Shenzhen CTL Electromagnetic Technology Co., Ltd.
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FCC PART 90 Test Report

Report Reference No.....:	**CTL1308241339-WF**
Compiled by (position+printed name+signature)..:	File administrators Jacky Chen
Name of the organization performing the tests (position+printed name+signature)..:	Test Engineer Tracy Qi
Approved by (position+printed name+signature)..:	Manager Tracy Qi
Date of issue.....:	Sept.11, 2013
Testing Laboratory Name .....:	**Shenzhen CTL Electromagnetic Technology Co., Ltd.**
Address.....:	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Applicant's name.....:	**Quantun Electronics, LLC**
Address.....:	14005 NW 8 Street Unit 2 Sunrise, Florida 33323, USA
Test specification:	
Standard .....:	**FCC Part 90: PRIVATE LAND MOBILE RADIO SERVICES**
TRF Originator.....:	Shenzhen CTL Electromagnetic Technology Co., Ltd.
Master TRF.....:	Dated 2011-01

Test item description ..... :	**Two-way Radio**
FCC ID..... :	**XMHQP-990-U1**
Trade Mark .....:	Quantun
Model/Type reference.....:	QP-990-U1
Modulation……..:	FM, 4L-FSK
Channel Separation.....	FM: 12.5KHz, 4L-FSK: 6.25KHz
Power Supply……..:	DC 7.4V
Rated Power……..:	4W
Operating Frequency Range…….:	From 400 MHz to 470 MHz
Result.....:	**Positive**

TEST REPORT

Test Report No. :	CTL1308241339-WF	Sept.11, 2013 Date of issue

Equipment under Test	:	Two-way Radio
Model /Type	:	QP-990-U1
Listed Models	:	/
Applicant	:	**Quantun Electronics, LLC**
Address	:	14005 NW 8 Street Unit 2 Sunrise, Florida 33323, USA
Manufacture	:	**Shenzhen Surwave Technologies Co., LTD**
Address	:	RM602-603, Bagua RD.2 Bagualing, Futian District, Shenzhen, China

Test Result according to the standards on page 4:	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

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

Date of receipt of test sample	:	Aug. 24, 2013
Testing commenced on	:	Aug. 24, 2013
Testing concluded on	:	Sept.11, 2013

2.2. Equipment Under Test

Power supply system utilised

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

DC 7.4 V from battery

2.3. Short description of the Equipment under Test (EUT)

The Quantun Electronics, LLC's Model: QP-990-U1 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	Two-way Radio	
Model Number	QP-990-U1	
FCC ID		
IC		
Rated Output Power	4 Watts(36.02dBm)	
Support data rate	4.8kbps	
Modilation Type	FM for Analog Voice	
	4L-FSK for Digital Voice/Digital Data	
	4L-FSK for Digital Data	
	Analog	11K0F3E for 12.5KHz Channel Separation
	Digital	4K00F1E for 6.25KHz Channel Separation
		/
Channel Separation	Analog Voice	12.5KHz
	Digital Voice/Data	6.25KHz
	Digital Data	6.25KHz
Antenna Type	External	
Frequency Range	From 400 MHz to 470 MHz	
Maximum Output Power	Analog	3.98 W for 12.5 KHz Channel Separation
	Digital	3.81 W for 6.25 KHz 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 Channel	Test Frequency (MHz)	
				TX	RX
400-470	Digital/4L-FSK	6.25	D001	406.5000	450.5000
			D002	418.0000	460.5000
			D003	435.5000	469.5000
			D004	453.5000	450.5000
			D005	469.5000	460.5000
	Analog/FM	12.5	A012	406.5000	450.5000
			A013	418.0000	460.5000
			A014	435.5000	469.5000
			A015	453.5000	450.5000
			A016	469.5000	460.5000

2.4. Short description of the Equipment under Test (EUT)

400-470MHz Two-way Radio (QP-990-U1).

For more details, refer to the user's manual of the EUT.

Serial number: Prototype

2.5. EUT operation mode

The EUT has been tested under typical operating condition.

2.6. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

●	Power Cable	Length (m) :	1.6m
		Shield :	No
		Detachable :	No
○	Multimeter	Manufacturer :	/
		Model No. :	/

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

This submittal(s) (test report) is intended for FCC ID: XMHQP-990-U1 filing to comply with the FCC Part 90 Rules.

2.8. Modifications

No modifications were implemented to meet testing criteria.

2.9. Note

The EUT is is a U frequency band (400-470MHz) Two-way Radio, The functions of the EUT listed as below:

	Test Standards	Reference Report
Radio	FCC Part 90	CTL1308241339-WF

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Bontek Compliance Testing Laboratory Ltd
1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 338263

Bontek Compliance Testing Laboratory Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 338263, March 24, 2008.

IC Registration No.: 7631A

The 3m alternate test site of Bontek Compliance Testing Laboratory Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 7631A on March, 2011.

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

Fig. 2-1 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

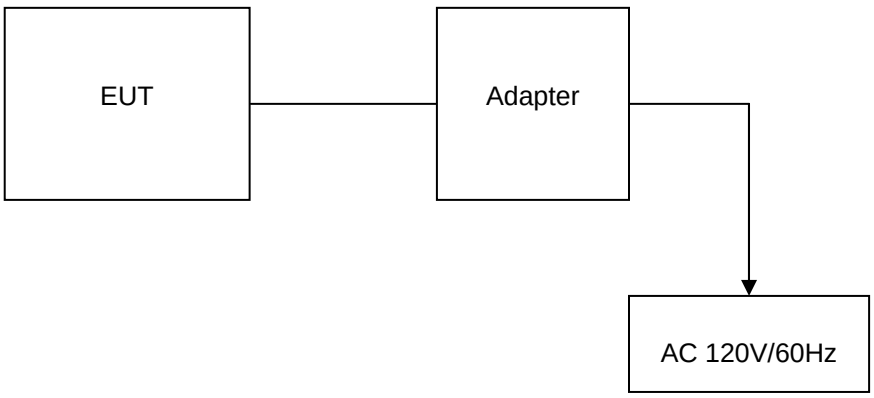


Table 2-1 Equipment Used in Tested System

Adapter: Model: SSA101F120103BR
Input:100-240V～50/60Hz 0.2A
Output: +12V DC 0.4A
Power Cable: 160cm
◇ Shielded ◆ Unshielded

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 Bontek Compliance Testing Laboratory 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 Bontek laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	1~12.75GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(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.	Last Cal.	Due. Date
1	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	2013/04/14	2014/04/13
2	Radio Communication Tester	ROHDE & SCHWARZ	CMU200	2013/04/14	2014/04/13
3	Dual Directional Coupler	Agilent	778D	2013/04/14	2014/04/13
4	10dB attenuator	SCHWARZBECK	MTAIMP-136	2013/04/14	2014/04/13
5	Tunable Bandreject filter	K&L	3TNF-800	2013/04/14	2014/04/13
6	Tunable Bandreject filter	K&L	5TNF-1700	2013/04/14	2014/04/13
7	High-Pass Filter	K&L	9SH10-2700/X12750-O/O	2013/04/14	2014/04/13
8	High-Pass Filter	K&L	41H10-1375/U12750-O/O	2013/04/14	2014/04/13
9	Coaxial Cable	Huber+Suhner	AC4-RF-H	2013/04/14	2014/04/13
10	AC Power Supply	IDRC	CF-500TP	2013/04/14	2014/04/13
11	DC Power Supply	IDRC	CD-035-020PR	2013/04/14	2014/04/13
12	RF Current Probe	FCC	F-33-4	2013/04/14	2014/04/13
13	Temperature /Humidity Meter	zhicheng	ZC1-2	2013/04/14	2014/04/13
14	MICROWAVE AMPLIFIER	HP	8349B	2013/04/14	2014/04/13
15	Amplifier	HP	8447D	2013/04/14	2014/04/13
16	SIGNAL GENERATOR	HP	8647A	2013/04/14	2014/04/13
17	Log Periodic Antenna	ELECTRO-METRICS	EM-6950	2013/04/14	2014/04/13
18	Horn Antenna	Schwarzbeck	BBHA9120A	2013/04/14	2014/04/13

19	EMI Test Receiver	R&S	ESPI	2013/04/14	2014/04/13
20	Loop Antenna	ZHINAN	ZN30900A	2013/04/14	2014/04/13
21	Horn Antenna	Schwarzbeck	BBHA9120D	2013/04/14	2014/04/13
22	Horn Antenna	Schwarzbeck	BBHA9170	2013/04/14	2014/04/13

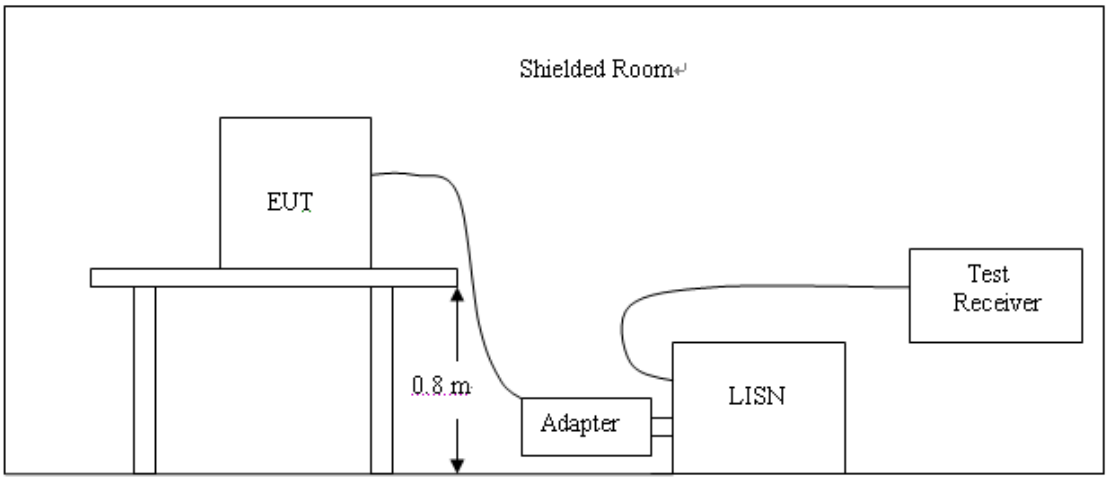
3.7. General Technical Requirements and Summary of Test Results

FCC Rules	Description of Test	Test Result
§ 15.107	Conducted Emission	Complies
§ 15.109	Receiver Radiated Spurious Emission	Complies
§ 15.109	Receiver Conducted Spurious Emission	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 Behavior	Complies
§ 90.210	Transmitter Radiated Spurious Emission	Complies
§ 90.210	Spurious Emission On Antenna Port	Complies

4. TEST CONDITIONS AND RESULTS

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 DC13.6 V power from the battery.
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	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

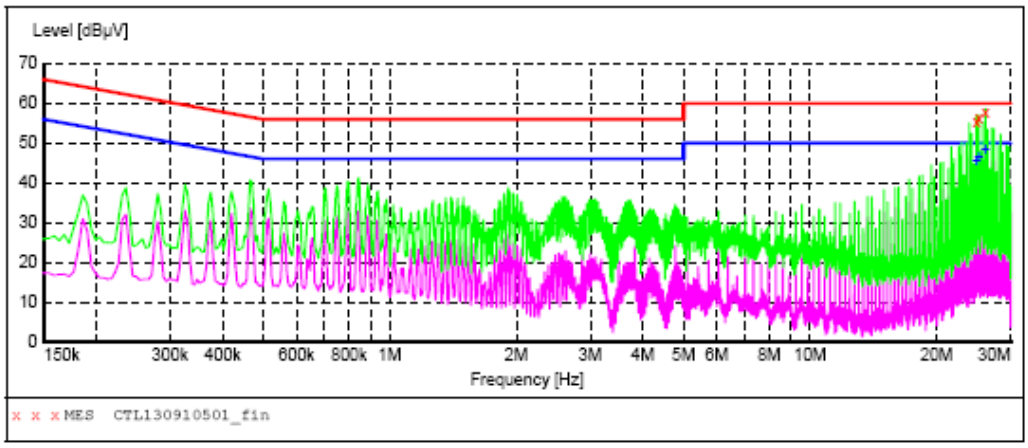
* Decreasing linearly with the logarithm of the frequency

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

TEST RESULTS

For FM Modulation @ 12.5 KHz

SCAN TABLE: "Voltage (9K-30M) FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL130910501_fin"

9/10/2013 2:07PM

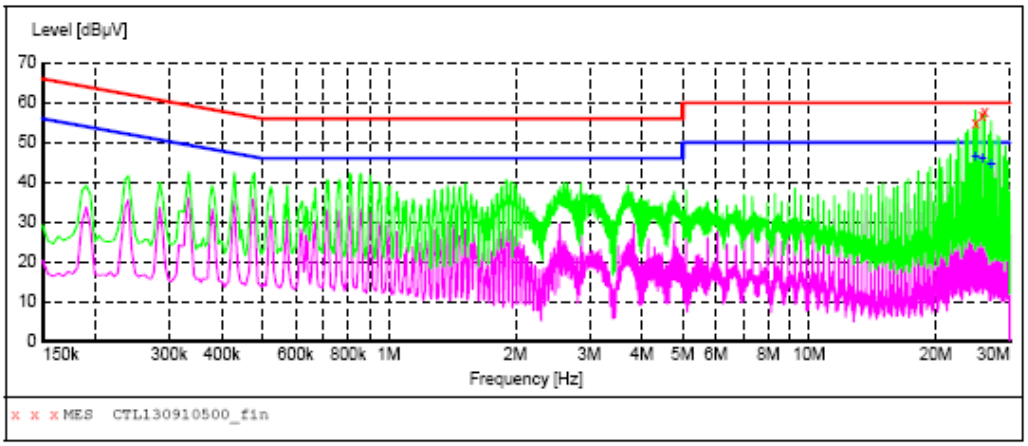
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
24.868500	55.40	10.4	60	4.6	QP	L1	GND
25.188000	56.30	10.5	60	3.7	QP	L1	GND
26.142000	58.00	10.5	60	2.0	QP	L1	GND

MEASUREMENT RESULT: "CTL130910501_fin2"

9/10/2013 2:07PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
24.868500	46.00	10.4	50	4.0	AV	L1	GND
25.183500	46.70	10.5	50	3.3	AV	L1	GND
26.142000	48.80	10.5	50	1.2	AV	L1	GND

SCAN TABLE: "Voltage (9K-30M) FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL130910500_fin"

9/10/2013 2:05PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
24.859500	55.10	10.4	60	4.9	QP	N	GND
25.818000	56.60	10.5	60	3.4	QP	N	GND
26.137500	57.60	10.5	60	2.4	QP	N	GND

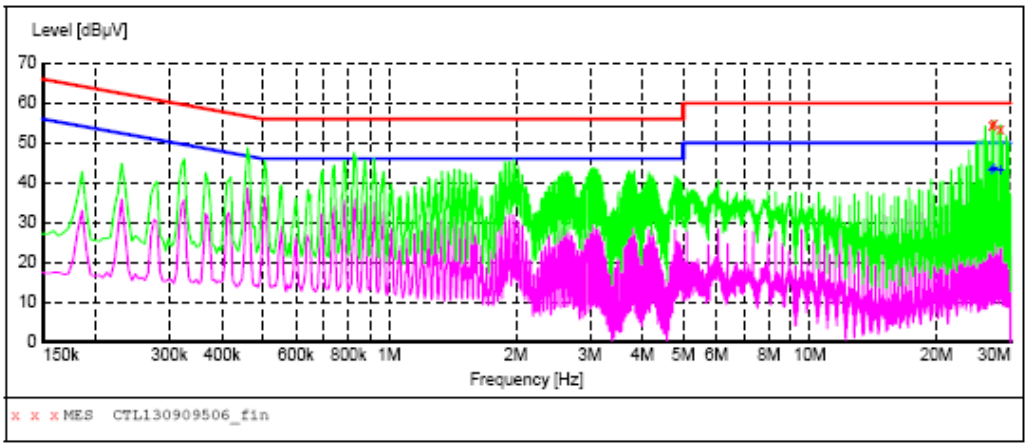
MEASUREMENT RESULT: "CTL130910500_fin2"

9/10/2013 2:05PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
24.864000	46.70	10.4	50	3.3	AV	N	GND
25.818000	46.50	10.5	50	3.5	AV	N	GND
27.096000	45.10	10.5	50	4.9	AV	N	GND

For 4L-FSK Modulation @ 6.25 KHz

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL130909506_fin"

9/9/2013 6:57PM

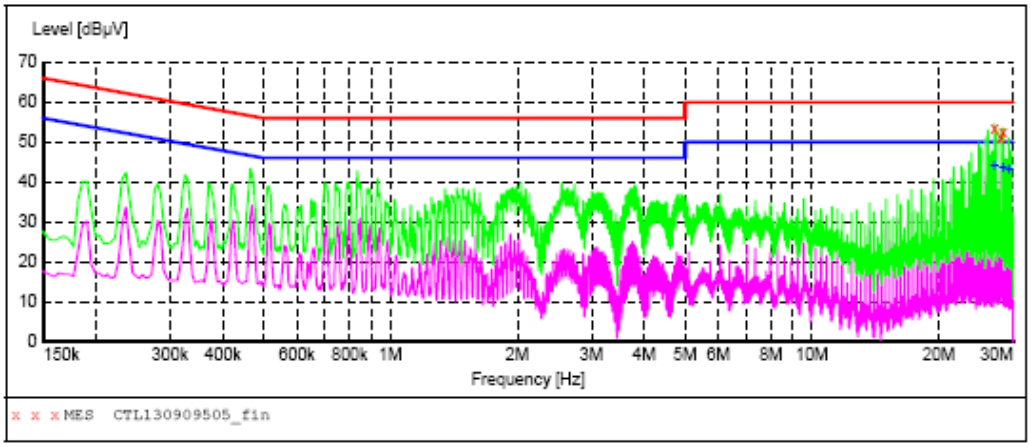
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
27.096000	54.20	10.5	60	5.8	QP	N	GND
27.415500	54.90	10.5	60	5.1	QP	N	GND
28.374000	53.40	10.5	60	6.6	QP	N	GND

MEASUREMENT RESULT: "CTL130909506_fin2"

9/9/2013 6:57PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
27.096000	43.50	10.5	50	6.5	AV	N	GND
27.415500	44.10	10.5	50	5.9	AV	N	GND
28.374000	43.20	10.5	50	6.8	AV	N	GND

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL130909505_fin"

9/9/2013 6:54PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
27.096000	53.60	10.5	60	6.4	QP	L1	GND
28.054500	50.90	10.5	60	9.1	QP	L1	GND
28.369500	52.70	10.5	60	7.3	QP	L1	GND

MEASUREMENT RESULT: "CTL130909505_fin2"

9/9/2013 6:54PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
27.096000	44.20	10.5	50	5.8	AV	L1	GND
28.369500	44.00	10.5	50	6.0	AV	L1	GND
29.328000	43.60	10.5	50	6.4	AV	L1	GND

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.

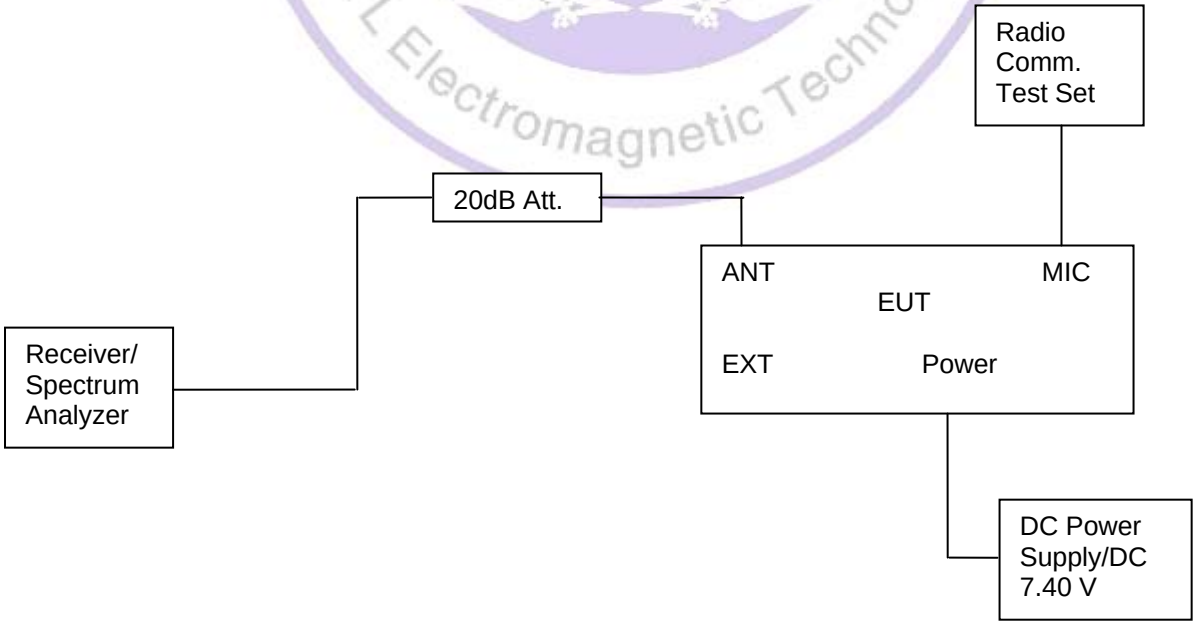
(d). Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emis-sion must be attenuated below the power (P) of the highest emission con-tained within the authorized band-width as follows:

(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 placed on a turn table which is 0.8m above ground plane.
2 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) and 5 kHz (25 kHz channel spacing).
3 Set EUT as normal operation.
4 Set SPA Center Frequency = fundamental frequency, RBW=300Hz, VBW= 3 KHz, span =50 KHz.
5 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

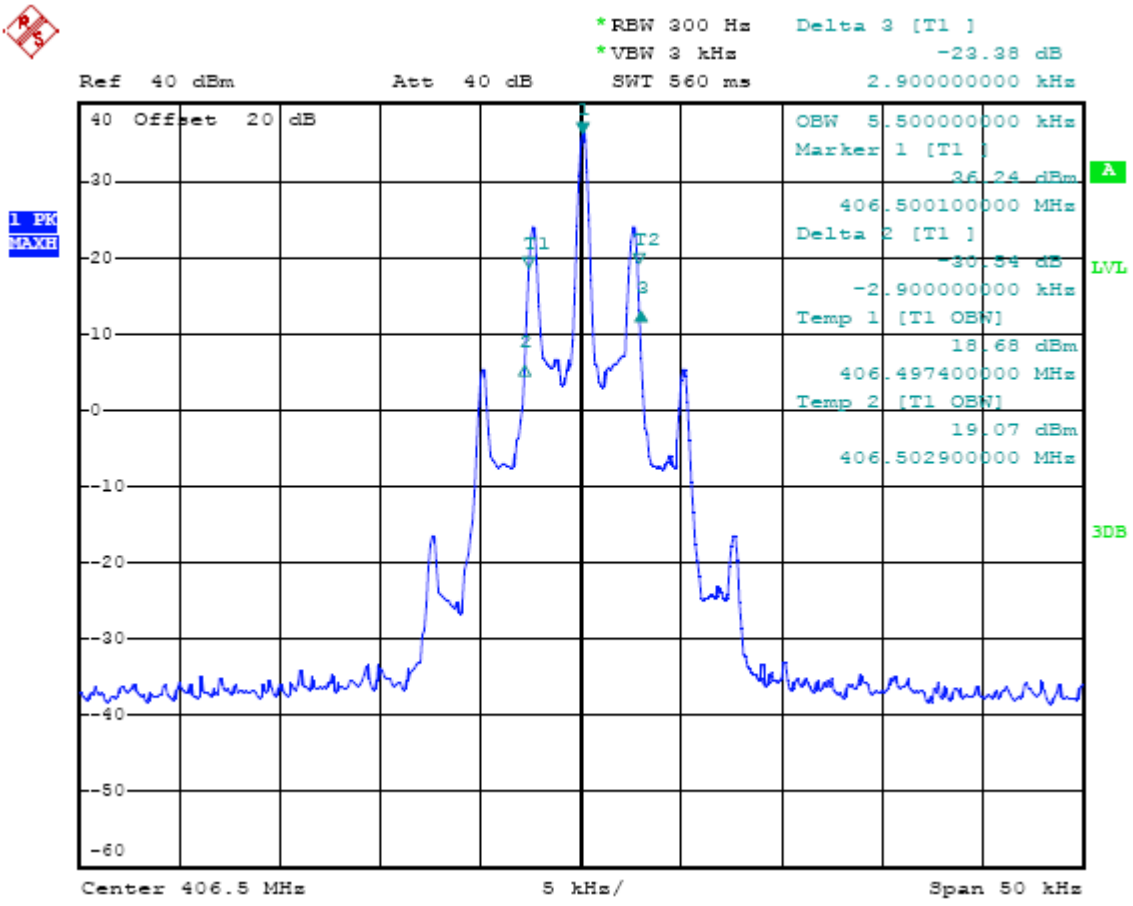
TEST RESULTS:

4.2.1 Occupied Bandwidth

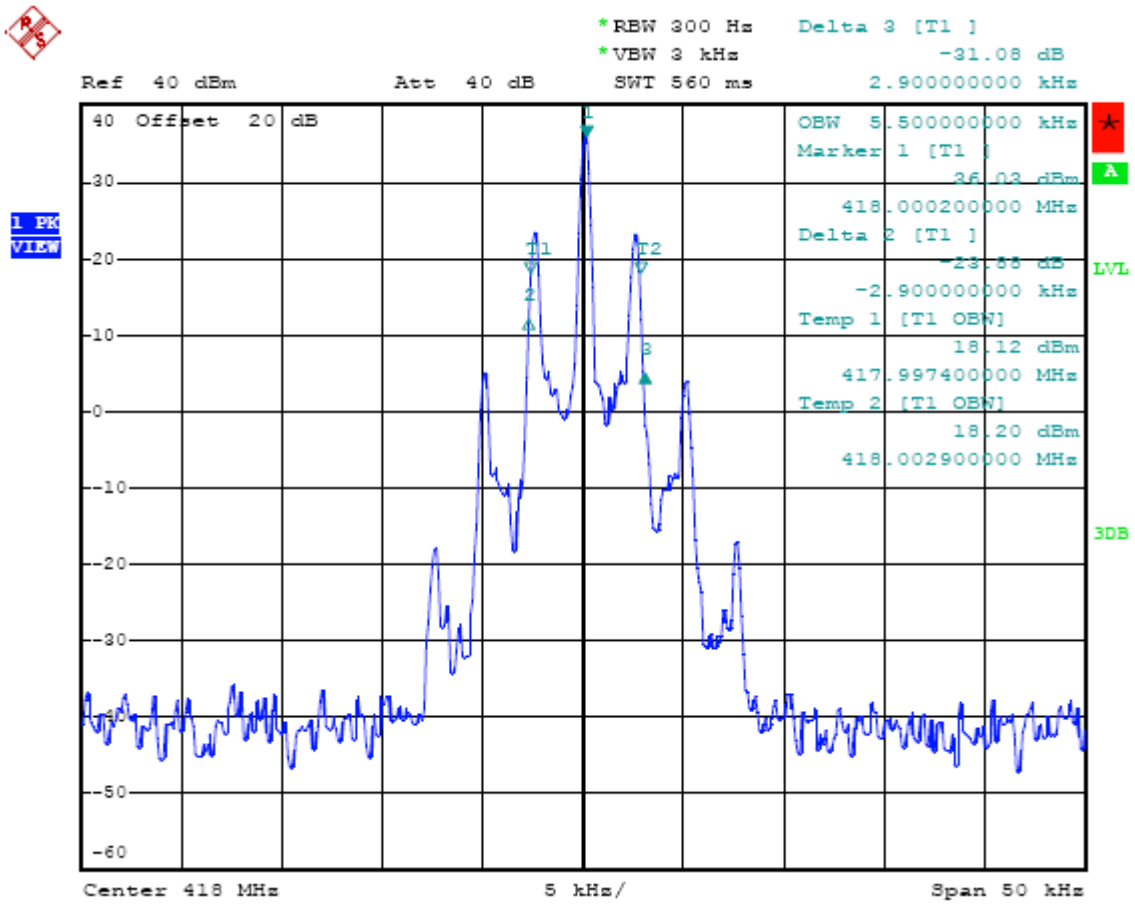
Modulation Type	Channel Separation	Test Channel	Test Frequency	99% Occupied Bandwidth	26dB Occupied Band width
FM	12.5KHz	D001	406.5000	5.50 KHz	5.80 KHz
		D002	418.0000	5.50 KHz	5.80 KHz
		D003	435.5000	5.40 KHz	5.80 KHz
		D004	453.5000	5.50 KHz	5.80 KHz
		D005	469.5000	5.40 KHz	5.80 KHz
4L-FSK	6.25KHz	A012	406.5000	2.45 KHz	3.05 KHz
		A013	418.0000	2.30 KHz	3.10 KHz
		A014	435.5000	2.40 KHz	3.35 KHz
		A015	453.5000	2.45 KHz	3.15 KHz
		A016	469.5000	2.40 KHz	3.40 KHz
Limit		11.25KHz for 12.5KHz Channel Separation			
		6.00KHz for 6.25KHz Channel Separation			
Test Results		Compliance			

Plots of 99% and 26dB Bandwidth Measurement

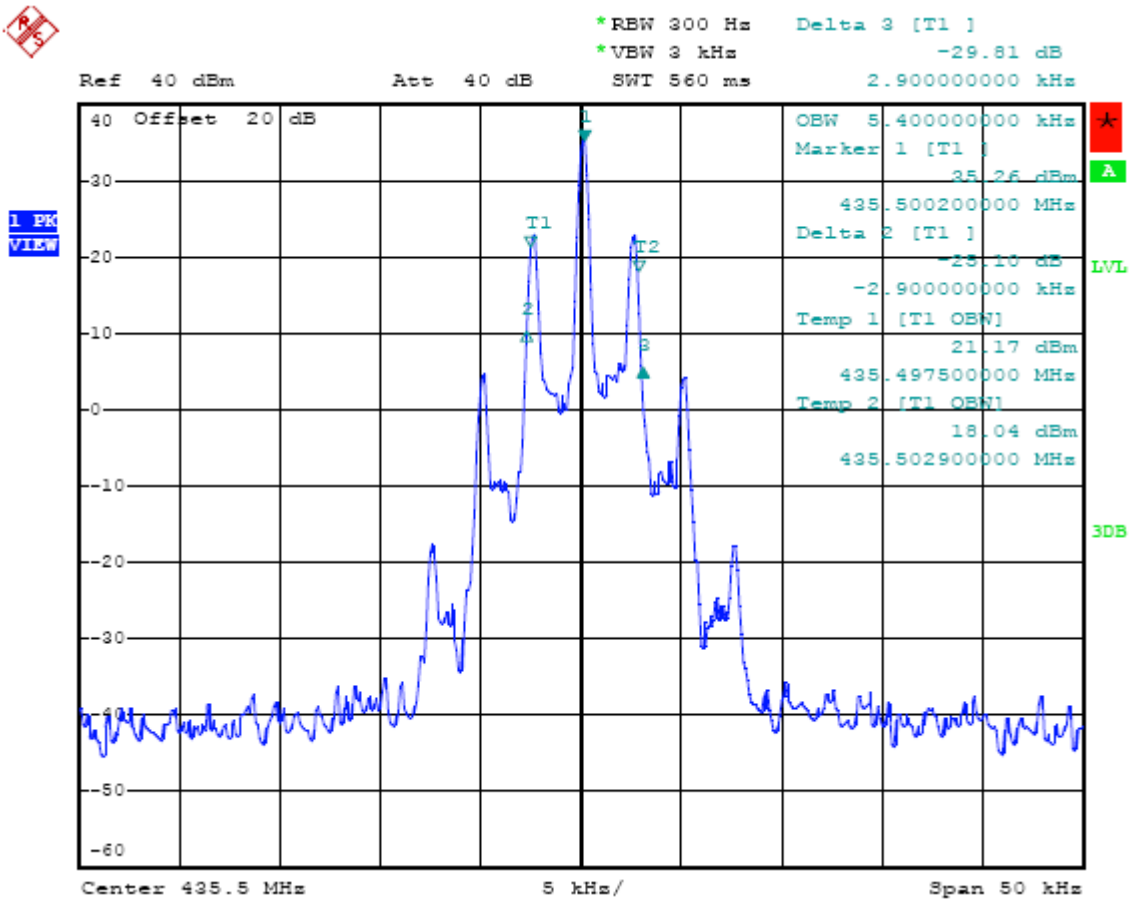
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5 KHz	406.5000	5.50	5.80	11.25	Compliance



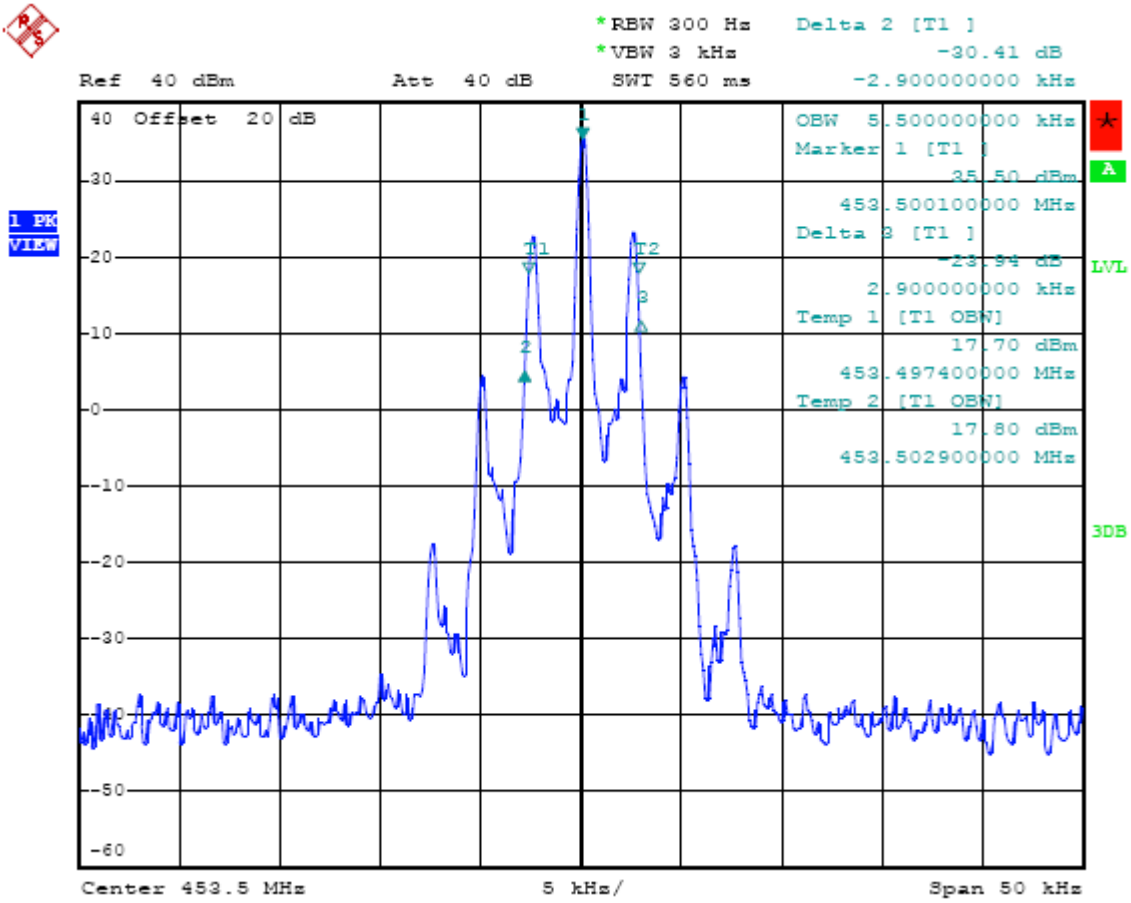
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5 KHz	418.000	5.50	5.80	11.25	Compliance



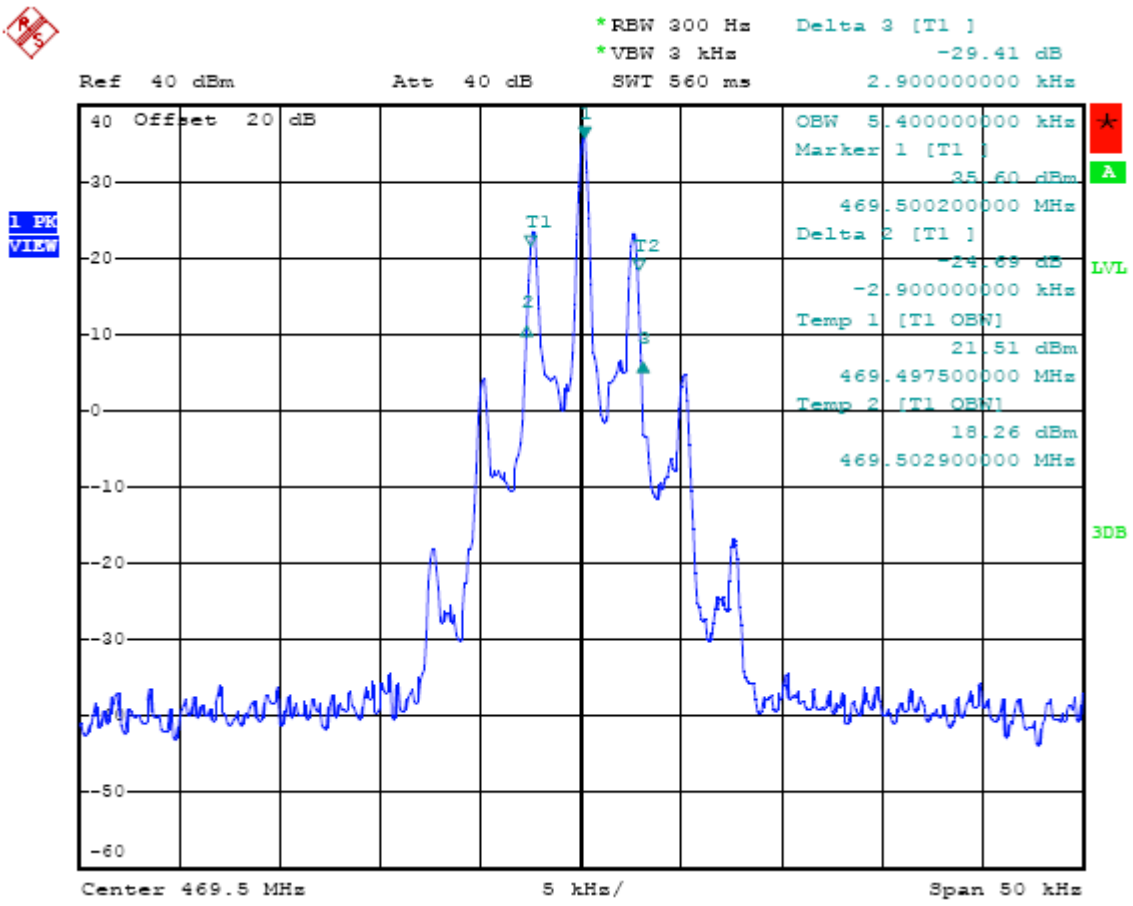
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5 KHz	435.5000	5.40	5.80	11.25	Compliance



