



FCC PART 90 TEST REPORT

FCC Part 90

Report Reference No.....: TRE1310003101 R/C: 88428

FCC ID.....: YAMRD62XU1

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Date of issue.....: Nov 12, 2013

Testing Laboratory Name: Shenzhen Huatongwei International Inspection Co., Ltd

Address.....: Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China

Applicant's name: Hytera Communications Corporation Ltd.

Address.....: HYT Tower, Hi-Tech Industrial Park North, Nanshan District, Shenzhen China. 518057

Test specification:

Standard: FCC Part 90/FCC Part 2/ FCC Part 15B

TRF Originator.....: Shenzhen Huatongwei International Inspection CO., Ltd

Master TRF.....: Dated 2006-06

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Test item description: Digital Wall-mounted Repeater

Trade Mark



Manufacturer: Hytera Communications Corporation Ltd.

Model/Type reference.....: RD622 U(1)

Listed Models: RD620 U(1), RD625 U(1), RD626 U(1), RD628 U(1)

Ratings.....: DC 13.6V/AC 120V/60Hz

Modulation: FM&4FSK

Channel Separation.....: 12.5KHz

Rated Power: 25 Watts(43.98dBm)/1Watts(30.00dBm)

Operation Frequency Range: From 400 MHz to 470 MHz

Result.....: PASS

TEST REPORT

Test Report No. : TRE1310003101	Nov 10, 2013
	Date of issue

Equipment under Test : Digital Wall-mounted Repeater

Model /Type : RD622 U(1)

Listed Models : RD620 U(1), RD625 U(1), RD626 U(1), RD628 U(1)

Applicant : **Hytera Communications Corporation Ltd.**

Address : HYT Tower,Hi-Tech Industrial Park North,Nanshan District,Shenzhen China.518057

Manufacturer : **Hytera Communications Corporation Ltd.**

Address : HYT Tower,Hi-Tech Industrial Park North,Nanshan District,Shenzhen China.518057

Test Result	PASS
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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

<u>1.</u>	<u>TEST STANDARDS</u>	<u>4</u>
<u>2.</u>	<u>SUMMARY</u>	<u>5</u>
2.1.	General Remarks	5
2.2.	Product Description	5
2.3.	Equipment under Test	5
2.4.	Short description of the Equipment under Test (EUT)	6
2.5.	EUT Configuration	6
2.6.	EUT operation mode	6
2.7.	EUT configuration	6
2.8.	Related Submittal(s) / Grant (s)	6
2.9.	Modifications	6
2.10.	Note	7
<u>3.</u>	<u>TEST ENVIRONMENT</u>	<u>8</u>
3.1.	Address of the test laboratory	8
3.2.	Test Facility	8
3.3.	Environmental conditions	9
3.4.	Configuration of Tested System	9
3.5.	Statement of the measurement uncertainty	9
3.6.	Test Description	10
3.7.	Equipments Used during the Test	10
<u>4.</u>	<u>TEST CONDITIONS AND RESULTS</u>	<u>12</u>
4.1.	Conducted Emissions Test	12
4.2.	Occupied Bandwidth and Emission Mask Test	18
4.3.	Transmitter Radiated Spurious Emssion	32
4.4.	Spurious Emssion on Antenna Port	36
4.5.	Modulation Charcateristics	68
4.6.	Frequency Stability Test	71
4.7.	Maximum Transmitter Power	74
4.8.	Transmitter Frequency Behavior	87
<u>5.</u>	<u>TEST SETUP PHOTOS OF THE EUT</u>	<u>91</u>
<u>6.</u>	<u>EXTERNAL AND INTERNAL PHOTOS OF THE EUT</u>	<u>93</u>

1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 90 :2012:](#) PRIVATE LAND MOBILE RADIO SERVICES.

[TIA/EIA 603 D:June 2010:](#) Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[47 CFR FCC Part 15 Subpart B:2012](#) - 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	:	Oct 14, 2013
Testing commenced on	:	Oct 14, 2013
Testing concluded on	:	Nov 12, 2013

2.2. Product Description

The Hytera Communications Corporation Ltd.'s Model: RD622 U(1) 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	Digital Portable Repeater	
Model Number	RD622 U(1), RD620 U(1), RD625 U(1), RD626 U(1), RD628 U(1),	
FCC ID	YAMRD62XU1	
Rated Output Power	25 Watts(43.98dBm)/1 Watts(30.00dBm)	
Support data rate	9.6kbps	
Modulation Type	FM for Analog Voice	
	4FSK for Digital Voice/Digital Data	
	4FSK for Digital Data	
	Analog	11K0F3E for 12.5KHz Channel Separation
	Digital	7K60FXD for Digital Data only 7K60FXW for Digital Data & Digital Voice
Channel Separation	Analog Voice	12.5KHz
	Digital Voice/Data	12.5KHz
	Digital Data	12.5KHz
Antenna Type	External	
Frequency Range	From 406 MHz to 470 MHz	
Maximum Transmitter Power	Analog	29.85W for 12.5 KHz Channel Separation
	Digital	29.85W for 12.5 KHz Channel Separation

Note: The product has the same digital working characters when operating in both two digitized voice/data mode (7K60FXD and 7K60FXW). So only one set of test results for digital modulation modes are provided in this test report.

2.3. 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 13.60V/AC 120V/60Hz

Test frequency list

Modulation Type	Test Channel	Channel Separation	Test Frequency (MHz)
Analog/FM	Ch1	12.5KHz	406.5
	Ch2		435.0
	Ch3		469.5
Digital/4FSK	Ch4	12.5KHz	406.5
	Ch5		435.0
	Ch6		469.5

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

400-470 MHz U frequency band Digital Wall-mounted Repeater.

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

2.5. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.6. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

EUT operation mode no.	Description of operation mode	Additional information
Op 1	FM+BW12.5KHz+TX	The equipment is set with FM modulation and 12.5KHz bandwidth for transmitter at maximum rated power,powered by AC 120V/60Hz
Op 2	FM+BW12.5KHz+TX	The equipment is set with FM modulation and 12.5KHz bandwidth at maximum rated power for transmitter,powered by DC 13.60V
Op 3	FM+BW12.5KHz+TX	The equipment is set with FM modulation and 12.5KHz bandwidth for transmitter at minimum rated power,powered by AC 120V/60Hz
Op 4	FM+BW12.5KHz+TX	The equipment is set with FM modulation and 12.5KHz bandwidth at minimum rated power for transmitter,powered by DC 13.60V
Op 5	4FSK+BW12.5KHz+TX	The equipment is set with 4FSK modulation and 12.5KHz bandwidth at maximum rated power for transmitter,powered by AC 120V/60Hz
Op 6	4FSK+BW12.5KHz+TX	The equipment is set with 4FSK modulation and 12.5KHz bandwidth at maximum rated power for transmitter,powered by DC 13.60V
Op 7	4FSK+BW12.5KHz+TX	The equipment is set with 4FSK modulation and 12.5KHz bandwidth at minimum rated power for transmitter,powered by AC 120V/60Hz
Op 8	4FSK+BW12.5KHz+TX	The equipment is set with 4FSK modulation and 12.5KHz bandwidth at minimum rated power for transmitter,powered by DC 13.60V

2.7. 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) :	3.00
		Shield :	Unshielded
		Detachable :	Undetachable
○	Multimeter	Manufacturer :	/
		Model No. :	/

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

This submittal(s) (test report) is intended for **FCC:YAMRD62XU1** filing to comply with FCC Part 90 rules.

2.9. Modifications

No modifications were implemented to meet testing criteria.

2.10. Note

1. The EUT is a U frequency band (400-470MHz) Digital Wall-mounted Repeater, The functions of the EUT listed as below:

	Test Standards	Reference Report
Radio	FCC Part 90	TRE1310003101
MPE	Oet 65	TRE1310003102

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Huatongwei International Inspection Co., Ltd
Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China
Phone: 86-755-26715686 Fax: 86-755-26748089

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

3.2. Test Facility

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

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: Mar. 01, 2012. Valid time is until Feb. 28, 2015.

A2LA-Lab Cert. No. 2243.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until Sept. 30, 2015.

FCC-Registration No.: 662850

Shenzhen Huatongwei International Inspection Co., 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 662850, Renewal date Jul. 01, 2009, valid time is until Jun. 30, 2015.

IC-Registration No.: 5377A

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A on Jan. 25, 2011, valid time is until Jan. 24, 2014.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

VCCI

The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) and Shielded Room (8m×4m×3m) of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-292. Date of Registration: Dec. 24, 2010. Valid time is until Dec. 23, 2013.

Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 19, 2015.

Telecommunication Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-1837. Date of Registration: May 07, 2010. Valid time is until May 06, 2013.

DNV

Shenzhen Huatongwei International Inspection Co., Ltd. has been found to comply with the requirements of DNV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Directives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-ups according to relevant parts of ISO/IEC Guide 17025 (2005), in accordance with the requirements of the DNV Laboratory Quality Manual towards subcontractors. Valid time is until Aug. 24, 2016.

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

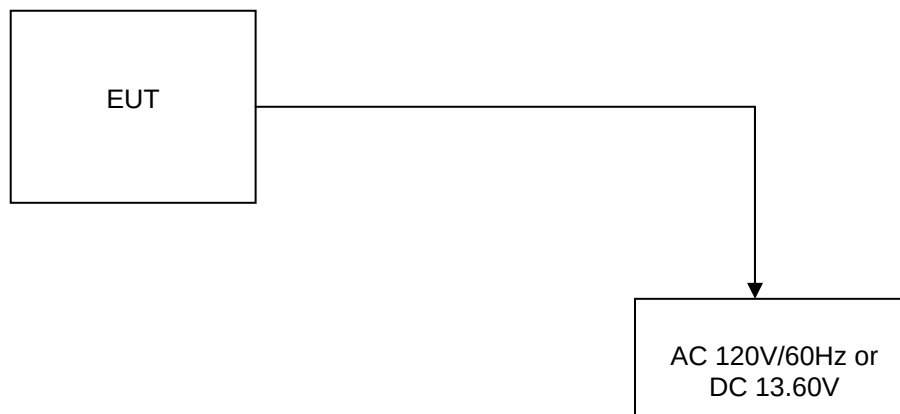


Table 2-1 Equipment Used in Tested System

3.5. Statement of the measurement uncertainty

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

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Frequency stability	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	1.60 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 30~1000MHz	4.65 dB	(1)
Radiated Emissio 1~18GHz	5.16 dB	(1)
Radiated Emissio 18-40GHz	5.54 dB	(1)
Occupied Bandwidth	-----	(1)
Emission Mask	-----	(1)
Modulation Characteristic	-----	(1)
Transmitter Frequency Behavior	-----	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

3.6. Test Description

Test specification clause	Test case	Verdict
FCC Part 15.107	Conducted Emission	PASS
FCC Part 90.205	Maximum Transmitter Power	PASS
FCC Part 90.207	Modulation Characteristic	PASS
FCC Part 90.209	Occupied Bandwidth	PASS
FCC Part 90.210	Emission Mask	PASS
FCC Part 90.213	Frequency Stability	PASS
FCC Part 90.214	Transmitter Frequency Behavior	PASS
FCC Part 90.210	Transmitter Radiated Spurious Emssion	PASS
FCC Part 90.210	Spurious Emssion On Antenna Port	PASS
FCC Part 15.109	Receiver Radiated Spurious Emssion	N/A ^[2]
FCC Part 15.109	Receiver Conducted Spurious Emssion	N/A ^[2]

- Remark:1.The product was continuous transmitter after receive signal to activate transmitter;
 2.The product can not state only receiver mode and the product was continuous transmitter after receive signal to activate transmitter;
 3.The measurement uncertainty is not included in the test result.

3.7. Equipments Used during the Test

AC Power Conducted Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	10/26/2014
EMI Test Receiver	Rohde&Schwarz	ESCS 30	100038	10/26/2014
Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	10/26/2014
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/26/2014

DC Power Conducted Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Artificial Mains	Rohde&Schwarz	ESH2-Z6	100210	10/26/2014
Artificial Mains	Rohde&Schwarz	ESH2-Z6	100211	10/26/2014
EMI Test Receiver	Rohde&Schwarz	ESCS 30	100038	10/26/2014
Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	10/26/2014
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/26/2014

Modulation Characteristic				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/26/2014

Frequency Stability				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/26/2014
Signal Generator	Rohde&Schwarz	SMT03	100059	10/26/2014
Climate Chamber	ESPEC	EL-10KA	05107008	10/26/2014

Transmitter Radiated Spurious Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Ultra-Broadband Antenna	Rohde&Schwarz	HL562	100015	10/26/2014
EMI Test Receiver	Rohde&Schwarz	ESI 26	100009	10/26/2014
RF Test Panel	Rohde&Schwarz	TS / RSP	335015/ 0017	N/A
HORN ANTENNA	Rohde&Schwarz	HF906	100039	10/26/2014
Turntable	ETS	2088	2149	N/A
Antenna Mast	ETS	2075	2346	N/A
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/26/2014
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	10/26/2014
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	10/26/2014
HORN ANTENNA	ShwarzBeck	9120D	1012	10/26/2014
HORN ANTENNA	ShwarzBeck	9120D	1011	10/26/2014
TURNTABLE	MATURO	TT2.0	----	N/A
ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A

Maximum Transmitter Power & Spurious Emission On Antenna Port & Occupied Bandwidth & Emission Mask				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Receiver	Rohde&Schwarz	ESI 26	100009	10/26/2014
Attenuator	R&S	ESH3-22	100449	10/26/2014
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/26/2014
High-Pass Filter	Anritsu	MP526B	6220875256	10/26/2014
High-Pass Filter	Anritsu	MP526D	6220878392	10/26/2014
Spectrum Analyzer	Aglient	E4407B	MY44210775	10/26/2014
Spectrum Analyzer	Rohde&Schwarz	FSP40	1164.4391.40	10/26/2014

Transient Frequency Behavior				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Signal Generator	Rohde&Schwarz	SMT03	100059	10/26/2014
Storage Oscilloscope	Tektronix	TDS3054B	B033027	10/26/2014
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/26/2014

The calibration interval was one year.

