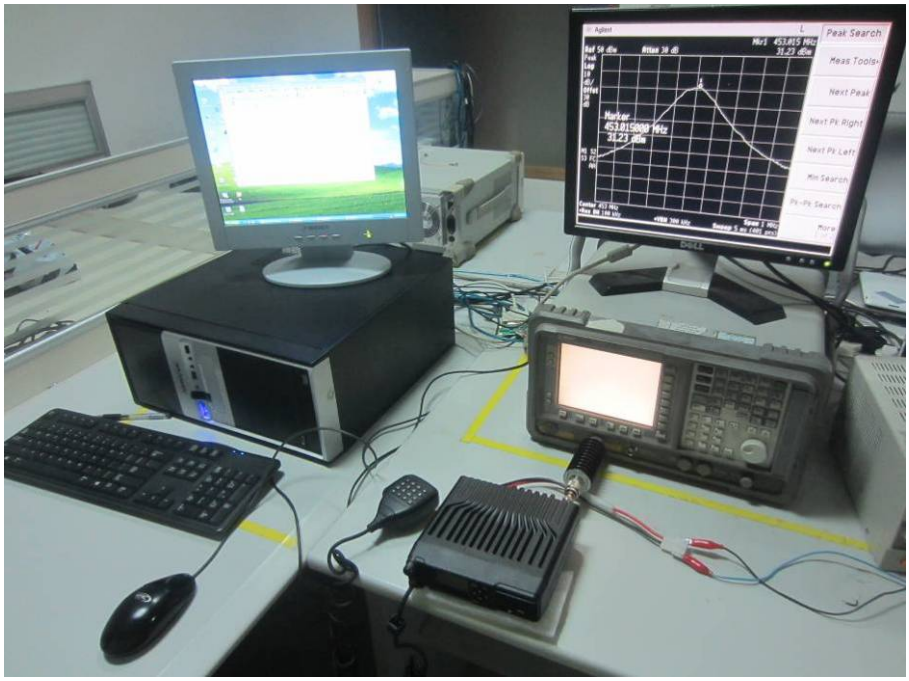
5 Test Setup Photos of the EUT

Radiated emission test





RF test



End of the report