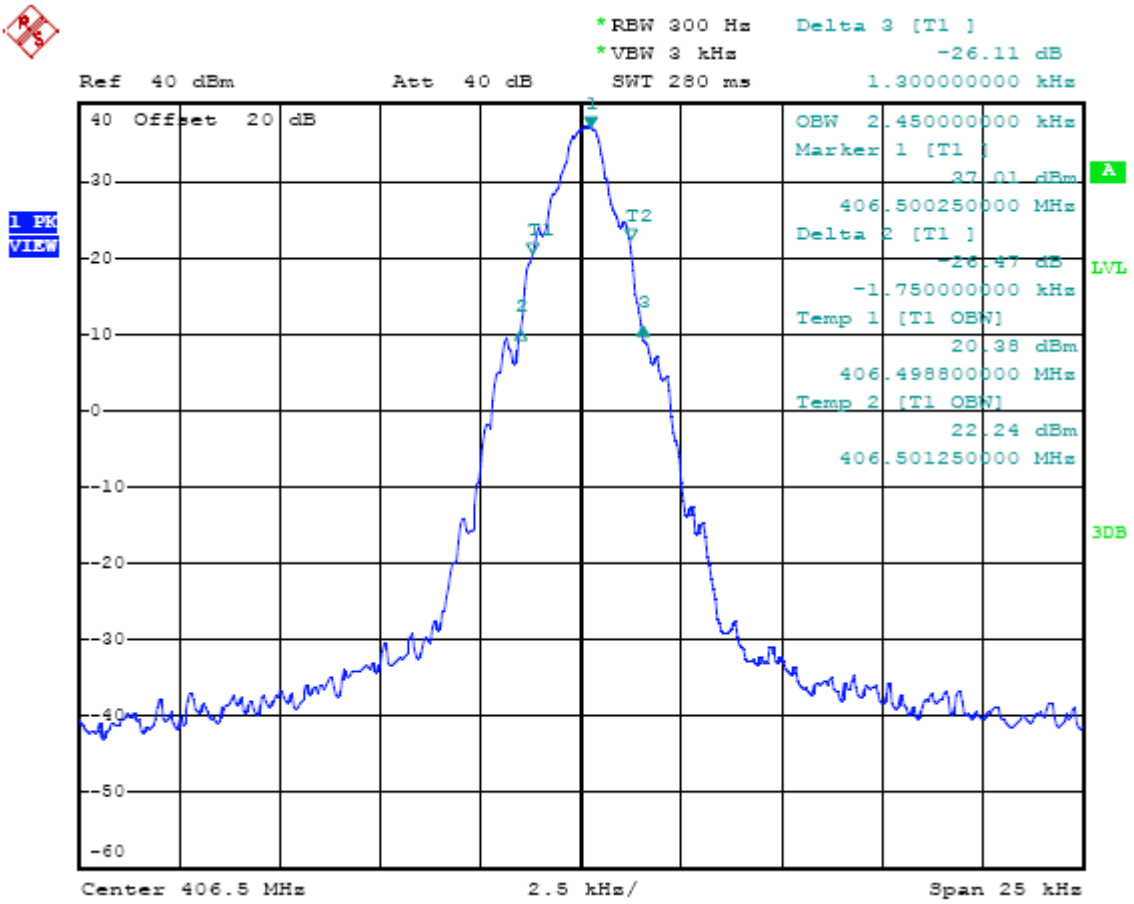
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5 KHz	453.5000	5.50	5.80	11.25	Compliance



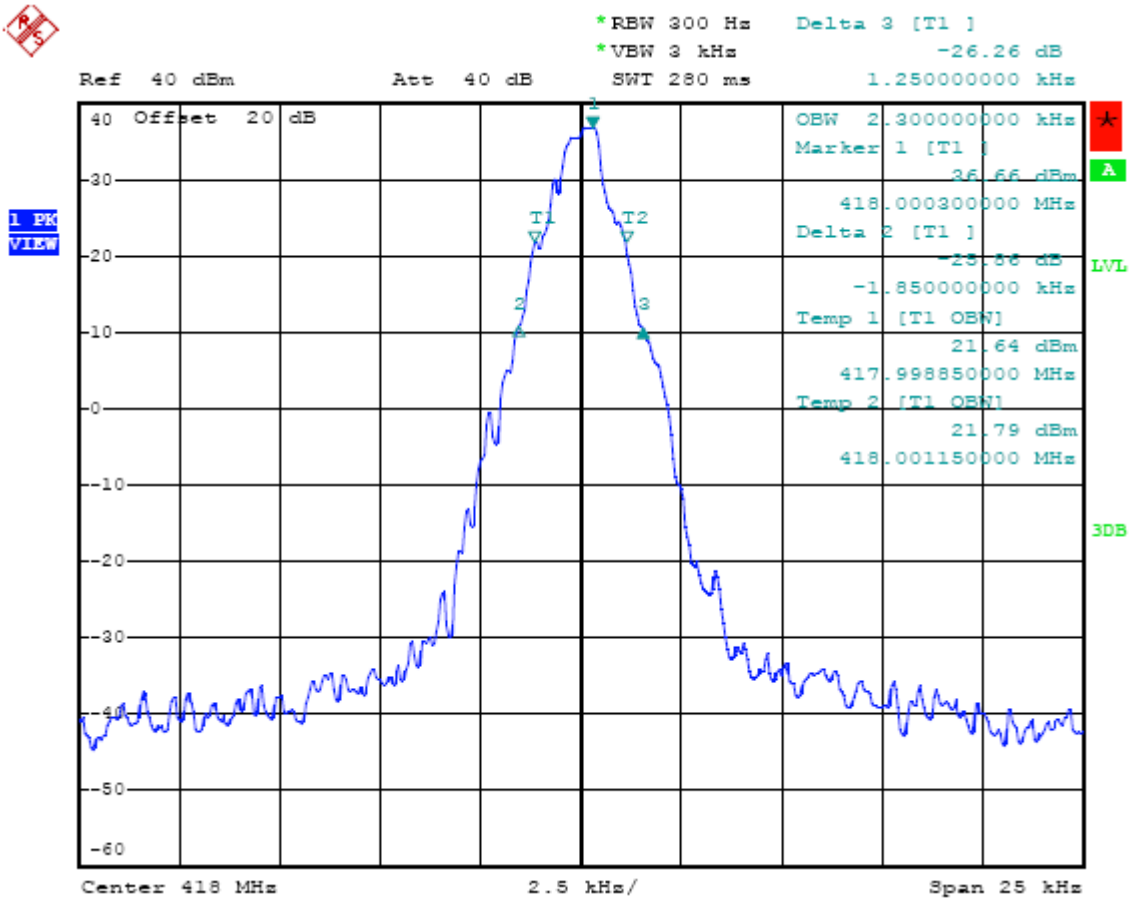
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	12.5 KHz	469.5000	5.40	5.80	11.25	Compliance



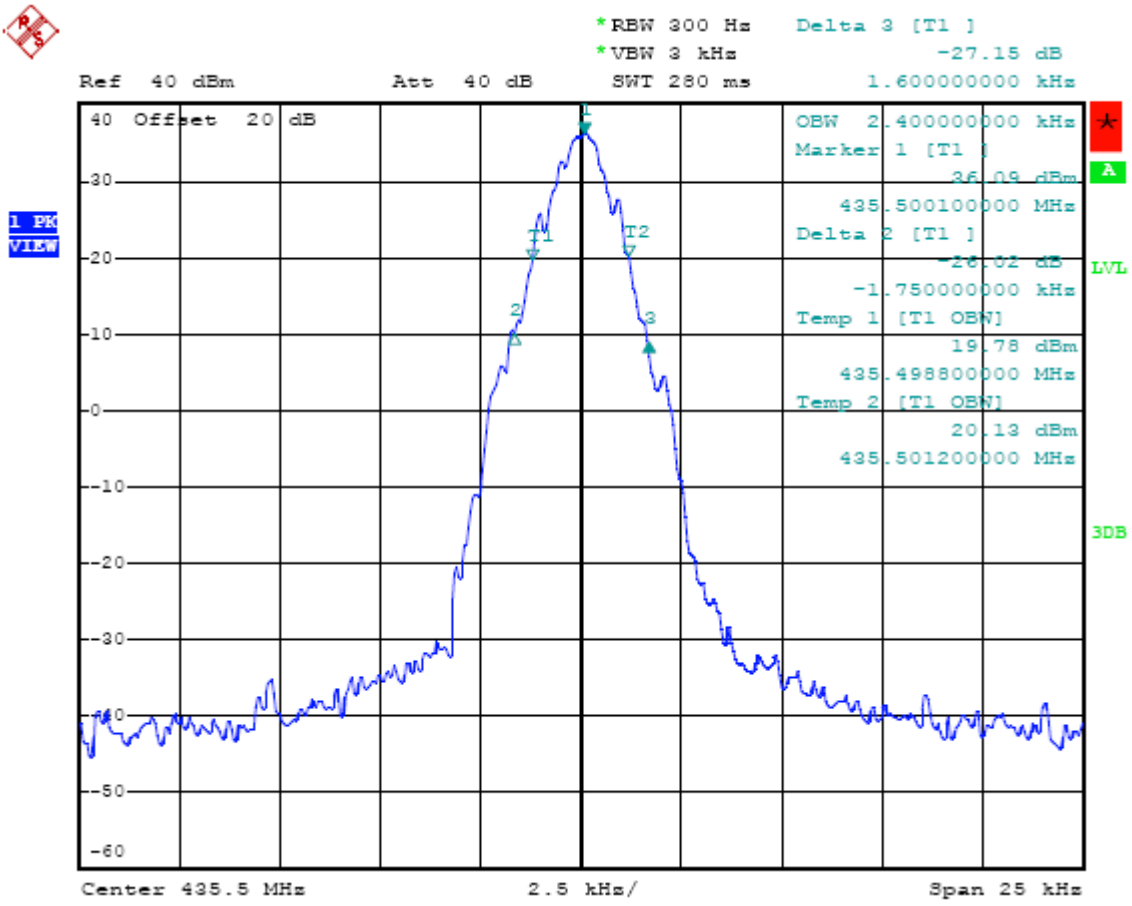
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4L-FSK	6.25 KHz	406.5000	2.45	3.05	6.00	Compliance



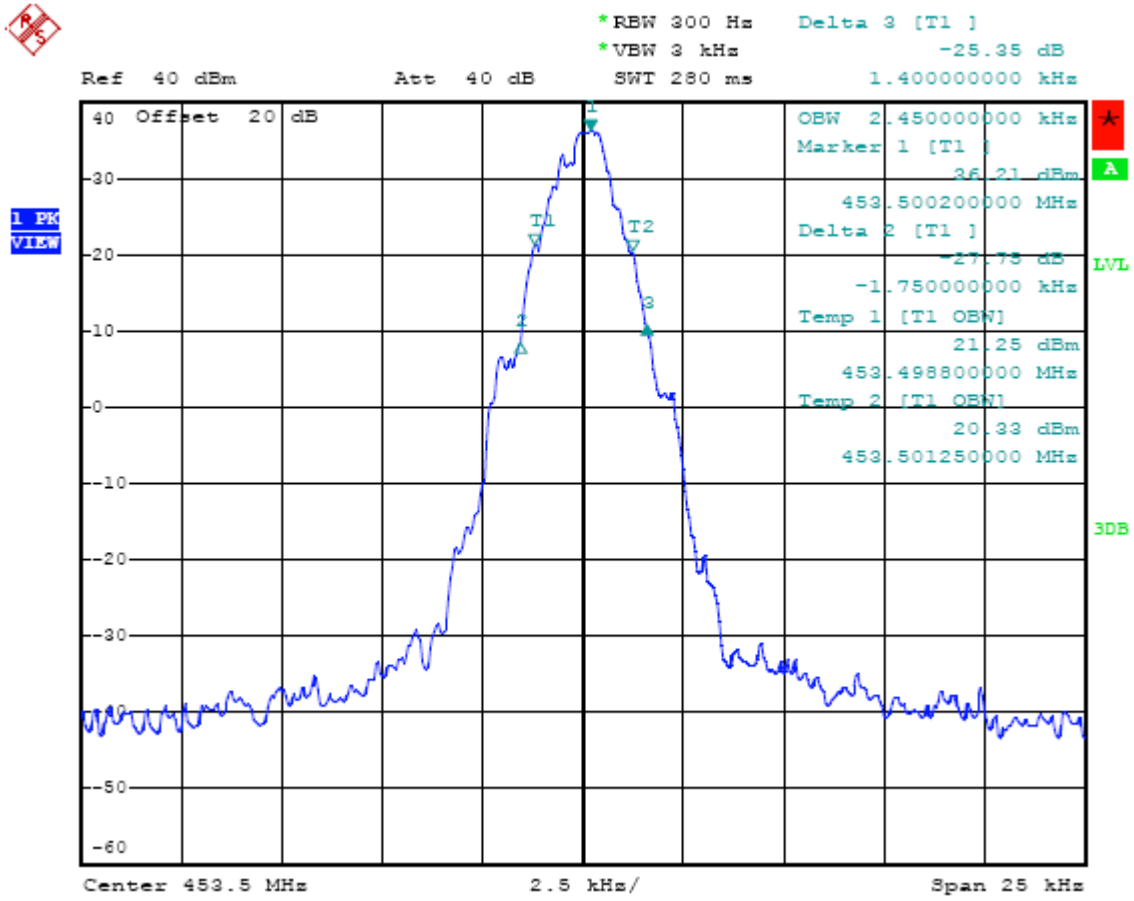
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4L-FSK	6.25 KHz	418.0000	2.30	3.10	6.000	Compliance



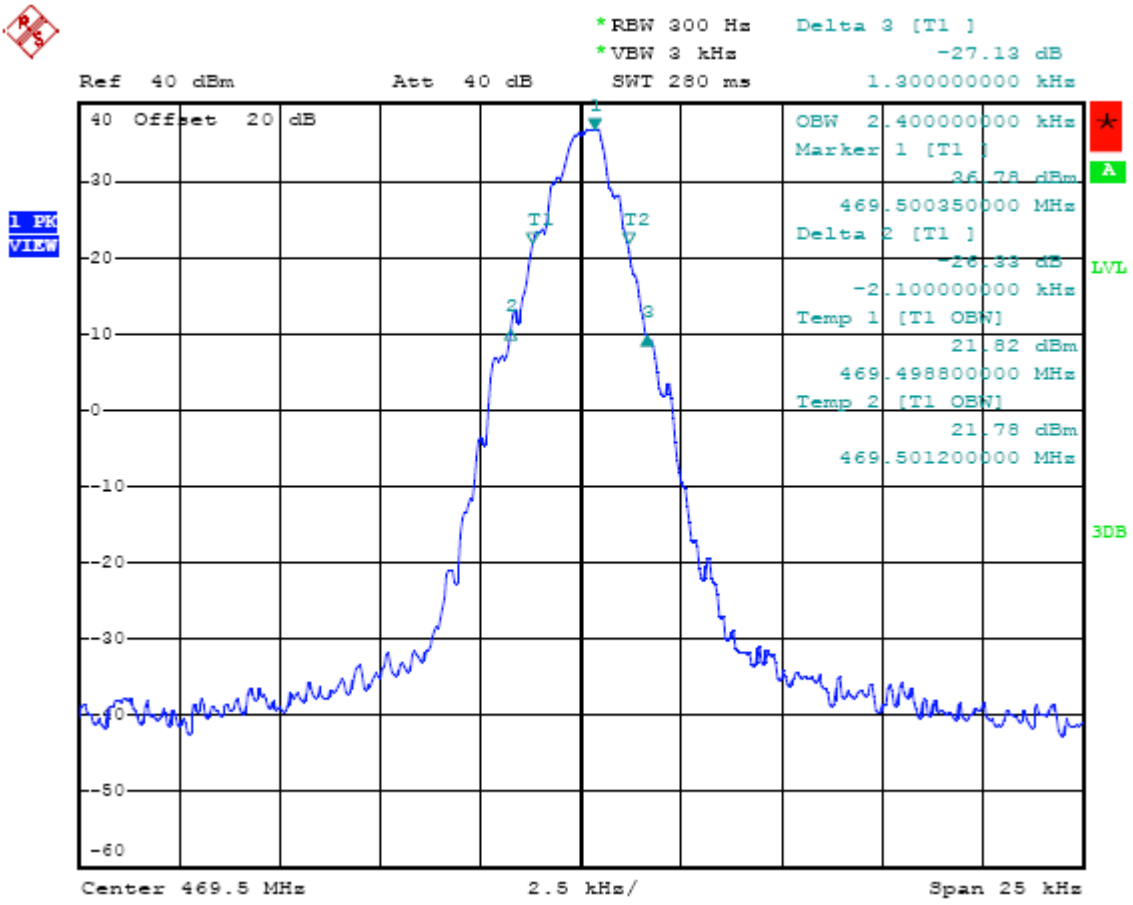
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4L-FSK	6.25 KHz	435.5000	2.40	3.35	6.000	Compliance



Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4L-FSK	6.25 KHz	453.5000	2.45	3.15	6.000	Compliance



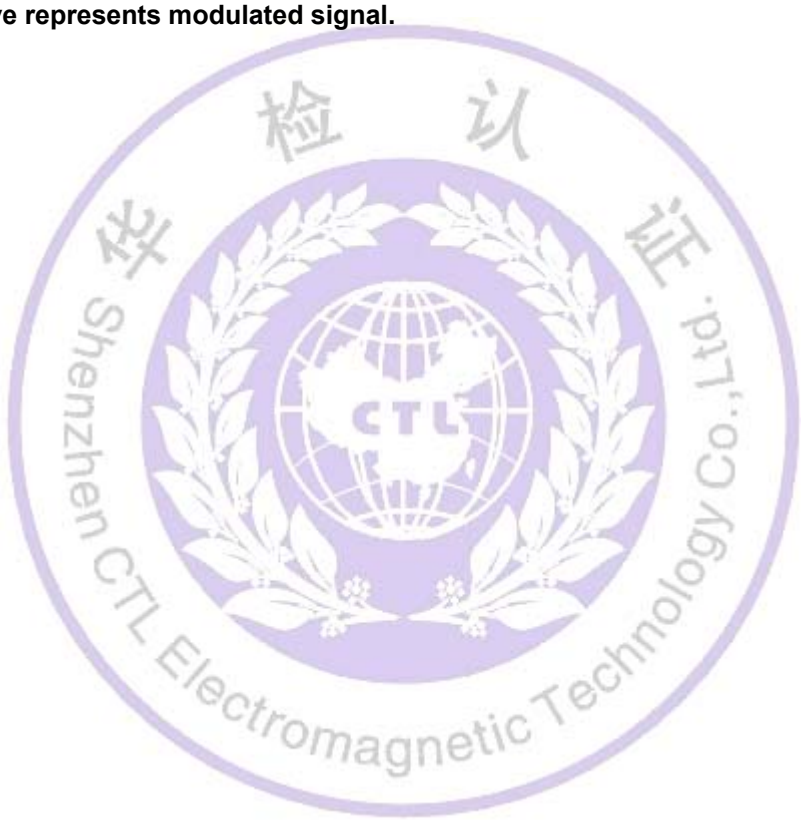
Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
4L-FSK	6.25 KHz	469.5000	2.40	3.40	6.000	Compliance



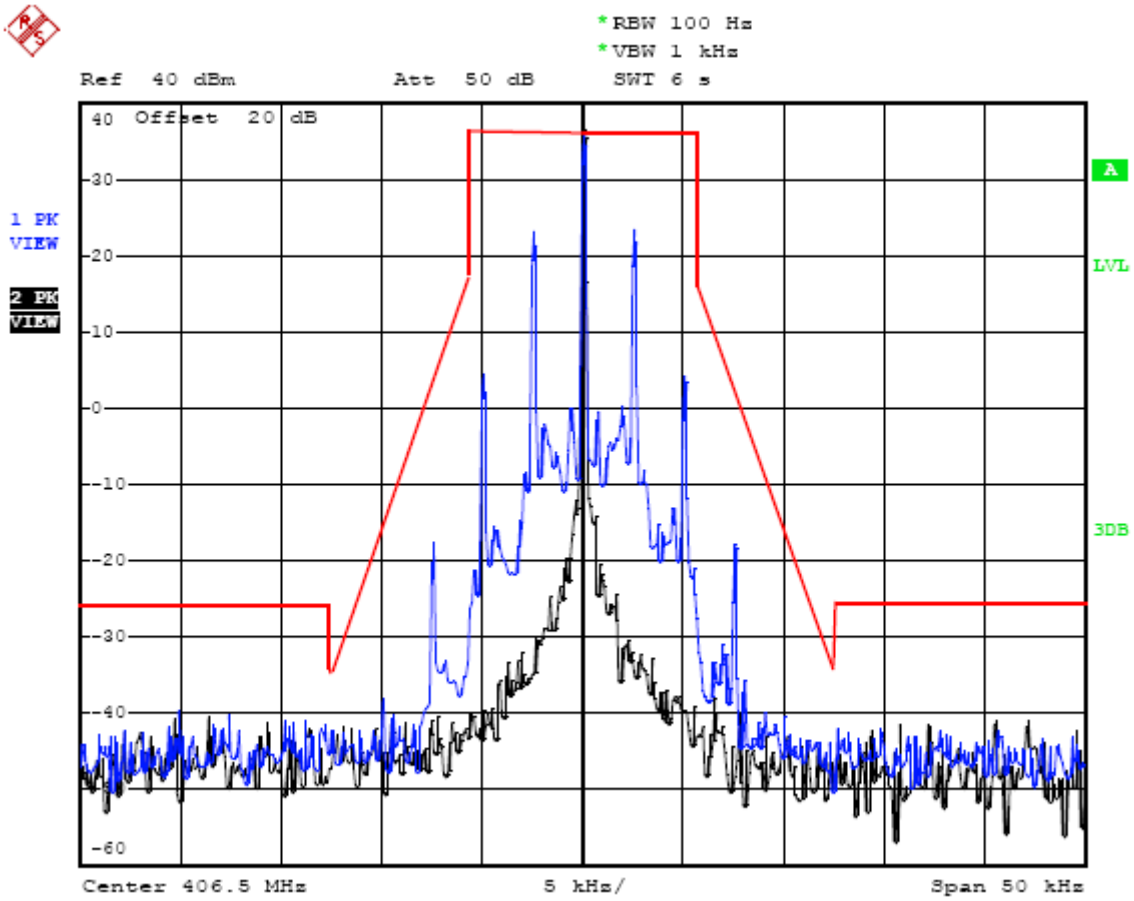
4.2.2 Emission Mask

Modulation Type	Channel Separation	Test Channel	Test Frequency	FCC Applicable Mask	RBW
FM	12.5KHz	D001	406.5000	D	100 Hz
		D002	418.0000	D	100 Hz
		D003	435.5000	D	100 Hz
		D004	453.5000	D	100 Hz
		D005	469.5000	D	100 Hz
4L-FSK	6.25KHz	D001	406.5000	E	100 Hz
		D002	418.0000	E	100 Hz
		D003	435.5000	E	100 Hz
		D004	453.5000	E	100 Hz
		D005	469.5000	E	100 Hz
Test Results		Compliance			

Referred as the attached plot hereinafter
Note: The black curve represents unmodulated signal.
The blue curve represents modulated signal.

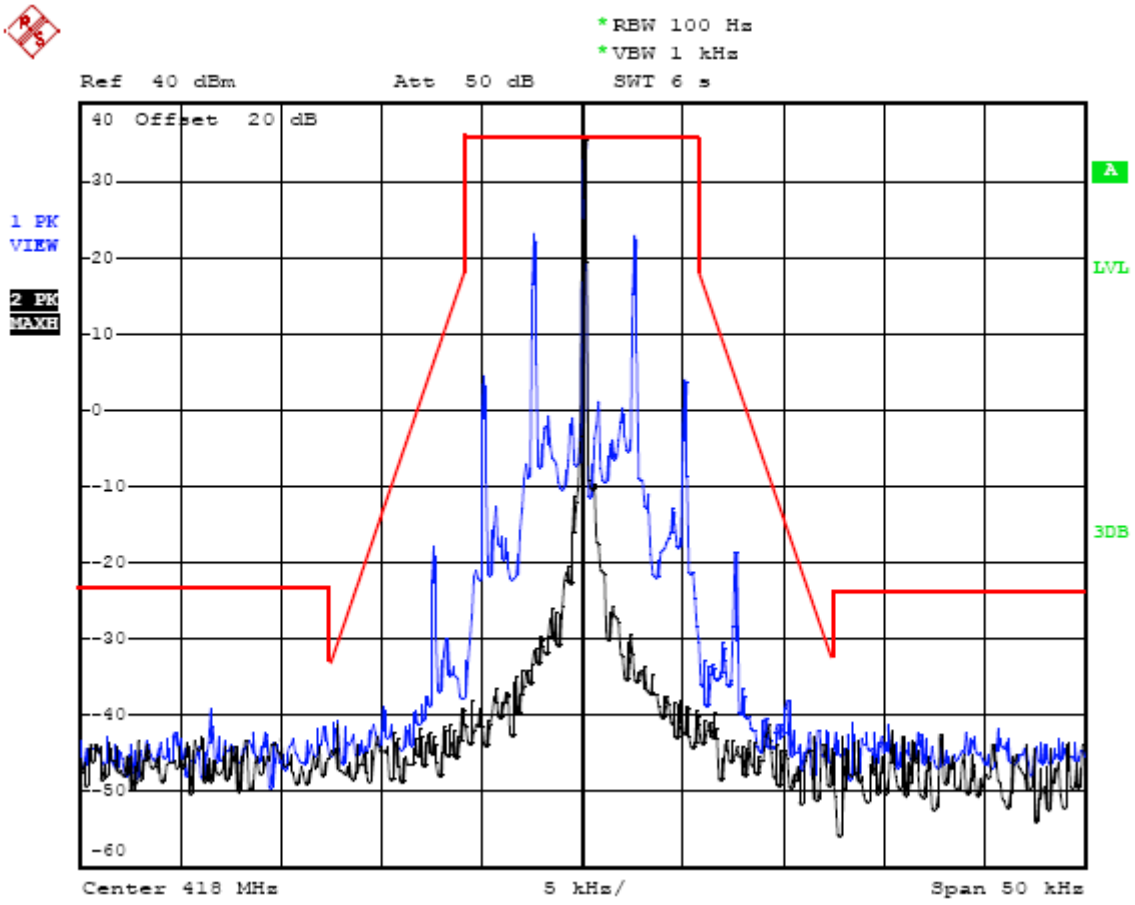


Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5 KHz	406.5000	D	100Hz	2.5	Compliance



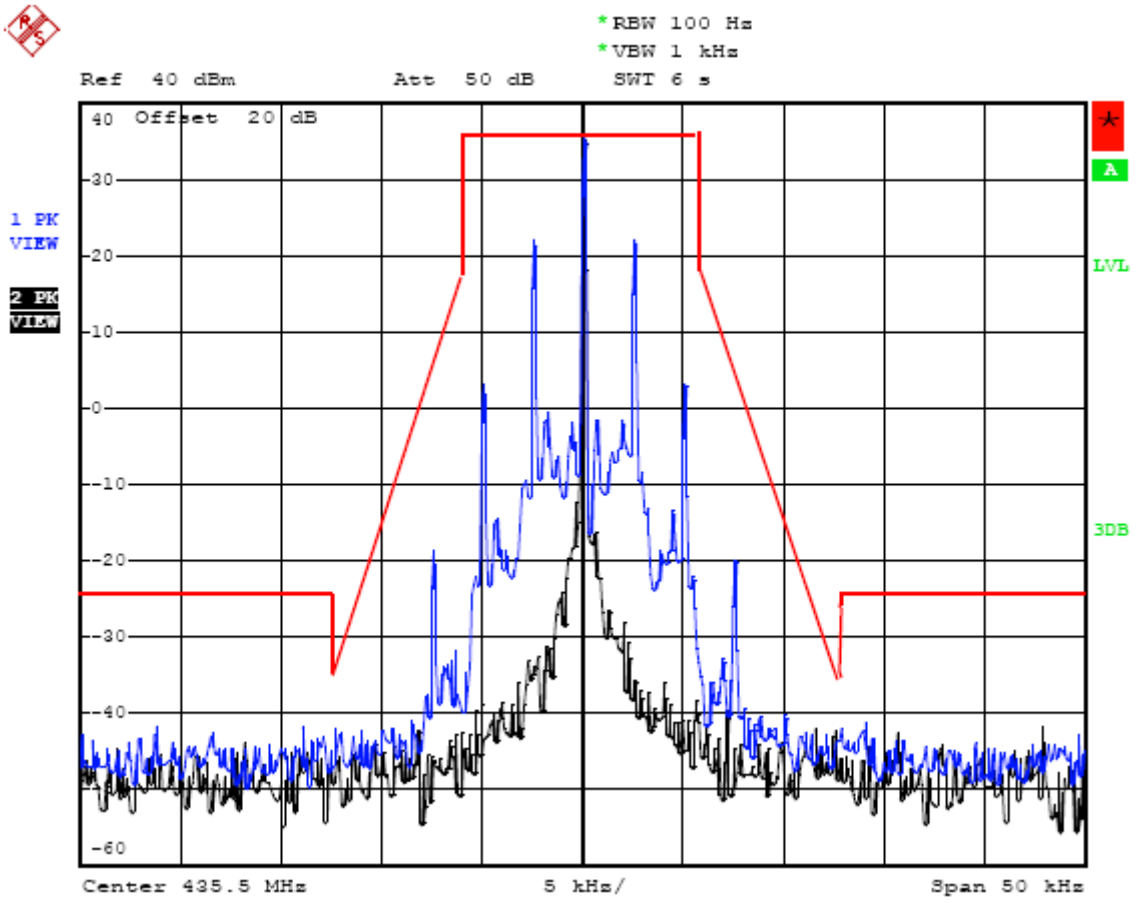
12.5 kHz Channel Spacing, 406.5000 MHz, 2500 Hz Audio Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5 KHz	418.0000	D	100Hz	2.5	Compliance



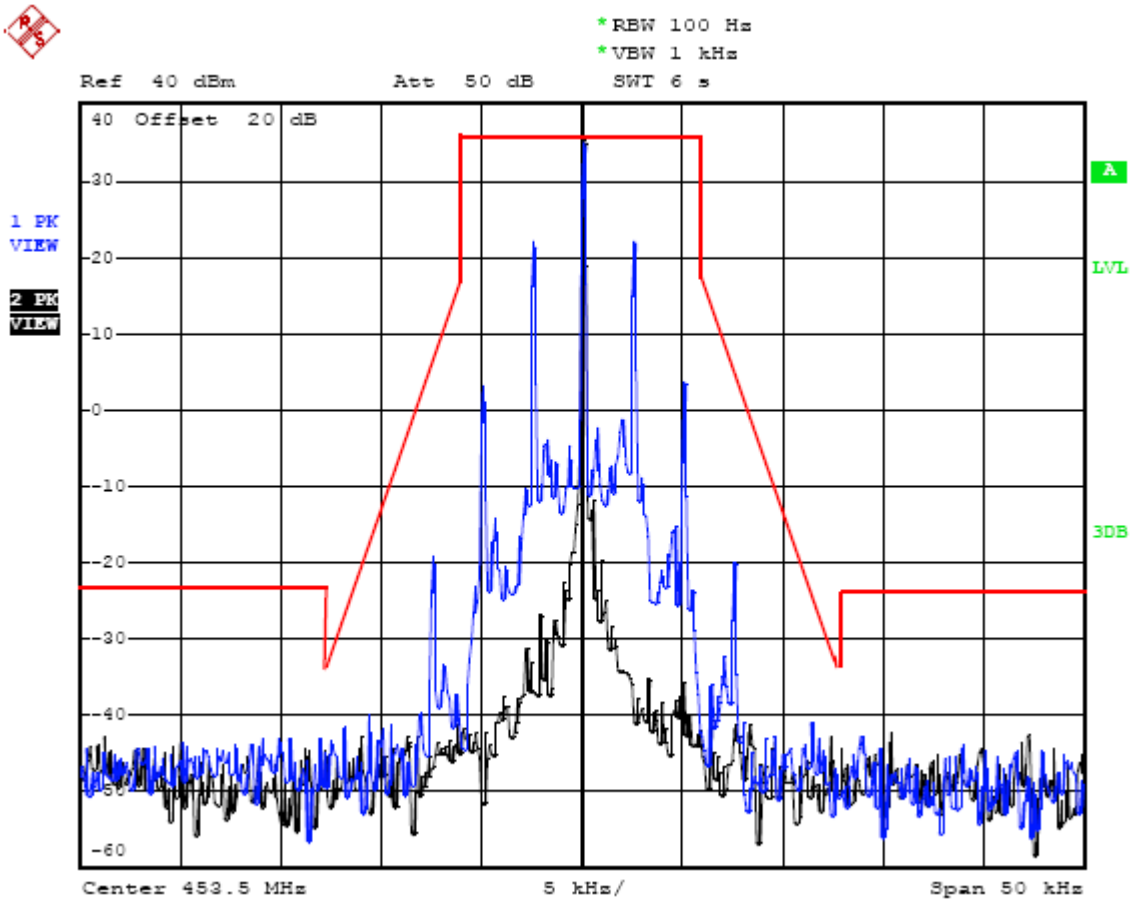
12.5 kHz Channel Spacing, 418.0000 MHz, 2500 Hz Audio Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5 KHz	435.5000	D	100Hz	2.5	Compliance



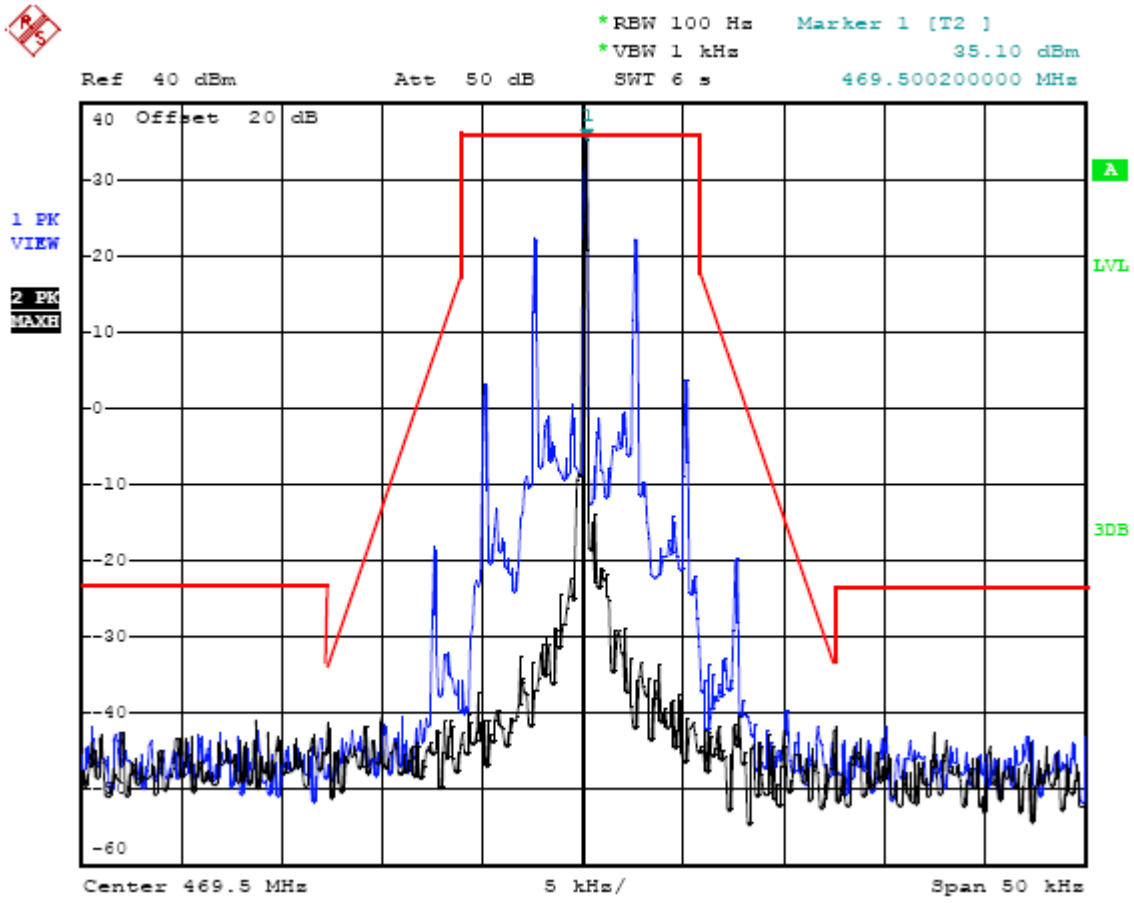
12.5 kHz Channel Spacing, 435.5000 MHz, 2500 Hz Audio Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5 KHz	453.5000	D	100Hz	2.5	Compliance



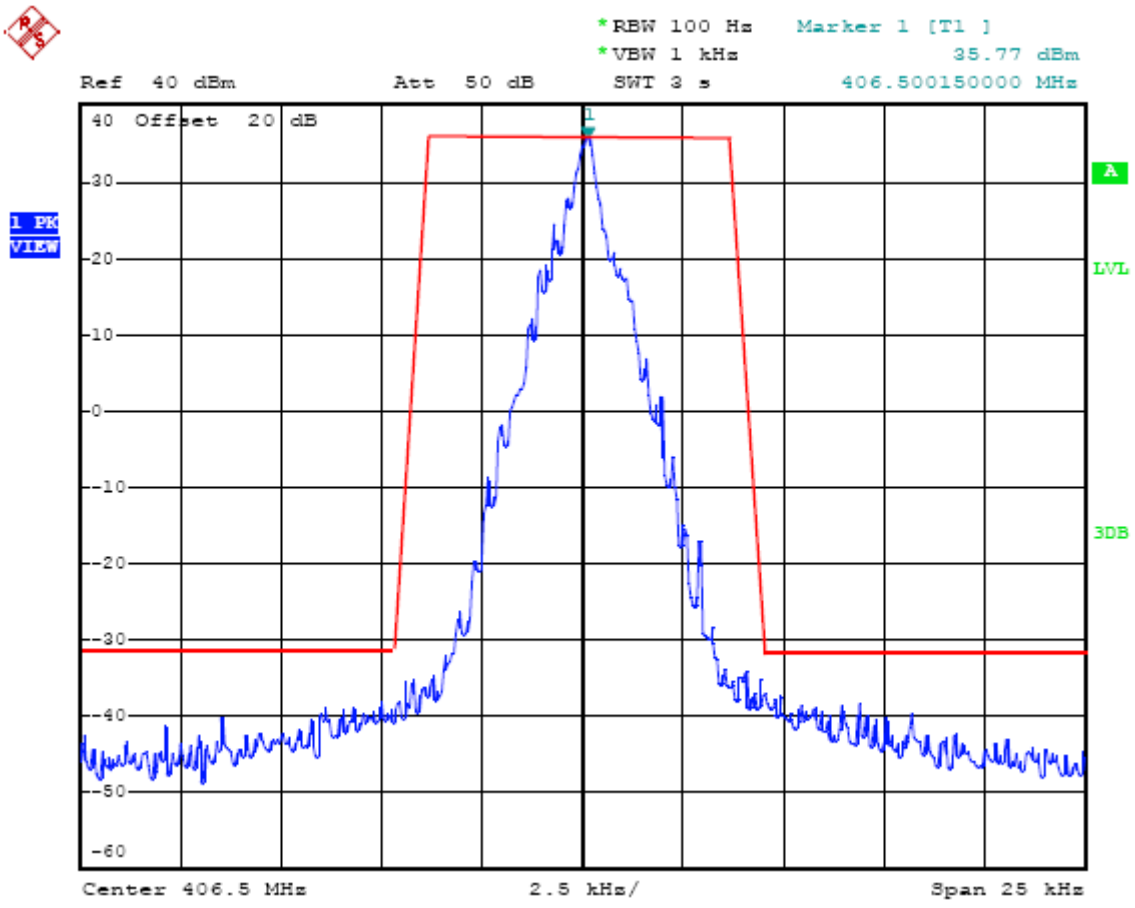
12.5 kHz Channel Spacing, 453.5000 MHz, 2500 Hz Audio Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	12.5 KHz	469.5000	D	100Hz	2.5	Compliance