4. TEST CONDITIONS AND RESULTS

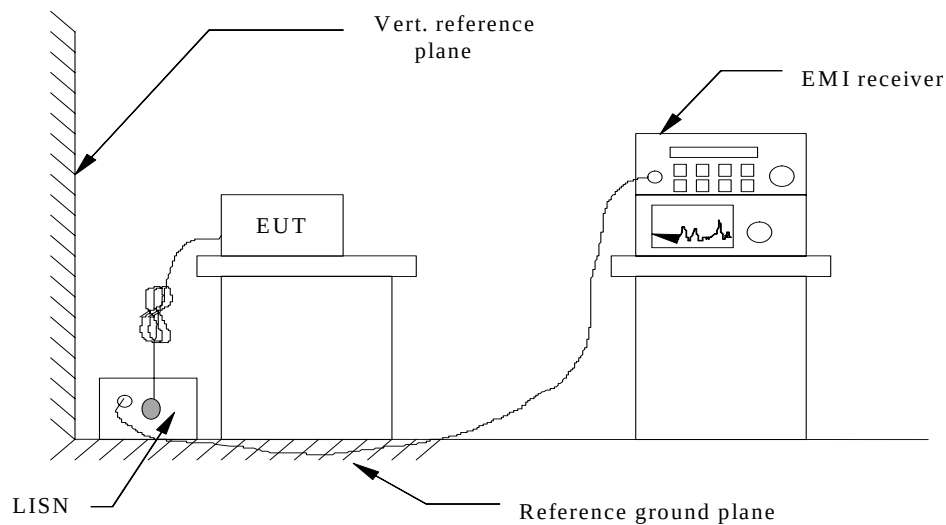
4.1. Conducted Emissions Test

TEST APPLICABLE

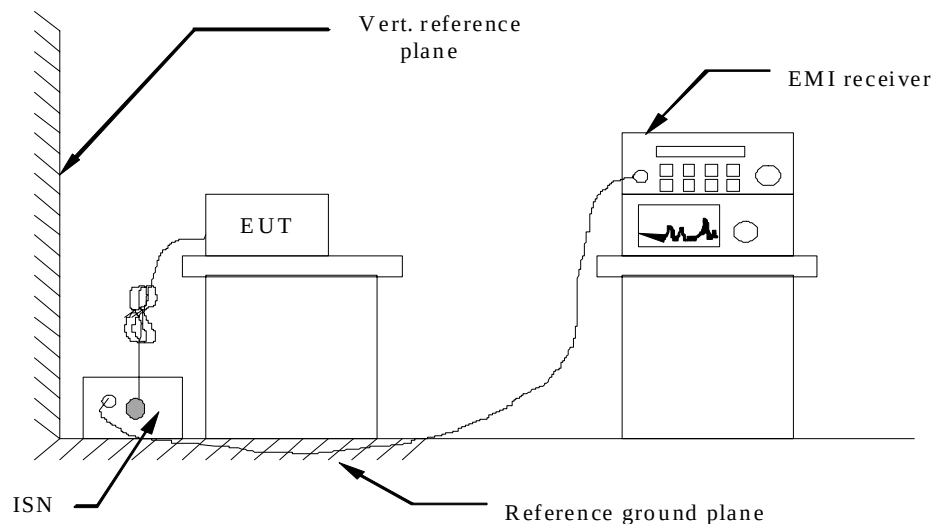
The EUT was tested according to ANSI C63.4 - 2009. The frequency spectrum from 0.15 MHz to 30 MHz was investigated. The LISN used was 50 ohm / 50 u Henry as specified by section 5.1 of ANSI C63.4 - 2009. Cables and peripherals were moved to find the maximum emission levels for each frequency.

TEST CONFIGURATION

For AC Power



For DC Power



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 C63.4-2009.
- 2 Support equipment, if needed, was placed as per ANSI C63.4-2009.
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4-2009.
- 4 If a EUT received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.

- 5 If a EUT received DC 13.60V power through a Impedance Stabilization Network (ISN) which supplied power source and was grounded to the ground plane.
- 6 All support equipments received AC power from a second LISN, if any.
- 7 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.
- 8 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 9 During the above scans, the emissions were maximized by cable manipulation.

Conducted Power Line Emission Limit

For intentional device, according to § 15.207(a) and RSS-Gen Section 7.2.4 for AC Power Conducted Emission Limits is as following:

Frequency (MHz)	Maximum RF Line Voltage (dB μ V)			
	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

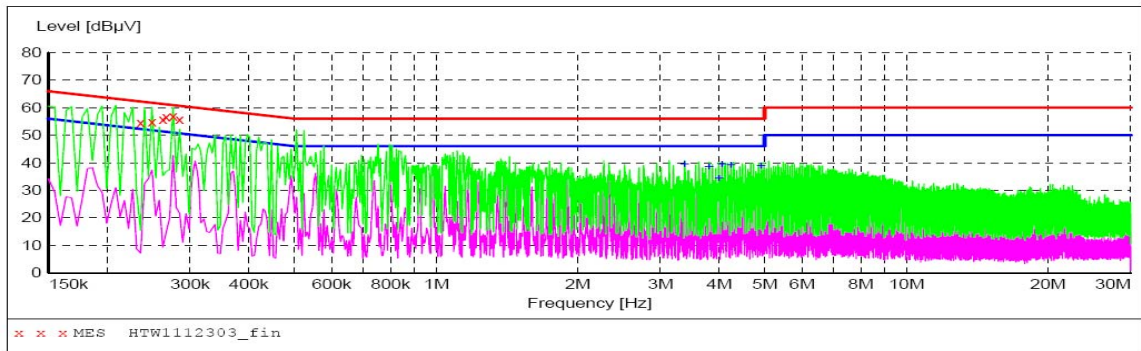
* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

Remark: we tested all Op 1 to Op 8, recorded worst case at Op 1,Op 2,Op 5 and Op 6.

Op 1

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

**MEASUREMENT RESULT: "HTW1112303_fin"**

11/12/2013 8:50AM

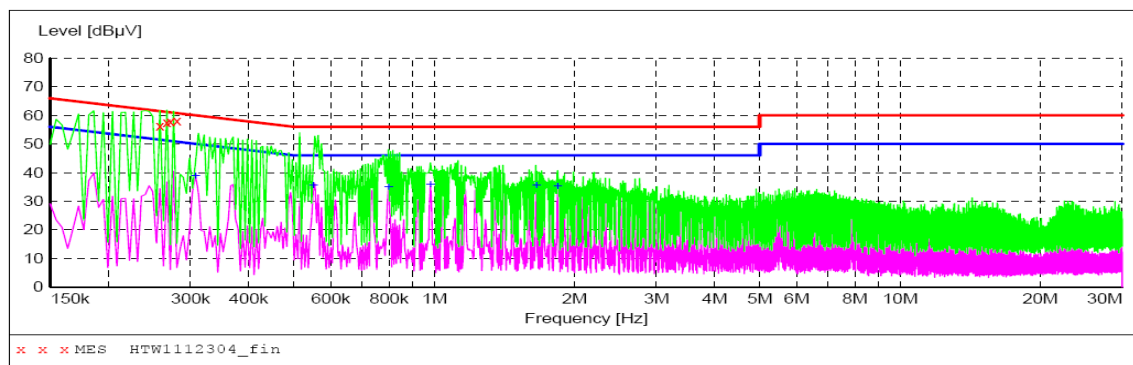
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.235500	54.60	10.1	62	7.7	QP	L1	GND
0.249000	55.00	10.1	62	6.8	QP	L1	GND
0.262500	55.90	10.1	61	5.5	QP	L1	GND
0.267000	56.70	10.1	61	4.5	QP	L1	GND
0.276000	56.80	10.1	61	4.1	QP	L1	GND
0.285000	55.70	10.1	61	5.0	QP	L1	GND

MEASUREMENT RESULT: "HTW1112303_fin2"

11/12/2013 8:50AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
3.376500	39.30	10.3	46	6.7	AV	L1	GND
3.804000	38.30	10.3	46	7.7	AV	L1	GND
3.993000	34.10	10.3	46	11.9	AV	L1	GND
4.051500	39.40	10.3	46	6.6	AV	L1	GND
4.236000	39.00	10.3	46	7.0	AV	L1	GND
4.911000	38.70	10.3	46	7.3	AV	L1	GND

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

**MEASUREMENT RESULT: "HTW1112304_fin"**

11/12/2013 8:53AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.258000	56.50	10.1	62	5.0	QP	N	GND
0.267000	57.60	10.1	61	3.6	QP	N	GND
0.271500	58.00	10.1	61	3.1	QP	N	GND
0.280500	58.30	10.1	61	2.5	QP	N	GND

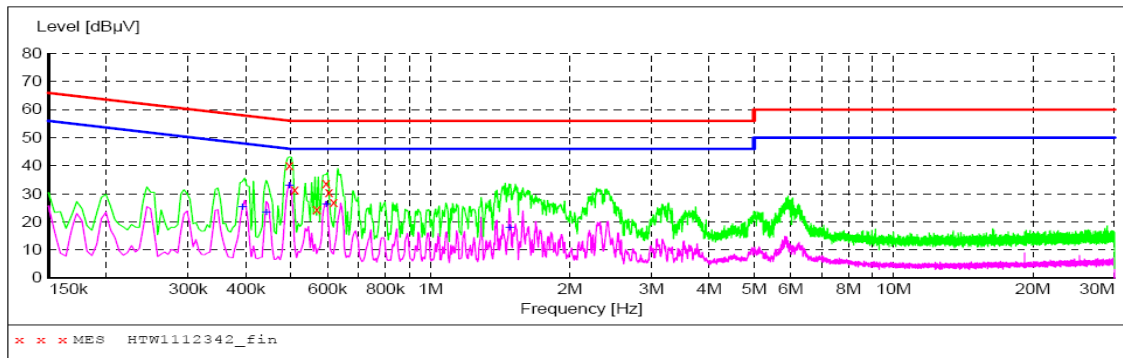
MEASUREMENT RESULT: "HTW1112304_fin2"

11/12/2013 8:53AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.307500	38.60	10.1	50	11.4	AV	N	GND
0.550500	35.50	10.1	46	10.5	AV	N	GND
0.798000	34.80	10.2	46	11.2	AV	N	GND
0.982500	35.70	10.3	46	10.3	AV	N	GND
1.657500	35.30	10.3	46	10.7	AV	N	GND
1.842000	35.20	10.3	46	10.8	AV	N	GND

Op 2

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

**MEASUREMENT RESULT: "HTW1112342_fin"**

11/12/2013 4:02PM

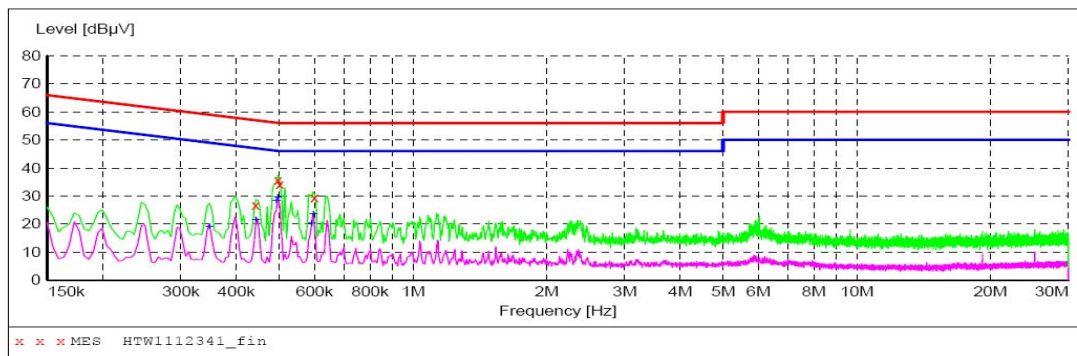
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.496500	40.00	10.1	56	16.1	QP	-	GND
0.510000	31.50	10.1	56	24.5	QP	-	GND
0.568500	24.30	10.1	56	31.7	QP	-	GND
0.595500	33.60	10.2	56	22.4	QP	-	GND
0.604500	30.40	10.2	56	25.6	QP	-	GND
0.618000	26.90	10.2	56	29.1	QP	-	GND

MEASUREMENT RESULT: "HTW1112342_fin2"

11/12/2013 4:02PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.393000	25.30	10.1	48	22.7	AV	-	GND
0.442500	23.50	10.1	47	23.5	AV	-	GND
0.496500	33.10	10.1	46	13.0	AV	-	GND
0.595500	26.40	10.2	46	19.6	AV	-	GND
1.482000	18.00	10.3	46	28.0	AV	-	GND

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

**MEASUREMENT RESULT: "HTW1112341_fin"**

11/12/2013 3:59PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.442500	26.60	10.1	57	30.4	QP	+	GND
0.496500	35.80	10.1	56	20.3	QP	+	GND
0.501000	34.20	10.1	56	21.8	QP	+	GND
0.600000	29.30	10.2	56	26.7	QP	+	GND

MEASUREMENT RESULT: "HTW1112341_fin2"