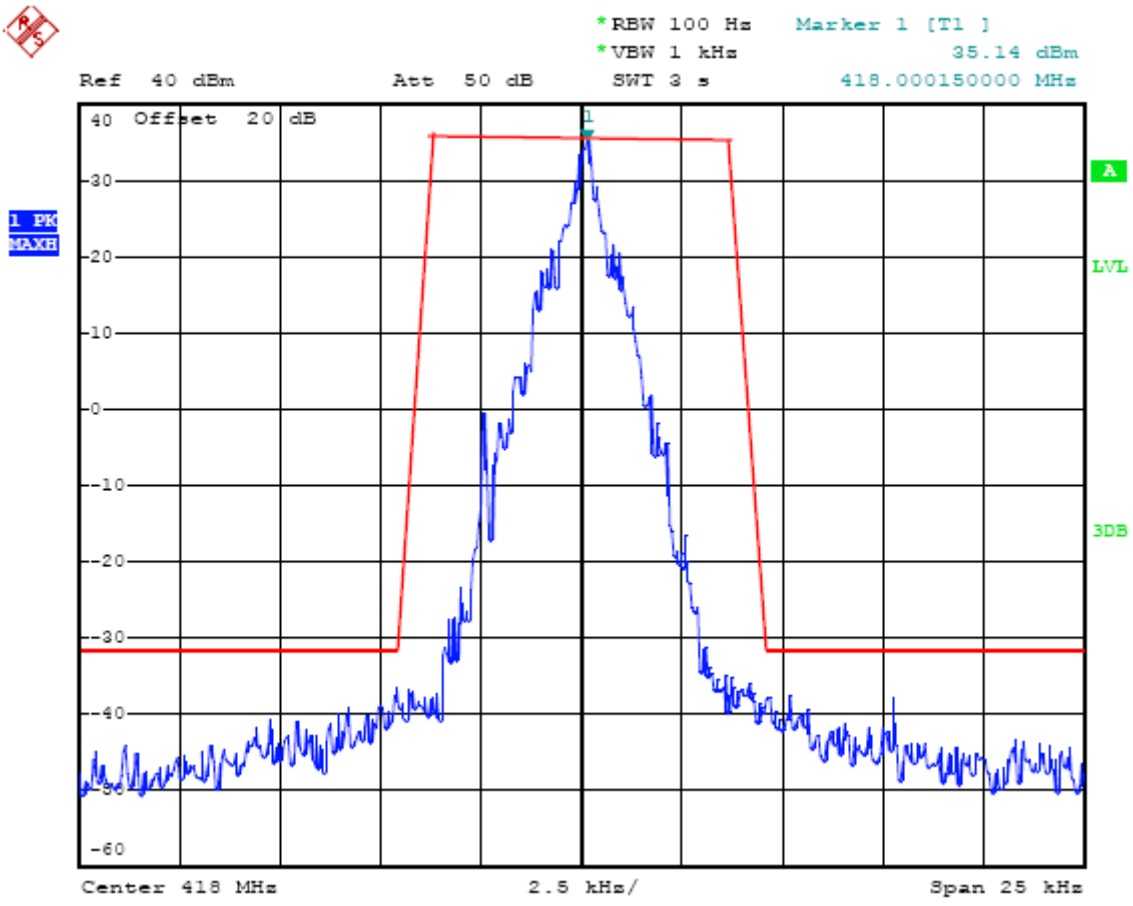
12.5 kHz Channel Spacing, 469.5000 MHz, 2500 Hz Audio Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4L-FSK	6.25 KHz	406.5000	E	100Hz	/	Compliance



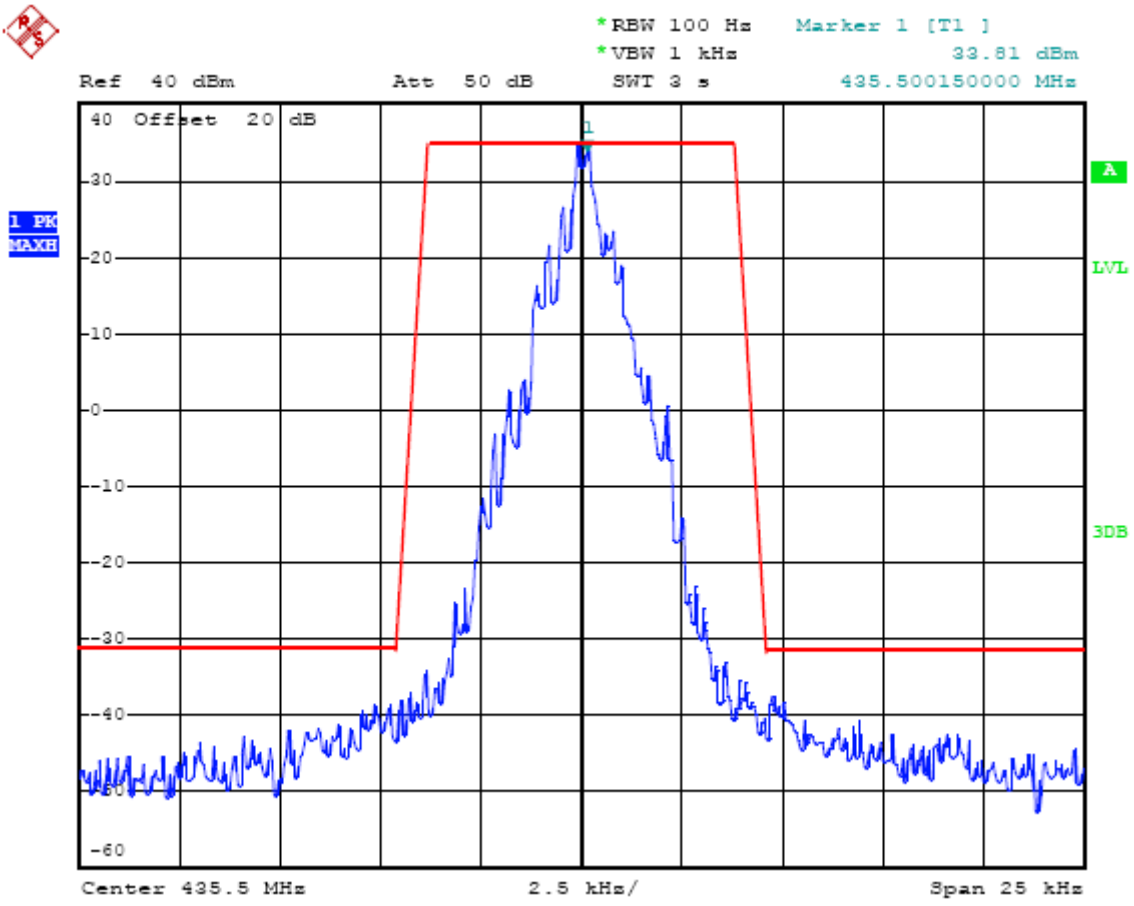
6.25 kHz Channel Spacing, 406.5000 MHz, 4L-FSK Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4L-FSK	6.25 KHz	418.0000	E	100Hz	/	Compliance



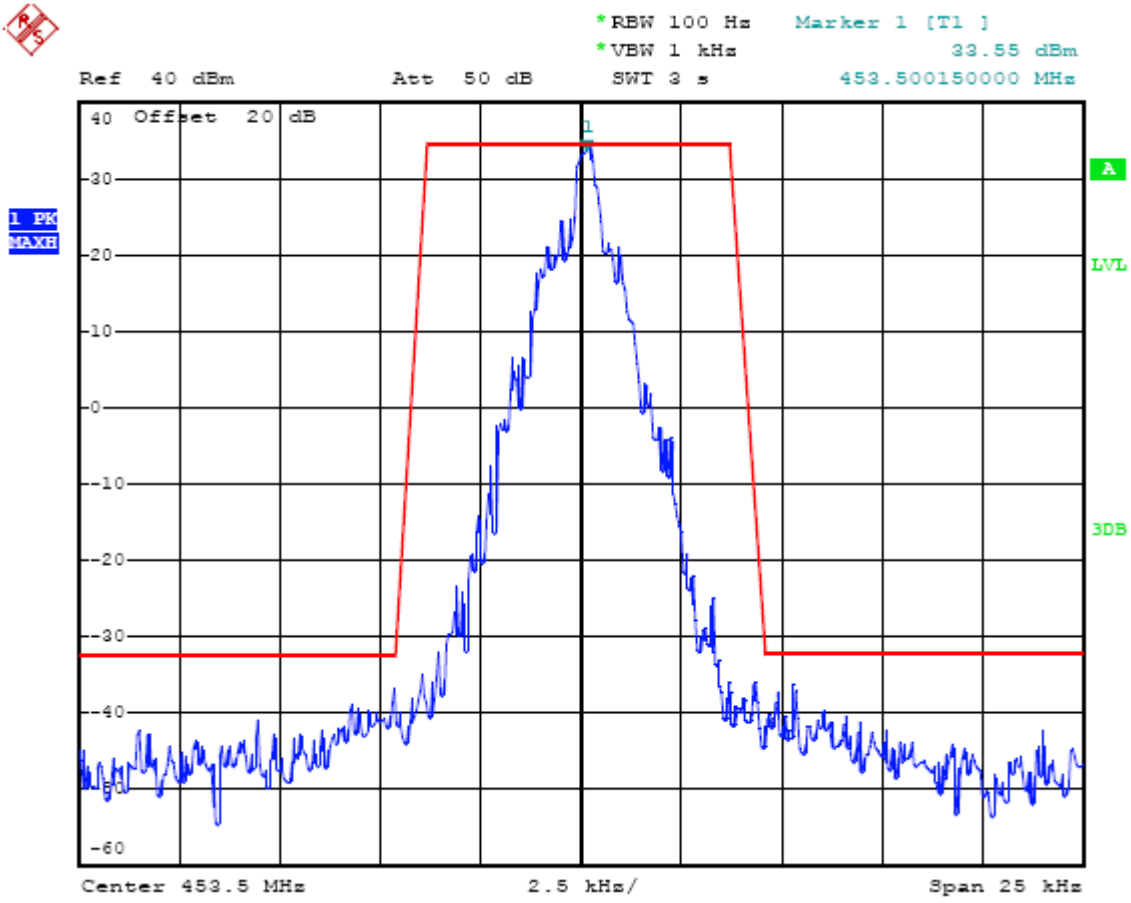
6.25 kHz Channel Spacing, 418.0000 MHz, 4L-FSK Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4L-FSK	6.25 KHz	435.5000	E	100Hz	/	Compliance



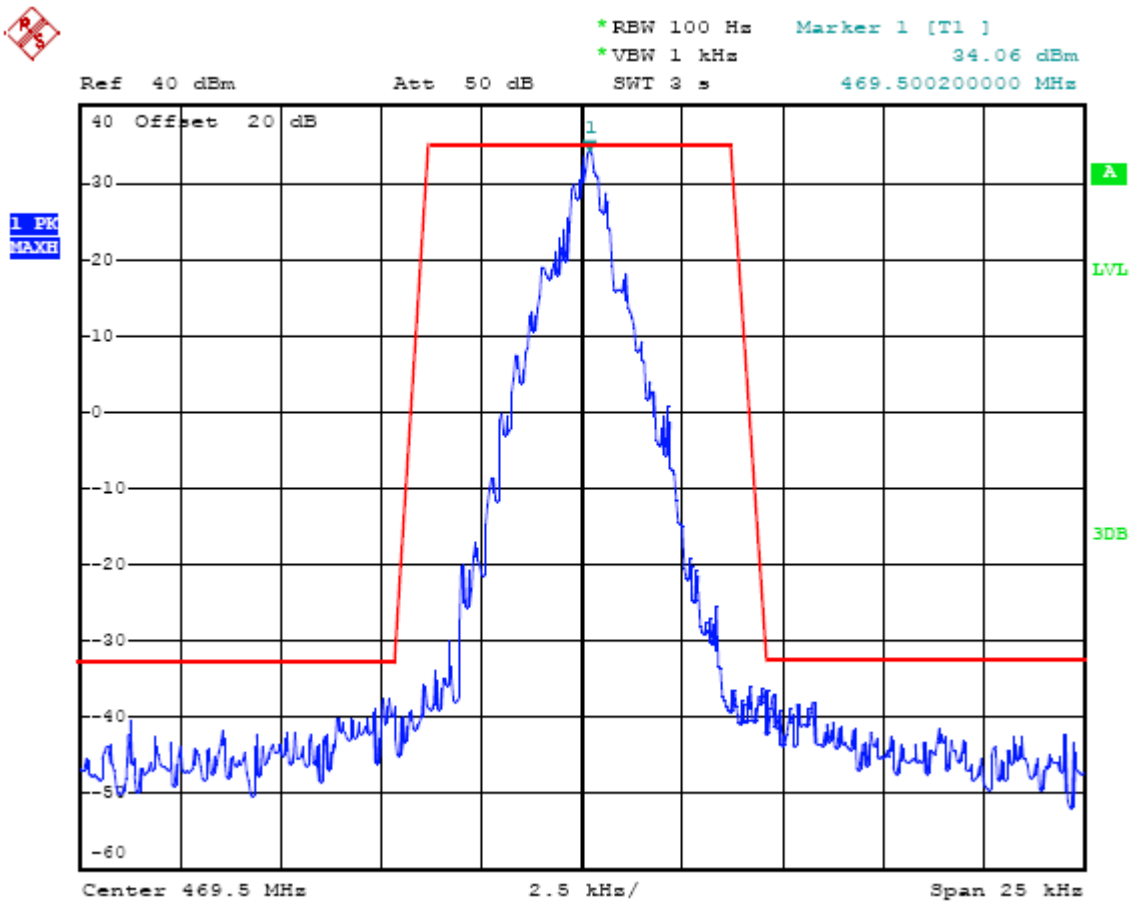
6.25 kHz Channel Spacing, 435.5000 MHz, 4L-FSK Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4L-FSK	6.25 KHz	453.5000	E	100Hz	/	Compliance



6.25 kHz Channel Spacing, 453.5000 MHz, 4L-FSK Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
4L-FSK	6.25 KHz	469.5000	E	100Hz	/	Compliance



6.25 kHz Channel Spacing, 469.5000 MHz, 4L-FSK Modulation Only

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:

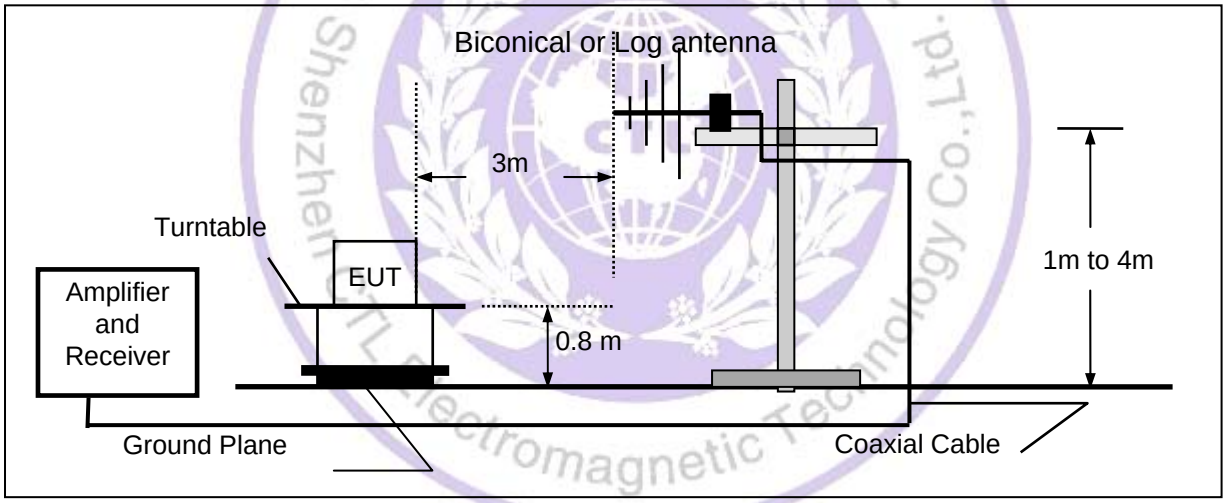
1 On any frequency removed from the center of the authorized bandwidth fo to 5.625 KHz removed from fo: Zero dB
2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) fo of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB
3 On any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

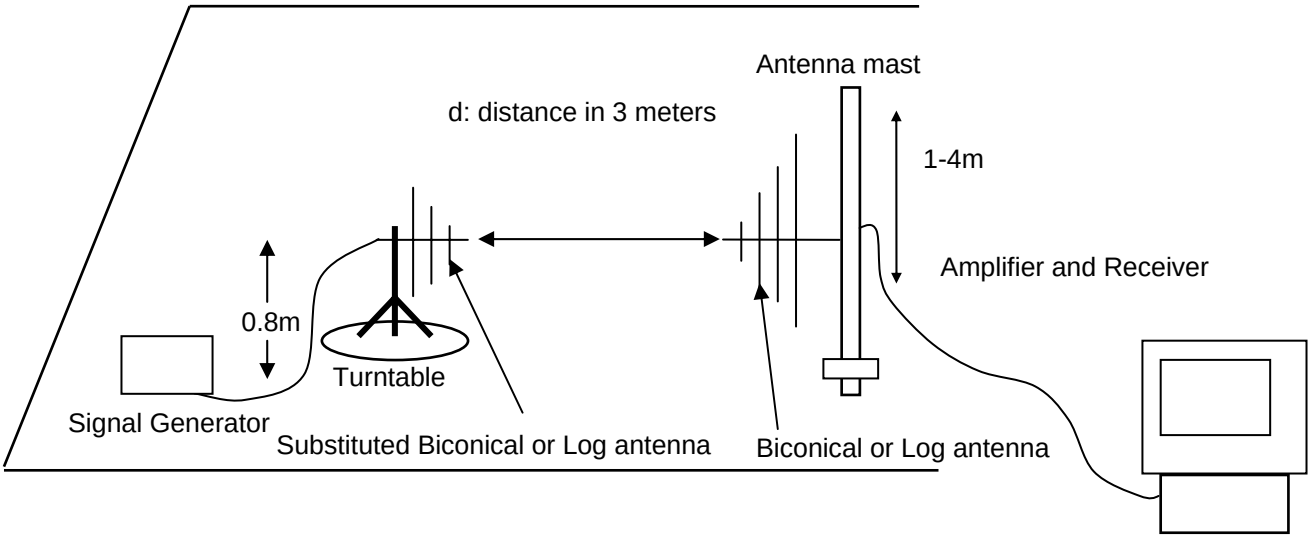
For transmitters designed to transmit with 25 KHz channel separation and equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as following:

1 On any frequency removed from the assigned frequency by more than 50 percent, but no 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 no 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+10Log (P) dB.

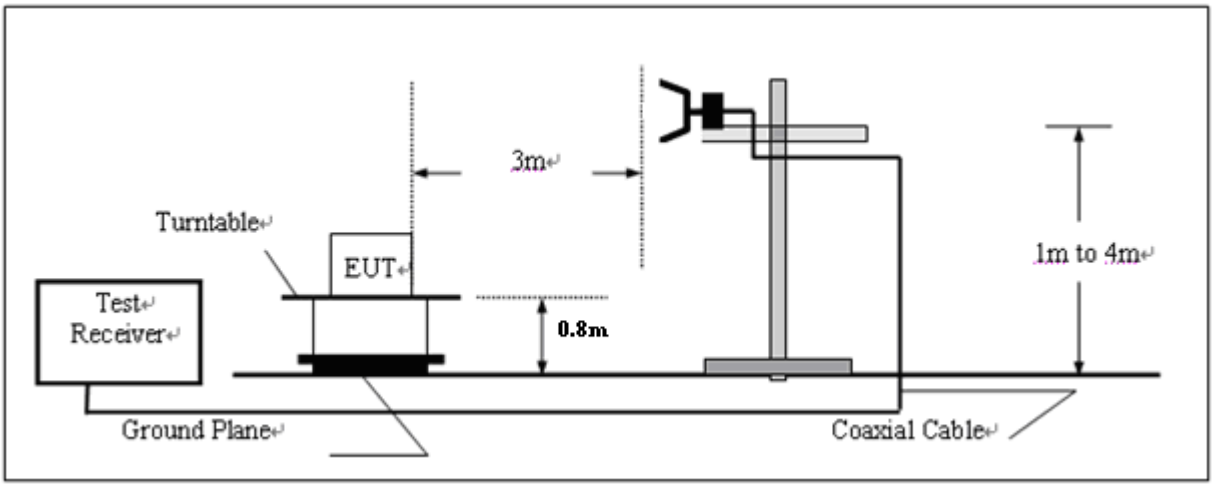
TEST CONFIGURATION

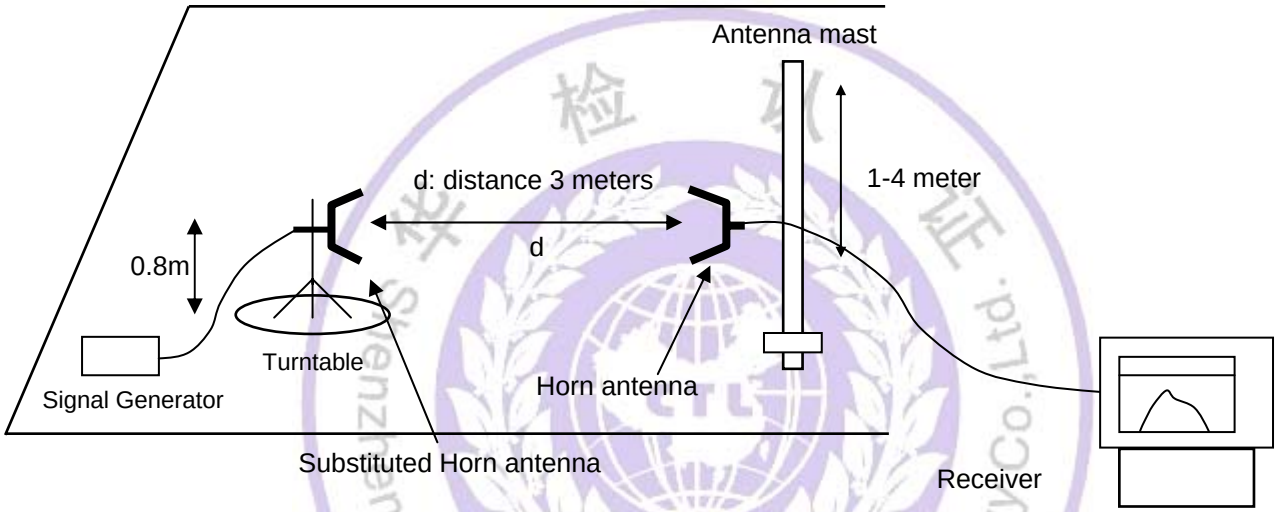
Below 1GHz





Above 1GHz





TEST PROCEDURE

1 Set the EMI Receiver (for measuring E-Field) and Receiver (for measuring EIRP) as follows:
Center Frequency: equal to the signal source
Resolution BW: 100 KHz
Video BW: VBW > RBW
Detector Mode: positive
Average: off
Span: 3 x the signal bandwidth

2 Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level
Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor+Amplifier Gain
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB)

3 The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)

4 Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
DIPOLE antenna for frequency from 30-1000 MHz or
HORN antenna for frequency above 1 GHz}.

5 Mount the transmitting antenna at 1.0 meter high from the ground plane.

6 Use one of the following antenna as a receiving antenna:
DIPOLE antenna for frequency from 30-1000 MHz or
HORN antenna for frequency above 1 GHz}.

7 If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.

8 Adjust both transmitting and receiving antenna in a VERTICAL polarization.

9 Tune the EMI Receivers to the test frequency.

10 Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.

11 The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.

12 Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.

13 Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
14 Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:
$P = P_1 - L_1 = (P_2 + L_2) – L_1 = P_3 + A + L_2 - L_1$
$EIRP = P + G1 = P_3 + L_2 - L_1 + A + G_1$
$ERP = EIRP – 2.15$ dB
Total Correction factor in EMI Receiver $= L_2 – L_1 + G_1$
Where:
P: Actual RF Power fed into the substitution antenna port after corrected.
P_1: Power output from the signal generator
P_2: Power measured at attenuator A input
P_3: Power reading on the Average Power Meter
EIRP: EIRP after correction
ERP: ERP after correction
15 Adjust both transmitting and receiving antenna in a Horizontal polarization, then repeat step (11) to (14).
16 Repeat step (4) to (16) for different test frequency
17 Repeat steps (3) to (12) with the substitution antenna oriented in horizontal polarization.
18 Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

TEST RESULTS

Modulation Type: FM

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (12.5 kHz Bandwidth only):
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 12.5 kHz at least:
Low: 50 + 10 log (Pwatts) = 50 + 10 log (3.35) =55.25 dB
High: 50 + 10 log (Pwatts) = 50 + 10 log (3.98) =56.00 dB
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)
Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 36.02 dBm.
Limit (dBm) =36.02-50-10log10 (3.98) = -20 dBm

Modulation Type: 4L-FSK

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (6.25 kHz Bandwidth only):
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 4.6 kHz at least:
Low: 55 + 10 log (Pwatts) = 55 + 10 log (3.27) =60.15 dB
High: 55 + 10 log (Pwatts) = 55 + 10 log (3.81) =60. 81dB
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-55-10log10 (TP)
Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 36.02 dBm.
Limit (dBm) =36.02-55-10log10 (3.81) = -25 dBm

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		FM		Channel Separation		12.5KHz		
Test Channel		A012		Test Frequency		406.5000 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)
813.000	60.33	Peak	H	367	231	-35.64	-20	15.64
2032.500	61.14	Peak	H	100	178	-34.24	-20	14.24
4065.000	68.62	Peak	H	245	304	-28.30	-20	8.30
…			H					
813.000	55.54	Peak	V	100	341	-40.73	-20	20.73
2032.500	64.43	Peak	V	100	107	-32.40	-20	12.40
4065.000	66.09	Peak	V	155	88	-29.81	-20	9.81
…	…		V					

Modulation		FM		Channel Separation		12.5KHz		
Test Channel		A013		Test Frequency		418.0000 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)
836.000	60.24	Peak	H	144	300	-35.72	-20	15.72
2508.000	56.37	Peak	H	200	34	-40.24	-20	20.24
3344.000	58.29	Peak	H	290	221	-37.75	-20	17.75
…			H					
836.000	58.41	Peak	V	100	93	-37.82	-20	17.82
2508.000	59.30	Peak	V	108	354	-36.45	-20	16.45
3344.000	61.71	Peak	V	114	122	-34.98	-20	14.98
…	…		V					

Modulation		FM		Channel Separation		12.5KHz		
Test Channel		A014		Test Frequency		435.5000 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)
871.000	56.41	Peak	H	400	189	-39.89	-20	19.89
2613.000	65.57	Peak	H	124	204	-30.67	-20	10.67
3484.000	69.52	Peak	H	150	77	-27.19	-20	7.19
…			H					
871.000	53.36	Peak	V	118	331	-43.29	-20	23.29
2613.000	68.17	Peak	V	100	144	-28.49	-20	8.49
3484.000	70.58	Peak	V	100	123	-26.85	-20	6.85
…	…		V					

Modulation		FM		Channel Separation		12.50KHz		
Test Channel		A015		Test Frequency		453.5000 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)
907.000	60.51	Peak	H	300	288	-35.91	-25	10.91
2721.000	62.57	Peak	H	289	301	-34.25	-25	9.25
3628.000	68.05	Peak	H	204	178	-28.57	-25	3.57
…	…		H					
907.000	55.43	Peak	V	105	348	-40.59	-25	15.59
2721.000	64.12	Peak	V	150	9	-32.64	-25	7.64
3628.000	67.75	Peak	V	100	122	-28.98	-25	3.98
…	…		V					

Modulation		FM		Channel Separation		12.50KHz		
Test Channel		A016		Test Frequency		469.5000 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)
939.000	60.88	Peak	H	205	305	-35.18	-25	10.18
2817.000	59.28	Peak	H	122	156	-37.28	-25	12.28
3756.000	60.00	Peak	H	150	99	-36.96	-25	11.96
…	…		H					
939.000	58.55	Peak	V	100	0	-38.02	-25	13.02
2817.000	62.16	Peak	V	100	299	-34.06	-25	9.06
3756.000	59.44	Peak	V	150	145	-37.10	-25	12.10
…	…		V					

Modulation		4L-FSK		Channel Separation		6.25KHz		
Test Channel		D001		Test Frequency		406.5000 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)
813.000	55.65	Peak	H	100	307	-40.46	-25	15.46
2032.500	65.57	Peak	H	200	88	-30.68	-25	5.68
4065.000	67.44	Peak	H	159	144	-28.96	-25	3.96
…	…		H					
813.000	53.98	Peak	V	100	273	-42.47	-25	17.47
2032.500	67.14	Peak	V	150	100	-29.32	-25	4.32
4065.000	69.07	Peak	V	150	56	-27.36	-25	2.36
…	…		V					

Modulation		4L-FSK		Channel Separation		6.25KHz		
Test Channel		D002		Test Frequency		418.0000 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)
836.000	55.37	Peak	H	100	307	-40.52	-25	15.52
2508.000	65.49	Peak	H	200	88	-30.88	-25	5.88
3344.000	67.52	Peak	H	159	144	-28.41	-25	3.41
…	…		H					
836.000	53.24	Peak	V	100	273	-42.85	-25	17.85
2508.000	67.19	Peak	V	150	100	-29.41	-25	4.41
3344.000	69.52	Peak	V	150	56	-27.49	-25	2.49
…	…		V					

Modulation		4L-FSK		Channel Separation		6.25KHz		
Test Channel		D003		Test Frequency		435.5000 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)
871.000	55.70	Peak	H	100	307	-40.69	-25	15.69
2613.000	65.59	Peak	H	200	88	-30.47	-25	5.47
3484.000	67.46	Peak	H	159	144	-28.08	-25	3.08
…	…		H					
871.000	53.29	Peak	V	100	273	-42.65	-25	17.65
2613.000	67.39	Peak	V	150	100	-29.37	-25	4.37
3484.000	69.50	Peak	V	150	56	-27.45	-25	2.45
…	…		V					

Modulation		4L-FSK		Channel Separation		6.25KHz		
Test Channel		D004		Test Frequency		453.5000 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)
907.000	55.64	Peak	H	100	307	-40.27	-25	15.27
2721.000	65.52	Peak	H	200	88	-30.54	-25	5.54
3628.000	67.45	Peak	H	159	144	-28.09	-25	3.09
…	…		H					
907.000	53.75	Peak	V	100	273	-42.85	-25	17.85
2721.000	67.14	Peak	V	150	100	-29.42	-25	4.42
3628.000	69.19	Peak	V	150	56	-27.55	-25	2.55
…	…		V					

Modulation		4L-FSK		Channel Separation		6.25KHz		
Test Channel		D005		Test Frequency		469.5000 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)
939.000	55.31	Peak	H	100	307	-40.27	-25	15.27
2817.000	65.47	Peak	H	200	88	-30.69	-25	5.69
3756.000	67.38	Peak	H	159	144	-28.50	-25	3.50
…	…		H					
939.000	53.83	Peak	V	100	273	-42.18	-25	17.18
2817.000	67.35	Peak	V	150	100	-29.92	-25	4.92
3756.000	69.32	Peak	V	150	56	-27.63	-25	2.63
…	…		V					

4.4. Spurious Emission On Antenna Port

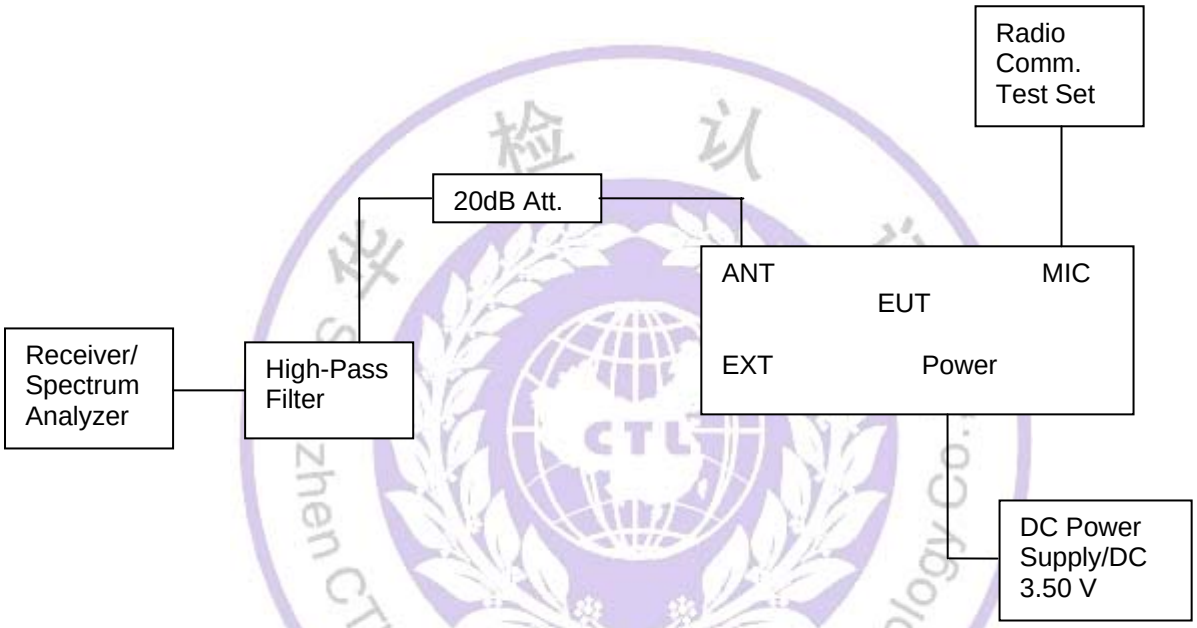
TEST APPLICABLE

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 10^{th} 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:

Modulation Type: FM

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (12.5 kHz Bandwidth only):
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 12.5 kHz at least:
Low: 50 + 10 log (Pwatts) = 50 + 10 log (3.35) =55.25 dB
High: 50 + 10 log (Pwatts) = 50 + 10 log (3.98) =56.00 dB
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 36.02 dBm.
Limit (dBm) =36.02-50-10log10 (3.98) = -20 dBm

Modulation Type: 4L-FSK

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (6.25 kHz Bandwidth only):
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 4.6 kHz at least:
Low: 55 + 10 log (Pwatts) = 55 + 10 log (3.27) =60.15 dB
High: 55 + 10 log (Pwatts) = 55 + 10 log (3.81) =60. 81dB
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-55-10log10 (TP)

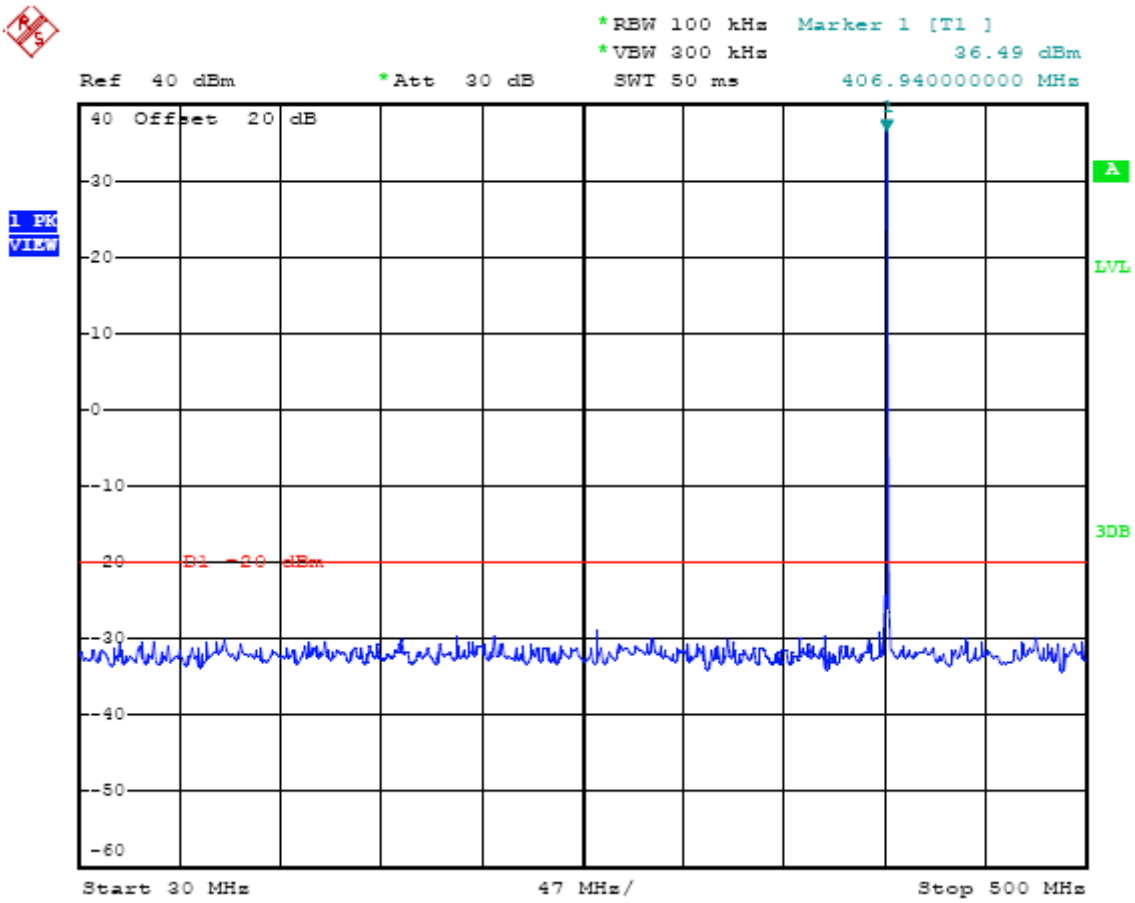
Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 36.02 dBm.
Limit (dBm) =36.02-55-10log10 (3.81) = -25 dBm

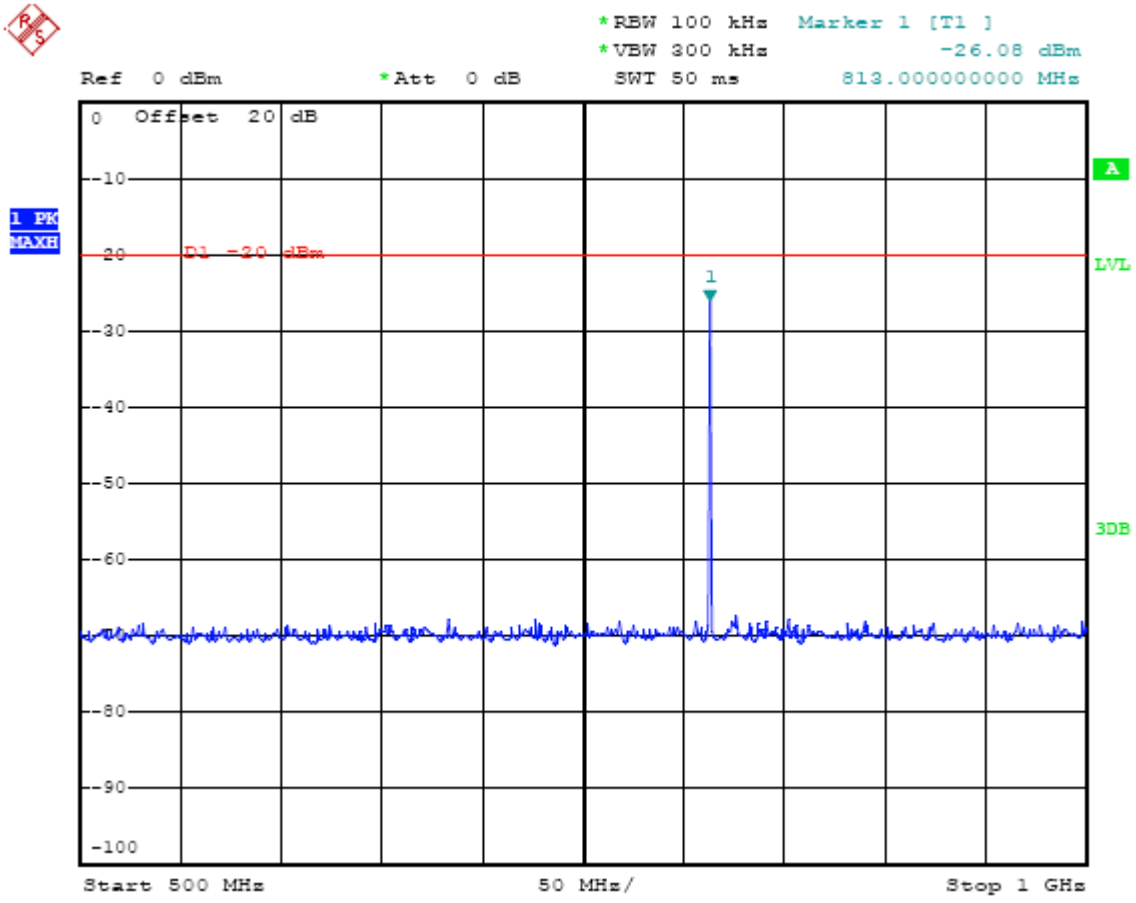
Note: 1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 6 GHz.

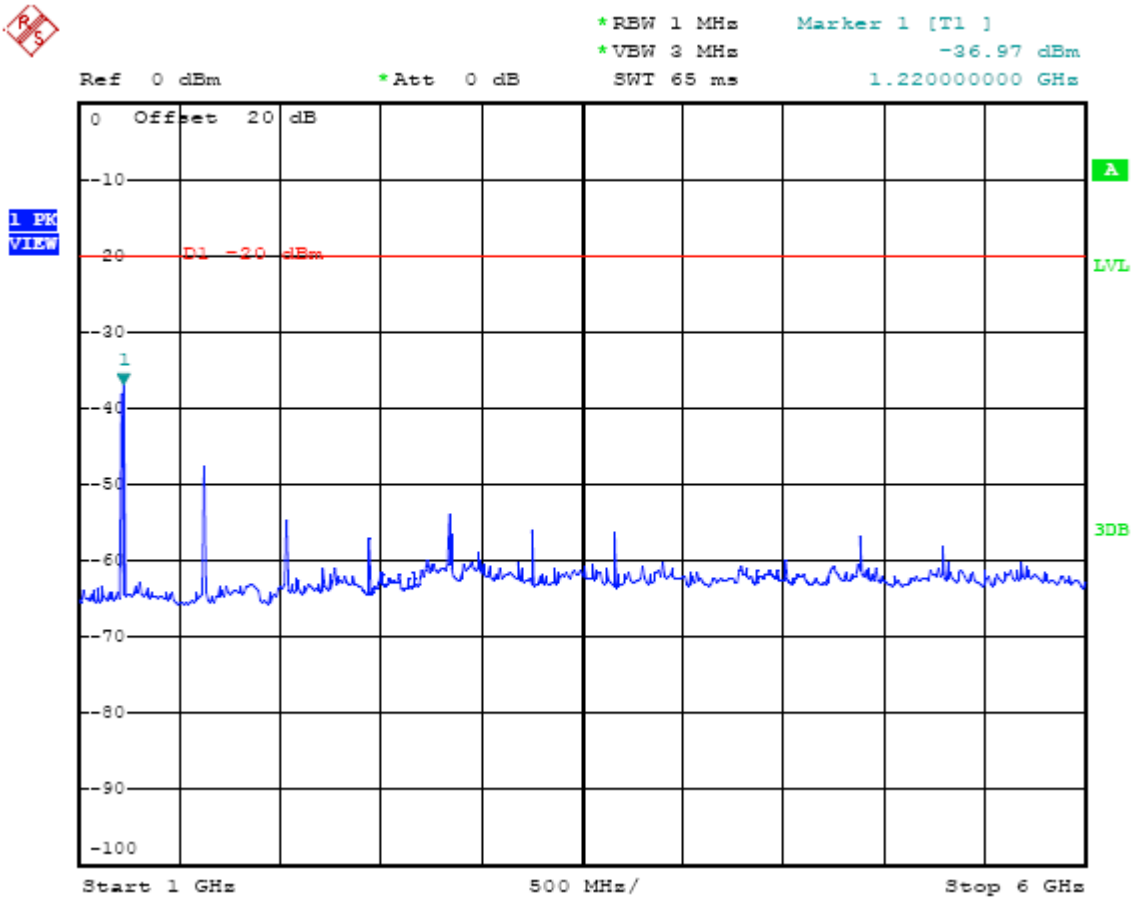
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz	
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)
Analog/FM	12.5KHz	D001	406.5000	813.00	-26.08	1220.00	-36.97
		D002	418.0000	836.00	-26.92	1670.00	-37.30
		D003	435.5000	871.00	-37.73	1300.00	-43.59
		D004	453.5000	907.00	-38.26	1810.00	-40.31
		D005	469.5000	939.00	-44.32	1400.00	-46.41
Digital/4L-FSK	6.25KHz	A012	406.5000	813.00	-26.93	1220.00	-38.98
		A013	418.0000	836.00	-26.78	1670.00	-37.70
		A014	435.5000	871.00	-38.04	1740.00	-47.12
		A015	453.5000	907.00	-38.19	1810.00	-40.49
		A016	469.5000	939.00	-43.87	1400.00	-46.30
Limit		-20dBm for 12.5KHz Channel Separation					
		-25dBm for 6.25KHz Channel Separation					
Test Results		Compliance					

Plots of Spurious Emission on Antenna Port Measurement

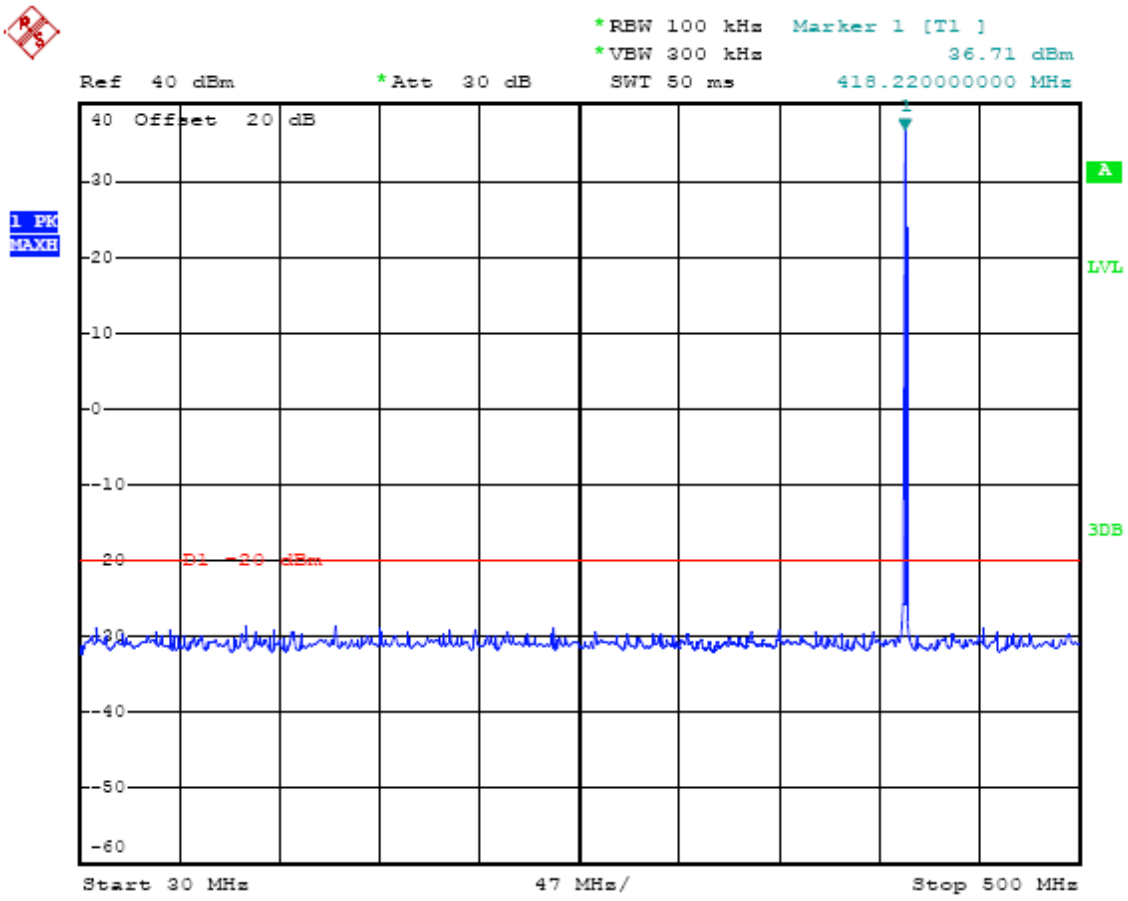
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	12.5KHz	A012	406.5000	813.00	-26.08	1220.00	-36.97	-20dBm
Test Results				Compliance				

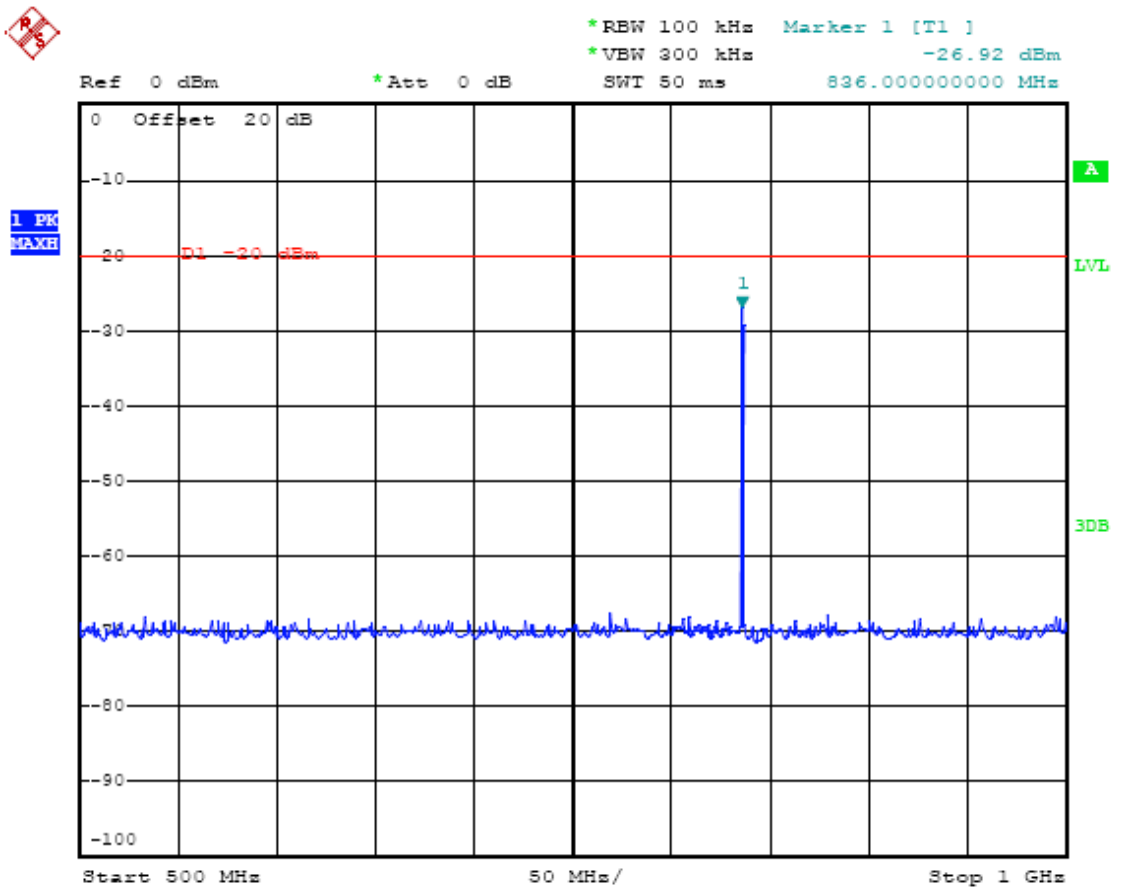


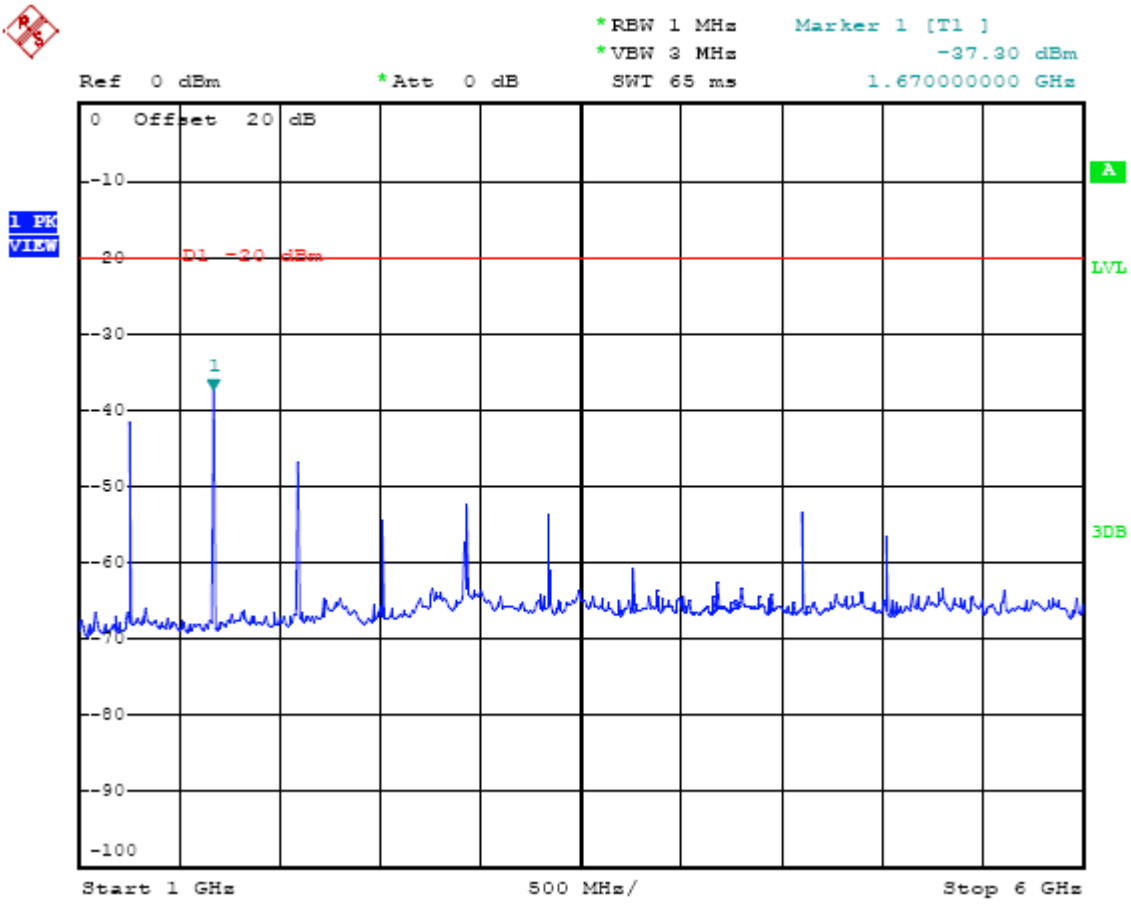

*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-26.08 dBm
Ref 0 dBm
*Att 0 dB
SWT 50 ms
813.000000000 MHz
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-80
-90
-100
D1 -20 dBm
1
A
LVL
3DB
1 PK
MAXH
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
Marker 1 [T1]
*VBW 3 MHz
-36.97 dBm
Ref 0 dBm
*Att 0 dB
SWT 65 ms
1.220000000 GHz
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
D1 -20 dBm
1
A
LVL
3DB
1 PK
VIEW
Start 1 GHz
500 MHz/
Stop 6 GHz

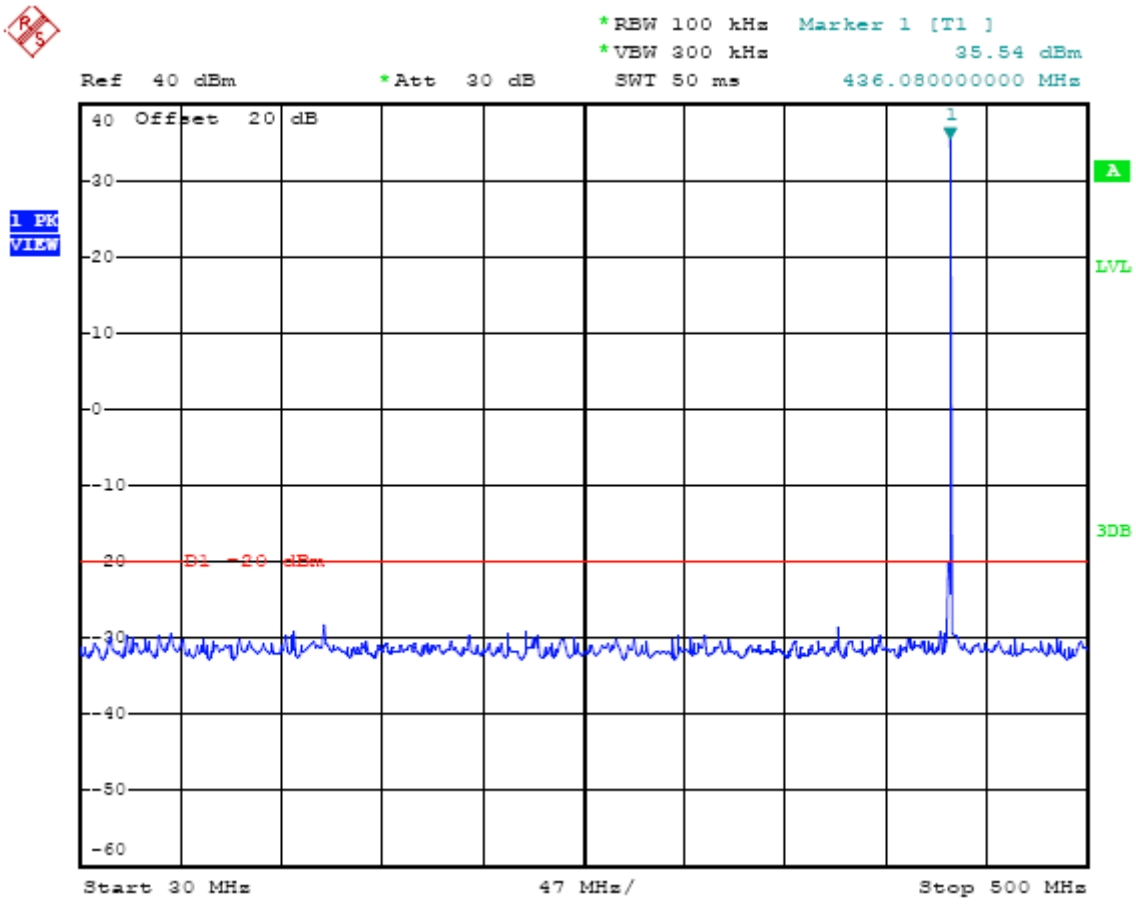
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	12.5KHz	A013	418.0000	836.00	-26.92	1670.00	-37.30	-20dBm
Test Results				Compliance				

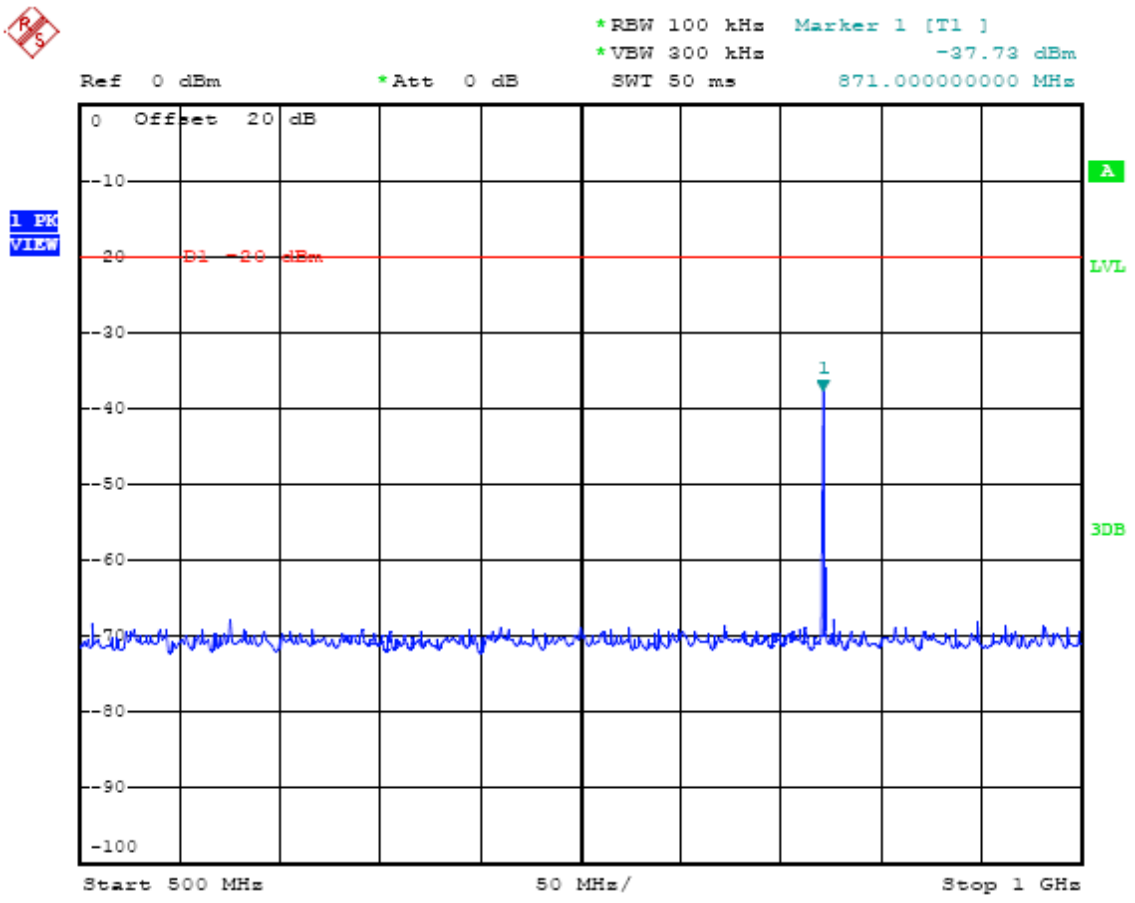


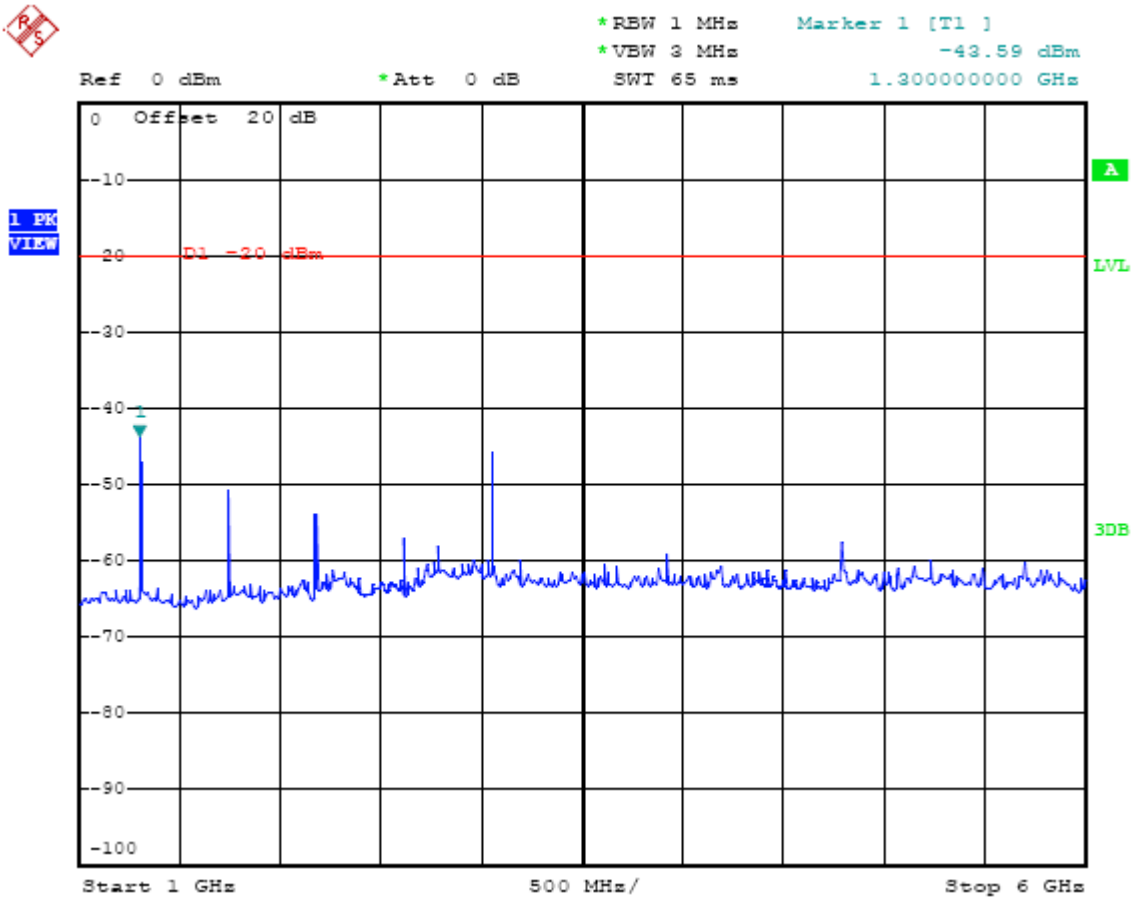

*RBW 100 kHz
*VBW 300 kHz
SWT 50 ms
Marker 1 [T1]
-26.92 dBm
836.000000000 MHz
Ref 0 dBm
*Att 0 dB
0 Offset 20 dB
1 PK MAXH
D1 -20 dBm
A
LVL
3DB
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
SWT 65 ms
Marker 1 [T1]
-37.30 dBm
1.670000000 GHz
Ref 0 dBm
*Att 0 dB
0 Offset 20 dB
1 PK VIEW
D1 -20 dBm
A
LVL
3DB
Start 1 GHz
500 MHz/
Stop 6 GHz

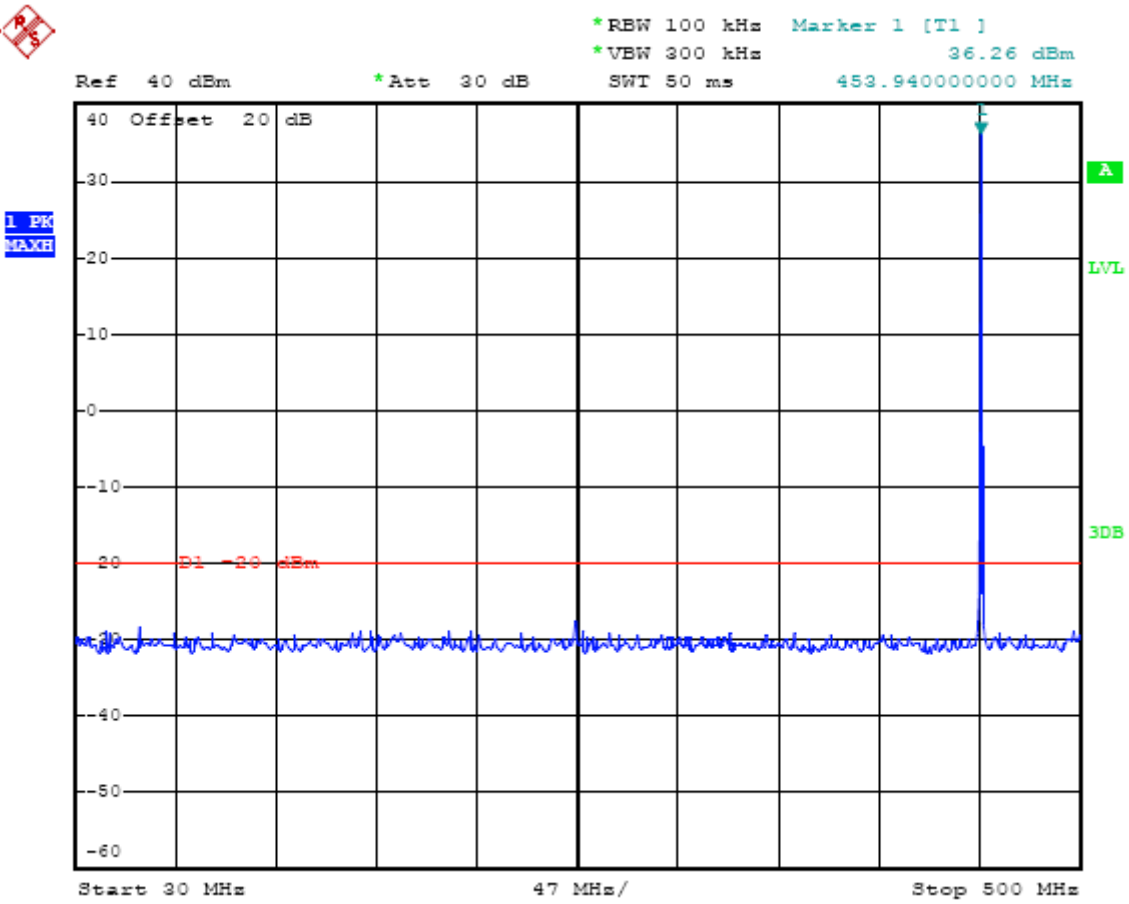
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	12.5KHz	A014	435.5000	871.00	-37.73	1300.00	-43.59	-20dBm
Test Results				Compliance				

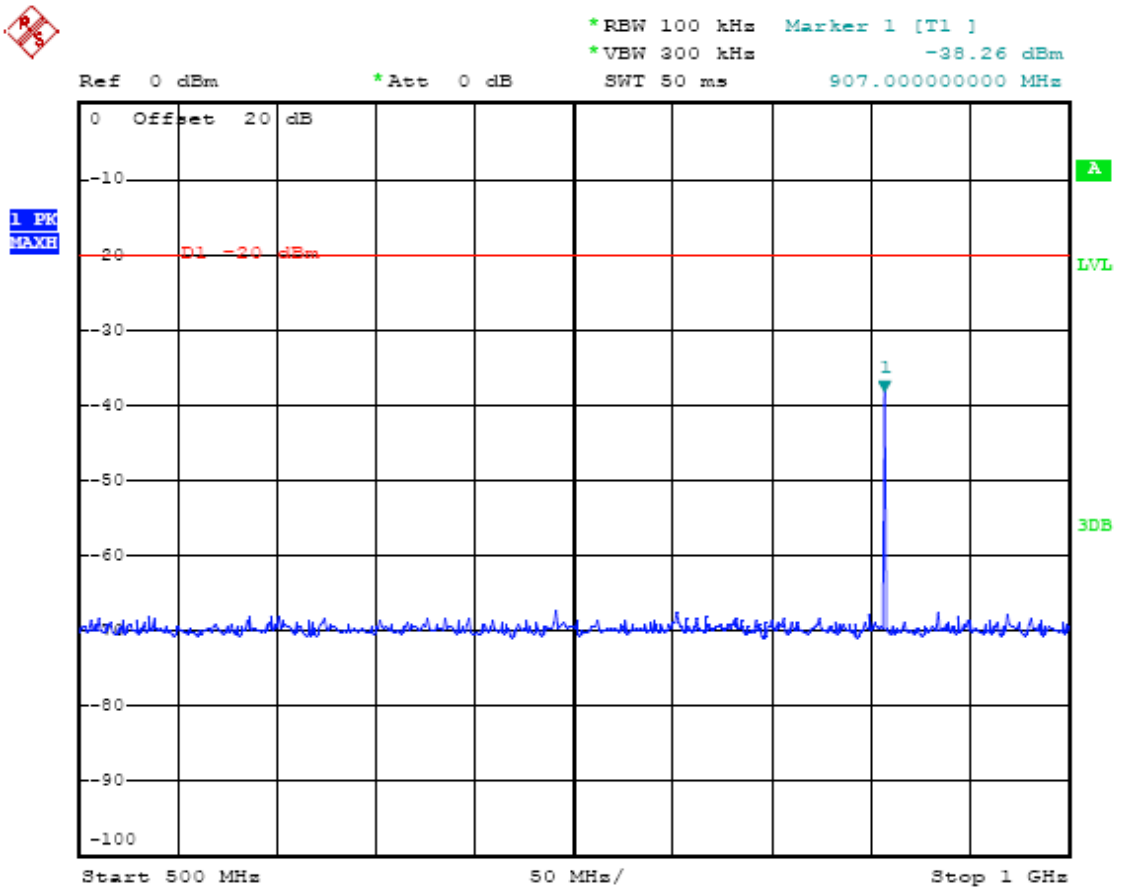


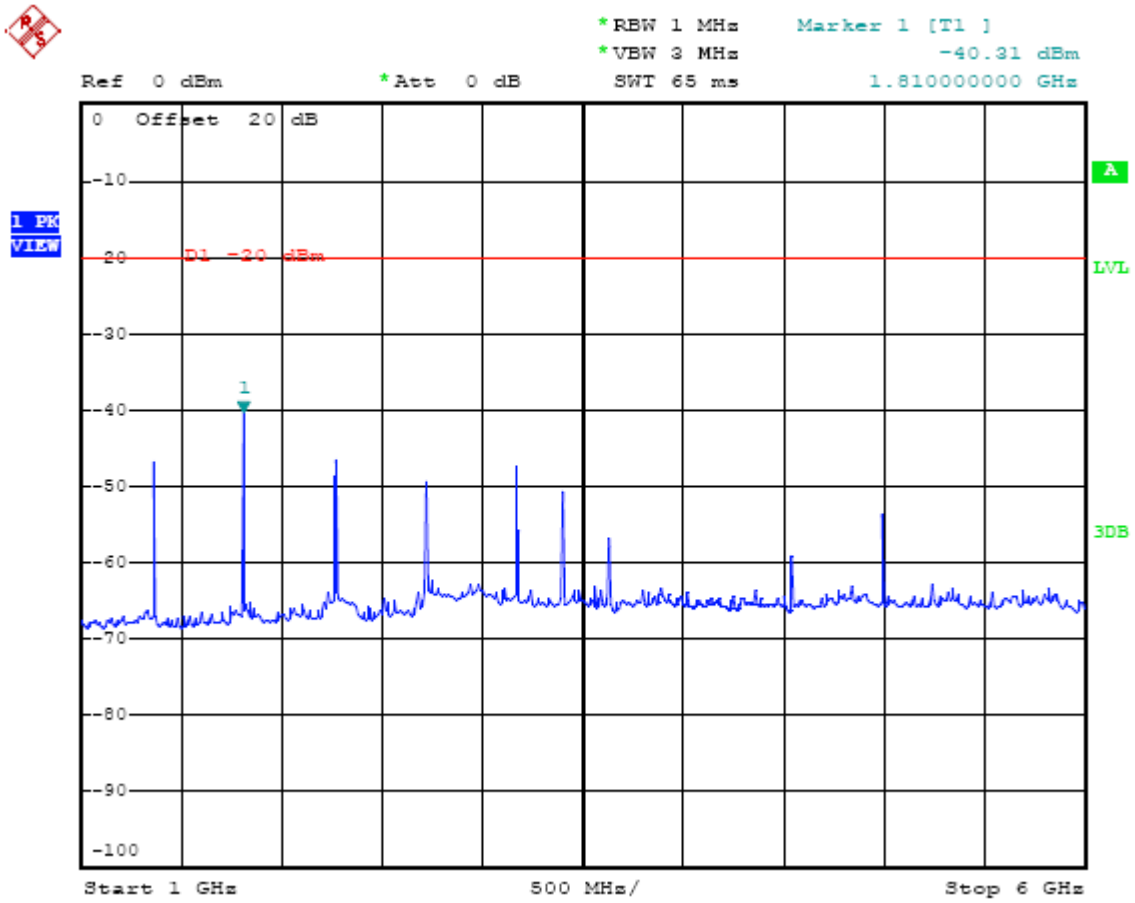

*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1]
-37.73 dBm
871.000000000 MHz
Ref 0 dBm
*Att 0 dB
SWT 50 ms
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
D1 -20 dBm
1 PK
VIEW
A
LVL
3DB
1
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
Marker 1 [T1]
-43.59 dBm
1.300000000 GHz
Ref 0 dBm
*Att 0 dB
SWT 65 ms
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
D1 -20 dBm
1 PK
VIEW
A
LVL
3DB
1
Start 1 GHz
500 MHz/
Stop 6 GHz

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	12.5KHz	A015	453.5000	907.00	-38.26	1810.00	-40.31	-20dBm
Test Results				Compliance				

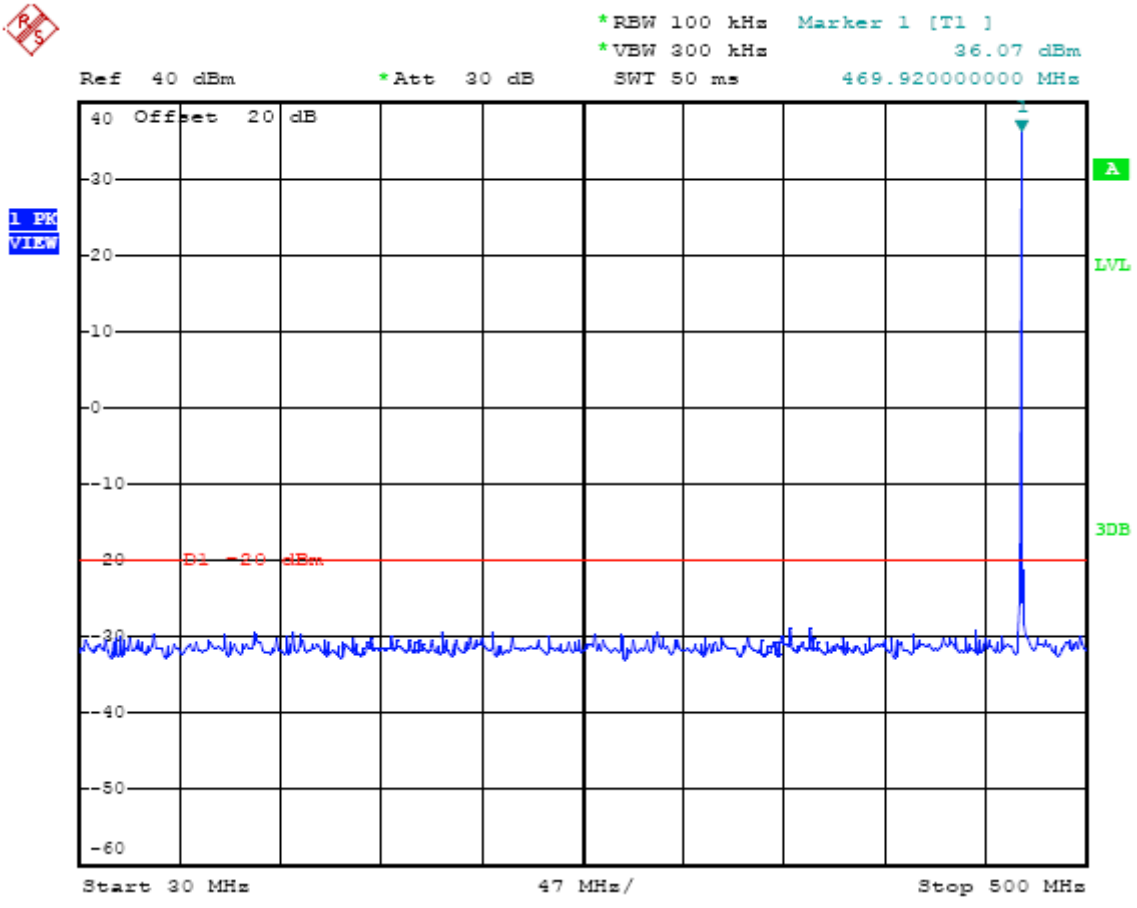


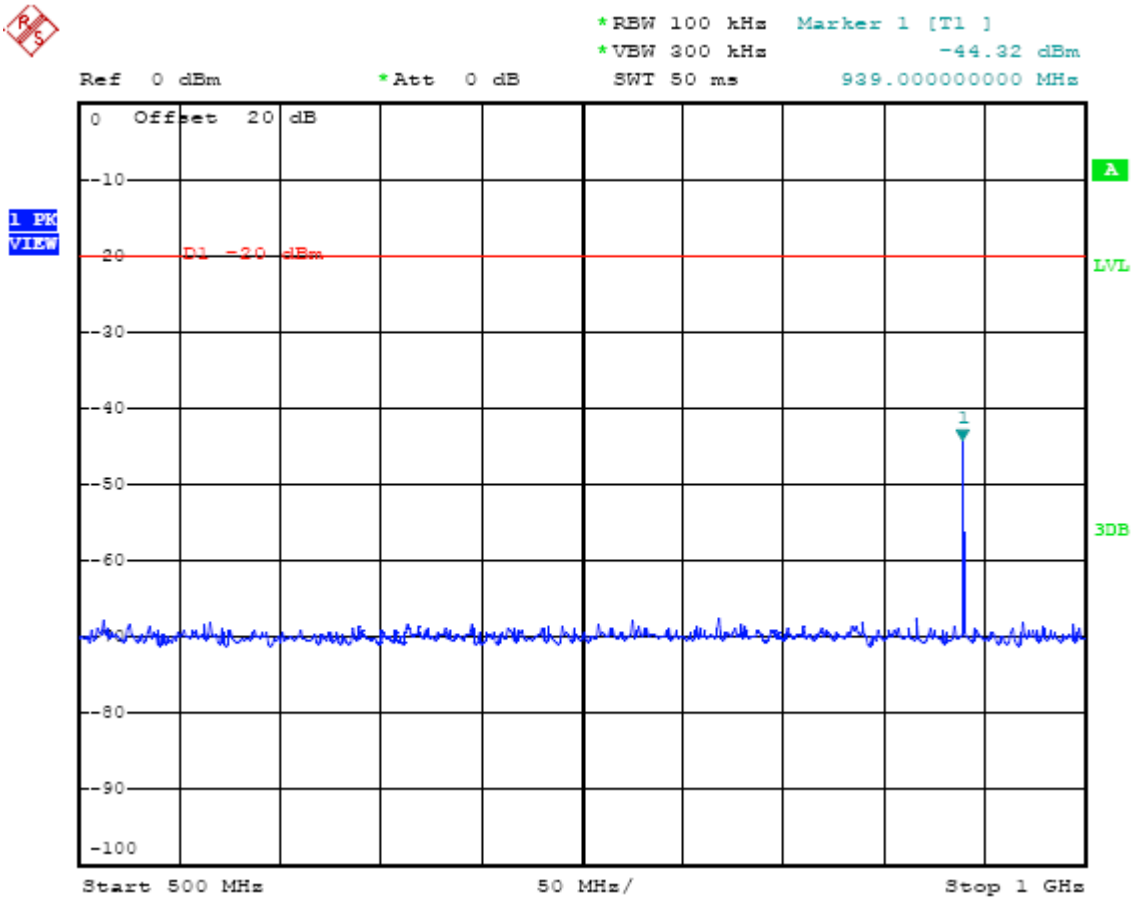

*RBW 100 kHz
*VBW 300 kHz
SWT 50 ms
Marker 1 [T1]
-38.26 dBm
907.000000000 MHz
Ref 0 dBm
*Att 0 dB
0 Offset 20 dB
1 PK
MAXH
D1 -20 dBm
A
LVL
3DB
Start 500 MHz
50 MHz/
Stop 1 GHz