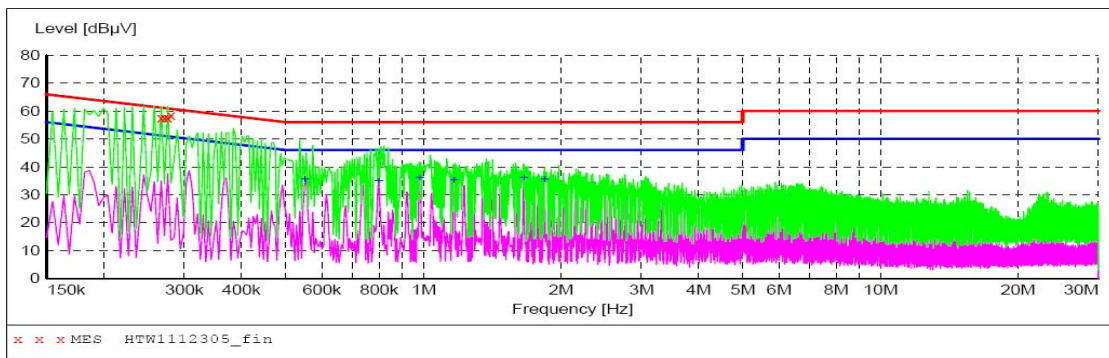
11/12/2013 3:59PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.348000	19.00	10.1	49	30.0	AV	+	GND
0.442500	21.30	10.1	47	25.7	AV	+	GND
0.492000	28.20	10.1	46	17.9	AV	+	GND
0.496500	29.30	10.1	46	16.8	AV	+	GND
0.591000	20.00	10.1	46	26.0	AV	+	GND
0.595500	23.50	10.2	46	22.5	AV	+	GND

Op 5

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

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "HTW1112305_fin"**

11/12/2013 8:56AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.267000	57.60	10.1	61	3.6	QP	N	GND
0.271500	57.70	10.1	61	3.4	QP	N	GND
0.276000	57.50	10.1	61	3.4	QP	N	GND
0.280500	58.40	10.1	61	2.4	QP	N	GND

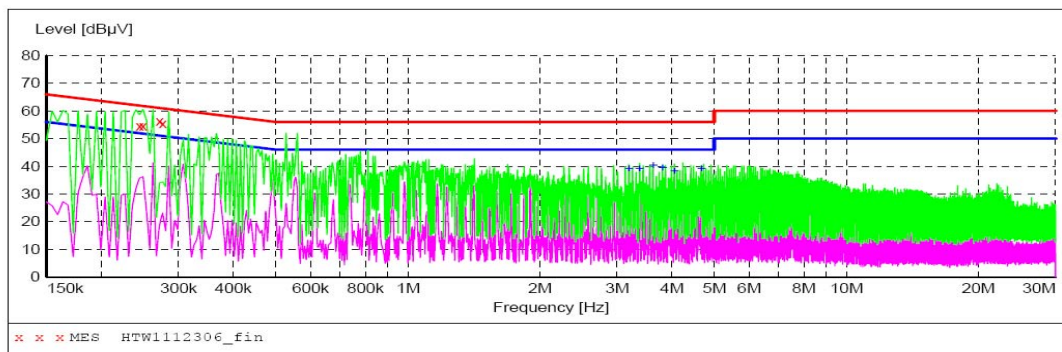
MEASUREMENT RESULT: "HTW1112305_fin2"

11/12/2013 8:56AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.550500	35.30	10.1	46	10.7	AV	N	GND
0.798000	34.80	10.2	46	11.2	AV	N	GND
0.982500	36.00	10.3	46	10.0	AV	N	GND
1.167000	35.00	10.3	46	11.0	AV	N	GND
1.657500	35.90	10.3	46	10.1	AV	N	GND
1.842000	35.30	10.3	46	10.7	AV	N	GND

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

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "HTW1112306_fin"**

11/12/2013 8:58AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.244500	54.50	10.1	62	7.4	QP	L1	GND
0.249000	54.60	10.1	62	7.2	QP	L1	GND
0.271500	56.30	10.1	61	4.8	QP	L1	GND
0.276000	55.40	10.1	61	5.5	QP	L1	GND

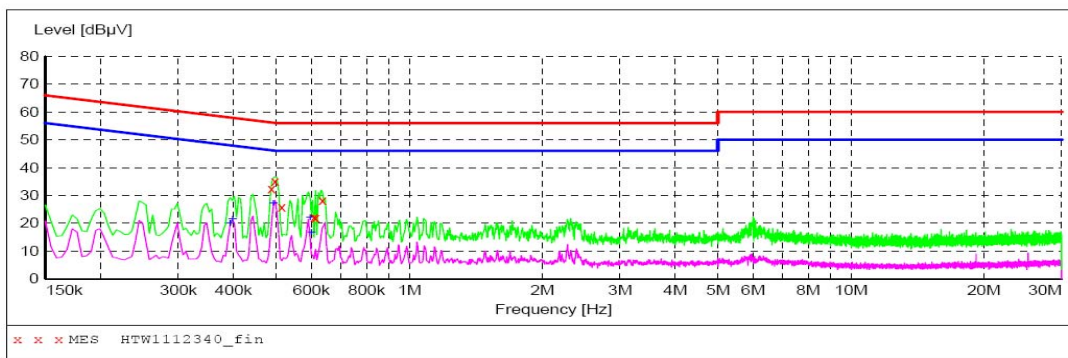
MEASUREMENT RESULT: "HTW1112306_fin2"

11/12/2013 8:58AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
3.192000	39.00	10.3	46	7.0	AV	L1	GND
3.376500	39.10	10.3	46	6.9	AV	L1	GND
3.624000	40.10	10.3	46	5.9	AV	L1	GND
3.808500	39.20	10.3	46	6.8	AV	L1	GND
4.056000	38.00	10.3	46	8.0	AV	L1	GND
4.668000	39.00	10.3	46	7.0	AV	L1	GND

Op 6

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

**MEASUREMENT RESULT: "HTW1112340_fin"**

11/12/2013 3:57PM

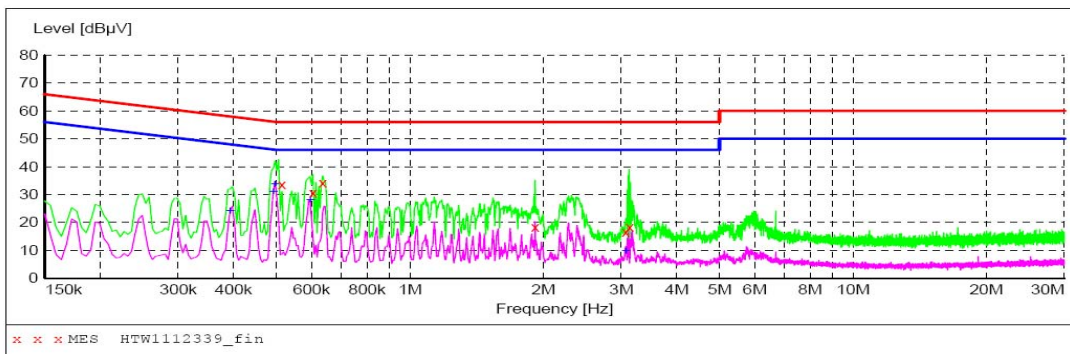
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.487500	32.40	10.1	56	23.8	QP	+	GND
0.496500	35.10	10.1	56	21.0	QP	+	GND
0.514500	25.80	10.1	56	30.2	QP	+	GND
0.609000	22.30	10.2	56	33.7	QP	+	GND
0.613500	22.00	10.2	56	34.0	QP	+	GND
0.636000	28.30	10.2	56	27.7	QP	+	GND

MEASUREMENT RESULT: "HTW1112340_fin2"

11/12/2013 3:57PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.393000	19.70	10.1	48	28.3	AV	+	GND
0.397500	21.40	10.1	48	26.5	AV	+	GND
0.492000	27.00	10.1	46	19.1	AV	+	GND
0.595500	22.00	10.2	46	24.0	AV	+	GND
0.600000	16.60	10.2	46	29.4	AV	+	GND

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

**MEASUREMENT RESULT: "HTW1112339_fin"**

11/12/2013 3:54PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.514500	33.70	10.1	56	22.3	QP	-	GND
0.604500	30.60	10.2	56	25.4	QP	-	GND
0.636000	34.30	10.2	56	21.7	QP	-	GND
1.918500	18.40	10.3	56	37.6	QP	-	GND
3.070500	16.70	10.3	56	39.3	QP	-	GND
3.133500	18.30	10.3	56	37.7	QP	-	GND

MEASUREMENT RESULT: "HTW1112339_fin2"

11/12/2013 3:54PM

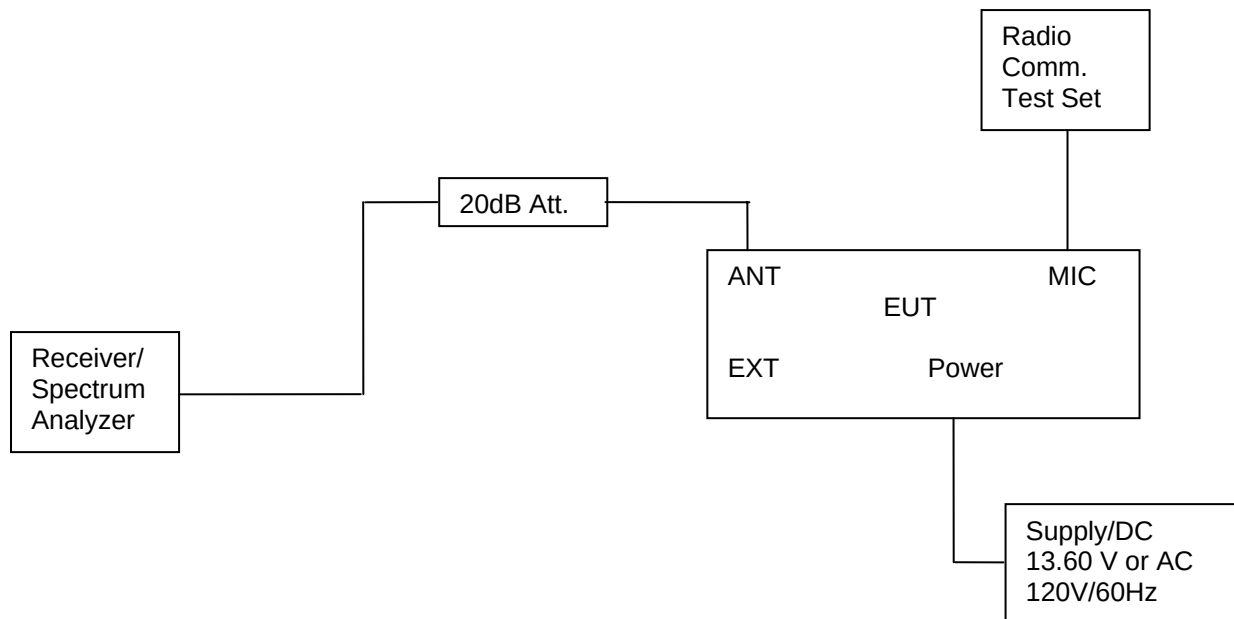
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.393000	24.00	10.1	48	24.0	AV	-	GND
0.492000	31.00	10.1	46	15.1	AV	-	GND
0.496500	33.50	10.1	46	12.6	AV	-	GND
0.595500	27.90	10.2	46	18.1	AV	-	GND
3.070500	9.50	10.3	46	36.5	AV	-	GND

4.2. Occupied Bandwidth and Emission Mask Test

TEST 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 f_0 to 5.625 kHz removed from f_0 : Zero dB.
 - (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
 - (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

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 =300Hz, VBW=1 KHz, span=50 KHz for 12.5 channel spacing.

TEST RESULTS

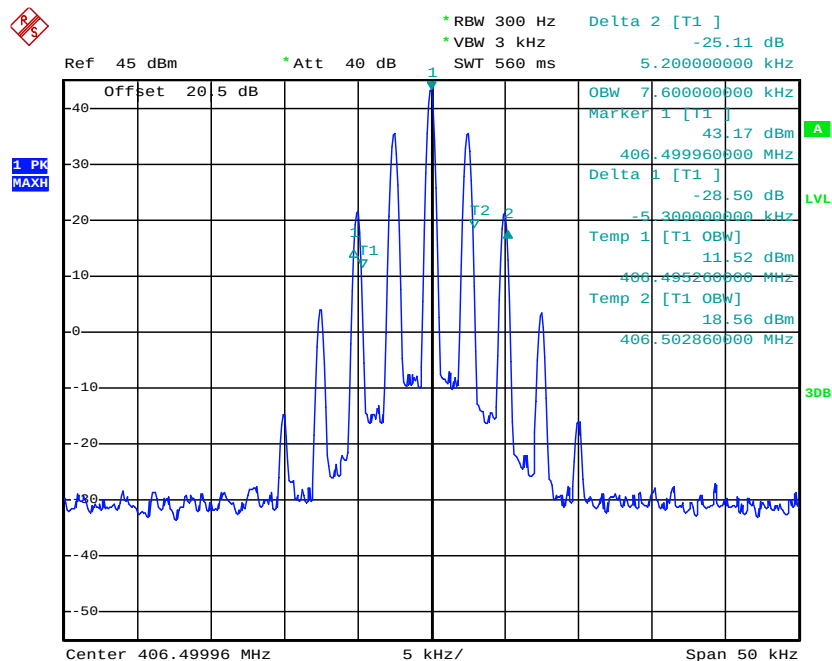
Remark: We tested Op 1 to Op 8, recorded worst case at Op 1, Op 2, Op 5 and Op 6.