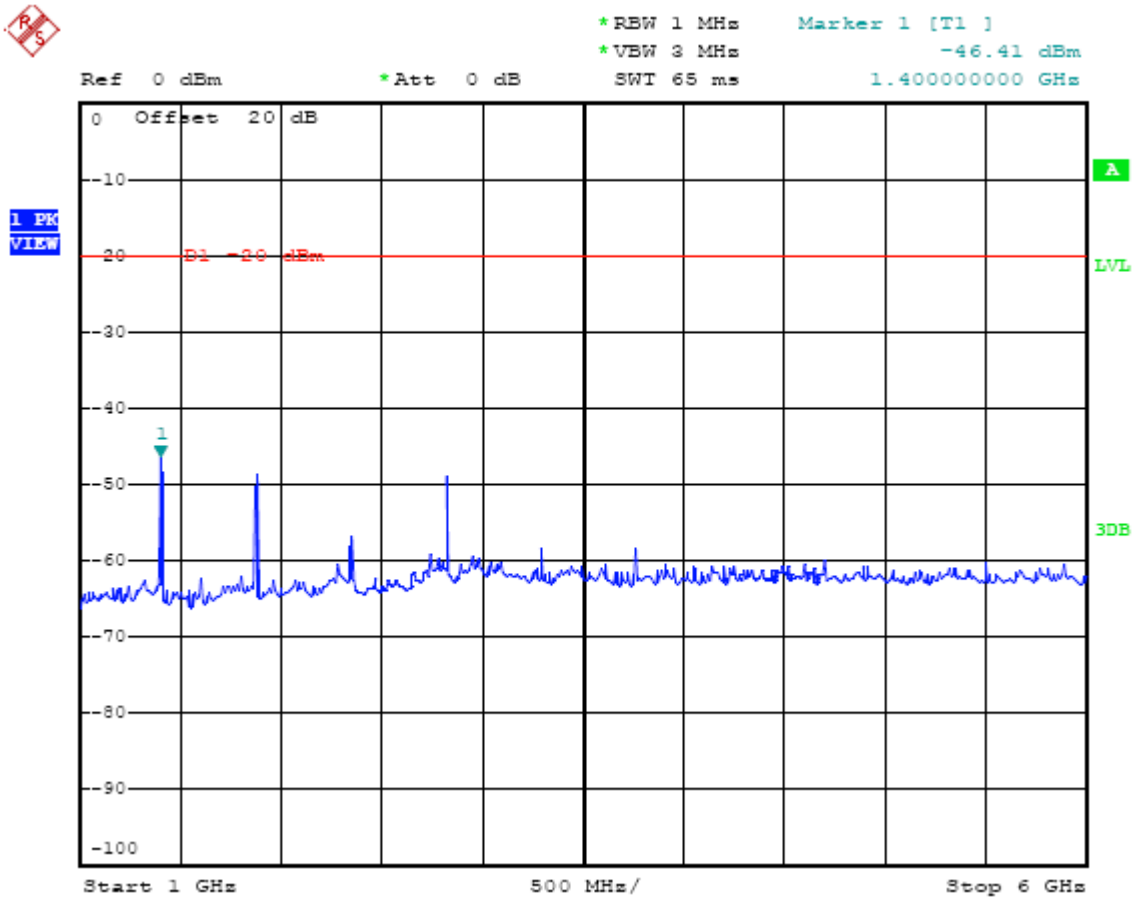

*RBW 1 MHz
*VBW 3 MHz
SWT 65 ms
Marker 1 [T1]
-40.31 dBm
1.810000000 GHz
Ref 0 dBm
*Att 0 dB
0 Offset 20 dB
1 PK
VIEW
D1 -20 dBm
A
LVL
3DB
Start 1 GHz
500 MHz/
Stop 6 GHz

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	12.5KHz	A016	469.5000	939.00	-44.32	1400.00	-46.41	-20dBm
Test Results				Compliance				

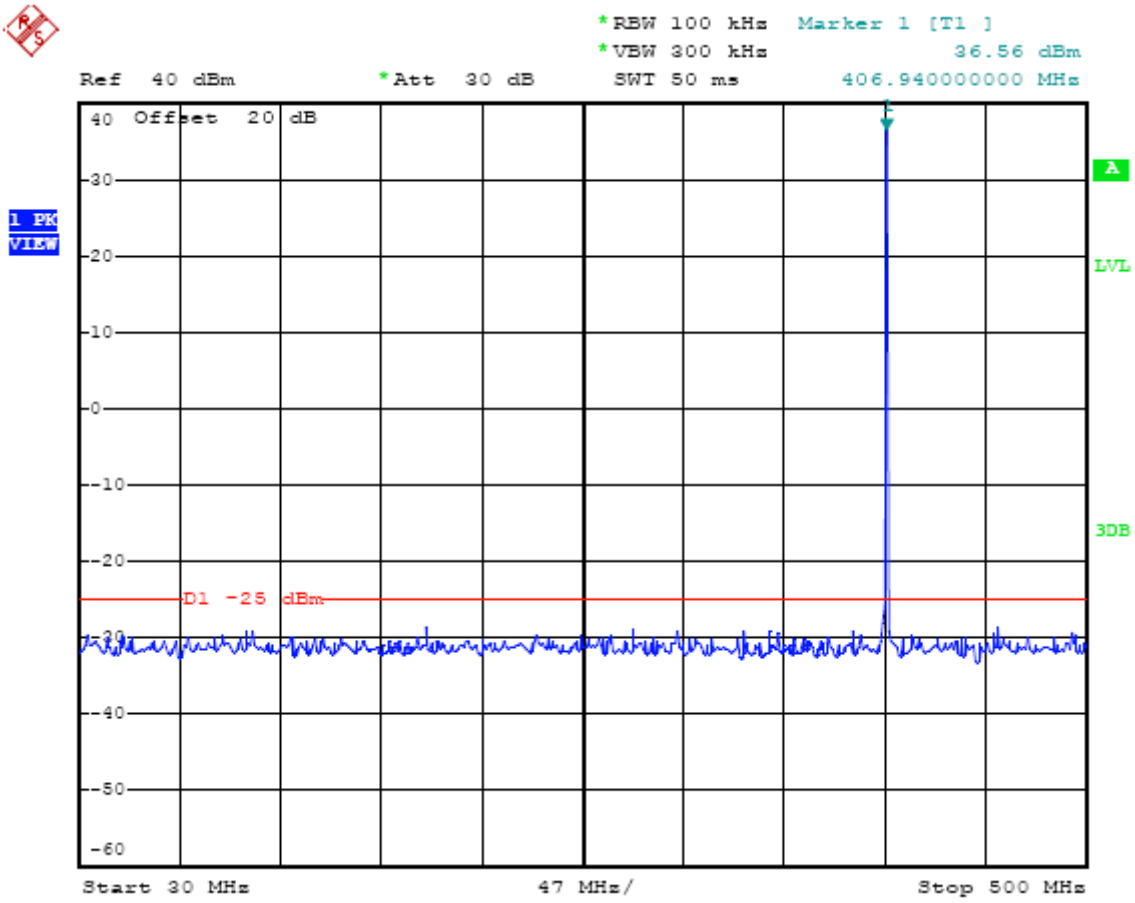
469.5M

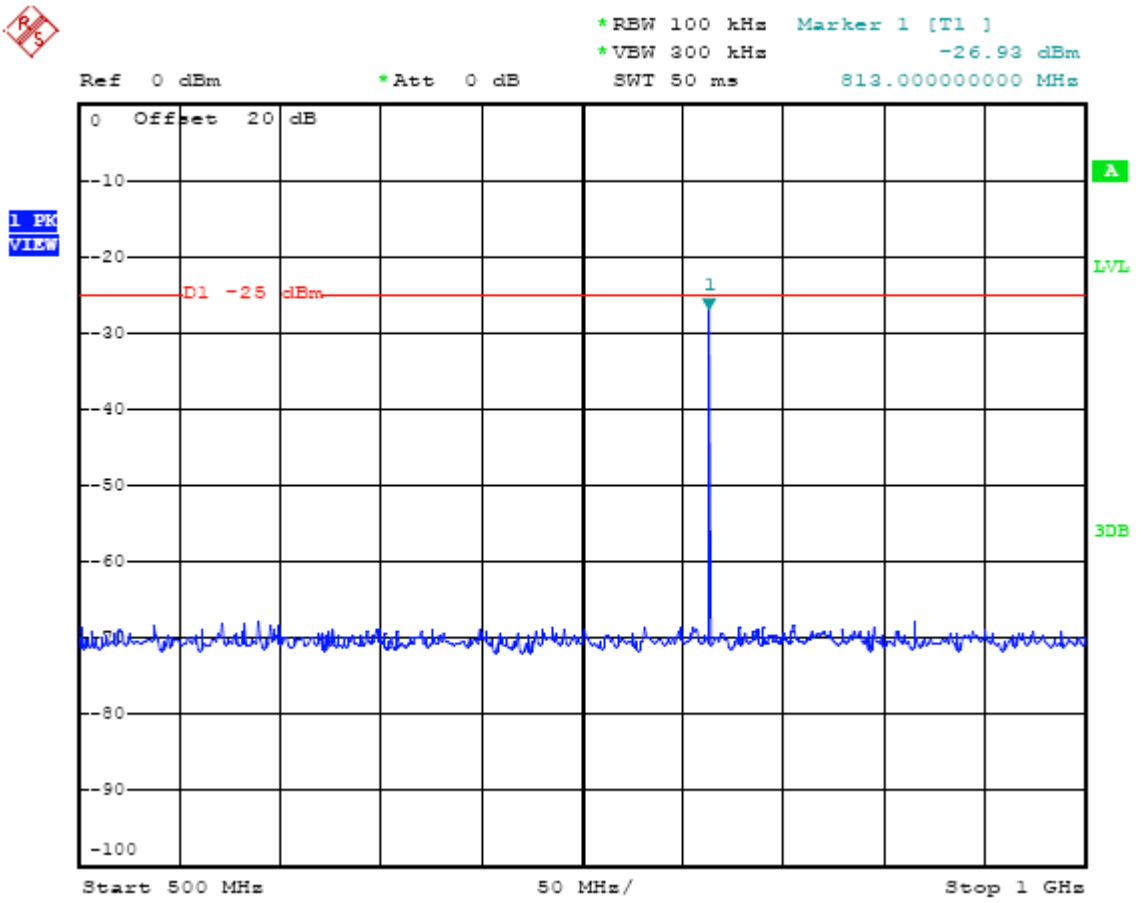


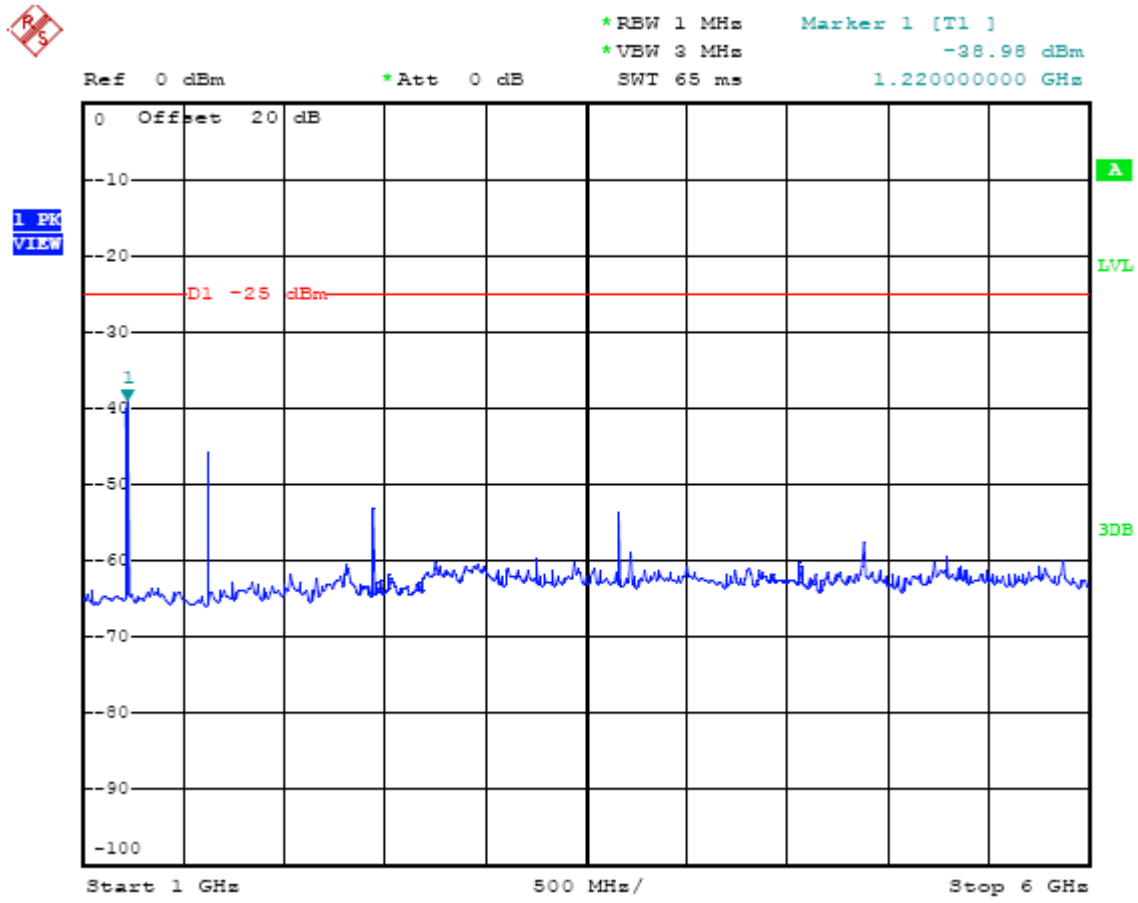

*RBW 100 kHz
*VBW 300 kHz
SWT 50 ms
Marker 1 [T1]
-44.32 dBm
939.000000000 MHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK
VIEW
D1 -20 dBm
A
LVL
3DB
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
SWT 65 ms
Marker 1 [T1]
-46.41 dBm
1.400000000 GHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK
VIEW
D1 -20 dBm
A
LVL
3DB
Start 1 GHz
500 MHz/
Stop 6 GHz

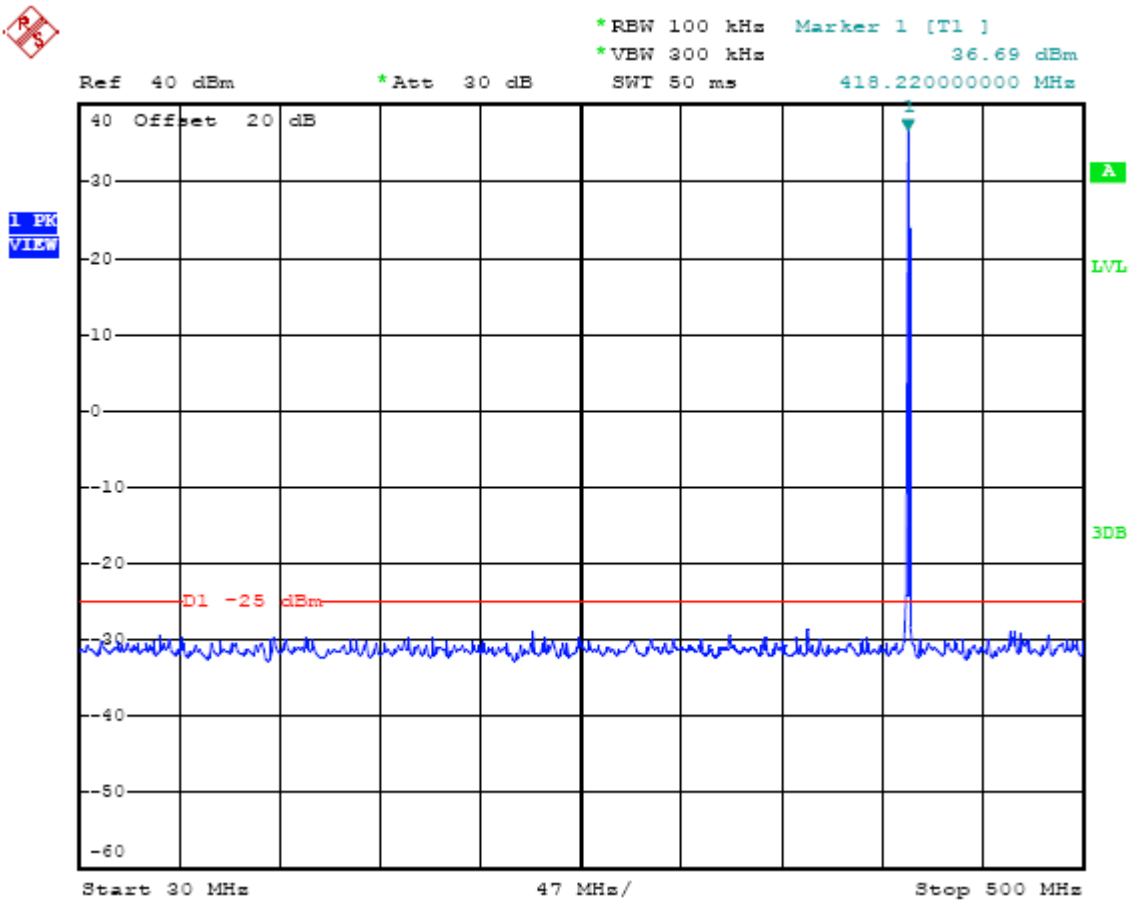
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
4L-FSK	6.25KHz	D001	406.5000	813.00	-26.93	1220.00	-38.98	-25dBm
Test Results				Compliance				

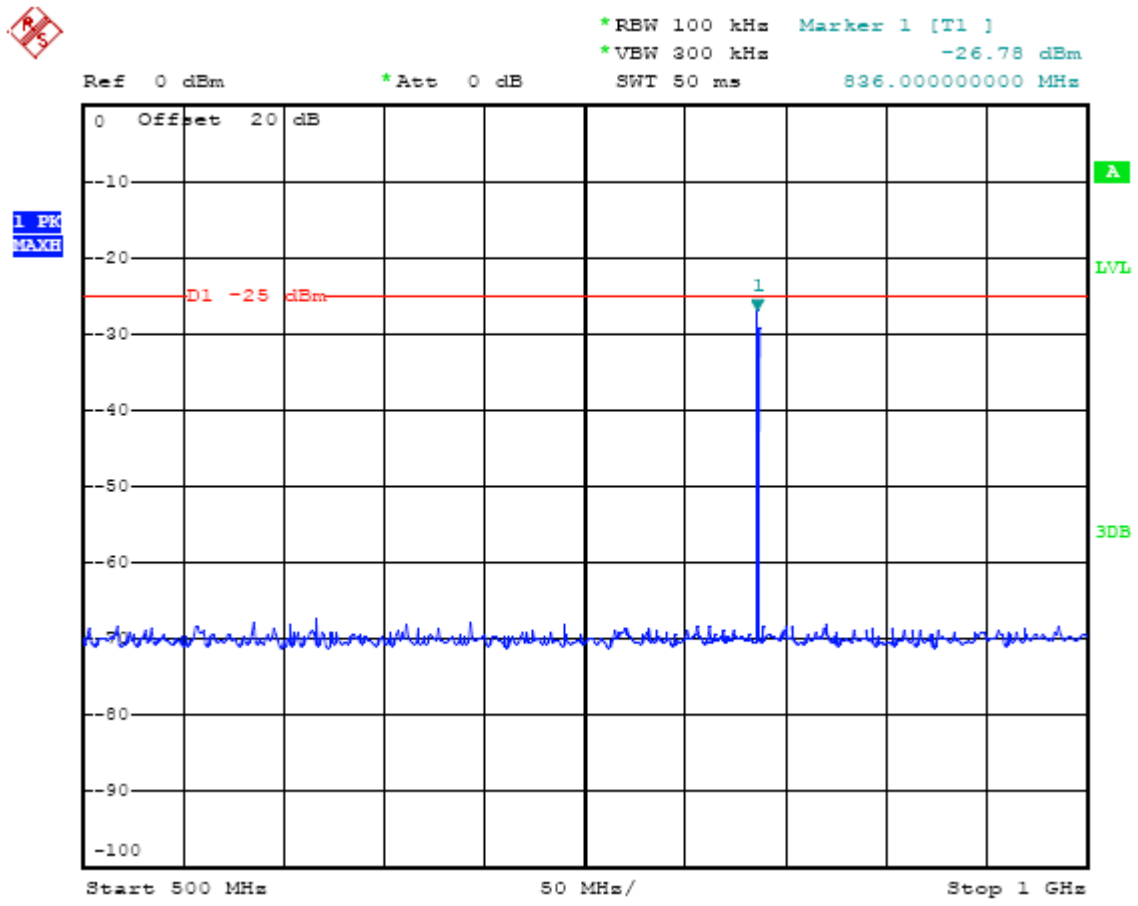


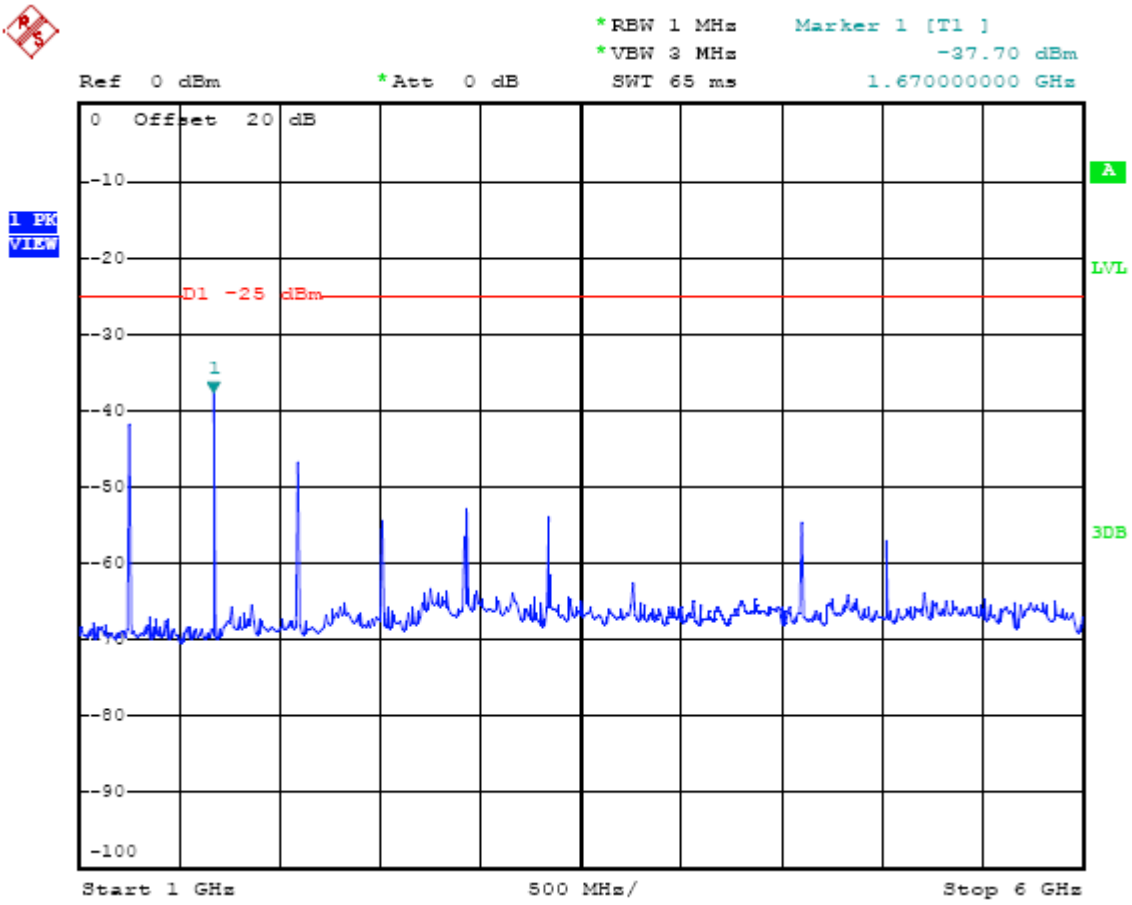

*RBW 100 kHz
*VBW 300 kHz
SWT 50 ms
Marker 1 [T1]
-26.93 dBm
813.000000000 MHz
Ref 0 dBm
*Att 0 dB
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
D1 -25 dBm
1 PK
VIEW
A
LVL
3DB
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
SWT 65 ms
Marker 1 [T1]
-38.98 dBm
1.220000000 GHz
Ref 0 dBm
*Att 0 dB
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
D1 -25 dBm
1 PK
VIEW
A
LVL
3DB
Start 1 GHz
500 MHz/
Stop 6 GHz

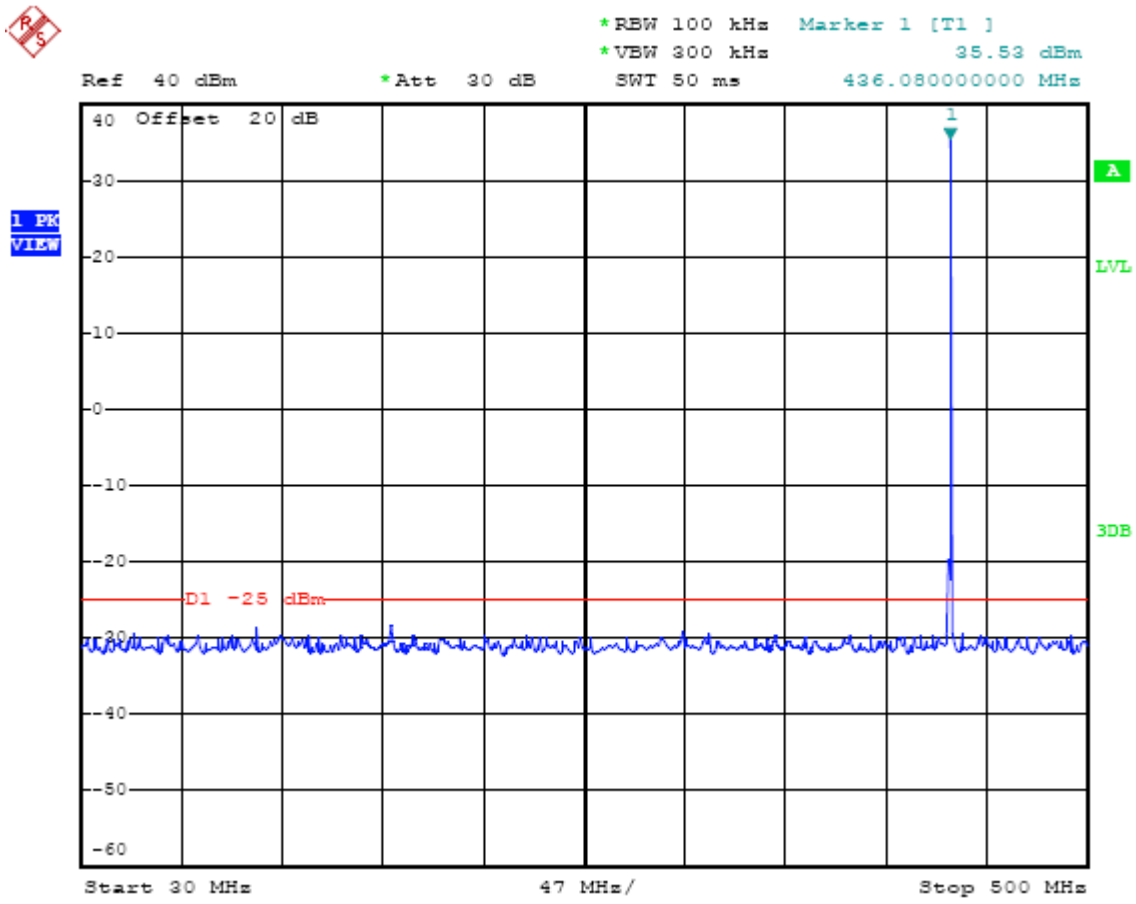
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
4L-FSK	6.25KHz	D002	418.0000	836.00	-26.78	1670.00	-37.70	-25dBm
Test Results				Compliance				

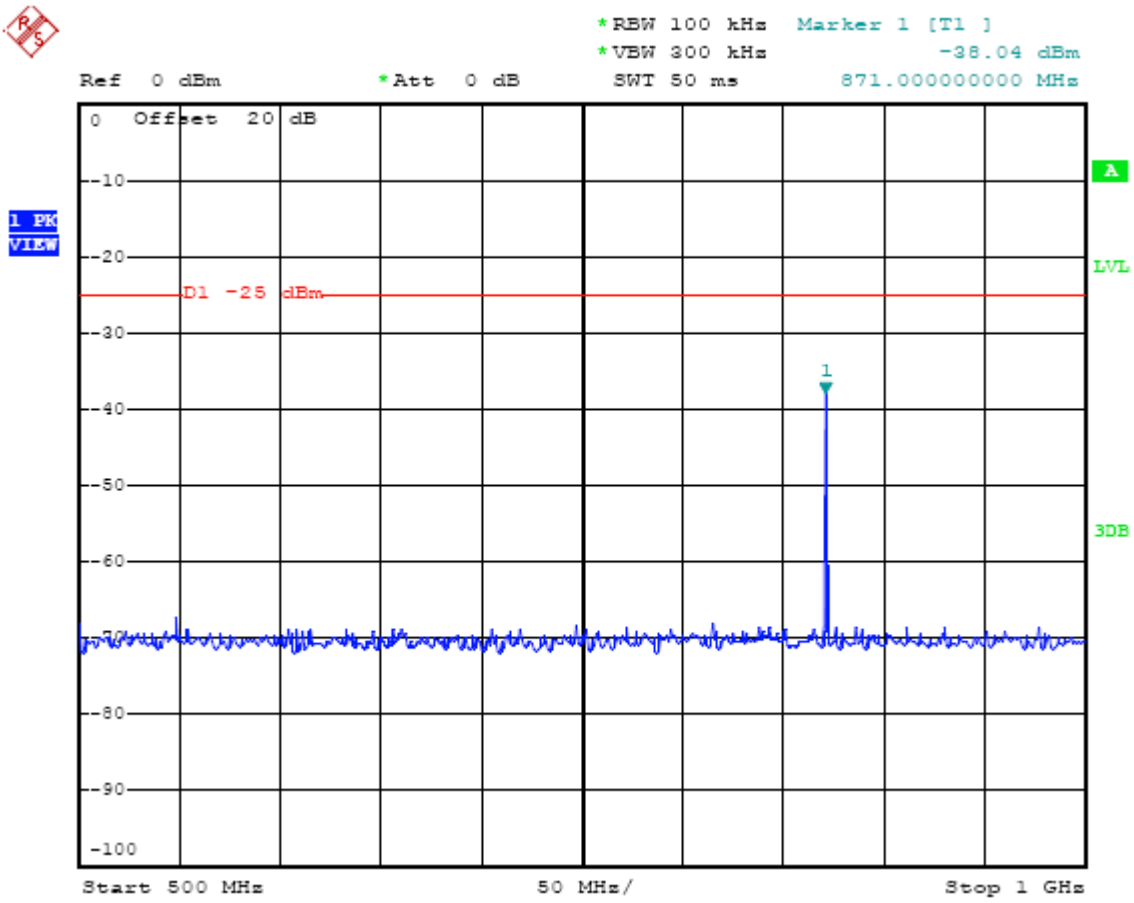


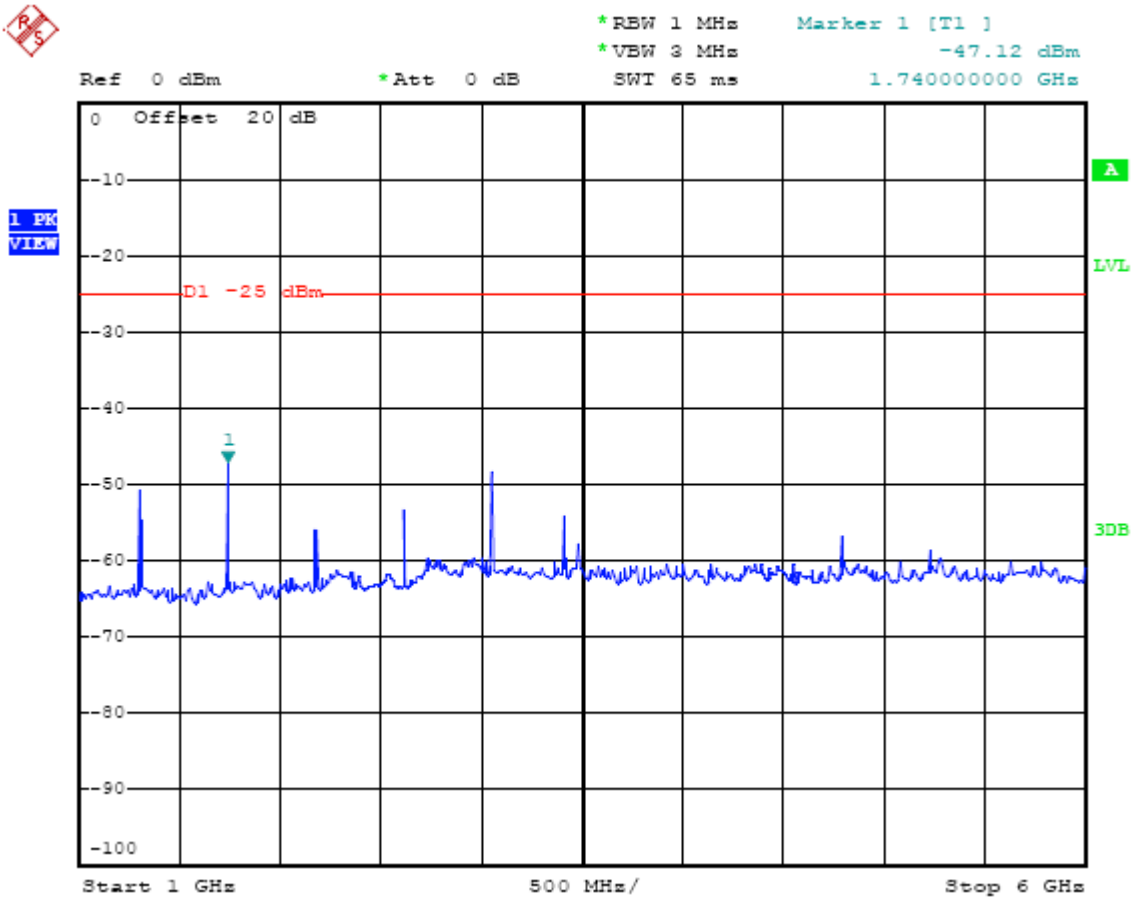

*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1]
-26.78 dBm
Ref 0 dBm
*Att 0 dB
SWT 50 ms
836.000000000 MHz
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-80
-90
-100
D1 -25 dBm
1
1 PK
MAXH
A
LVL
3DB
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
Marker 1 [T1]
-37.70 dBm
Ref 0 dBm
*Att 0 dB
SWT 65 ms
1.670000000 GHz
0 Offset 20 dB
-10
-20
-30
-40
-50
-60
-80
-90
-100
D1 -25 dBm
1
1 PK
VIEW
A
LVL
3DB
Start 1 GHz
500 MHz/
Stop 6 GHz

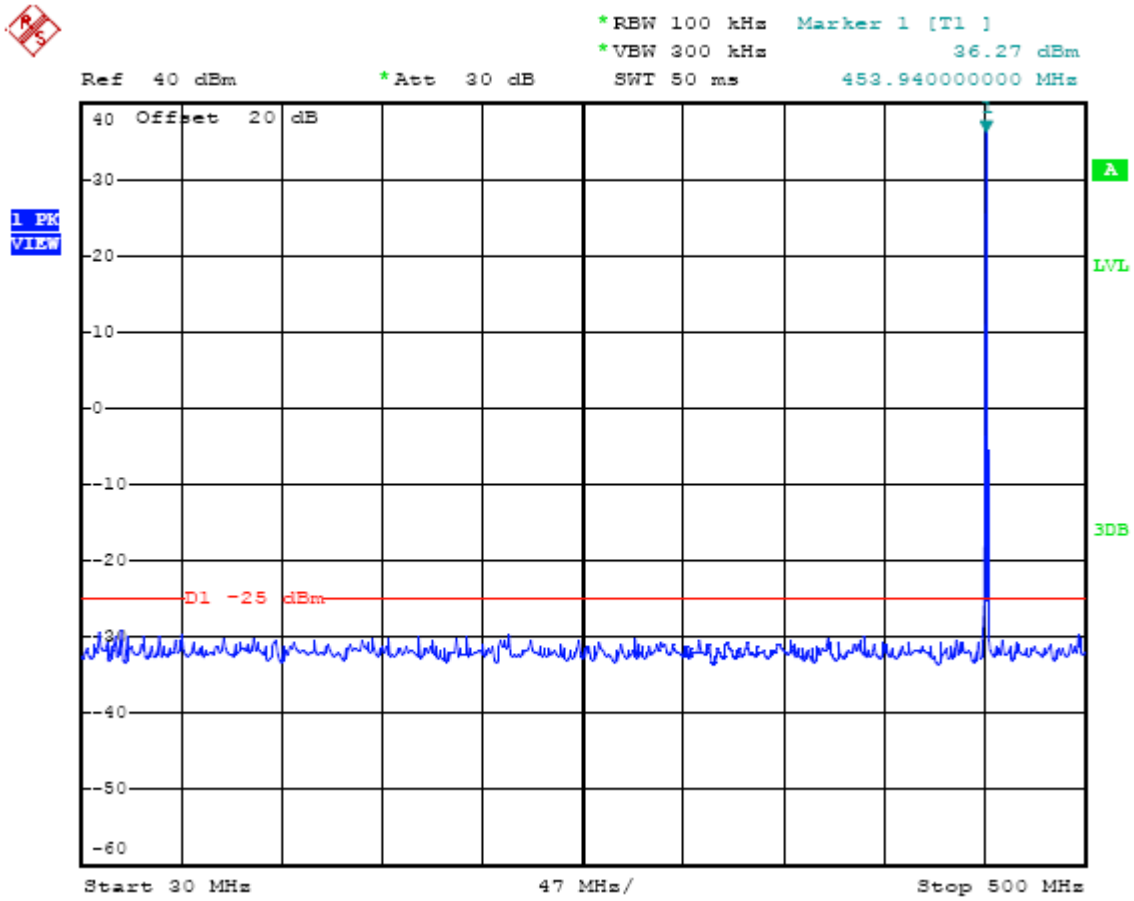
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
4L-FSK	6.25KHz	D003	435.5000	871.00	-38.04	1740.00	-47.12	-25dBm
Test Results				Compliance				

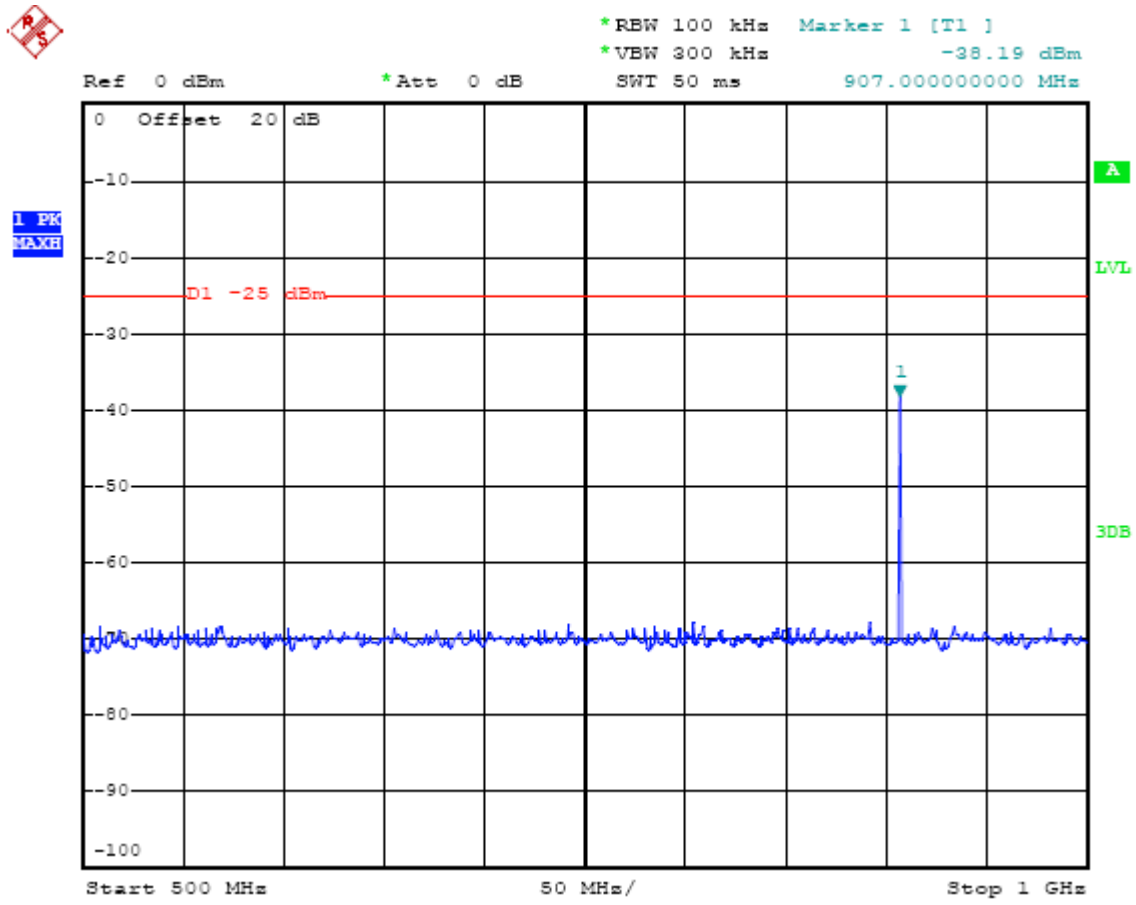


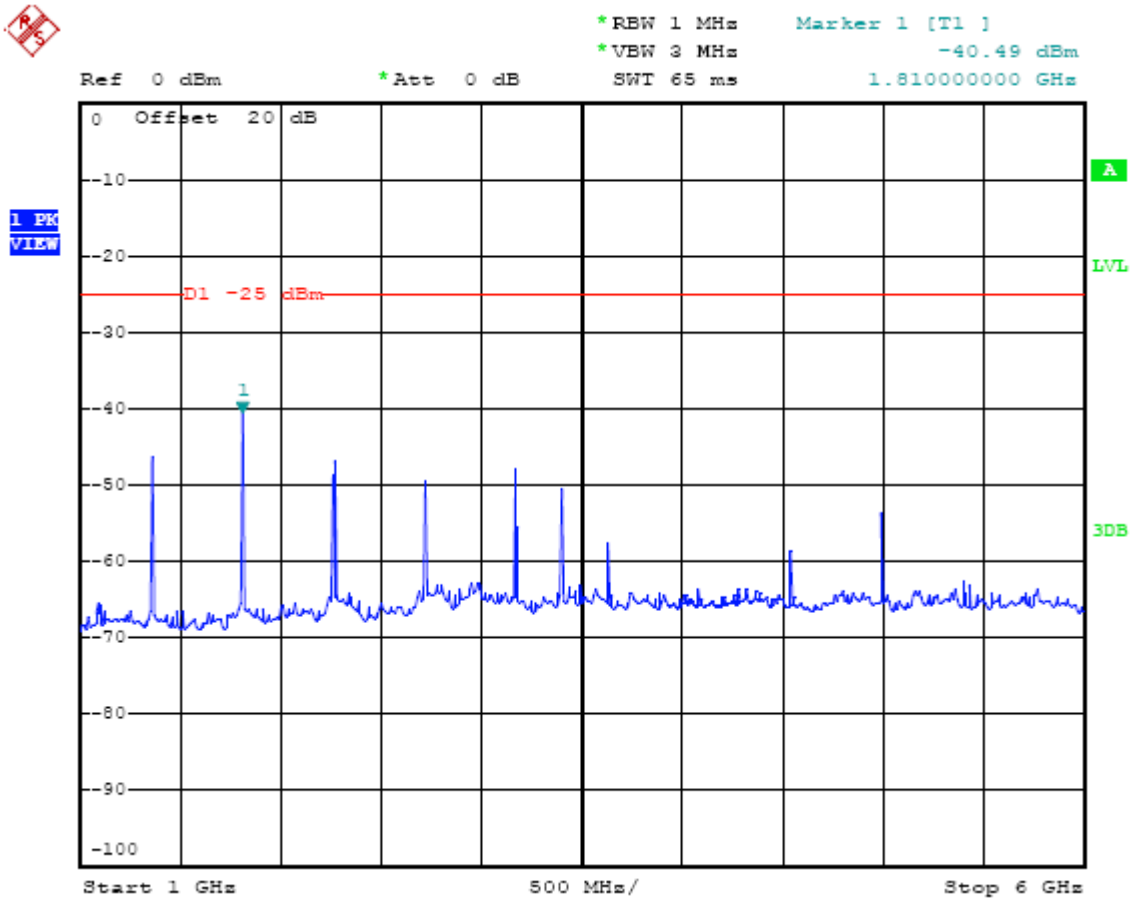

*RBW 100 kHz
*VBW 300 kHz
SWT 50 ms
Marker 1 [T1]
-38.04 dBm
871.000000000 MHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK VIEW
D1 -25 dBm
A
LVL
3DB
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
SWT 65 ms
Marker 1 [T1]
-47.12 dBm
1.740000000 GHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK VIEW
D1 -25 dBm
A
LVL
3DB
Start 1 GHz
500 MHz/
Stop 6 GHz

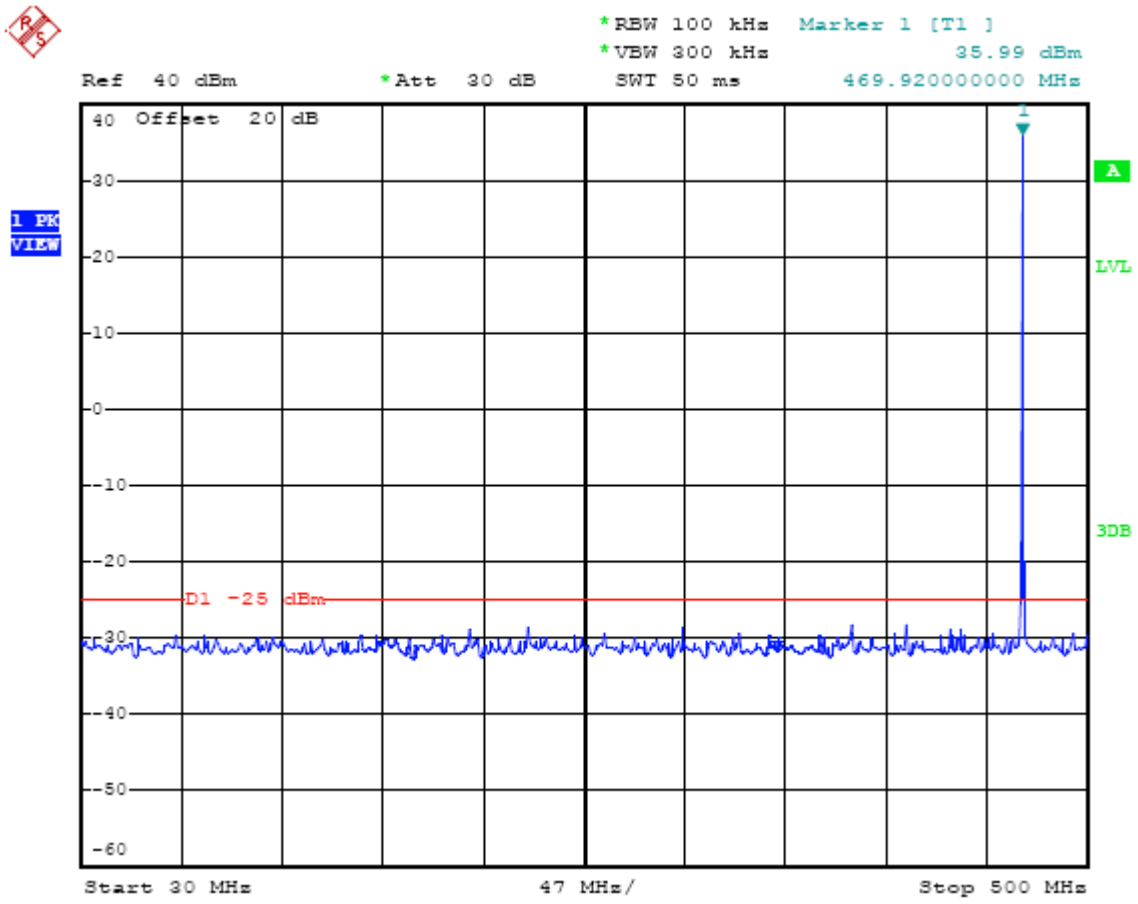
Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
4L-FSK	6.25KHz	D004	453.5000	907.00	-38.19	1810.00	-40.49	-25dBm
Test Results				Compliance				

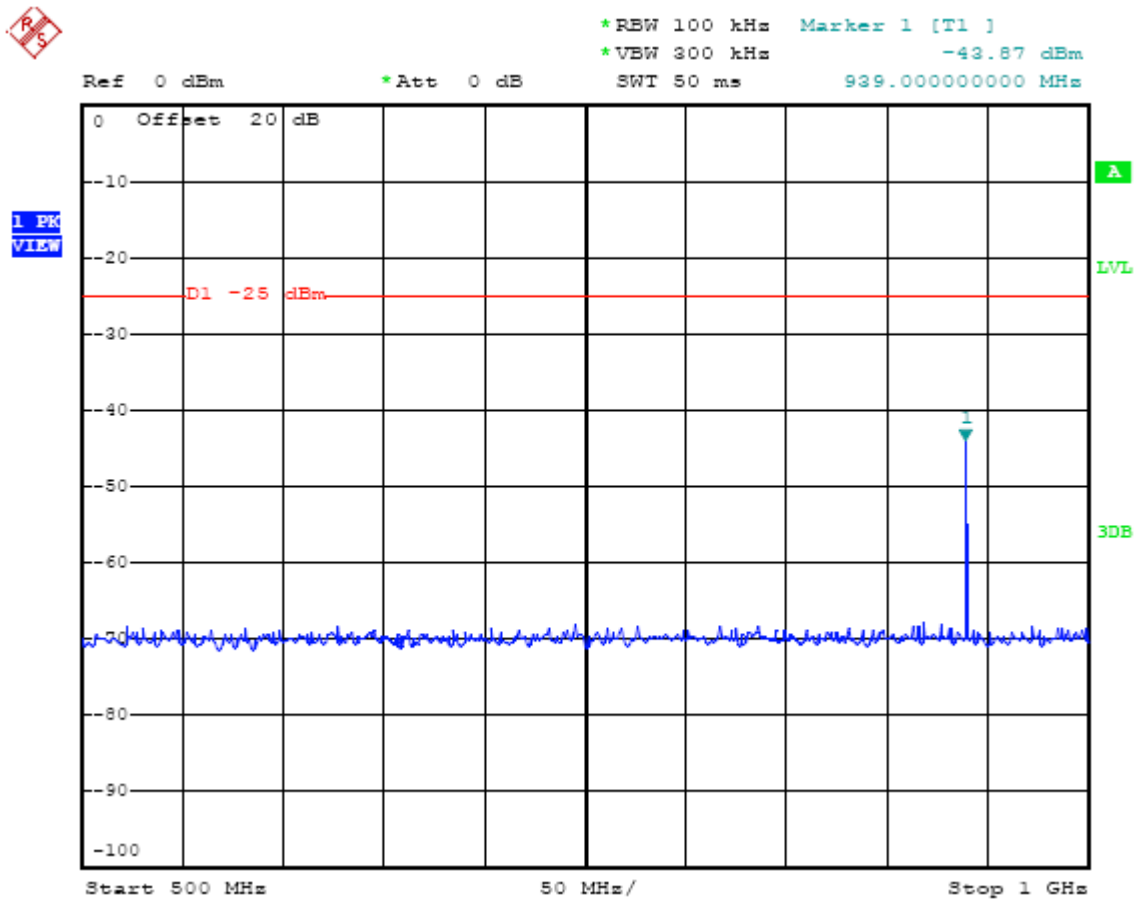


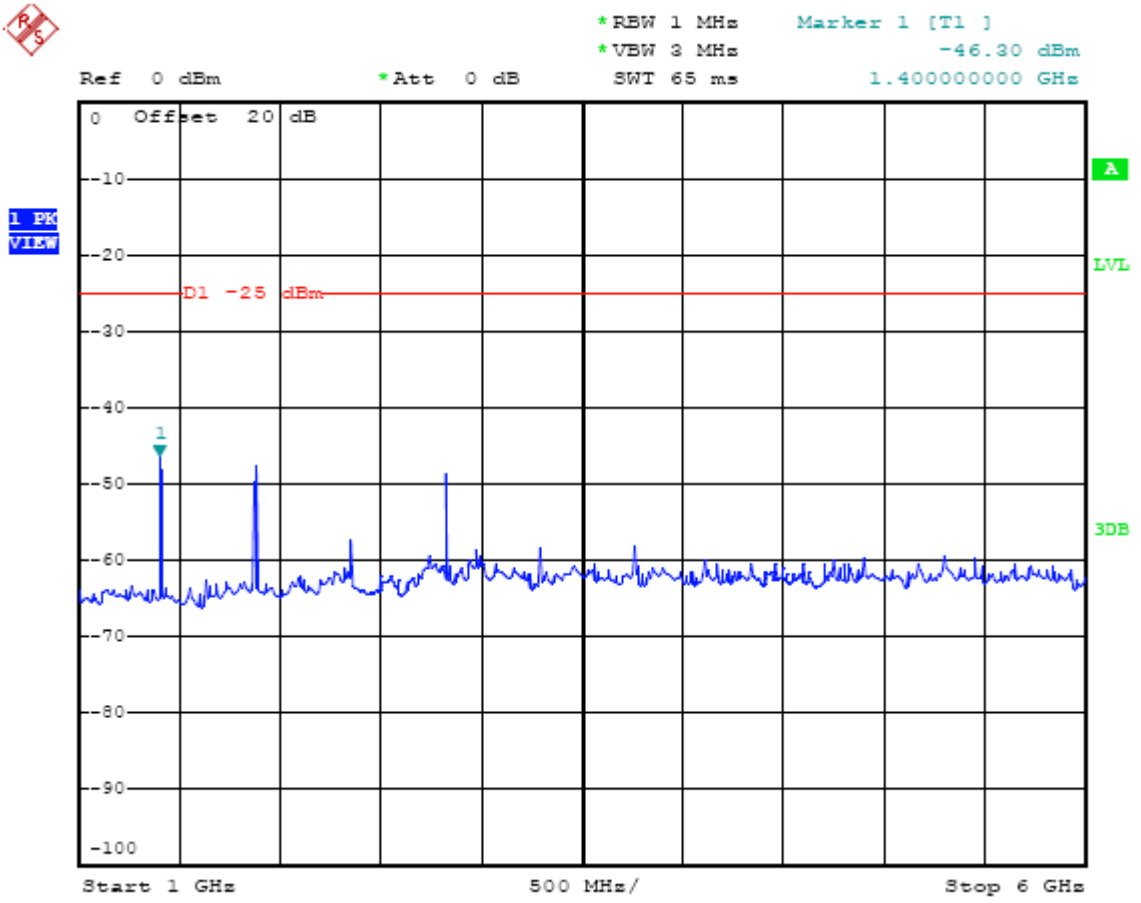

*RBW 100 kHz
*VBW 300 kHz
SWT 50 ms
Marker 1 [T1]
-38.19 dBm
907.000000000 MHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK MAXH
A
LVL
3DB
D1 -25 dBm
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
SWT 65 ms
Marker 1 [T1]
-40.49 dBm
1.810000000 GHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK VIEW
A
LVL
3DB
D1 -25 dBm
Start 1 GHz
500 MHz/
Stop 6 GHz

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
4L-FSK	6.25KHz	D005	469.5000	939.00	-43.87	1400.00	-46.30	-25dBm
Test Results				Compliance				




*RBW 100 kHz
*VBW 300 kHz
SWT 50 ms
Marker 1 [T1]
-43.87 dBm
939.000000000 MHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK VIEW
D1 -25 dBm
A
LVL
3DB
Start 500 MHz
50 MHz/
Stop 1 GHz


*RBW 1 MHz
*VBW 3 MHz
SWT 65 ms
Marker 1 [T1]
-46.30 dBm
1.400000000 GHz
Ref 0 dBm
*Att 0 dB
Offset 20 dB
1 PK VIEW
D1 -25 dBm
A
LVL
3DB
Start 1 GHz
500 MHz/
Stop 6 GHz

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

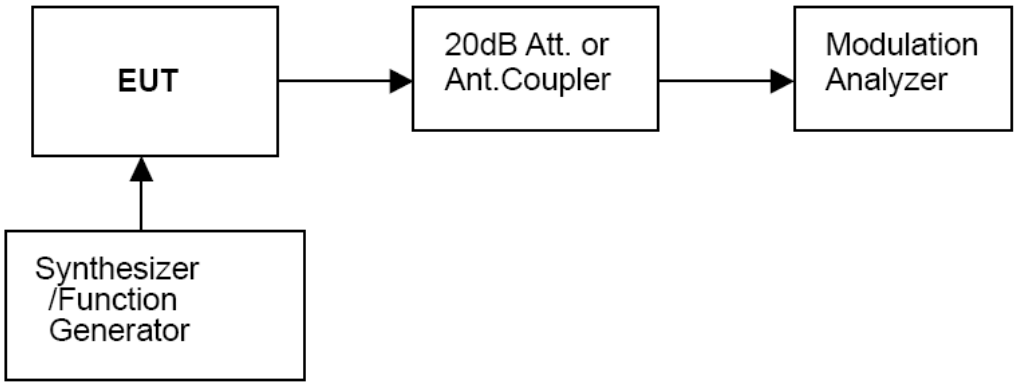
Modulation Limit

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

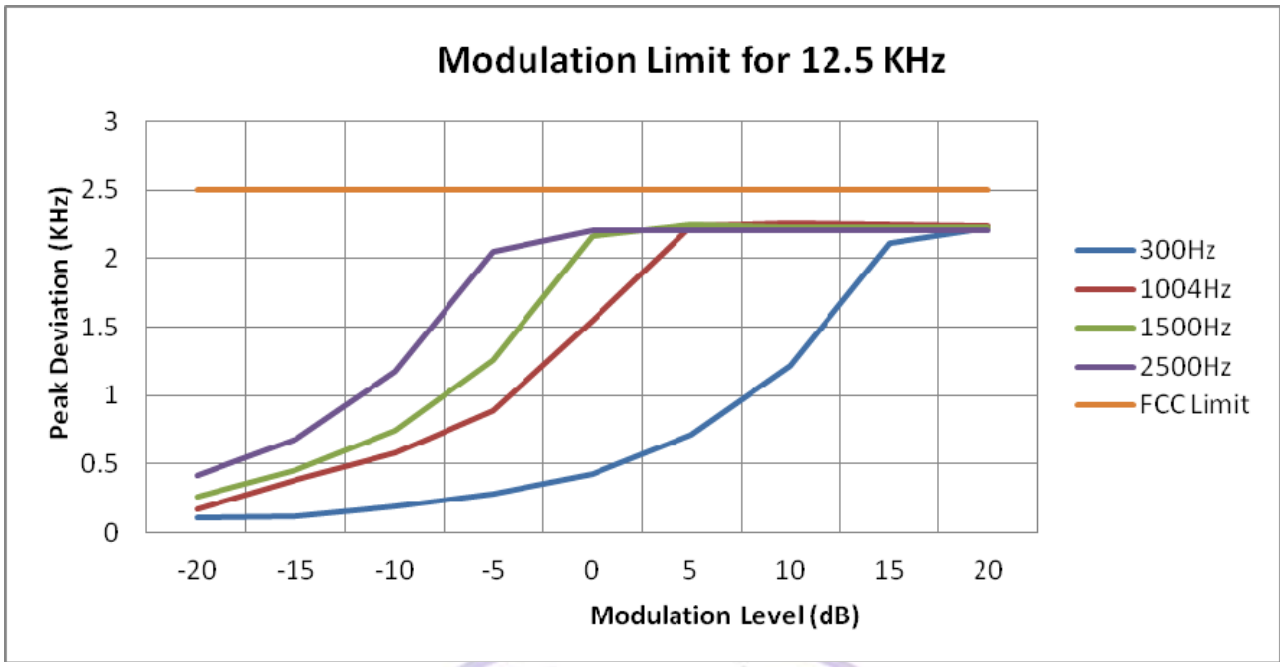


TEST RESULTS

Modulation Type: FM

12.5 KHz Channel Separation

Modulation Level(dB)	Peak Freq. Deviation At 300 Hz(KHz)	Peak Freq. Deviation At 1004 H(KHz)	Peak Freq. Deviation At 1500 Hz(KHz)	Peak Freq. Deviation At 2500 Hz(KHz)
-20	0.11	0.17	0.26	0.42
-15	0.12	0.38	0.46	0.68
-10	0.19	0.58	0.75	1.18
-5	0.28	0.89	1.26	2.05
0	0.43	1.55	2.16	2.21
+5	0.71	2.24	2.25	2.20
+10	1.22	2.26	2.23	2.21
+15	2.11	2.25	2.23	2.21
+20	2.23	2.24	2.23	2.21



Modulation type: 4L-FSK

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

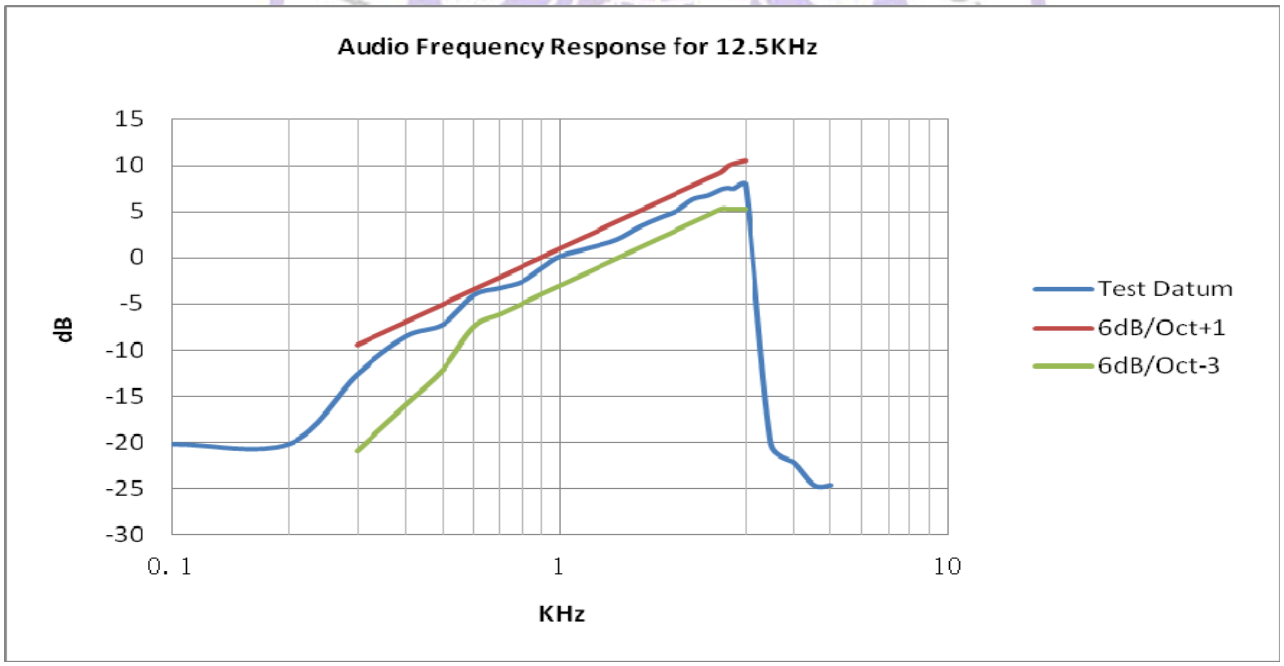
Test Audio Level (1 KHz and 20% maximum deviation) is 2.90mv for 12.5 KHz channel separation.

Note:

1 Not applicable to new standard. However, tests are conducted under FCC's recommendation.
2 The Audio Frequency Response is identical for 12.5 KHz channel separation

12.5 KHz Channel Separation

Frequency (KHz)	Frequency Deviation (KHz)	1KHz Reference Deviation (KHz)	Audio Frequency Response (dB)
0.1	0.05	0.51	-20.17
0.2	0.05	0.51	-20.17
0.3	0.15	0.51	-12.63
0.4	0.27	0.51	-8.52
0.5	0.25	0.51	-7.19
0.6	0.32	0.51	-4.05
0.7	0.35	0.51	-3.27
0.8	0.38	0.51	-2.56
0.9	0.45	0.51	-1.09
1.0	0.52	0.51	0.17
1.2	0.58	0.51	1.12
1.4	0.64	0.51	1.97
1.6	0.75	0.51	3.35
1.8	0.84	0.51	4.33
2.0	0.92	0.51	5.12
2.2	1.06	0.51	6.35
2.4	1.11	0.51	6.76
2.6	1.20	0.51	7.43
2.7	1.22	0.51	7.58
2.8	1.21	0.51	7.50
3.0	1.27	0.51	7.92
3.5	0.05	0.51	-20.17
4.0	0.04	0.51	-22.11
4.5	0.03	0.51	-24.61
5.0	0.03	0.51	-24.61



Modulation type: 4L-FSK

Channel bandwidth: 6.25 kHz

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

4.6. Frequency Stability Measurement

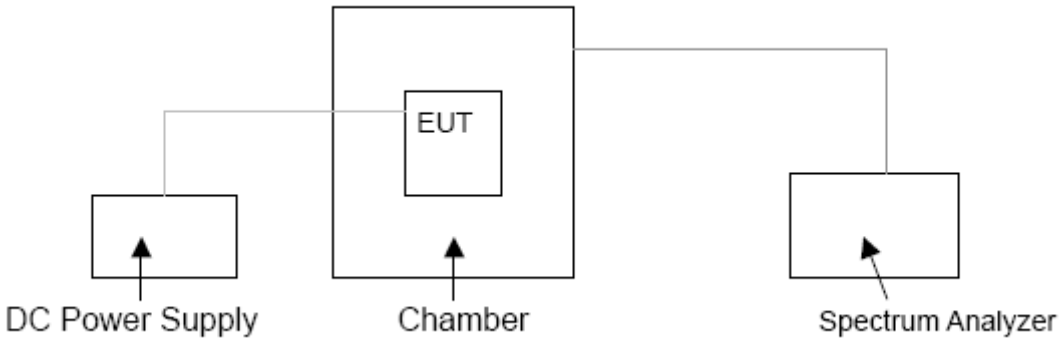
TEST APPLICABLE

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 (℃)	406.5000 (MHz)	418.0000 (MHz)	435.5000 (MHz)	453.5000 (MHz)	469.5000 (MHz
Analog/FM	12.5KHz	7.40	-30	-0.74	-0.71	-0.71	0.70	0.72
			-20	-0.74	-0.69	-0.71	0.70	0.71
			-10	-0.62	-0.69	-0.71	0.63	0.65
			0	-0.55	-0.52	-0.55	0.54	0.57
			10	-0.42	-0.40	-0.41	0.42	0.43
			20	-0.36	-0.33	-0.33	0.34	0.35
			30	-0.36	-0.33	-0.32	0.35	0.32
			40	-0.45	-0.45	-0.41	0.42	0.43
			50	-0.60	-0.45	-0.55	0.50	0.51
		6.35 (End Point)	25	-0.36	-0.36	-0.33	0.30	0.32
		6.29 (85% Rated)	20	-0.36	-0.33	-0.32	0.34	0.37
		8.51 (115% Rated)	20	-0.36	-0.36	-0.32	0.38	0.35
Limit				2.50	2.50	2.50	2.50	2.50
Conclusion				Complies				

Modulation Type	Channel Separation	Test conditions		Frequency error (ppm)				
		Voltage(V)	Temp (℃)	406.5000 (MHz)	418.0000 (MHz)	435.5000 (MHz)	453.5000 (MHz)	469.5000 (MHz
Digital/4L-FSK	6.25KHz	7.40	-30	-0.72	-0.70	-0.73	0.71	0.72
			-20	-0.73	-0.69	-0.70	0.72	0.72
			-10	-0.69	-0.66	-0.71	0.62	0.66
			0	-0.54	-0.56	-0.50	0.53	0.55
			10	-0.42	-0.40	-0.43	0.44	0.43
			20	-0.36	-0.32	-0.30	0.34	0.32
			30	-0.34	-0.33	-0.32	0.32	0.34
			40	-0.45	-0.44	-0.41	0.42	0.45
			50	-0.60	-0.45	-0.54	0.51	0.51
		6.35 (End Point)	25	-0.36	-0.36	-0.33	0.34	0.33
		6.29 (85% Rated)	20	-0.36	-0.32	-0.31	0.35	0.36
		8.51 (115% Rated)	20	-0.36	-0.35	-0.33	0.39	0.37
Limit				1.00	1.00	1.00	1.00	1.00
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.
Per RSS-119 Section 5.4 and 5.4.1: The output power shall be within ±1.0 dB of the manufacturer's rated power. 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:
If 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

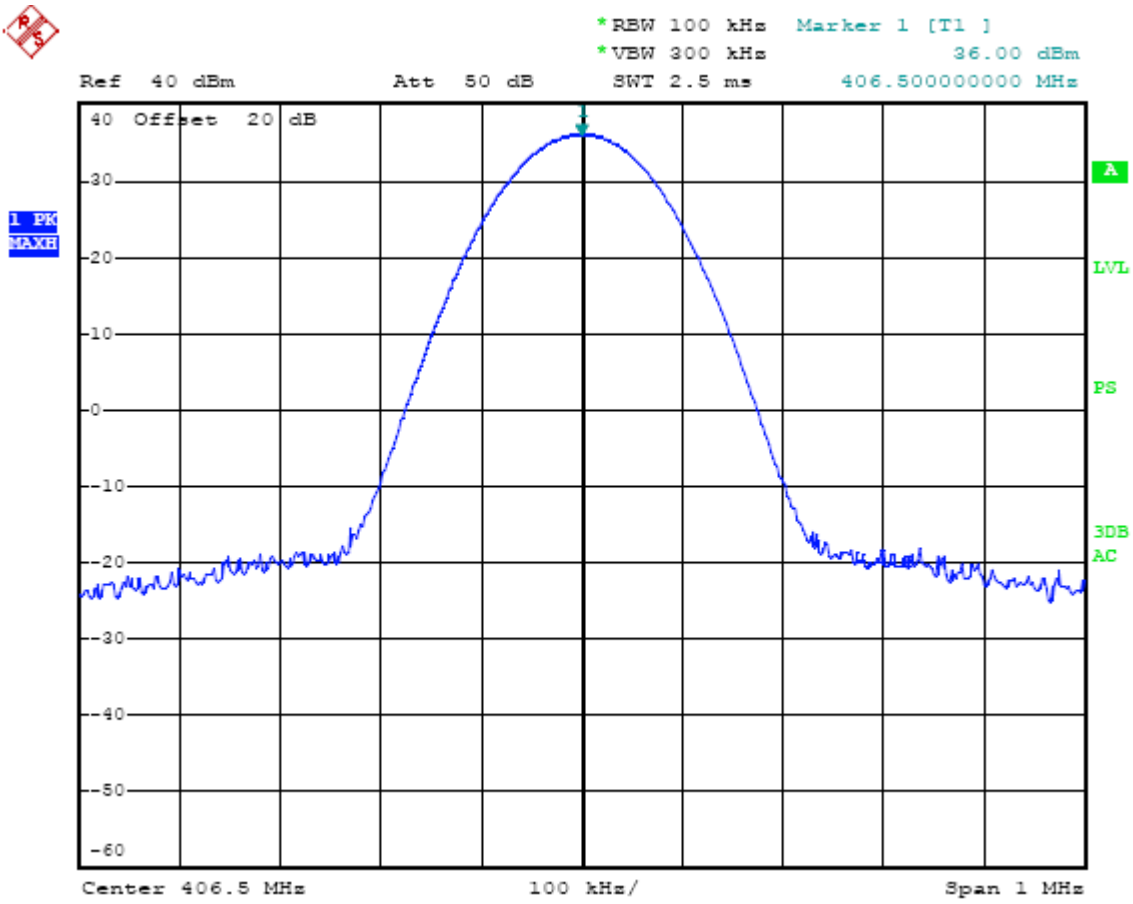
The EUT was directly connected to a RF Communication Test set by a 20 dB attenuator

TEST RESULTS

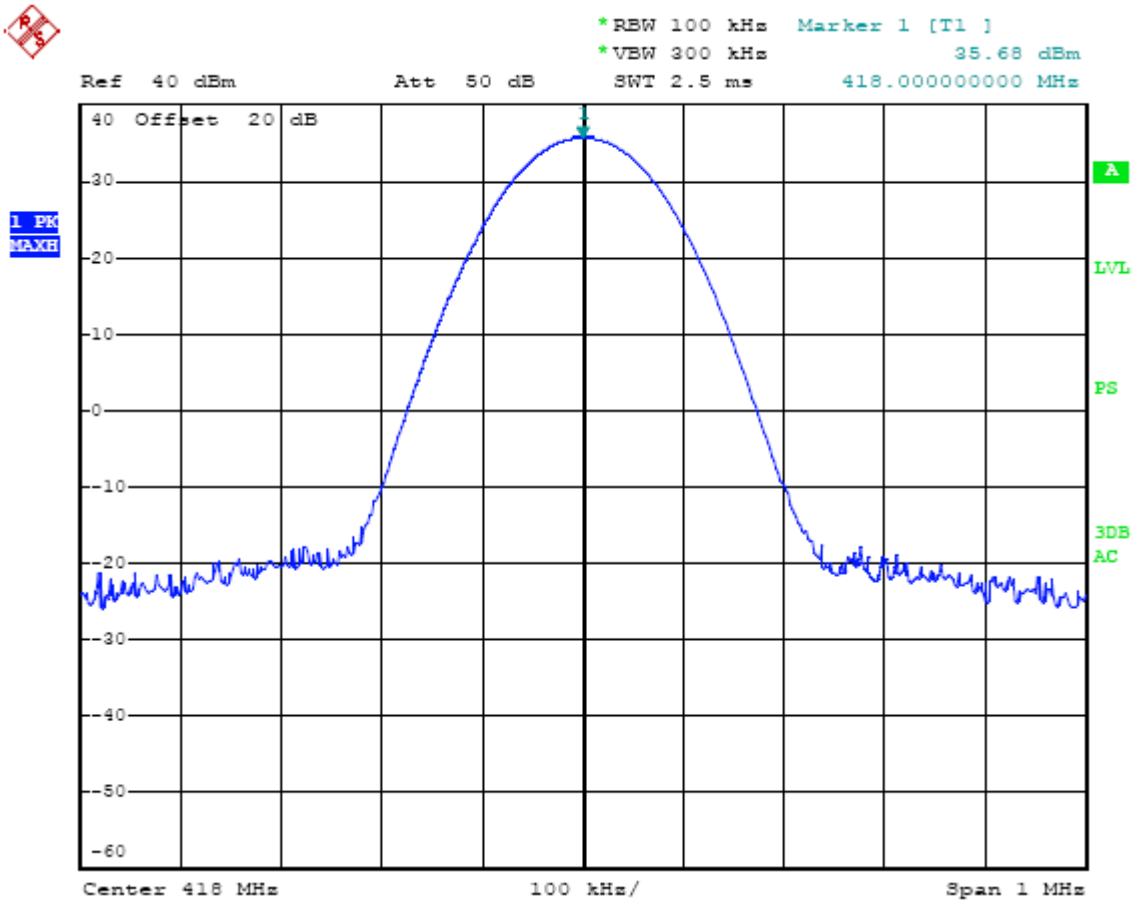
Frequency Range (MHz)	Modulation Type	Channel Separation (KHz)	Test Channel	Maximum Output Power Test Results (dBm)
400-470	Analog/FM	12.5	A012	36.00
			A013	35.68
			A014	35.95
			A015	35.25
			A016	35.56
400-470	Digital/4L-FSK	6.25	D001	35.53
			D002	35.45
			D003	35.81
			D004	35.14
			D005	35.47
Limit	FCC:The limit is dependent upon the station's antenna HAAT and required service area.			
	IC:The output power shall be within ±1.0 dB of the manufacturer's rated power.			
Test Results	Compliance			