4.2.1 Occupied Bandwidth

Modulation Type	Channel Sparation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)	
					99%	26dB
Analog/FM	12.5KHz	Op 1	Ch1	406.5	7.60	10.50
			Ch2	435.0	5.70	10.40
			Ch3	469.5	9.80	10.50
		Op 2	Ch1	406.5	9.40	10.50
			Ch2	435.0	5.70	10.40
			Ch3	469.5	9.80	10.50
Digital/4FSK	12.5KHz	Op 5	Ch4	406.5	7.50	9.40
			Ch5	435.0	7.70	9.20
			Ch6	469.5	7.90	9.00
		Op 6	Ch4	406.5	7.80	9.70
			Ch5	435.0	7.40	9.40
			Ch6	469.5	7.90	10.10
Limit			11.25KHz for 12.5KHz Channel Separation			
Test Results			PASS			

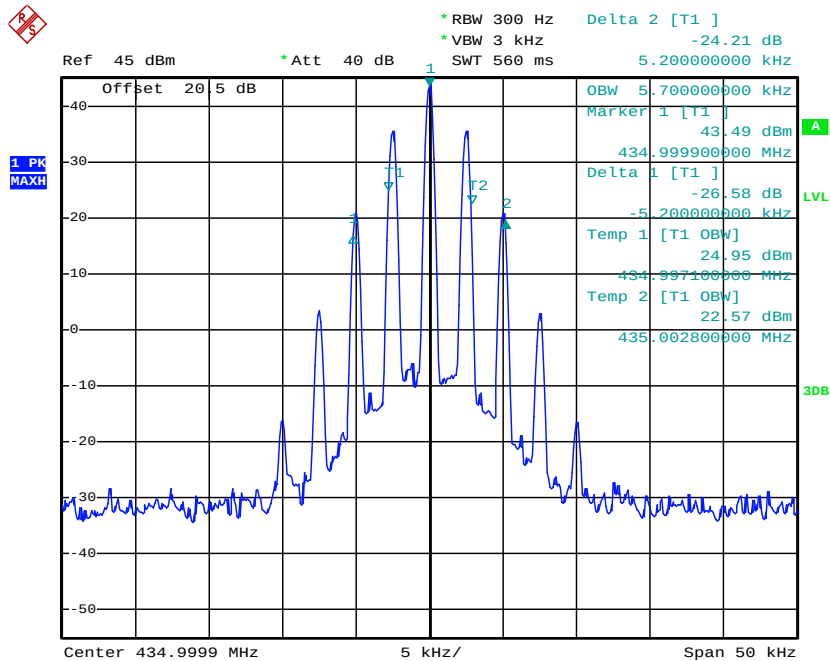
Plots of 99% and 26dB Bandwidth Measurement

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
FM	12.5 KHz	Op 1	Ch1	406.5	7.60	10.50	11.25	PASS



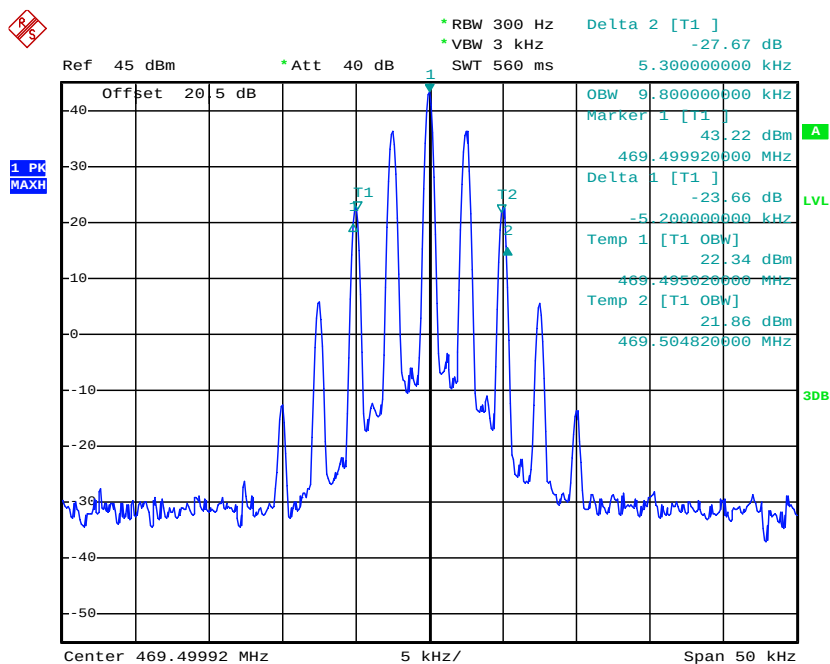
Date: 22.OCT.2013 12:19:25

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
FM	12.5 KHz	Op 1	Ch2	435.0	5.70	10.40	11.25	PASS



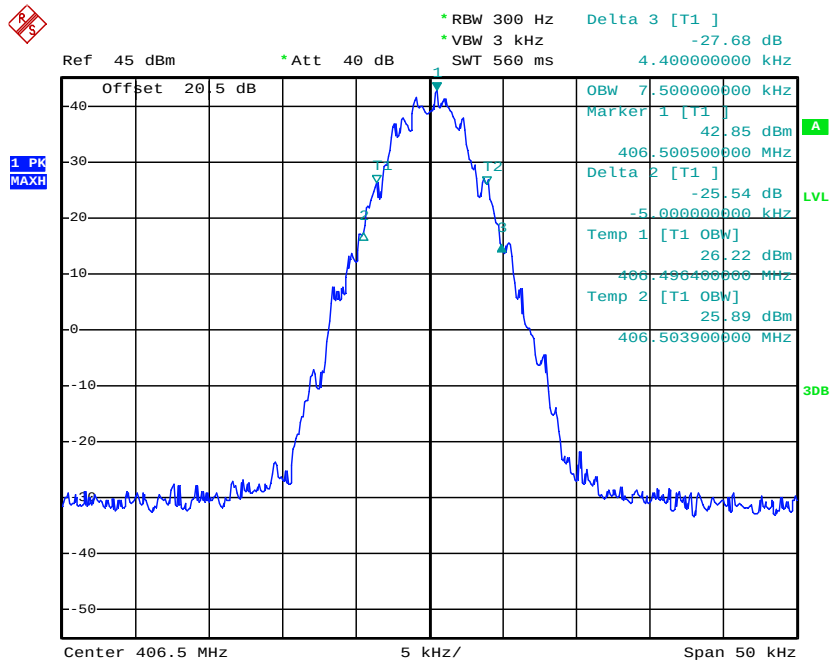
Date: 22.OCT.2013 12:35:03

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
FM	12.5 KHz	Op 1	Ch3	469.5	9.80	10.50	11.25	PASS



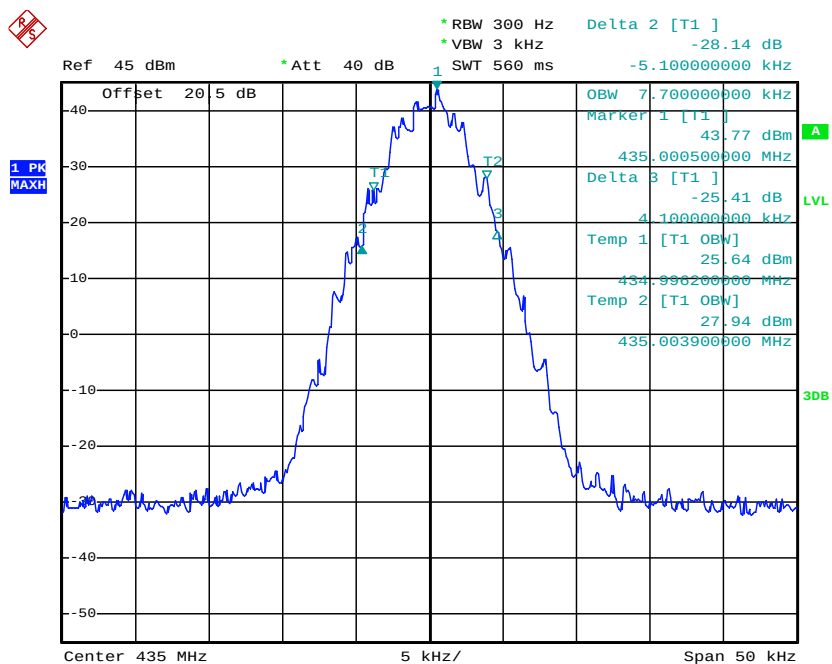
Date: 22.OCT.2013 12:47:24

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
4FSK	12.5 KHz	Op 5	Ch4	406.5	7.50	9.40	11.25	PASS



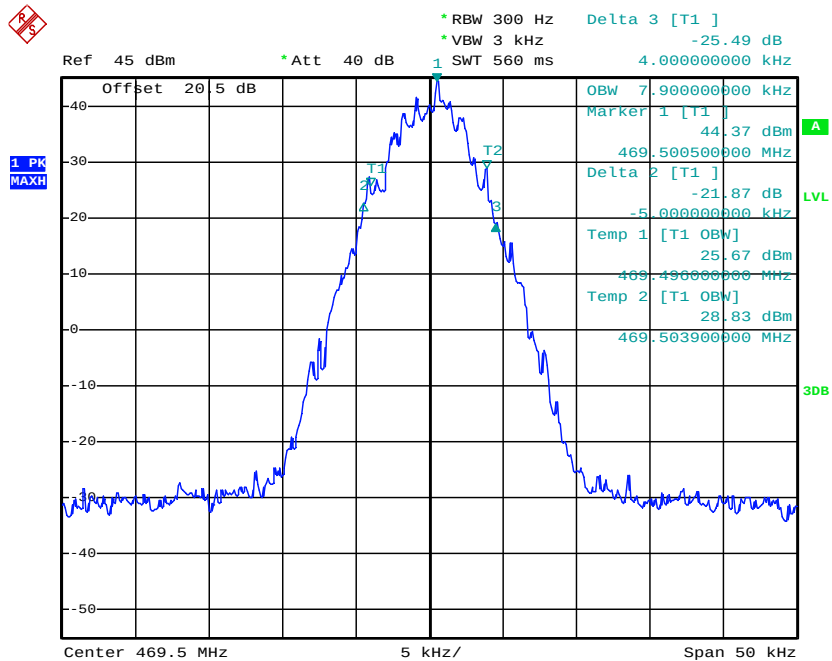
Date: 23.OCT.2013 12:36:25

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
4FSK	12.5 KHz	Op 5	Ch5	435.0	7.70	9.20	11.25	PASS



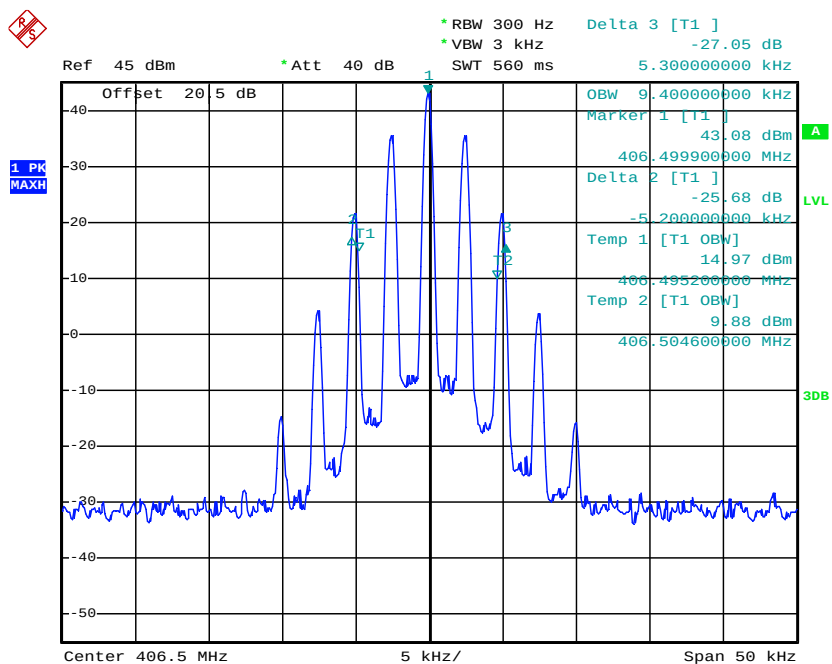
Date: 23.OCT.2013 12:33:51

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
4FSK	12.5 KHz	Op 5	Ch6	469.5	7.90	9.00	11.25	PASS



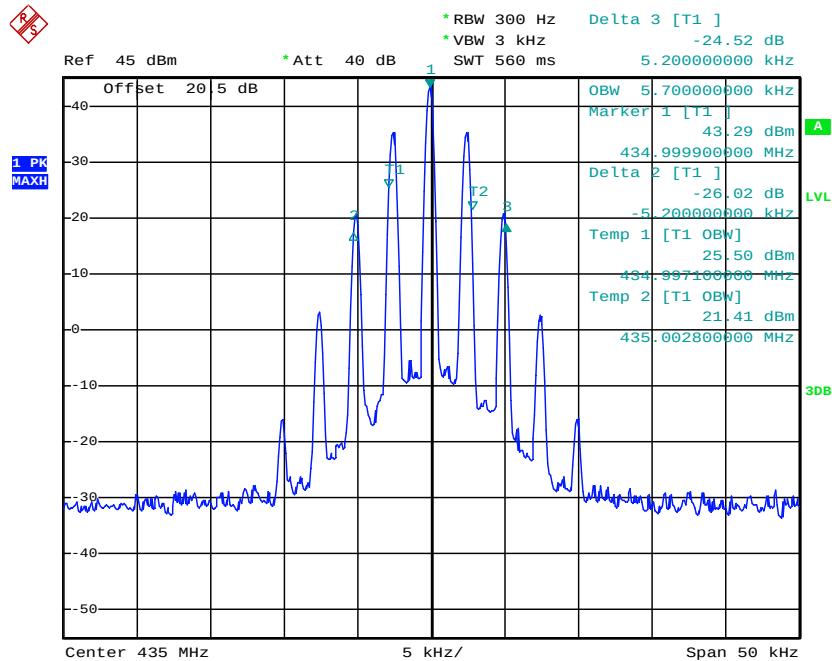
Date: 23.OCT.2013 12:28:45

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
FM	12.5 KHz	Op 2	Ch1	406.5	9.40	10.50	11.25	PASS



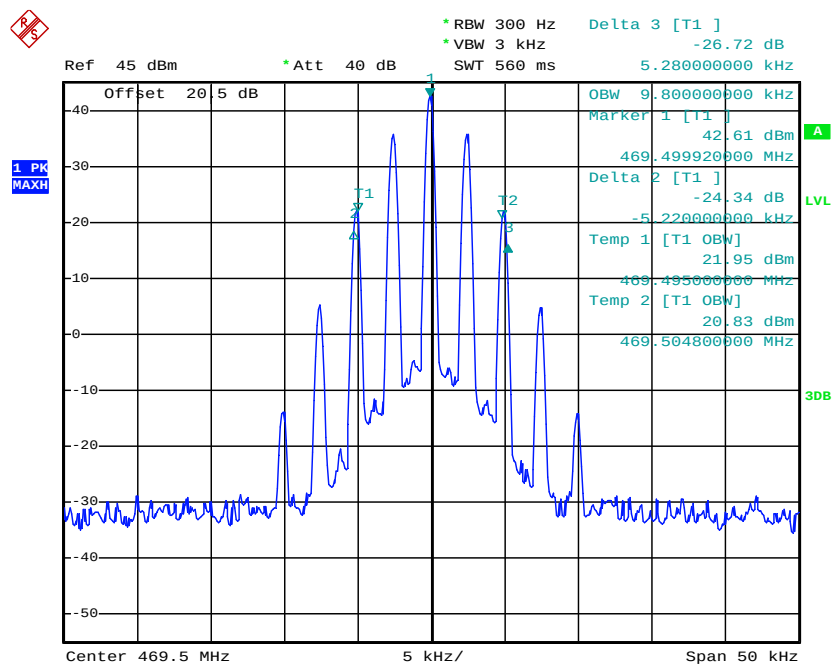
Date: 23.OCT.2013 15:47:56

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
FM	12.5 KHz	Op 2	Ch2	435.0	5.70	10.40	11.25	PASS



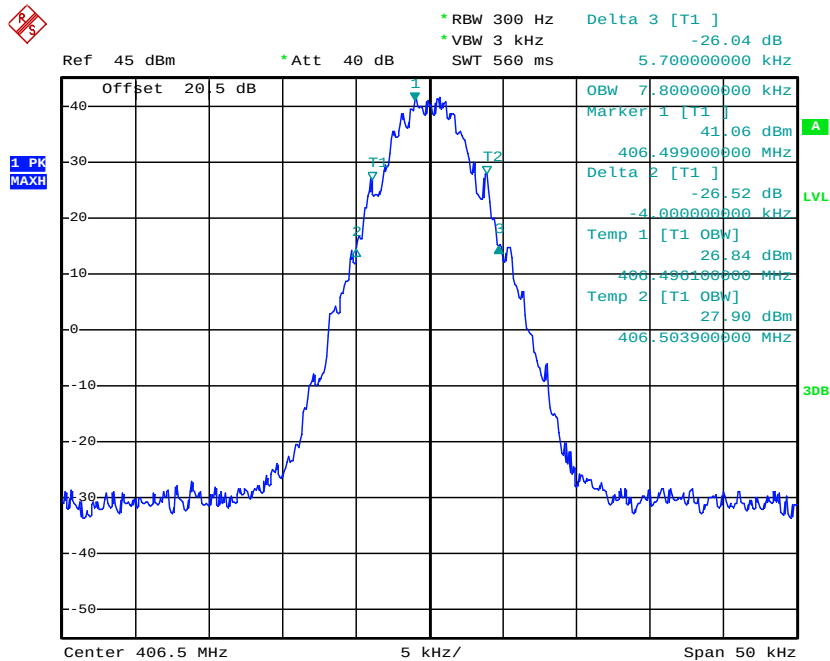
Date: 23.OCT.2013 15:50:39

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
FM	12.5 KHz	Op 2	Ch3	469.5	9.80	10.50	11.25	PASS



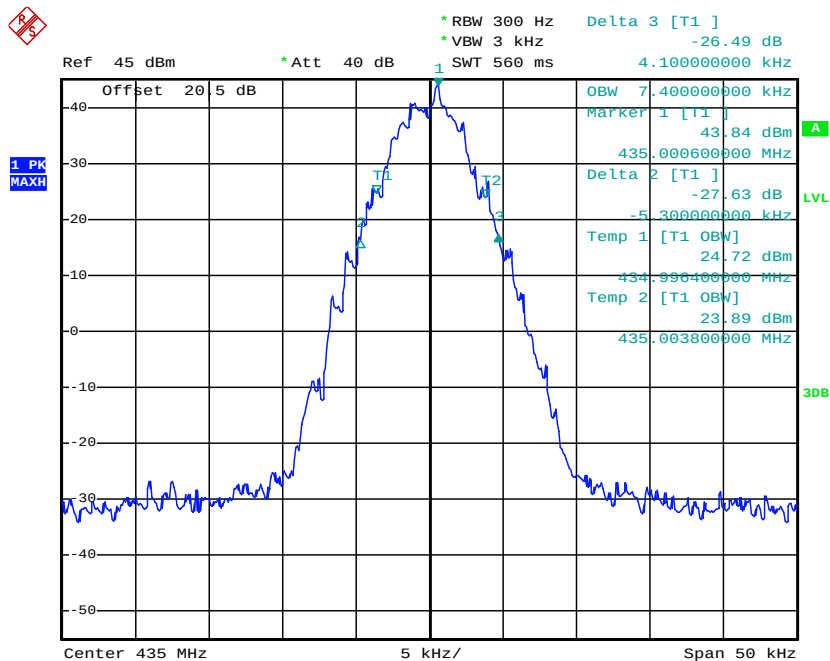
Date: 23.OCT.2013 15:52:15

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
4FSK	12.5 KHz	Op 6	Ch4	406.5	7.80	9.70	11.25	PASS



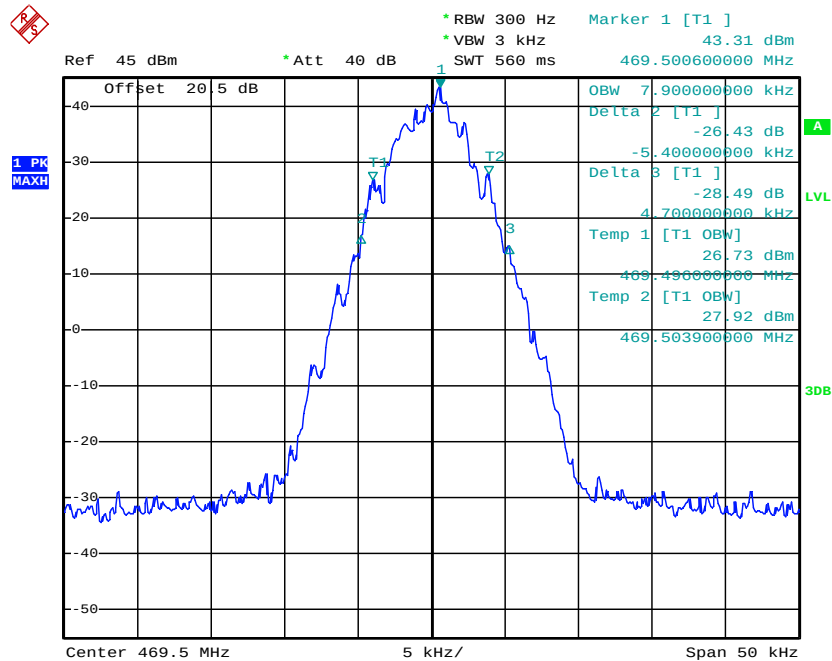
Date: 23.OCT.2013 16:44:37

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
4FSK	12.5 KHz	Op 6	Ch5	435.0	7.40	9.40	11.25	PASS



Date: 23.OCT.2013 16:42:28

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limit (KHz)	Results
					99%	26dB		
4FSK	12.5 KHz	Op 6	Ch6	469.5	7.90	10.10	11.25	PASS



Date: 23.OCT.2013 16:39:46

4.2.2 Emission Mask

Modulation Type	Channel Sparation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)
Analog/FM	12.5 KHz	Op 1	Ch1	406.5	D	300
			Ch2	435.0	D	300
			Ch3	469.5	D	300
		Op 2	Ch1	406.5	D	300
			Ch2	435.0	D	300
			Ch3	469.5	D	300
Digital/4FSK	12.5 KHz	Op 5	Ch1	406.5	D	300
			Ch2	435.0	D	300
			Ch3	469.5	D	300
		Op 6	Ch1	406.5	D	300
			Ch2	435.0	D	300
			Ch3	469.5	D	300
Test Results			PASS			

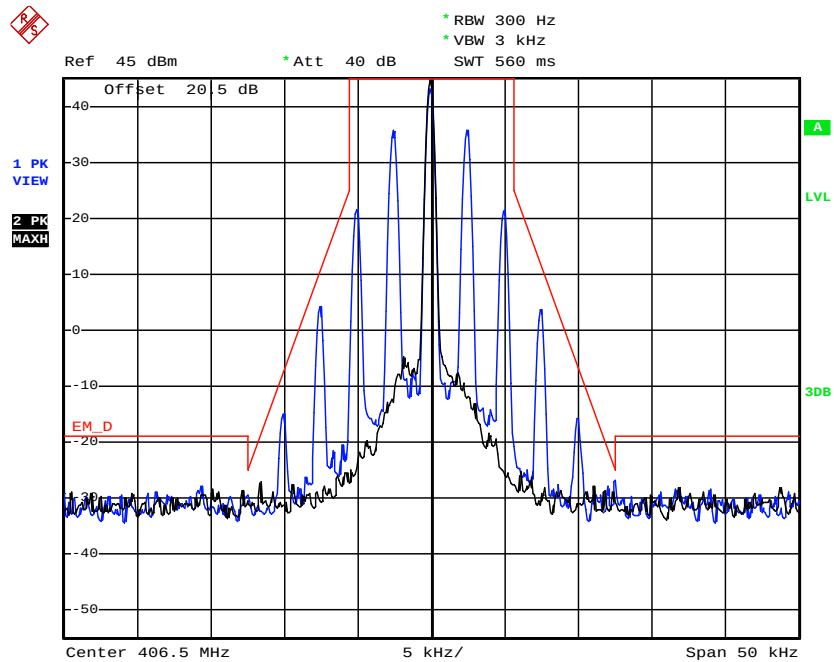
Plots of Emission Mask Measurement

Referred as the attached plot hereinafter

Note: The Black curve represents unmodulated signal.

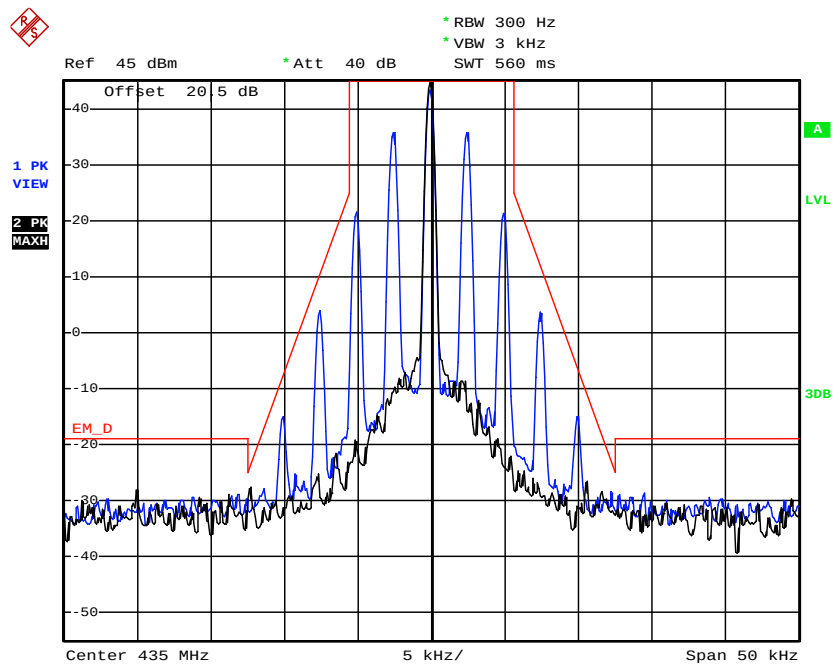
The Blue curve represents modulated signal.