Plots of Maximum Transmitter Power Measurement

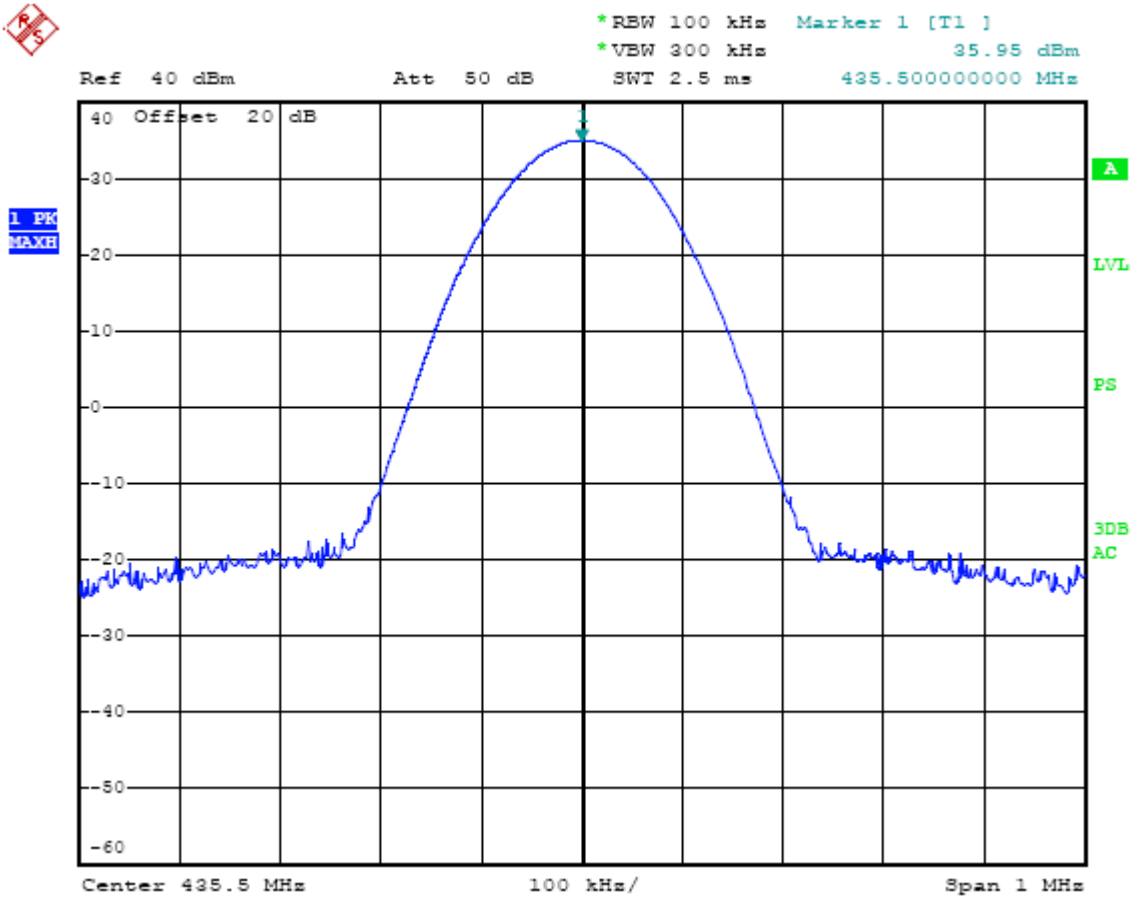
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
FM	12.5 KHz	406.5000	4	36.00	Varies	36.02±1	Compliance



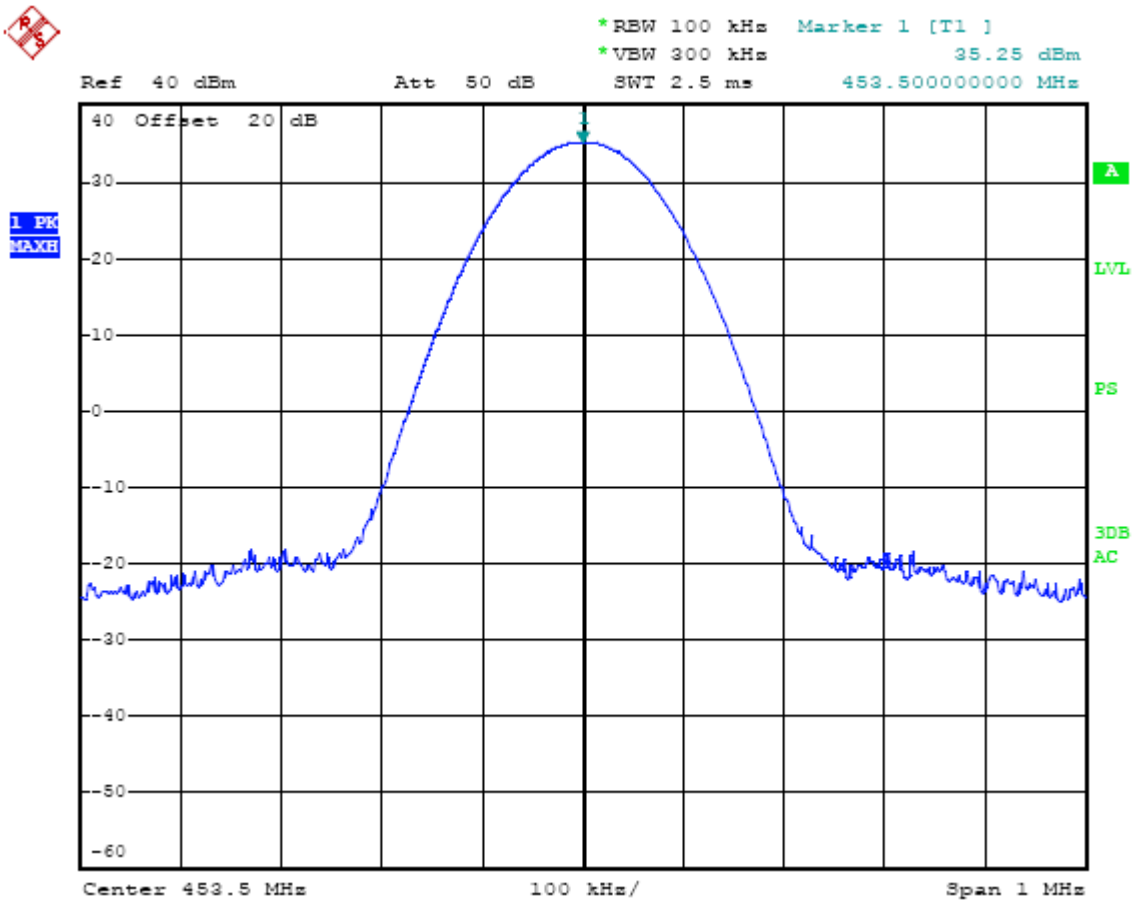
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
FM	12.5 KHz	418.0000	4	35.68	Varies	36.02±1	Compliance



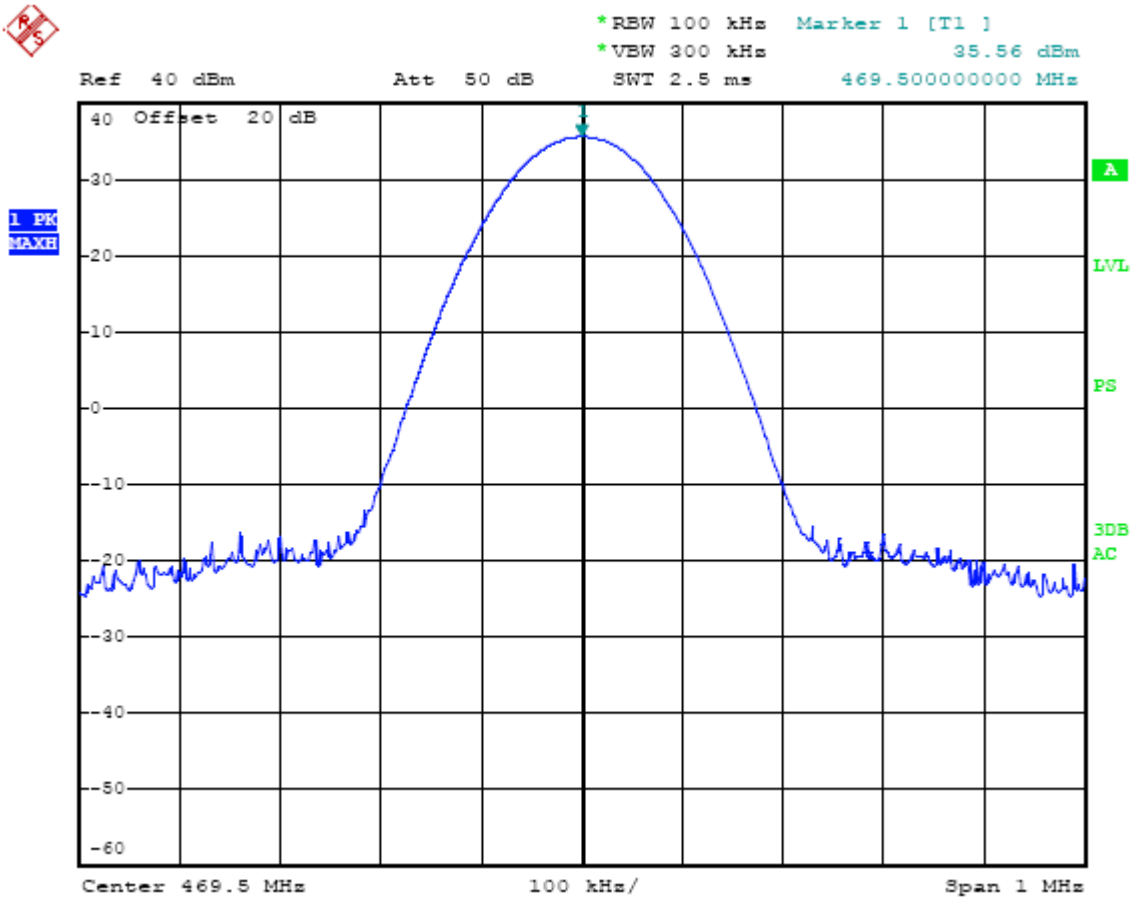
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
FM	12.5 KHz	435.5000	4	35.95	Varies	36.02±1	Compliance



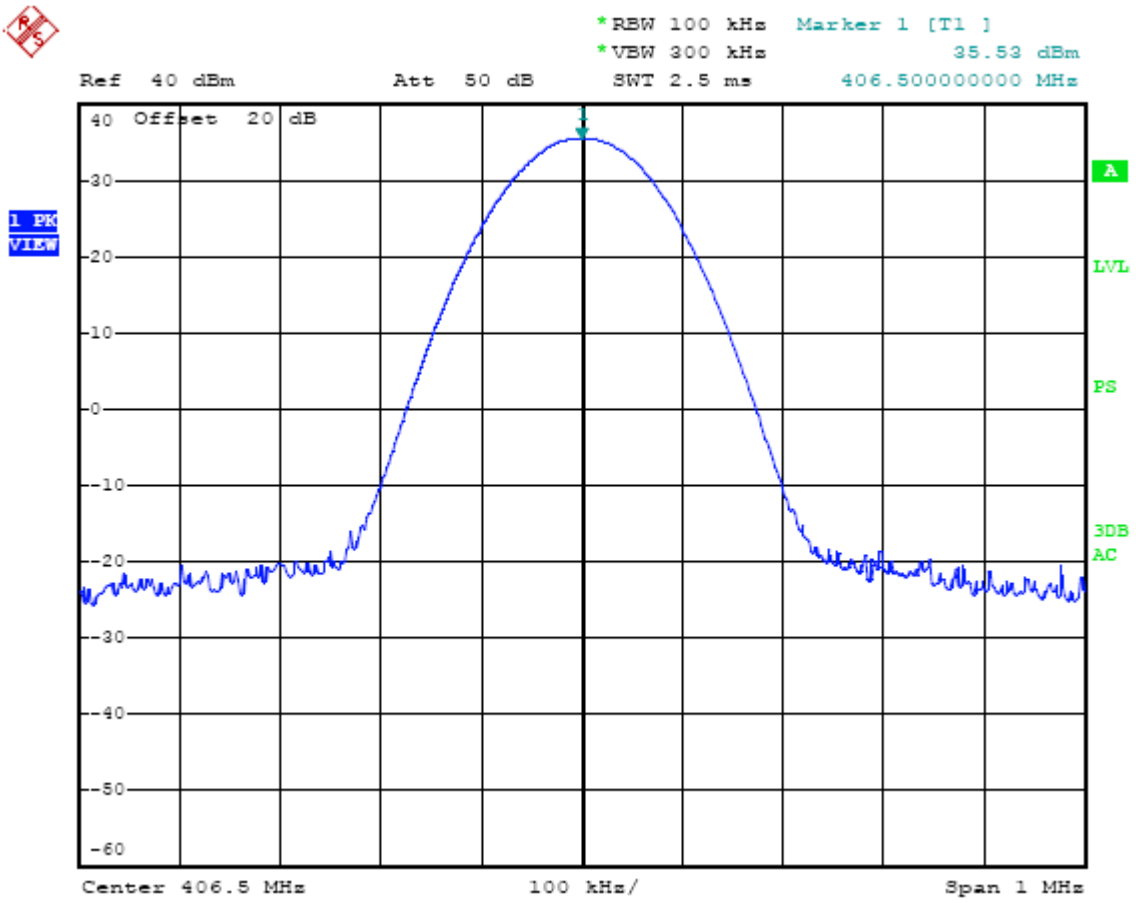
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
FM	12.5 KHz	453.5000	4	35.25	Varies	36.02±1	Compliance



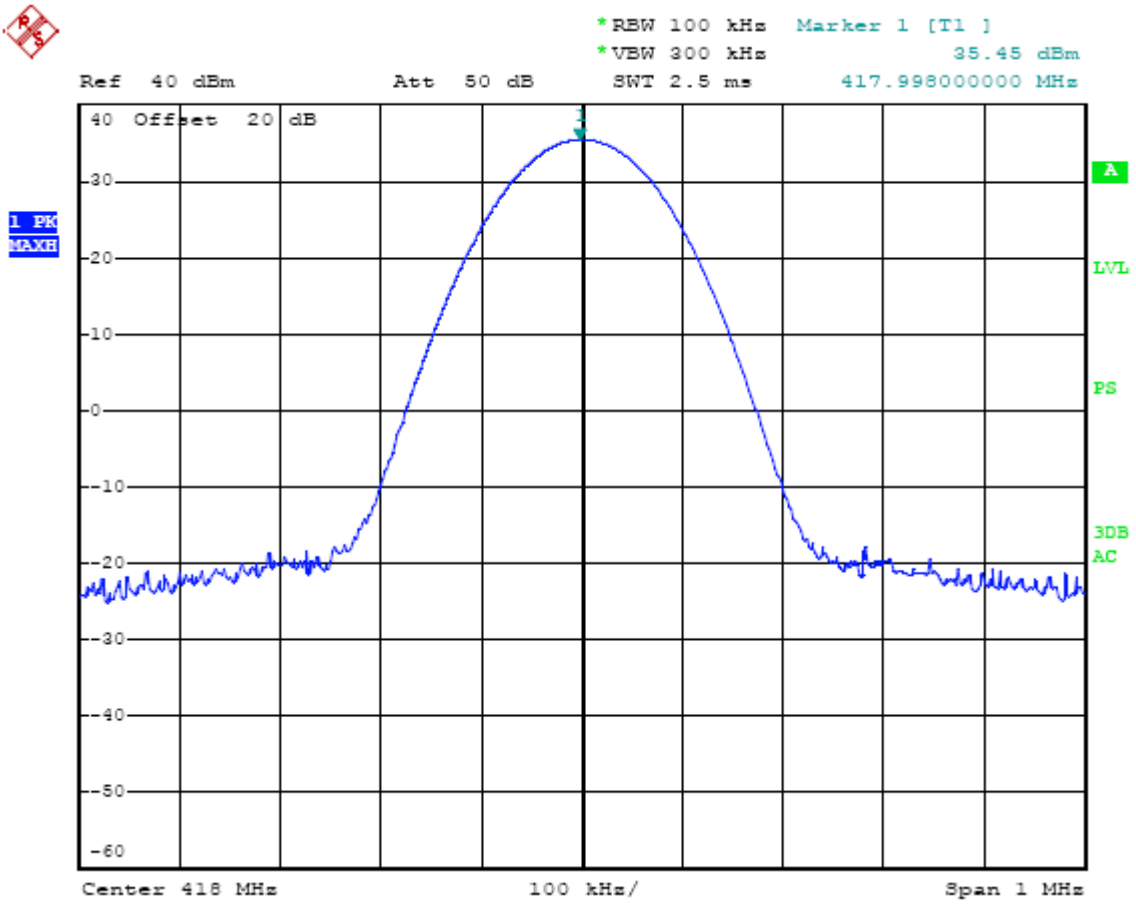
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
FM	12.5 KHz	469.5000	4	35.56	Varies	36.02±1	Compliance



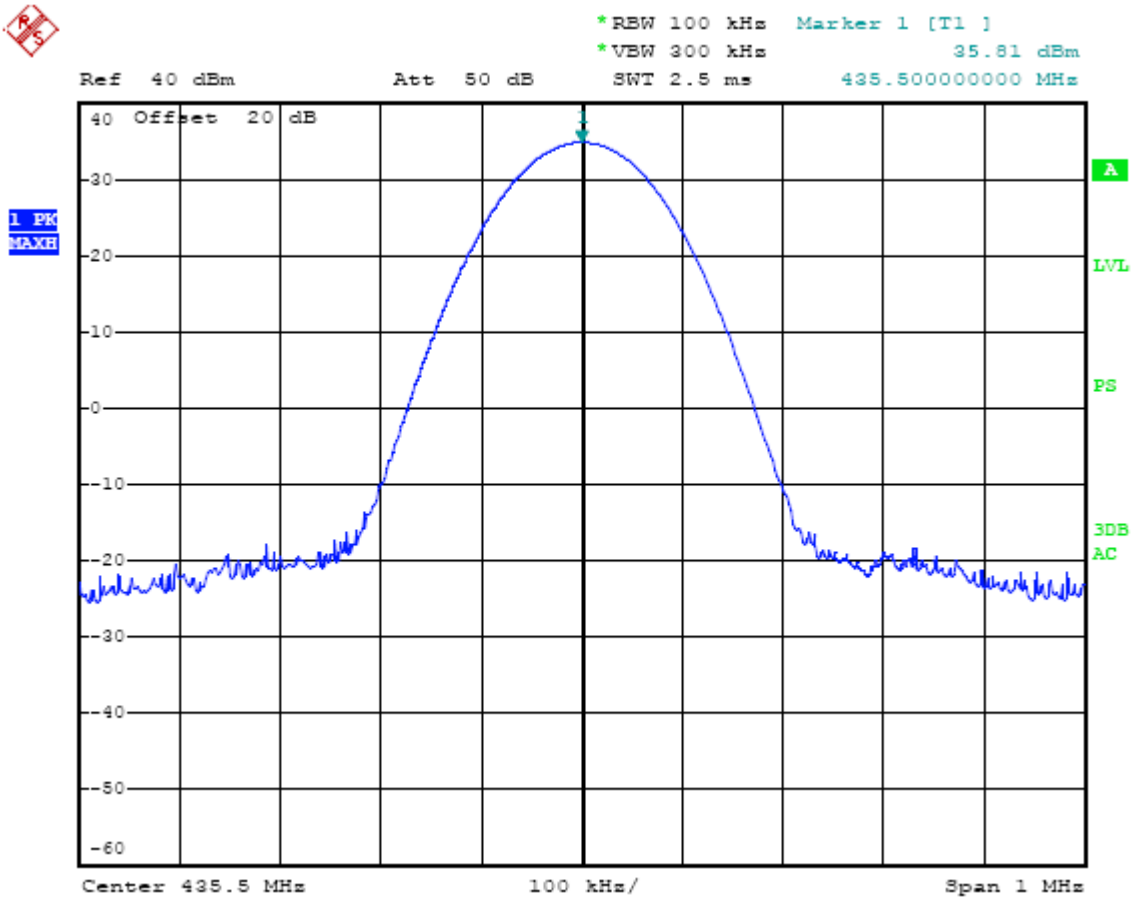
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
4L-FSK	6.25 KHz	406.5000	4	35.53	Varies	36.02±1	Compliance



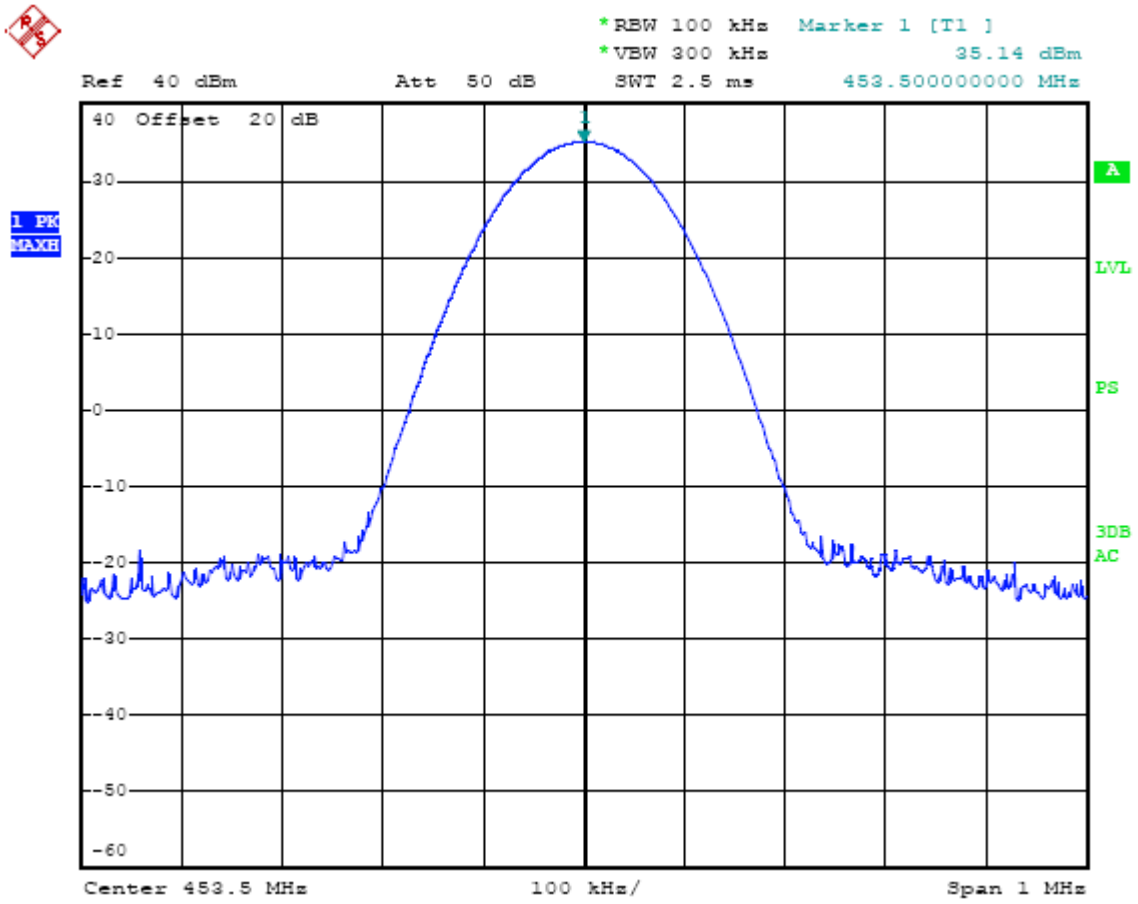
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
4L-FSK	6.25 KHz	418.0000	4	35.45	Varies	36.02±1	Compliance



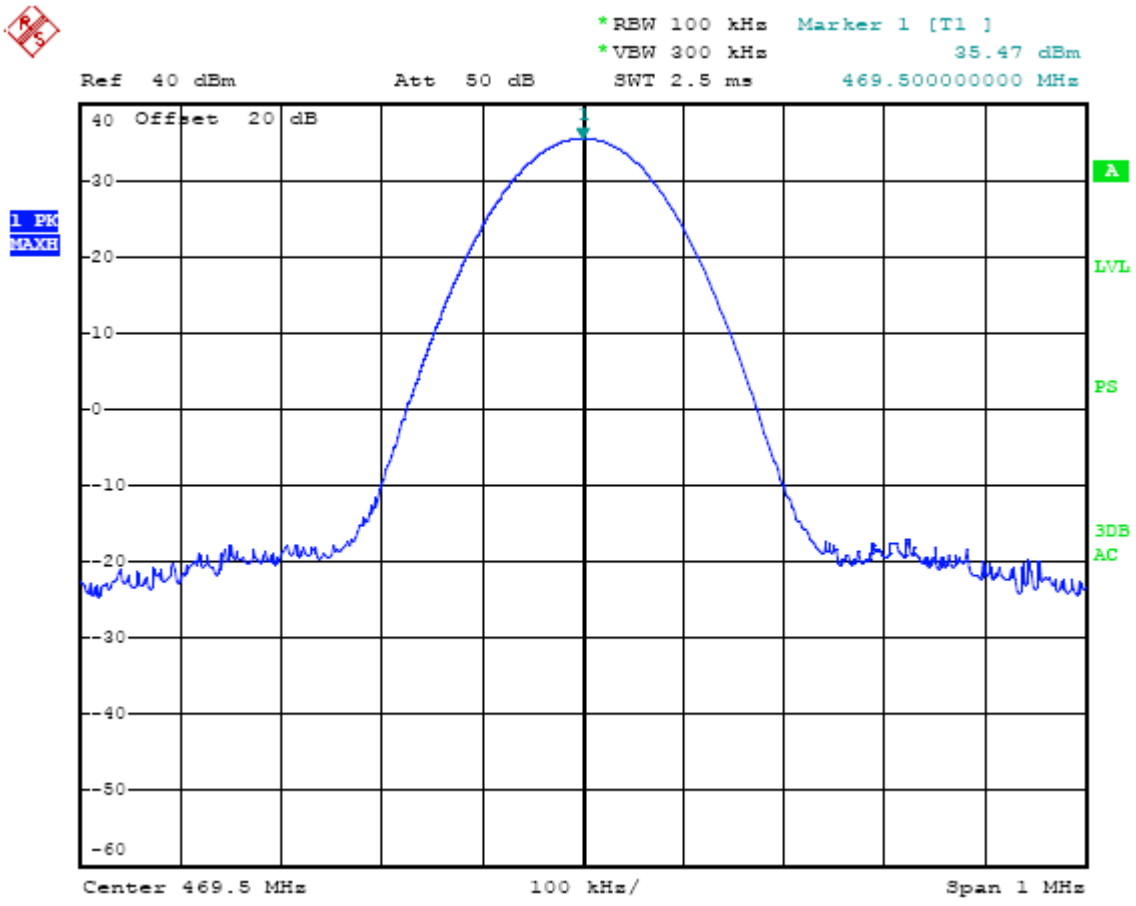
Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
4L-FSK	6.25 KHz	435.5000	4	35.81	Varies	36.02±1	Compliance



Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
4L-FSK	6.25 KHz	453.5000	4	35.14	Varies	36.02±1	Compliance



Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	IC Limit (dB)	Results
4L-FSK	6.25 KHz	469.5000	4	35.47	Varies	36.02±1	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:

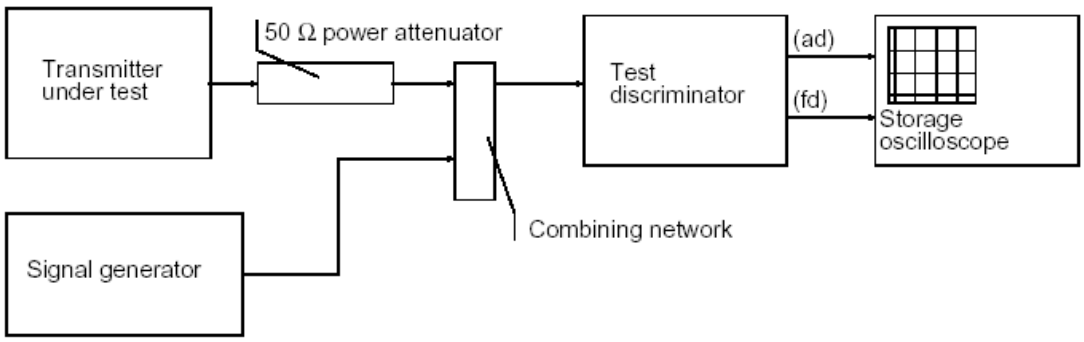
Time intervals [1, 2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 KHz Channels			
t_1 [4]	± 25.0 KHz	5.0 ms	10.0 ms
t_2	± 12.5 KHz	20.0 ms	25.0 ms
t_3 [4]	± 25.0 KHz	5.0 ms	10.0 ms
Transient Frequency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

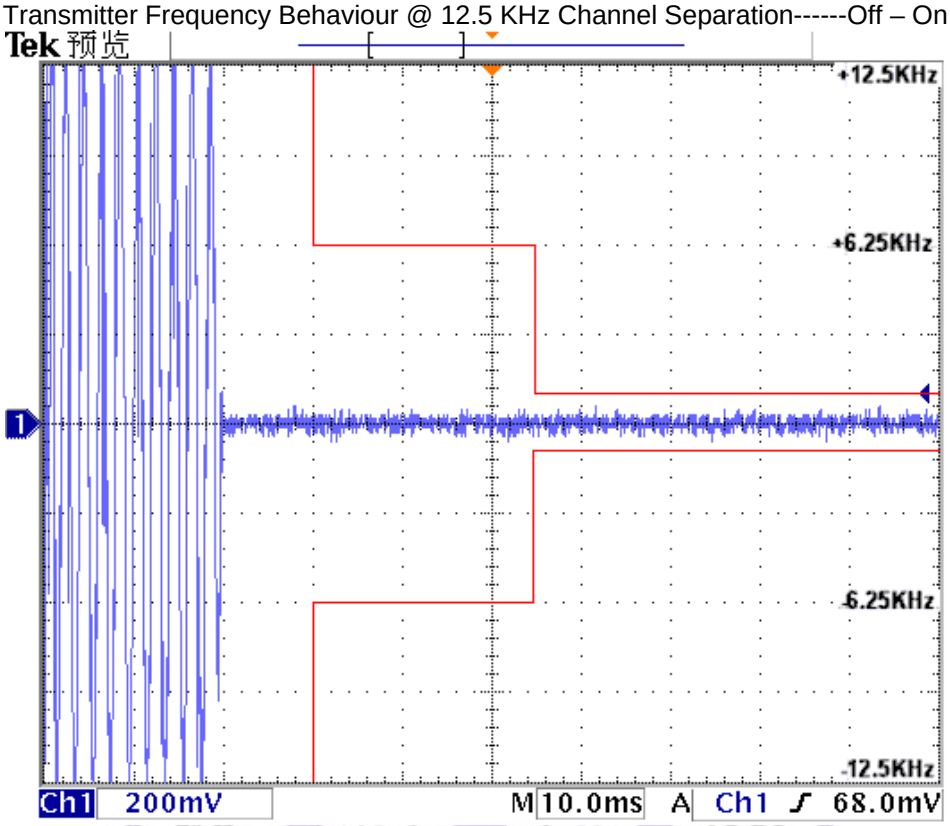


TEST RESULTS

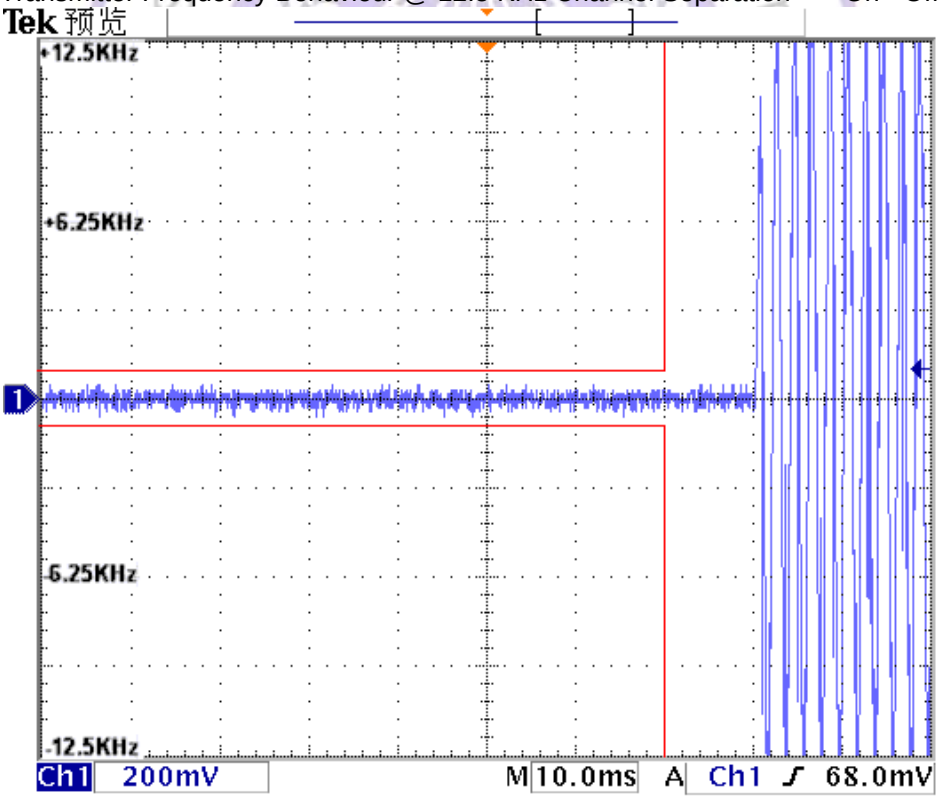
Please refer to the following plots.

Modulation Type: FM

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

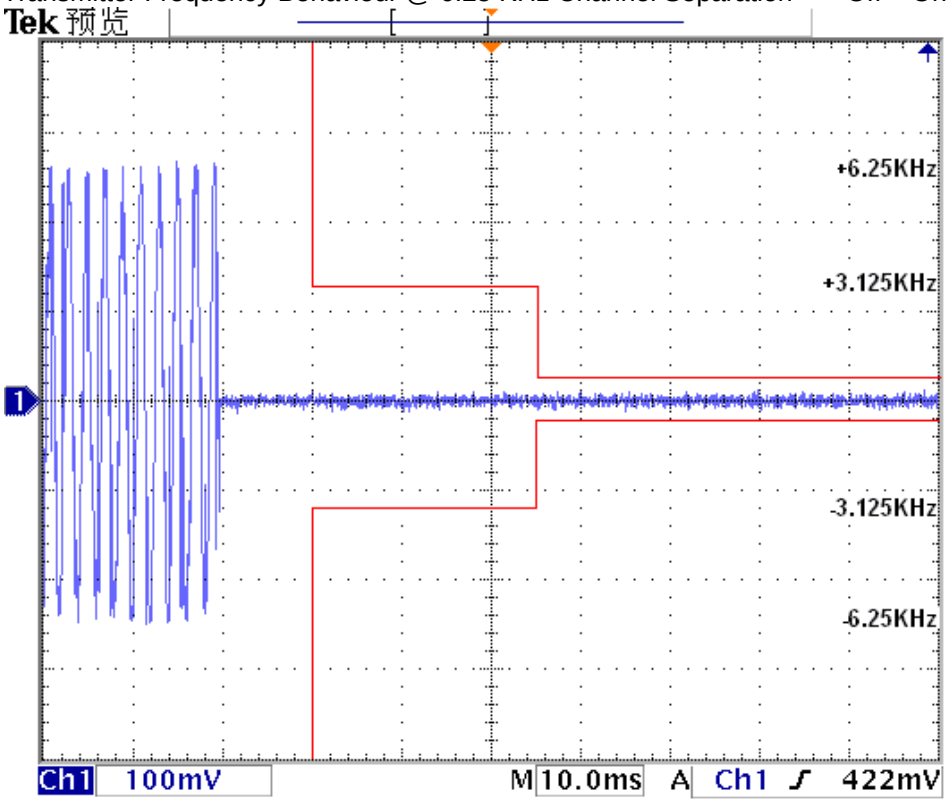


Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation------On - Off

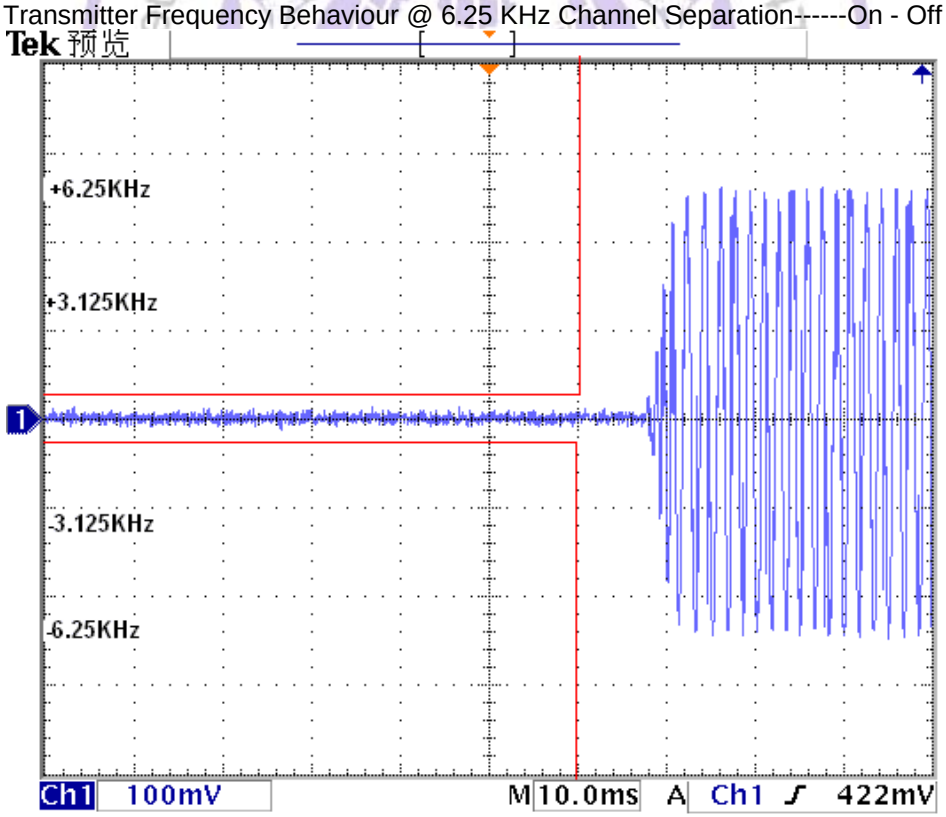


Modulation Type: 4L-FSK

Transmitter Frequency Behaviour @ 6.25 KHz Channel Separation------Off – On



Transmitter Frequency Behaviour @ 6.25 KHz Channel Separation------On - Off



4.9. Receiver Radiated Spurious Emission

TEST APPLICABLE

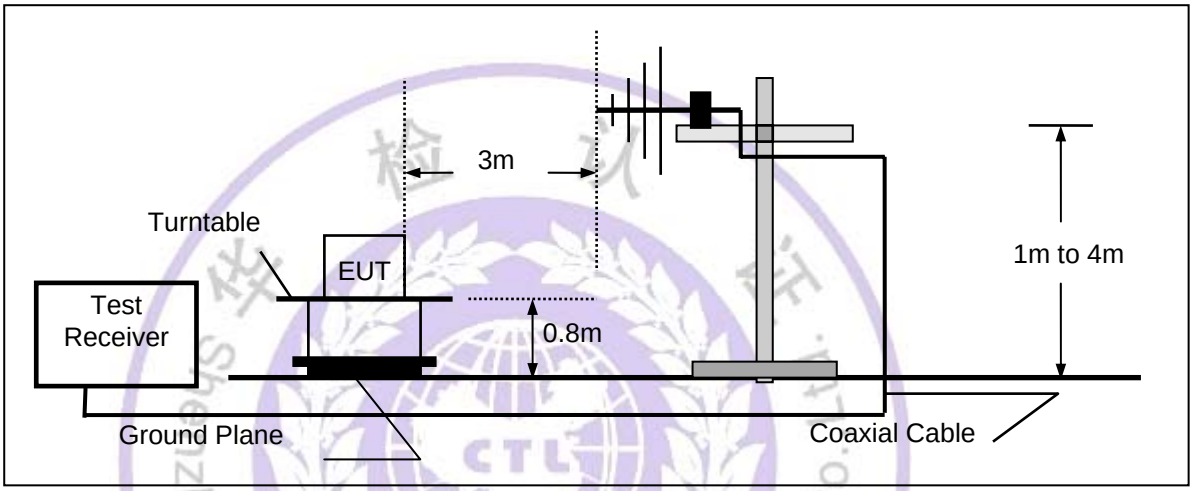
The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

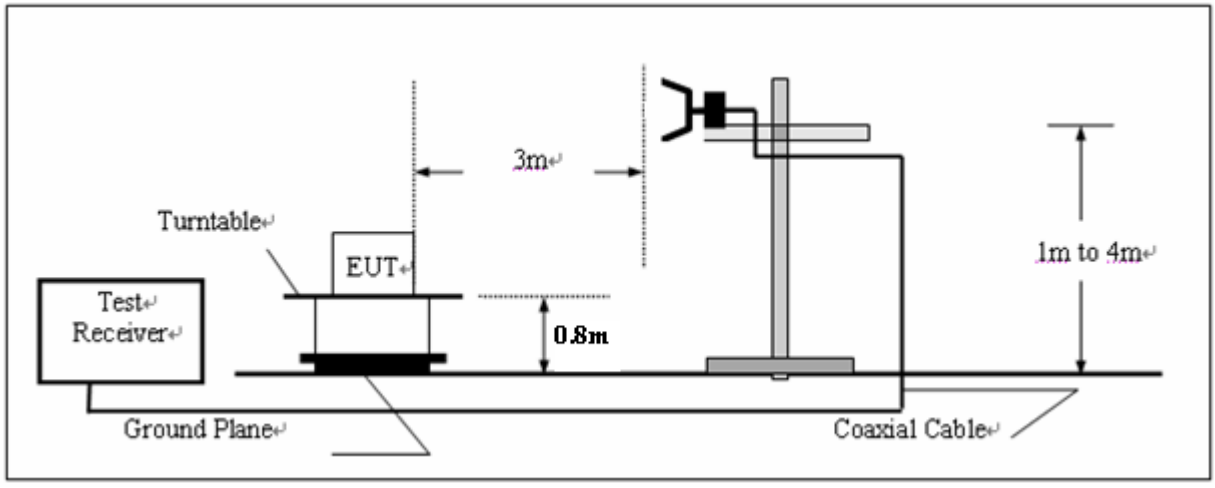
Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

TEST CONFIGURATION

(A) Radiated Emission Test Set-Up, Frequency below 1000MHz



(B) Radiated Emission Test Set-Up, Frequency above 1000MHz



TEST PROCEDURE

1 The EUT was placed on a turn table which is 0.8m above ground plane.
2 Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4 Repeat above procedures until all frequency measurements have been completed.