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
FM	12.5KHz	Op 1	Ch1	406.5	D	300	2.5	PASS



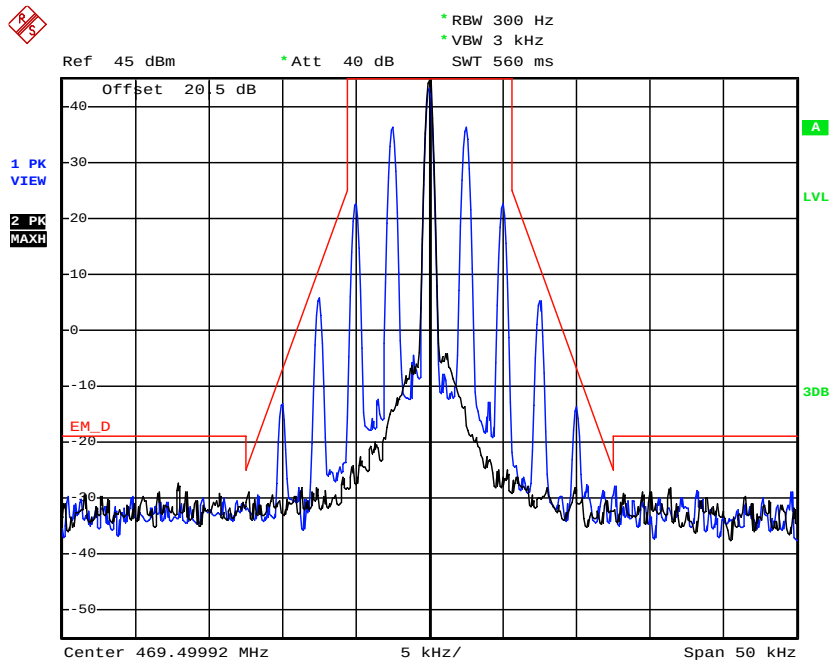
Date: 22.OCT.2013 12:31:18

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
FM	12.5KHz	Op 1	Ch2	435.0	D	300	2.5	PASS



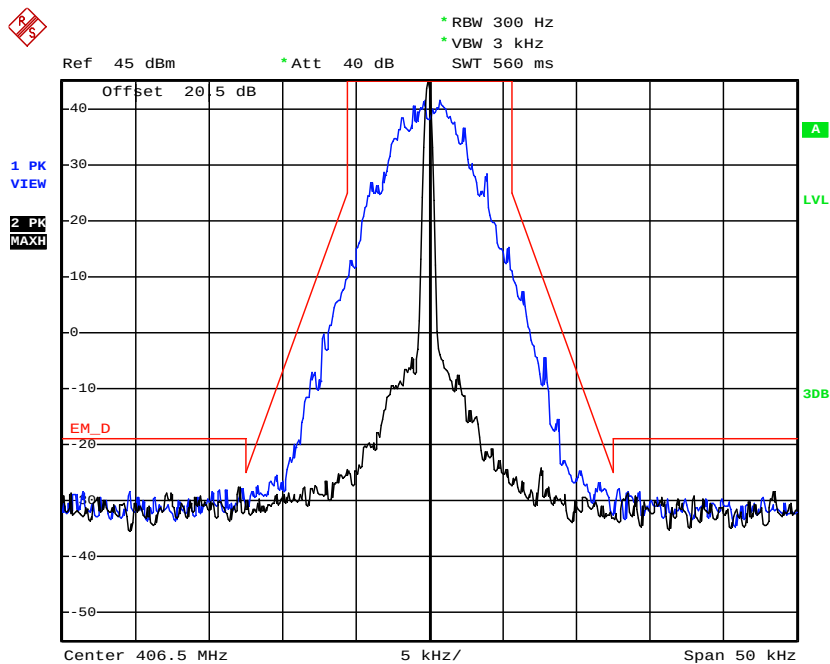
Date: 22.OCT.2013 12:33:43

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
FM	12.5KHz	Op 1	Ch3	469.5	D	300	2.5	PASS



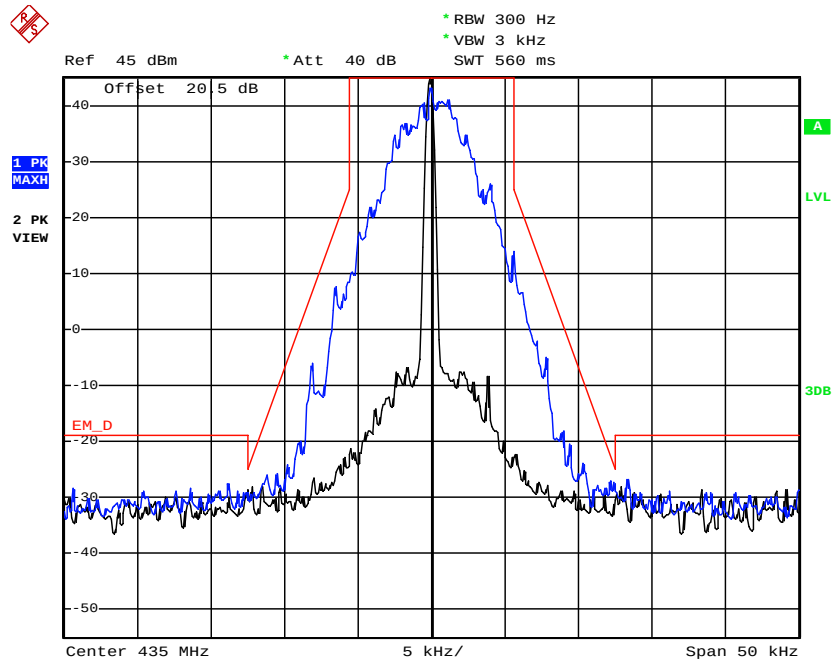
Date: 22.OCT.2013 12:48:20

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
4FSK	12.5KHz	Op 5	Ch1	406.5	D	300	/	PASS



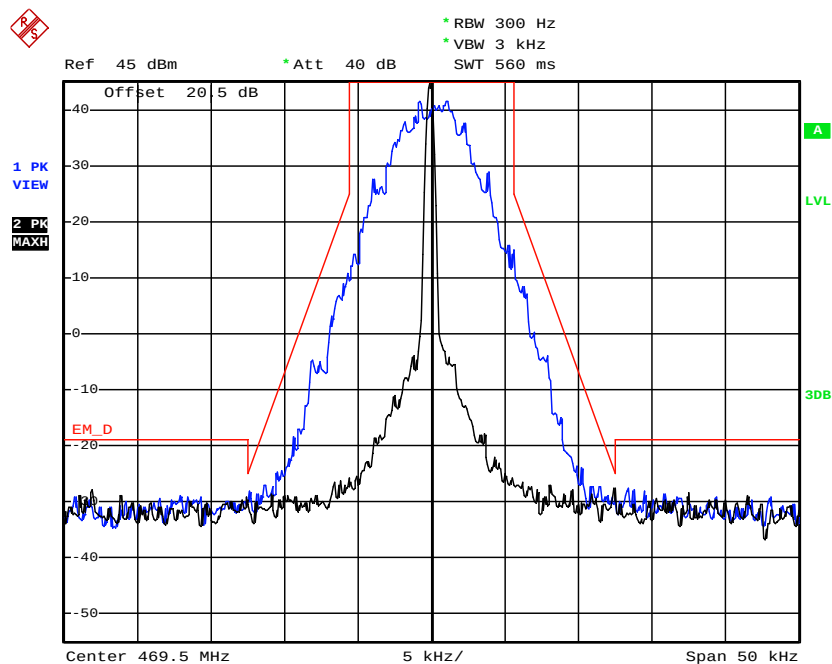
Date: 23.OCT.2013 12:37:20

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
4FSK	12.5KHz	Op 5	Ch2	435.0	D	300	/	PASS



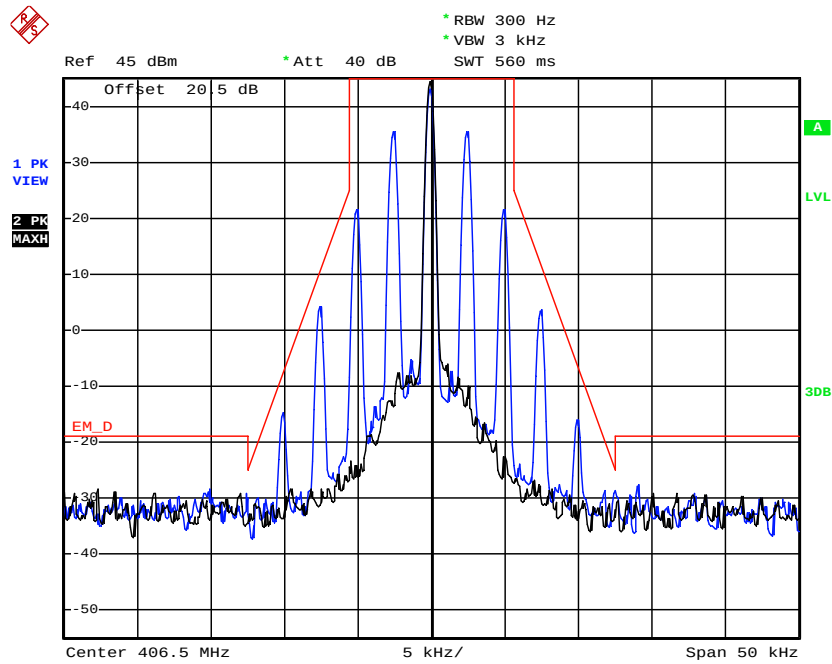
Date: 23.OCT.2013 12:32:28

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
4FSK	12.5KHz	Op 5	Ch3	469.5	D	300	/	PASS



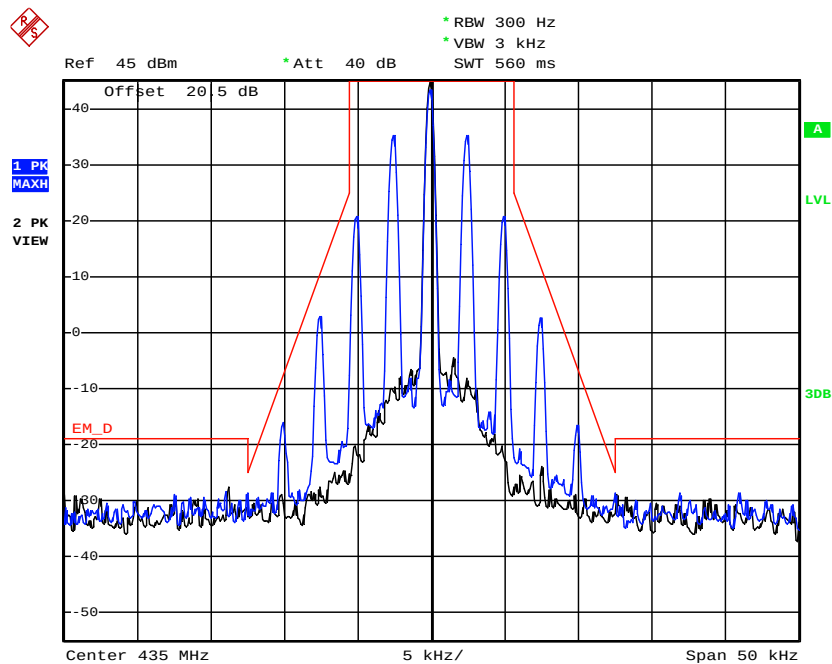
Date: 23.OCT.2013 12:30:58

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
FM	12.5KHz	Op 2	Ch1	406.5	D	300	2.5	PASS



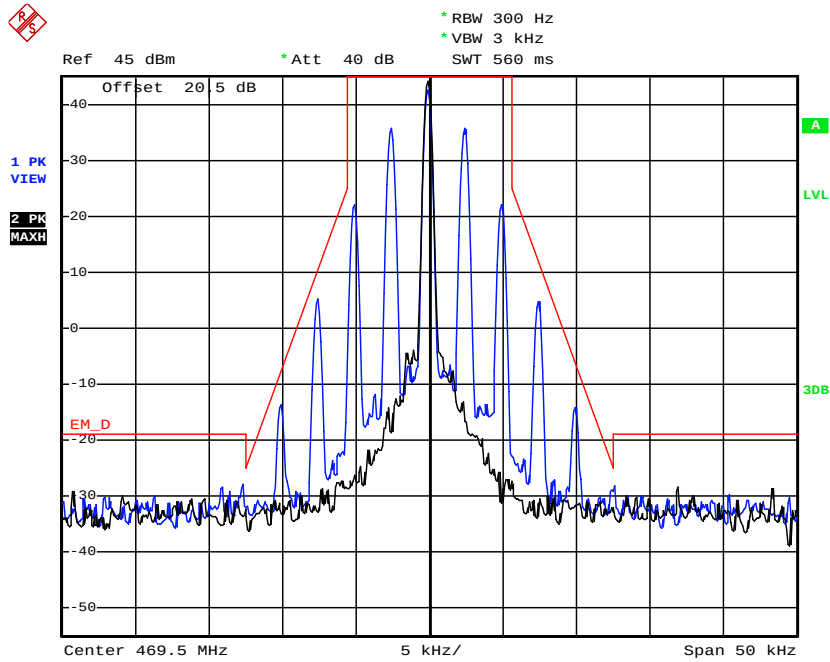
Date: 23.OCT.2013 15:48:46

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
FM	12.5KHz	Op 2	Ch2	435.0	D	300	2.5	PASS



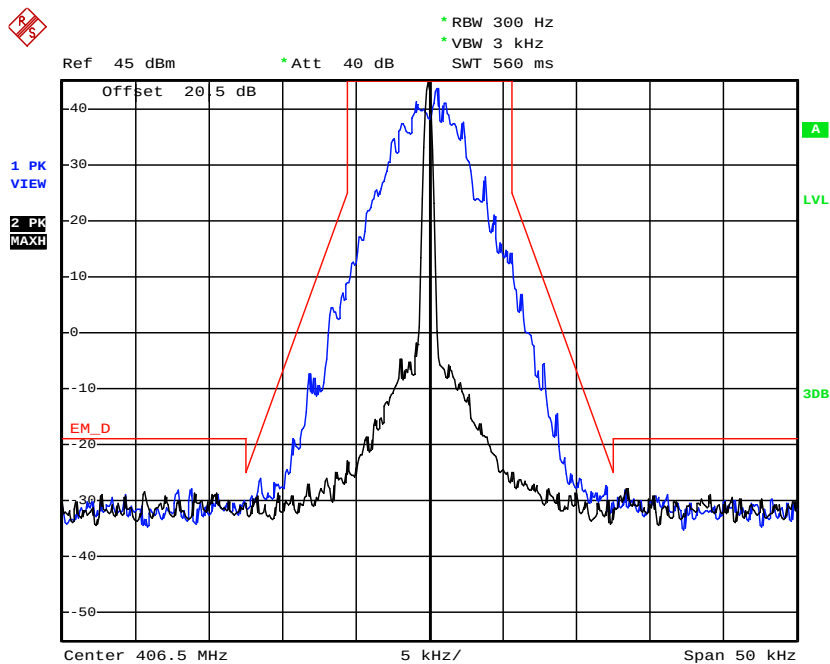
Date: 23.OCT.2013 15:49:43

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
FM	12.5KHz	Op 2	Ch3	469.5	D	300	2.5	PASS



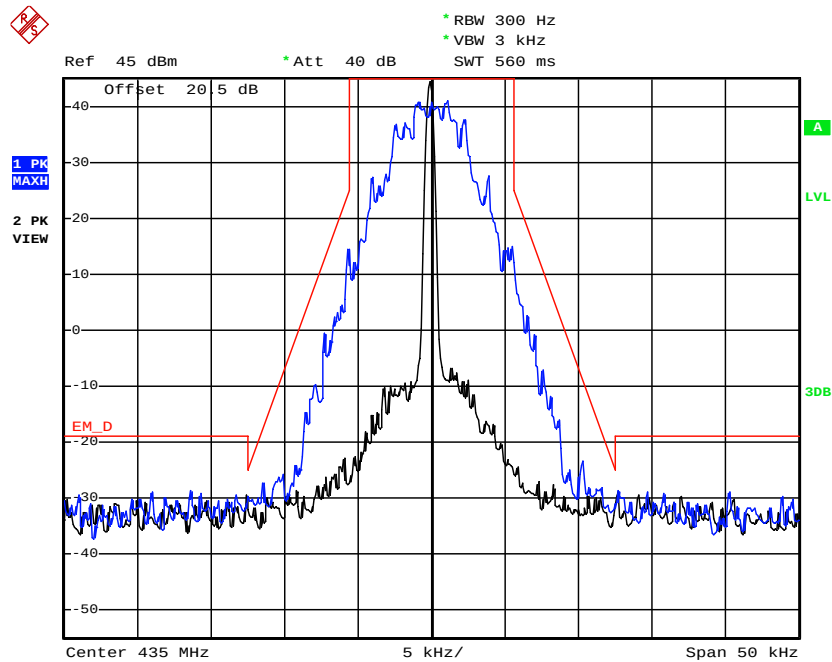
Date: 23.OCT.2013 15:52:43

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
4FSK	12.5KHz	Op 6	Ch1	406.5	D	300	/	PASS



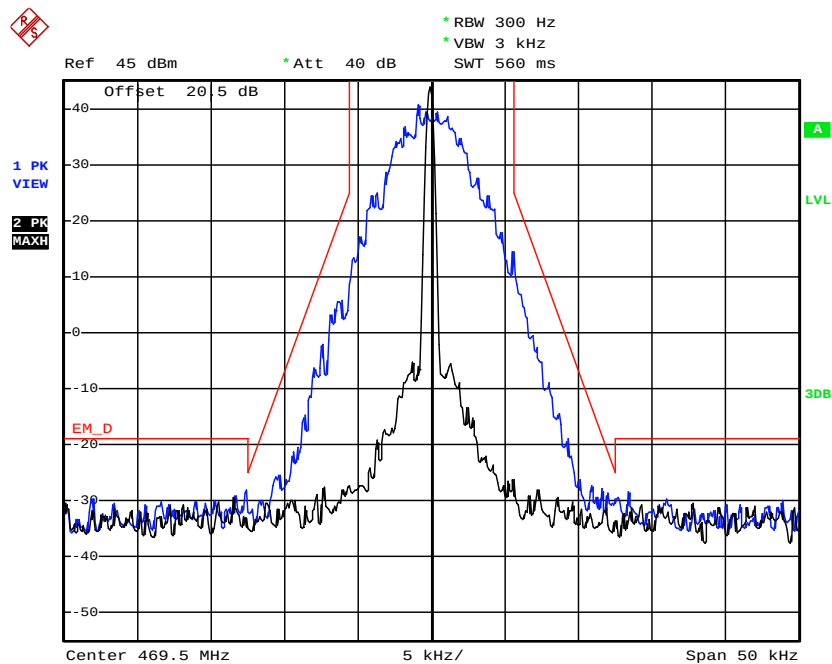
Date: 23.OCT.2013 16:45:34

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
4FSK	12.5KHz	Op 6	Ch2	435.0	D	300	/	PASS



Date: 23.OCT.2013 16:41:39

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)	Audio Freq. (KHz)	Results
4FSK	12.5KHz	Op 6	Ch3	469.5	D	300	/	PASS



Date: 23.OCT.2013 16:40:34

4.3. Transmitter Radiated Spurious Emission

TEST APPLICABLE

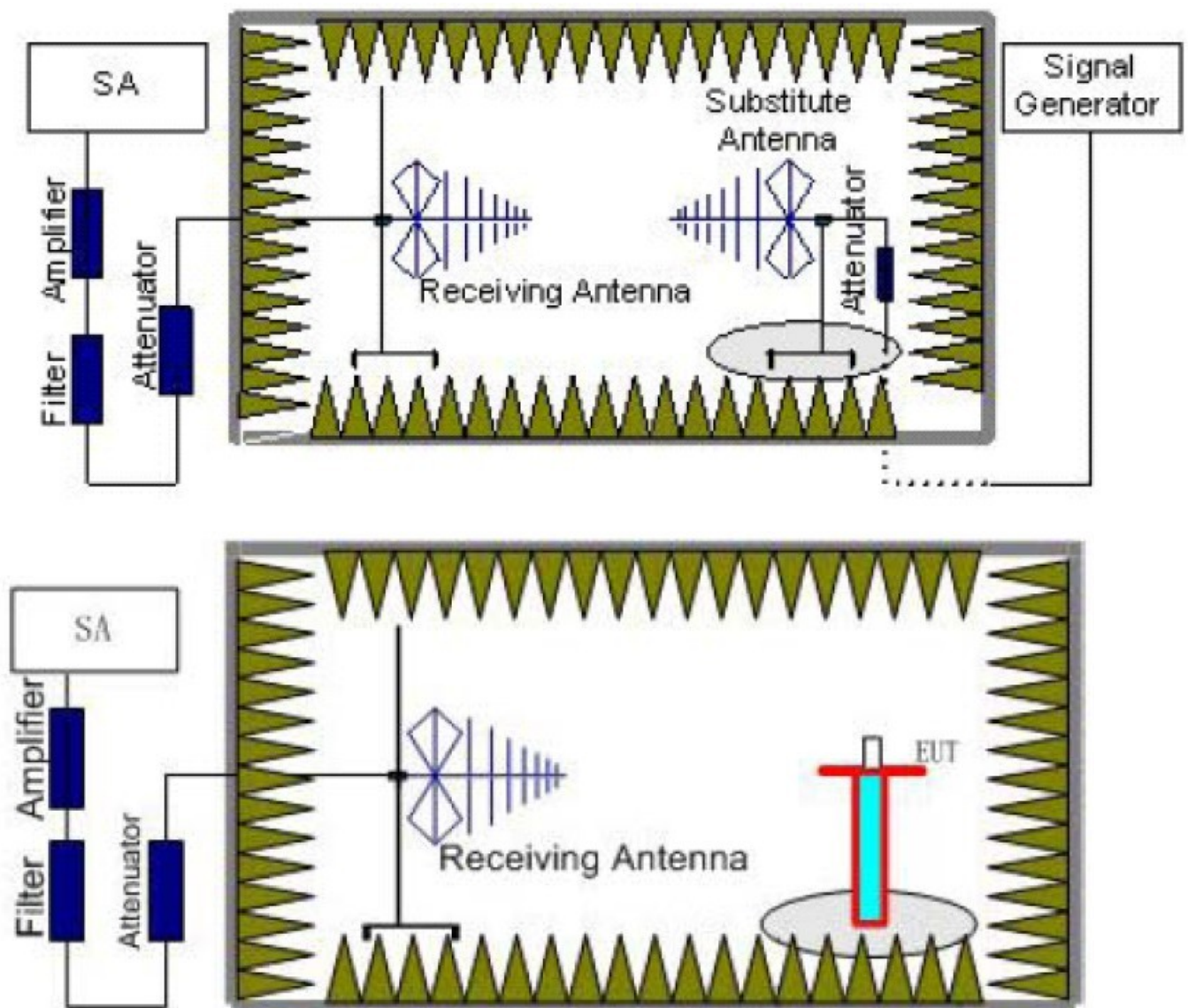
According to the TIA/EIA 603 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:

- 1 On any frequency removed from the center of the authorized bandwidth f_0 to 5.625 KHz removed from f_0 : Zero dB
- 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) f_0 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 (f_d in KHz) f_0 of more than 12.5 KHz: At least $50 + 10 \log(P)$ dB or 70 dB, whichever 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 $43 + 10 \log(P)$ dB.

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in six channels were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz for above 1GHz and RBW=100KHz, VBW=300KHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.
The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{Ag} - P_{cl} - G_a$$
 We used SMF100A microwave signal generator which signal level can up to 33dBm, so we not used power Amplifier for substitution test; The measurement results are amend as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{cl} - G_a$$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.

TEST RESULTS

Remark: We tested Op 1 to Op 8. recorded worst case at Op 1 and Op 5.

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: $50 + 10 \log(P_{\text{watts}}) = 50 + 10 \log(28.12) = 64.49 \text{ dB}$

High: $50 + 10 \log(P_{\text{watts}}) = 50 + 10 \log(29.85) = 64.75 \text{ dB}$

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

Calculation: Limit (dBm) = $EL - 50 - 10 \log_{10}(TP)$

Notes: EL is the emission level of the Output Power expressed in dBm,

In this application, the EL is 43.98 dBm.

Limit (dBm) = $43.98 - 50 - 10 \log_{10}(29.85) = -20 \text{ dBm}$

Modulation Type: 4FSK

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: $50 + 10 \log(P_{\text{watts}}) = 50 + 10 \log(28.58) = 54.56 \text{ dB}$

High: $50 + 10 \log(P_{\text{watts}}) = 50 + 10 \log(29.85) = 64.75 \text{ dB}$

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

Calculation: Limit (dBm) = $EL - 50 - 10 \log_{10}(TP)$

Notes: EL is the emission level of the Output Power expressed in dBm,

In this application, the EL is 43.98 dBm.

Limit (dBm) = $43.98 - 50 - 10 \log_{10}(29.85) = -20 \text{ dBm}$

- 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 Type:FM							
Operation Mode: Op 1				Channel Separation:12.5KHz			
Test Channel: Ch1				Test Frequency: 406.5MHz			
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1219.50	-31.39	0.87	6.38	2.15	-28.03	-20.00	H
2032.50	-57.12	1.13	10.03	2.15	-50.37	-20.00	H
2845.50	-54.26	1.30	10.95	2.15	-46.76	-20.00	H
...	...	...	...	...	...	...	H
1219.50	-34.22	0.87	6.38	2.15	-30.86	-20.00	V
2032.50	-58.50	1.13	10.03	2.15	-51.75	-20.00	V
2845.50	-54.00	1.30	10.95	2.15	-46.50	-20.00	V
...	...	...	...	...	...	...	V

Modulation Type:FM							
Operation Mode: Op 1				Channel Separation:12.5KHz			
Test Channel: Ch2				Test Frequency: 435.0MHz			
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1305.00	-54.21	0.92	6.36	2.15	-50.92	-20.00	H
1740.00	-59.68	1.06	9.88	2.15	-53.01	-20.00	H
2175.00	-62.43	1.10	9.29	2.15	-56.39	-20.00	H
...	...	...	...	...	...	...	H
1305.00	-57.02	0.92	6.36	2.15	-53.73	-20.00	V
1740.00	-60.39	1.06	9.88	2.15	-53.72	-20.00	V
2175.00	-63.54	1.10	9.29	2.15	-57.50	-20.00	V
...	...	...	...	...	...	...	V

Modulation Type:FM							
Operation Mode: Op 1				Channel Separation:12.5KHz			
Test Channel: Ch3				Test Frequency: 469.5MHz			
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1408.50	-48.86	0.92	7.25	2.15	-44.68	-20.00	H
2437.50	-57.25	1.29	10.56	2.15	-50.13	-20.00	H
2817.00	-58.07	1.29	10.89	2.15	-50.62	-20.00	H
...	...	...	...	...	...	...	H
1408.50	-47.75	0.92	7.25	2.15	-43.57	-20.00	V
2437.50	-62.61	1.29	10.56	2.15	-55.49	-20.00	V
2817.00	-53.08	1.29	10.89	2.15	-45.63	-20.00	V
...	...	...	...	...	...	...	V

Modulation Type:4FSK							
Operation Mode: Op 5				Channel Separation:12.5KHz			
Test Channel: Ch4				Test Frequency: 406.5MHz			
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1219.50	-35.39	0.87	6.38	2.15	-32.03	-20.00	H
2032.50	-62.50	1.13	10.03	2.15	-55.75	-20.00	H
2845.50	-63.94	1.30	10.95	2.15	-56.44	-20.00	H
...	...	...	...	...	...	...	H
1219.50	-39.27	0.87	6.38	2.15	-35.91	-20.00	V
2032.50	-65.22	1.13	10.03	2.15	-58.47	-20.00	V
2845.50	-59.94	1.30	10.95	2.15	-52.44	-20.00	V
...	...	...	...	...	...	...	V

Modulation Type:4FSK							
Operation Mode: Op 5				Channel Separation:12.5KHz			
Test Channel: Ch5				Test Frequency: 435.0MHz			
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1305.00	-54.85	0.92	6.36	2.15	-51.56	-20.00	H
1740.00	-59.66	1.06	9.88	2.15	-52.99	-20.00	H
2175.00	-62.79	1.10	9.29	2.15	-56.75	-20.00	H
...	...	...	...	...	...	...	H
1305.00	-56.89	0.92	6.36	2.15	-53.60	-20.00	V
1740.00	-61.55	1.06	9.88	2.15	-54.88	-20.00	V
2175.00	-64.45	1.10	9.29	2.15	-58.41	-20.00	V
...	...	...	...	...	...	...	V

Modulation Type:4FSK							
Operation Mode: Op 5				Channel Separation:12.5KHz			
Test Channel: Ch6				Test Frequency: 469.5MHz			
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
1408.50	-47.97	0.92	7.25	2.15	-43.79	-20.00	H
2437.50	-58.13	1.29	10.56	2.15	-51.01	-20.00	H
2817.00	-57.75	1.29	10.89	2.15	-50.30	-20.00	H
...	...	...	...	...	...	...	H
1408.50	-48.64	0.92	7.25	2.15	-44.46	-20.00	V
2437.50	-62.80	1.29	10.56	2.15	-55.68	-20.00	V
2817.00	-52.05	1.29	10.89	2.15	-44.60	-20.00	V
...	...	...	...	...	...	...	V