RECEIVER RADIATED SPOUIOUS LIMIT

For unintentional device, according to § 15.109(a) and RSS-Gen, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

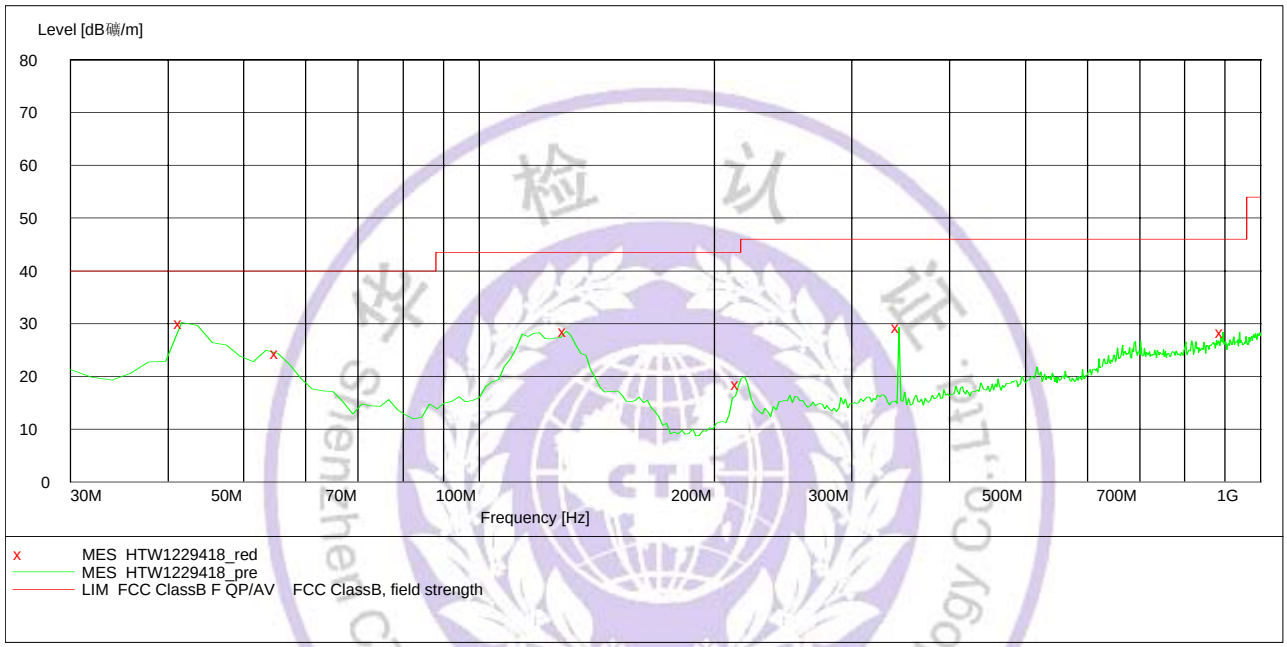
TEST RESULTS

The Radiated Measurement are performed to the three channels (the high channel, the middle channel and the low channel), the datum recorded below is the worst case for each channel separation; and the EUT shall be scanned from 30 MHz to the 5th harmonic of the highest oscillator frequency in the digital devices or 1 GHz whichever is higher.

Modulation Type	Channel Separation	Test Frequency (MHz)	Polar.	Maximum Radiated Emissions		FCC Limit (dBuV/m)
				Frequency (MHz)	Datum (dBuV/m)	
FM	12.5 KHz	469.5000	H	129.4	30.20	43.50
			V	41.66	30.20	40.00
Test Results			Compliance			

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	120 kHz	HL562 2013



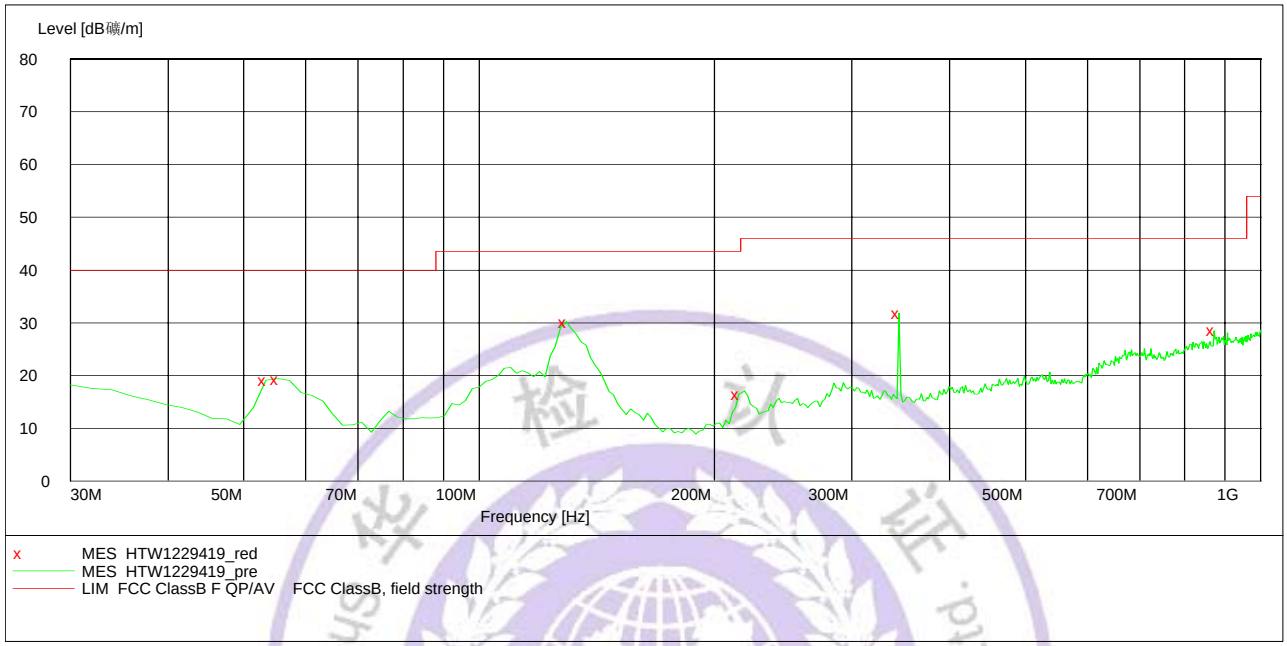
MEASUREMENT RESULT:

08/29/2012 12:45PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
41.663327	30.20	-17.6	40.0	9.8	Peak	100.0	3.00	VERTICAL
55.270541	24.40	-23.9	40.0	15.6	Peak	100.0	23.00	VERTICAL
129.138277	28.50	-20.3	43.5	15.0	Peak	100.0	9.00	VERTICAL
214.669339	18.50	-20.7	43.5	25.0	Peak	100.0	92.00	VERTICAL
344.909820	29.30	-16.5	46.0	16.7	Peak	100.0	211.00	VERTICAL
895.030060	28.40	-6.9	46.0	17.6	Peak	100.0	148.00	VERTICAL

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	120 kHz	HL562 2013



MEASUREMENT RESULT:

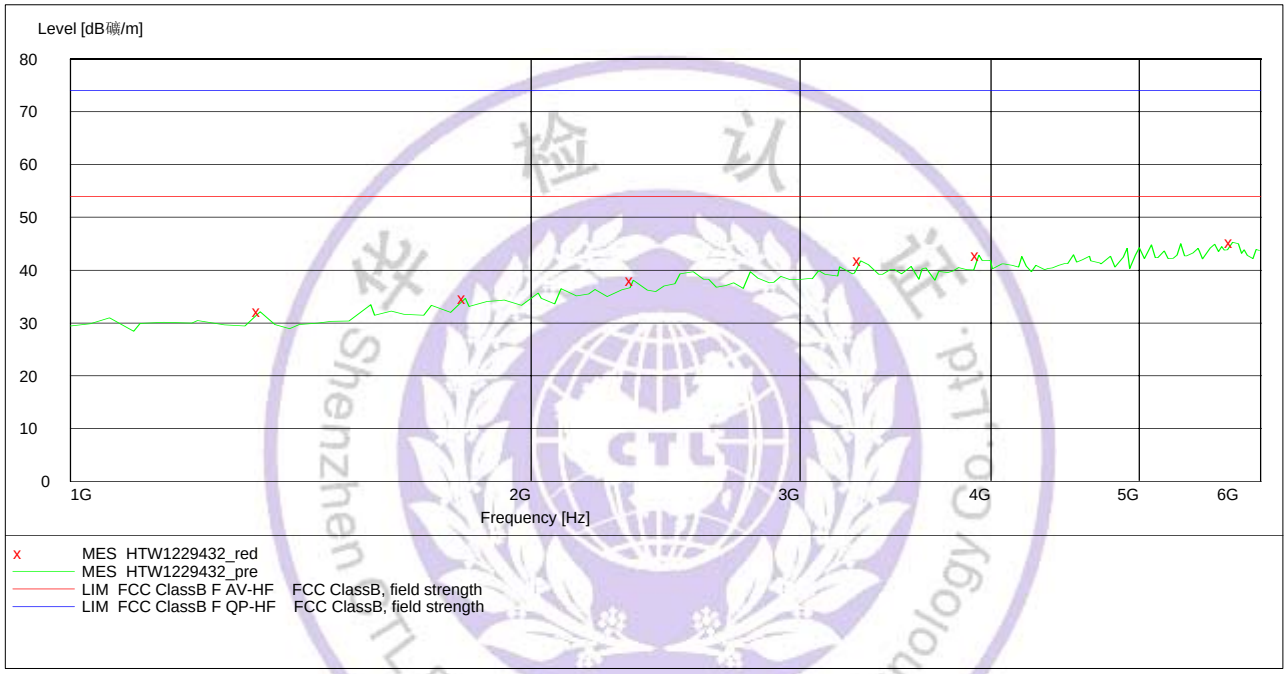
8/29/2012 12:49PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.326653	19.10	-23.3	40.0	20.9	Peak	300.0	102.00	HORIZONTAL
55.270541	19.40	-23.9	40.0	20.6	Peak	300.0	102.00	HORIZONTAL
129.138277	30.20	-20.3	43.5	13.3	Peak	300.0	215.00	HORIZONTAL
214.669339	16.50	-20.7	43.5	27.0	Peak	100.0	290.00	HORIZONTAL
344.909820	31.80	-16.5	46.0	14.2	Peak	100.0	283.00	HORIZONTAL
871.703407	28.50	-6.9	46.0	17.5	Peak	300.0	161.00	HORIZONTAL

Modulation Type	Channel Separation	Test Frequency (MHz)	Polar.	Maximum Radiated Emissions		FCC Limit (dBuV/m)
				Frequency (MHz)	Datum (dBuV/m)	
FM	12.5 KHz	469.5000	H	5358.71	45.80	54.00
			V	5198.39	46.60	54.00
Test Results			Compliance			

SWEEP TABLE: "test (1G-18G) P"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	**HF906 2013**



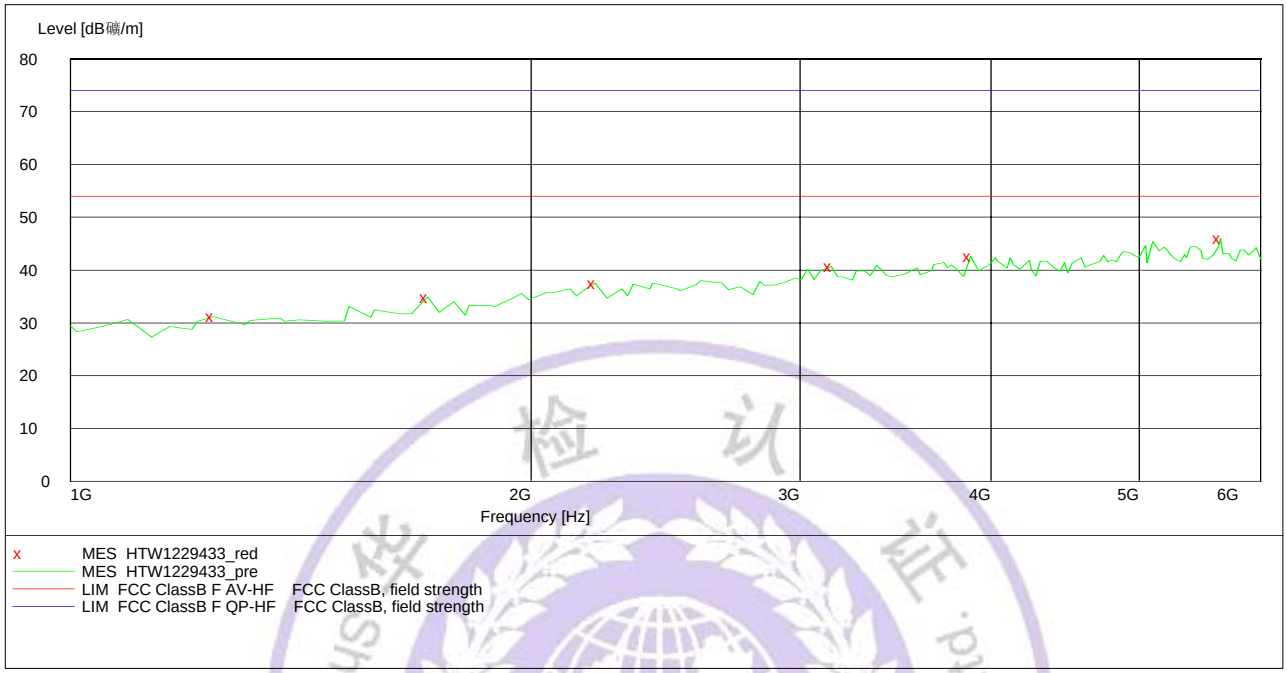
MEASUREMENT RESULT:

8/29/2012 3:59PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1330.661323	32.10	-24.6	54.0	21.9	PEAK	100.0	191.00	HORIZONTAL
1811.623246	34.70	-21.2	54.0	19.3	Peak	100.0	39.00	HORIZONTAL
2332.665331	38.10	-18.0	54.0	15.9	Peak	100.0	197.00	HORIZONTAL
3284.569138	41.80	-14.7	54.0	12.2	Peak	100.0	267.00	HORIZONTAL
3925.851703	42.90	-13.5	54.0	11.1	Peak	100.0	317.00	HORIZONTAL
5749.498998	45.30	-12.1	54.0	8.7	Peak	100.0	175.00	HORIZONTAL

SWEEP TABLE: "test (1G-18G) P"

Short Description:		EN 55022 Field Strength			
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	**HF906 2013**



MEASUREMENT RESULT:

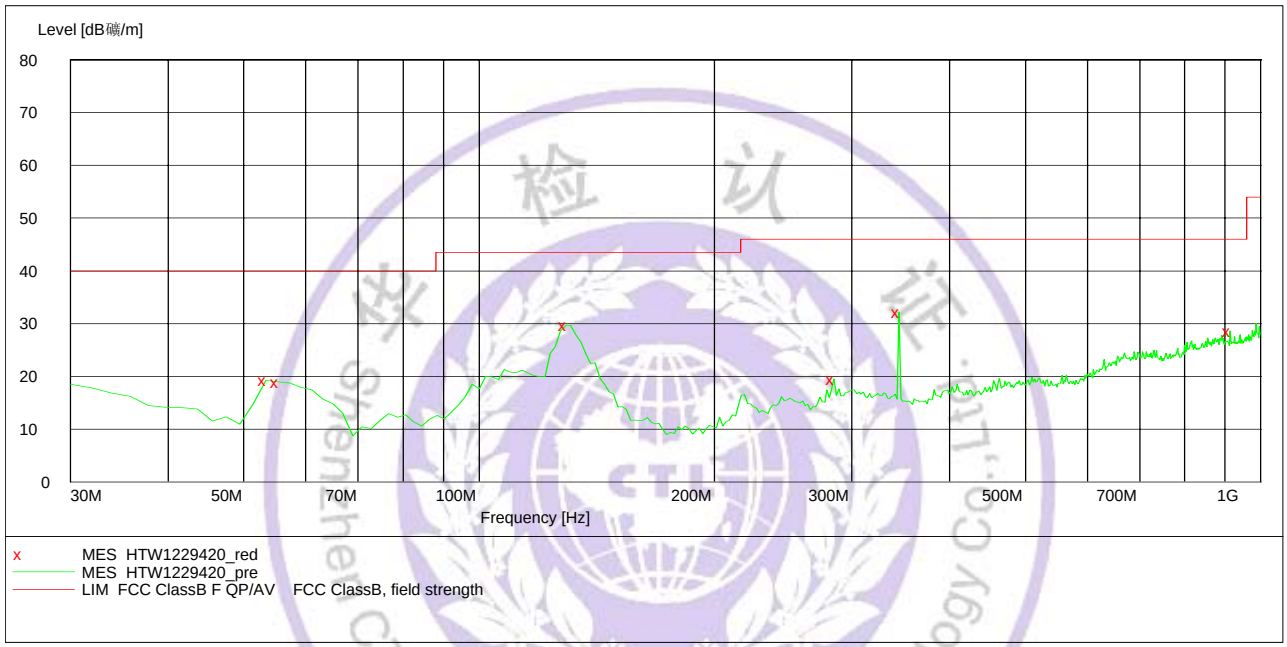
8/29/2012 4:01PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1240.480962	31.20	-25.2	54.0	22.8	Peak	100.0	23.00	VERTICAL
1711.422846	34.90	-21.9	54.0	19.1	Peak	100.0	170.00	VERTICAL
2202.404810	37.50	-18.6	54.0	16.5	Peak	100.0	337.00	VERTICAL
3144.288577	40.70	-15.1	54.0	13.3	Peak	100.0	48.00	VERTICAL
3875.751503	42.60	-13.6	54.0	11.4	Peak	100.0	314.00	VERTICAL
5649.298597	46.00	-12.1	54.0	8.0	Peak	100.0	227.00	VERTICAL

Modulation Type	Channel Separation	Test Frequency (MHz)	Polar.	Maximum Radiated Emissions		FCC Limit (dBuV/m)
				Frequency (MHz)	Datum (dBuV/m)	
4L-FSK	6.25 KHz	469.5000	H	129.14	29.70	43.50
			V	41.66	29.30	40.00
Test Results			Compliance			

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	120 kHz	HL562 2013



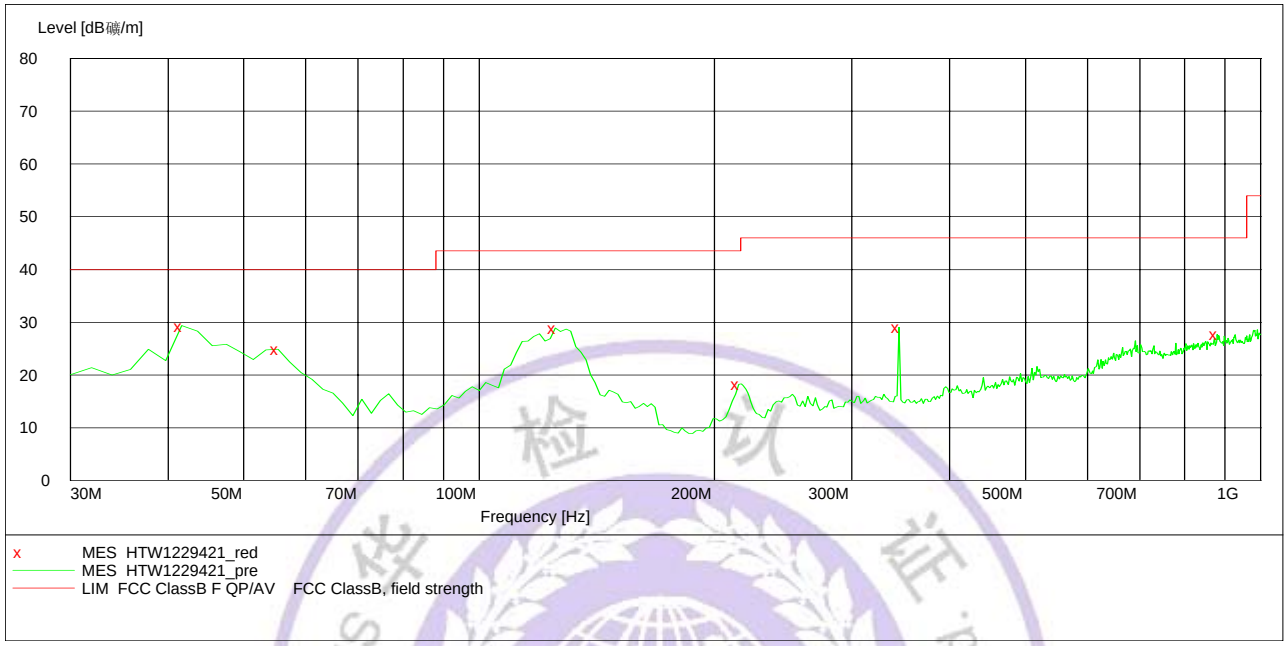
MEASUREMENT RESULT:

8/29/2012 12:51PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.326653	19.30	-23.3	40.0	20.7	Peak	300.0	101.00	HORIZONTAL
55.270541	19.00	-23.9	40.0	21.0	Peak	300.0	101.00	HORIZONTAL
129.138277	29.70	-20.3	43.5	13.8	Peak	300.0	200.00	HORIZONTAL
284.649299	19.50	-17.9	46.0	26.5	Peak	100.0	192.00	HORIZONTAL
344.909820	32.20	-16.5	46.0	13.8	Peak	100.0	290.00	HORIZONTAL
914.468938	28.60	-7.2	46.0	17.4	Peak	100.0	104.00	HORIZONTAL

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	120 kHz	HL562 2013



MEASUREMENT RESULT:

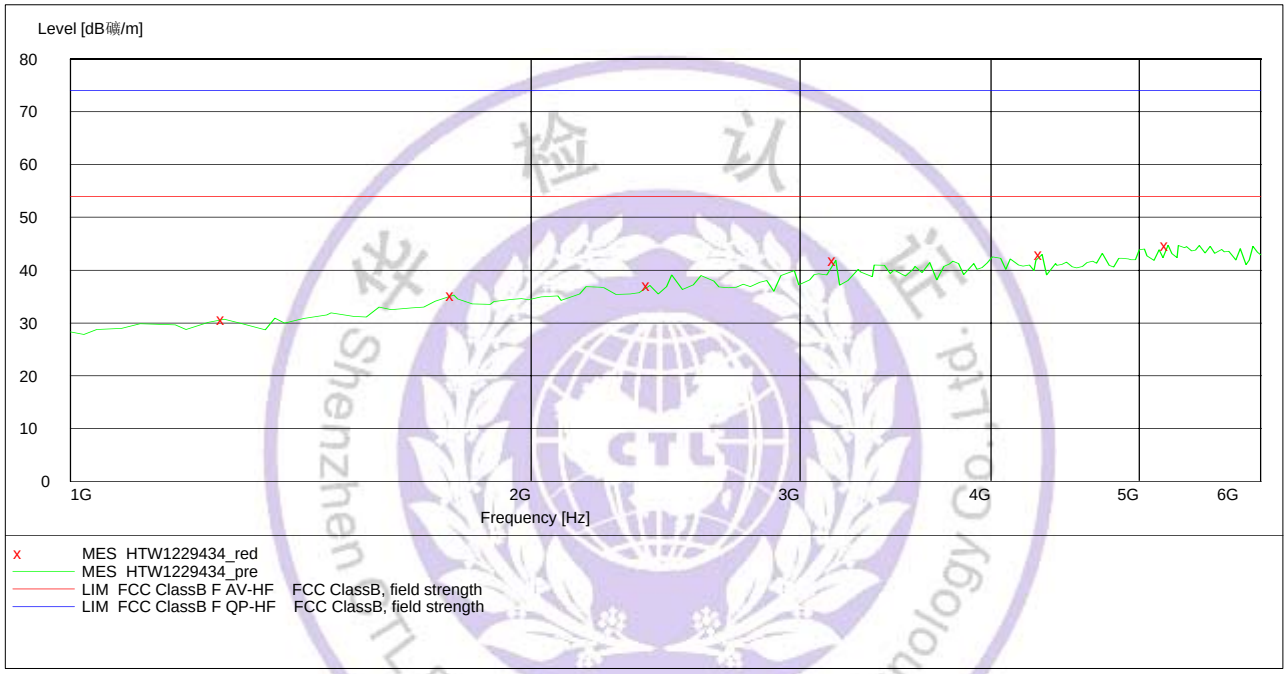
8/29/2012 12:53PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
41.663327	29.30	-17.6	40.0	10.7	Peak	100.0	13.00	VERTICAL
55.270541	24.90	-23.9	40.0	15.1	Peak	100.0	62.00	VERTICAL
125.250501	28.90	-19.7	43.5	14.6	Peak	100.0	308.00	VERTICAL
214.669339	18.20	-20.7	43.5	25.3	Peak	100.0	332.00	VERTICAL
344.909820	29.00	-16.5	46.0	17.0	Peak	100.0	222.00	VERTICAL
879.478958	27.70	-7.0	46.0	18.3	Peak	100.0	192.00	VERTICAL

Modulation Type	Channel Separation	Test Frequency (MHz)	Polar.	Maximum Radiated Emissions		FCC Limit (dBuV/m)
				Frequency (MHz)	Datum (dBuV/m)	
FM	12.5 KHz	469.5000	H	5669.34	47.20	54.00
			V	5218.44	44.70	54.00
Test Results			Compliance			

SWEEP TABLE: "test (1G-18G) P"

```
Short Description:           EN 55022 Field Strength
Start      Stop       Detector  Meas.     IF        Transducer
Frequency  Frequency             Time      Bandw.
1.0 GHz    18.0 GHz   MaxPeak   Coupled   1 MHz     HF906 2013
```



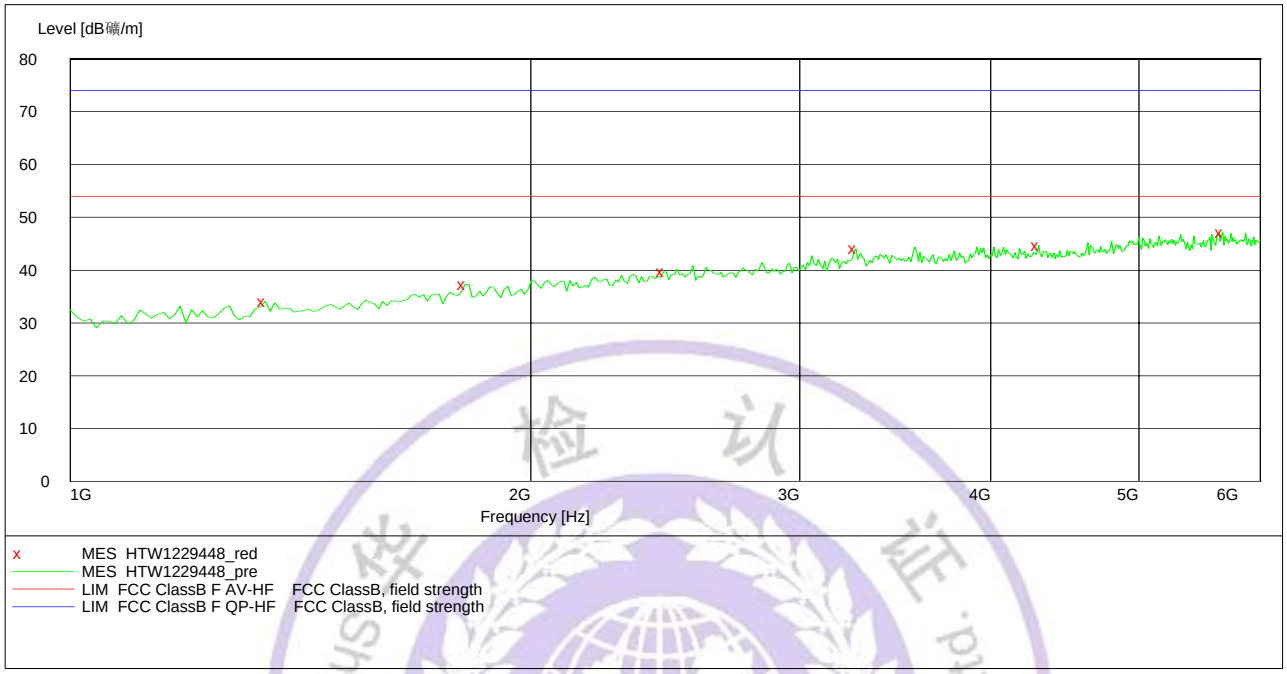
MEASUREMENT RESULT:

8/29/2012 4:01PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1260.521042	30.70	-25.0	54.0	23.3	Peak	100.0	333.00	VERTICAL
1781.563126	35.30	-21.4	54.0	18.7	Peak	100.0	22.00	VERTICAL
2392.785571	37.10	-17.6	54.0	16.9	Peak	100.0	175.00	VERTICAL
3164.328657	41.80	-15.0	54.0	12.2	Peak	100.0	55.00	VERTICAL
4316.633267	43.00	-13.8	54.0	11.0	Peak	100.0	99.00	VERTICAL
5218.436874	44.70	-12.2	54.0	9.3	Peak	100.0	114.00	VERTICAL

SWEEP TABLE: "test (1G-18G) P"

Short Description:		EN 55022 Field Strength			
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	HF906 2013

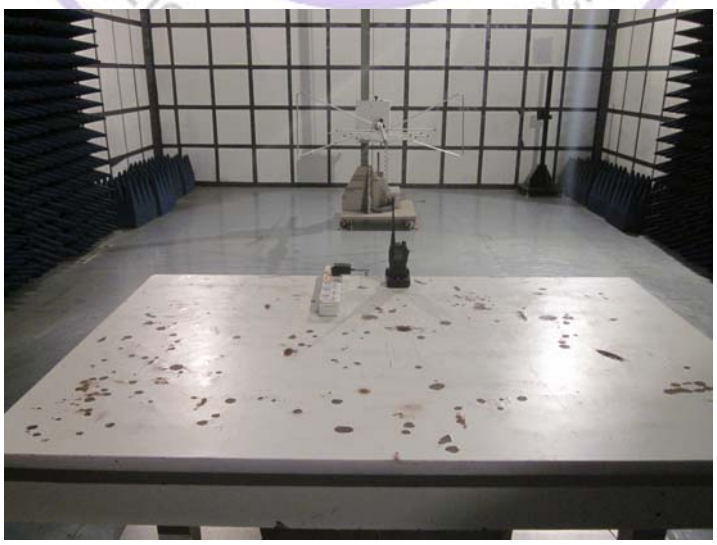


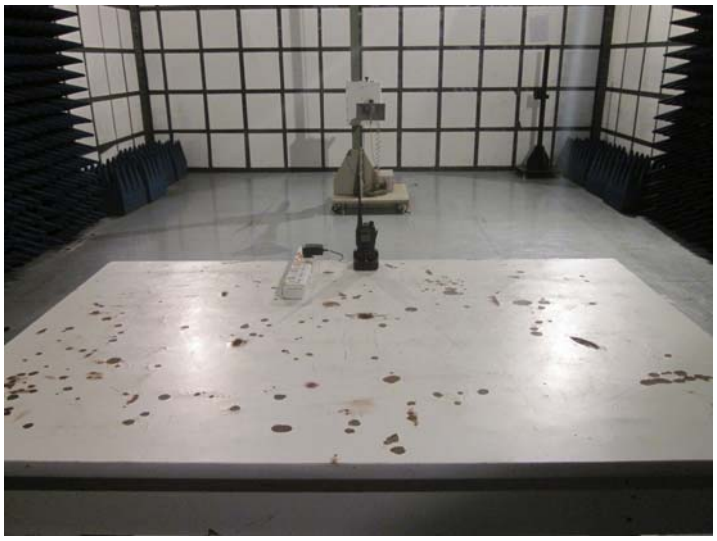
MEASUREMENT RESULT:

8/29/2012 6:51PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1340.681363	34.10	-24.6	54.0	19.9	Peak	100.0	308.00	HORIZONTAL
1811.623246	37.30	-21.2	54.0	16.7	Peak	100.0	122.00	HORIZONTAL
2442.885772	39.70	-17.4	54.0	14.3	Peak	100.0	181.00	HORIZONTAL
3264.529058	44.10	-14.8	54.0	9.9	Peak	100.0	130.00	HORIZONTAL
4296.593186	44.70	-13.8	54.0	9.3	Peak	100.0	343.00	HORIZONTAL
5669.338677	47.20	-12.1	54.0	6.8	Peak	100.0	178.00	HORIZONTAL

5. Test Setup Photos of the EUT



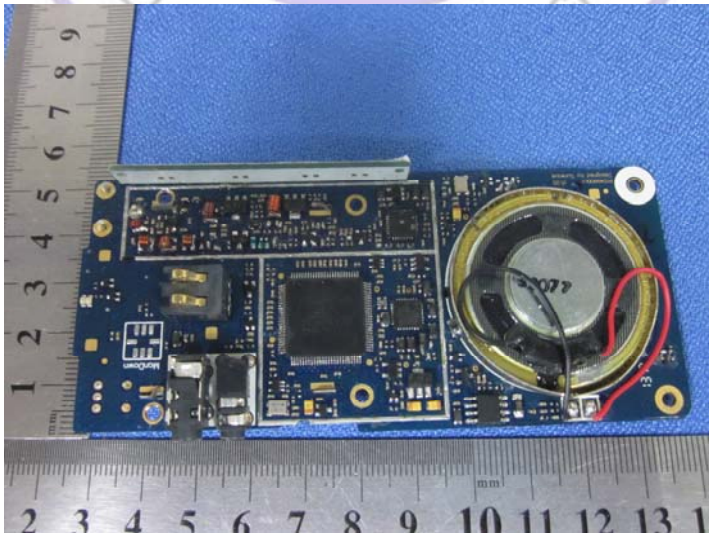


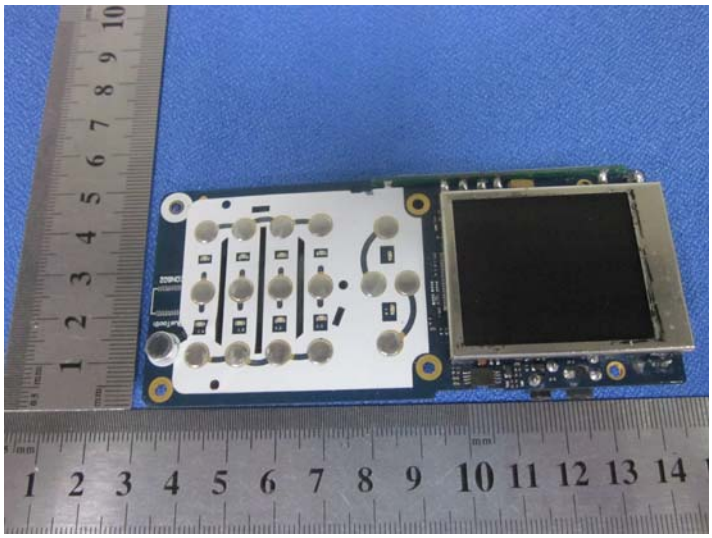
6. External and Internal Photos of the EUT

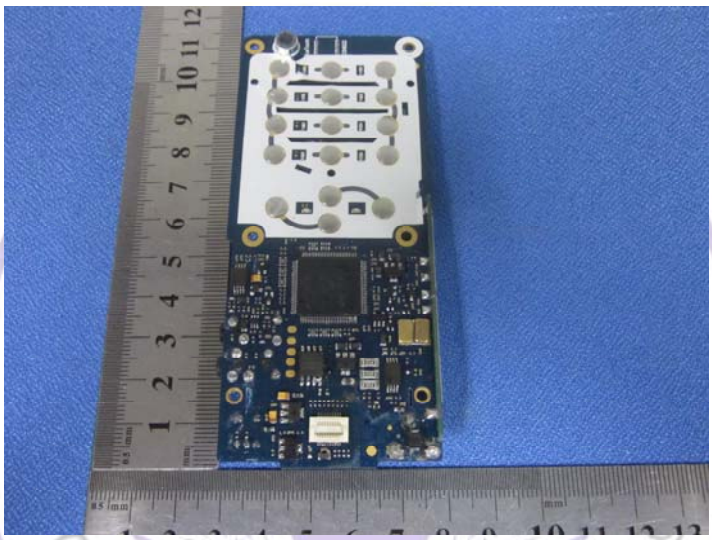
External Photos

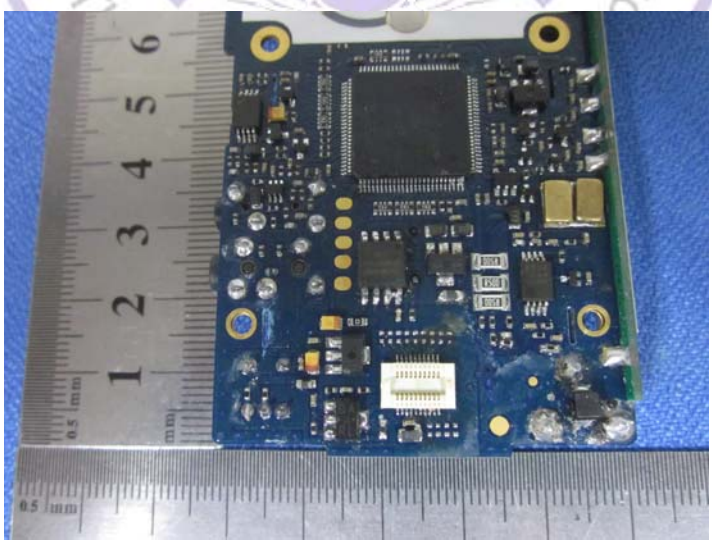

QUANTUM

Internal Photos









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