4.4. Spurious Emission on Antenna Port

TEST APPLICABLE

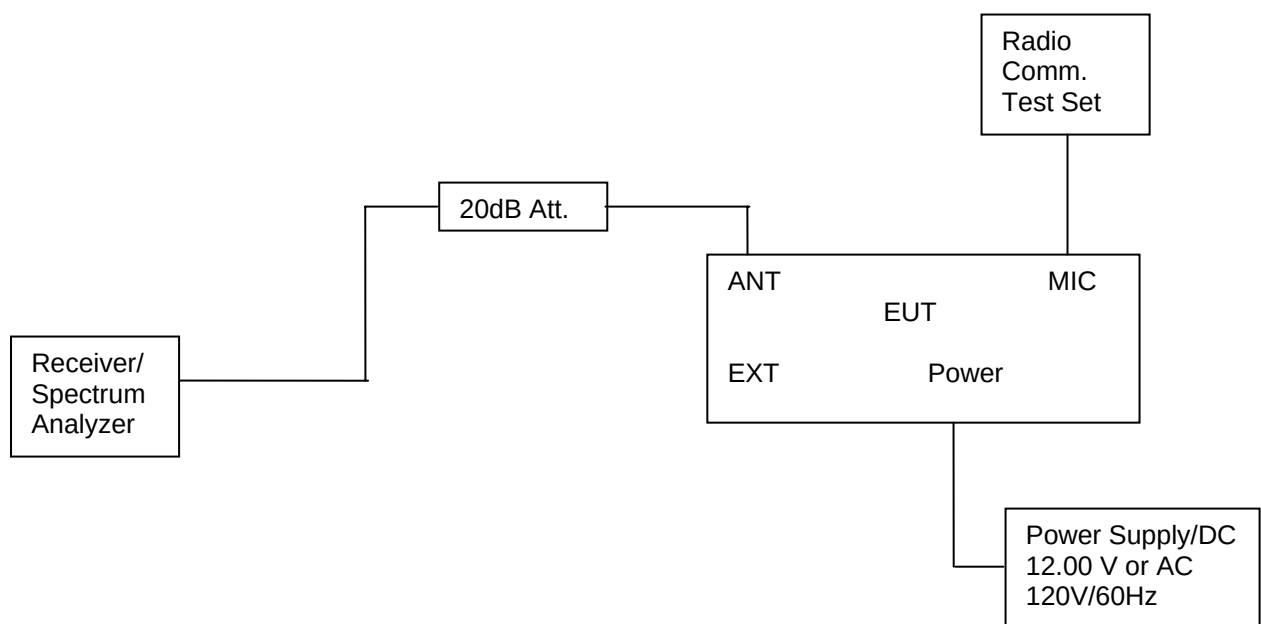
The same as Section 4.3

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

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: $50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (28.12) = 64.49 \text{ dB}$

High: $50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (29.85) = 64.75 \text{ dB}$

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 43.98 dBm.

Limit (dBm) = 43.98 - 50 - 10log10 (29.85) = -20 dBm

Modulation Type: 4FSK

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: $50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (28.58) = 54.56 \text{ dB}$

High: $50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (29.85) = 64.75 \text{ dB}$

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,

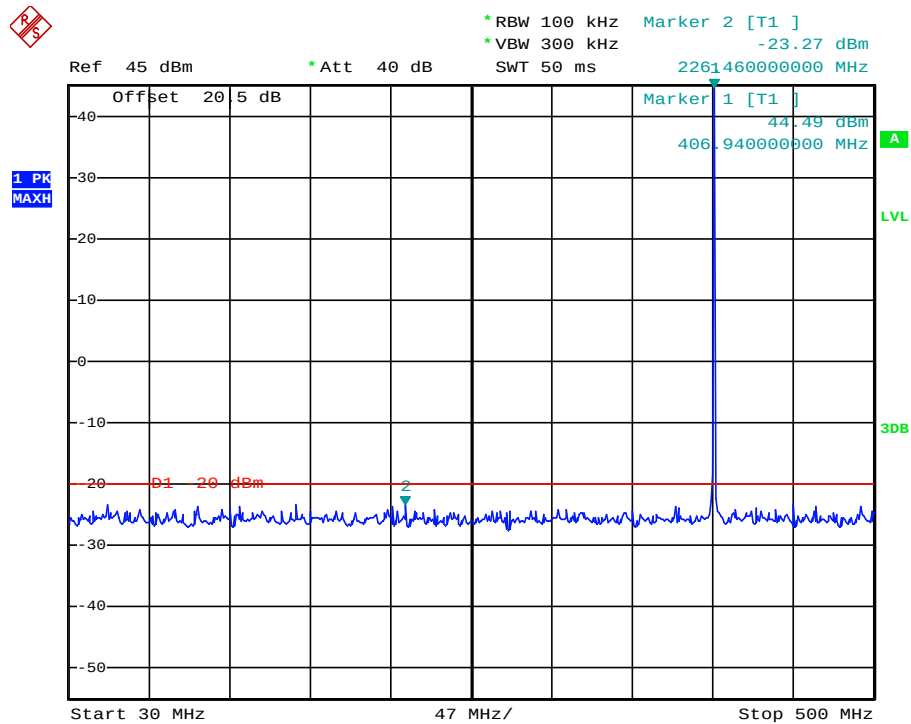
In this application, the EL is 43.98 dBm.
Limit (dBm) = $43.98 - 50 - 10 \log_{10}(29.85) = -20$ dBm

Note: 1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 5GHz.

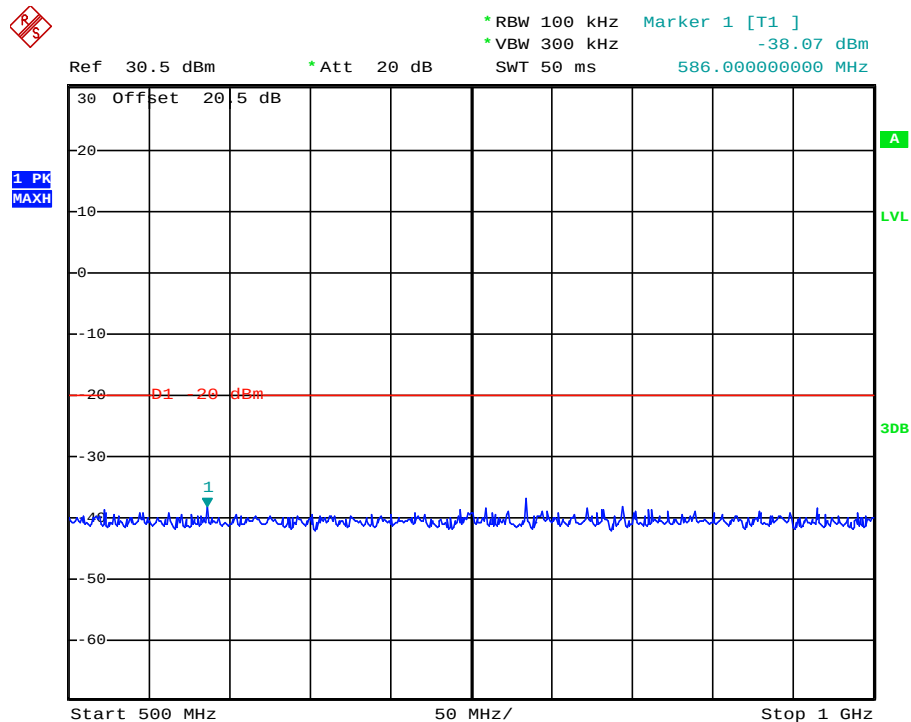
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz	
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)
Op 1	Ch1	406.5	226.46	-23.27	3304.00	-35.85
	Ch2	435.0	329.86	-23.71	3168.00	-25.89
	Ch3	469.5	276.28	-23.70	3176.00	-35.75
Op 2	Ch1	406.5	138.10	-24.26	3192.00	-35.33
	Ch2	435.0	98.62	-22.61	3272.00	-36.00
	Ch3	469.5	388.14	-23.58	1408.00	-35.01
Op 3	Ch1	406.5	813.76	-27.99	3232.00	-25.75
	Ch2	435.0	871.96	-27.03	3136.00	-26.36
	Ch3	469.5	939.86	-27.81	3088.00	-26.00
Op 4	Ch1	406.5	813.76	-24.09	3224.00	-25.62
	Ch2	435.0	871.96	-26.25	3112.00	-25.64
	Ch3	469.5	939.86	-25.81	3048.00	-25.73
Op 5	Ch4	406.5	329.86	-23.71	3176.00	-36.00
	Ch5	435.0	150.32	-22.17	3160.00	-35.92
	Ch6	469.5	496.24	-23.65	1408.00	-35.70
Op 6	Ch4	406.5	338.32	-23.75	3224.00	-36.05
	Ch5	435.0	334.56	-23.27	3224.00	-36.35
	Ch6	469.5	425.74	-23.41	1408.00	-35.48
Op 7	Ch4	406.5	656.62	-22.74	1216.00	-34.54
	Ch5	435.0	819.58	-22.81	1304.00	-37.02
	Ch6	469.5	870.02	-22.93	3144.00	-35.90
Op 8	Ch4	406.5	813.76	-26.20	3288.00	-25.90
	Ch5	435.0	871.96	-26.78	3120.00	-25.59
	Ch6	469.5	939.86	-26.10	3144.00	-24.68
Limit			-20dBm for 12.5KHz Channel Separation			
Test Results			PASS			

Plots of Spurious Emission on Antenna Port Measurement

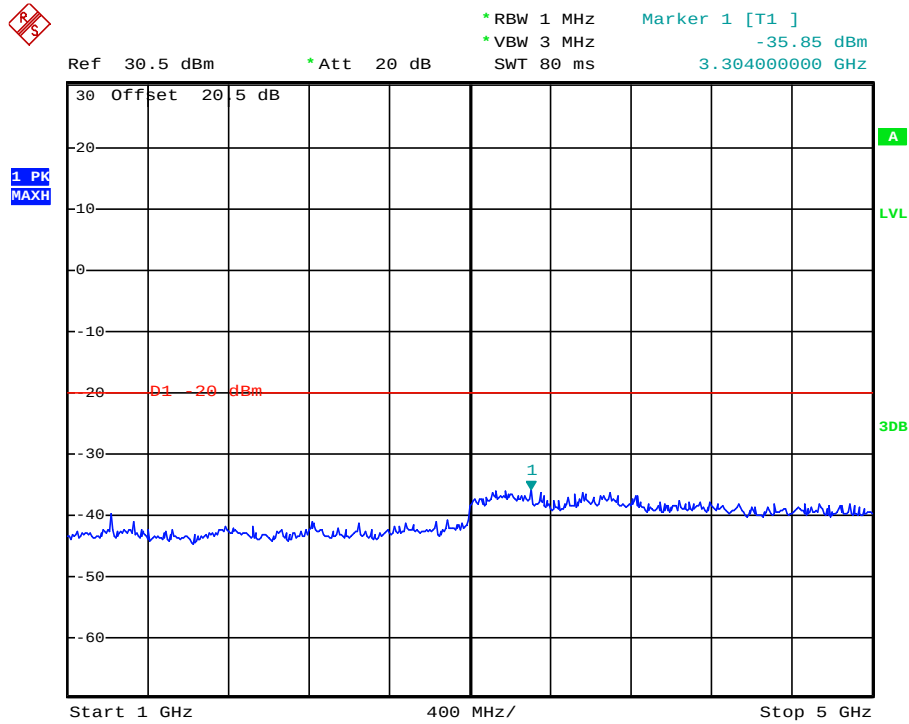
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 1	Ch1	406.5	226.46	-23.27	3304.00	-35.85	-20.00



Date: 23.OCT.2013 12:44:38

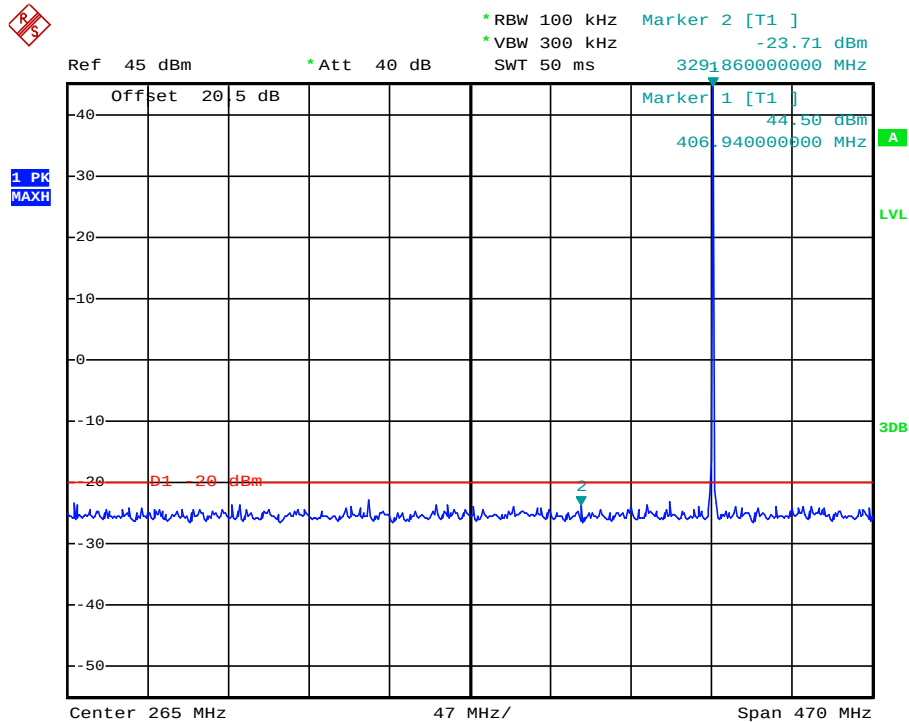


Date: 23.OCT.2013 12:48:22

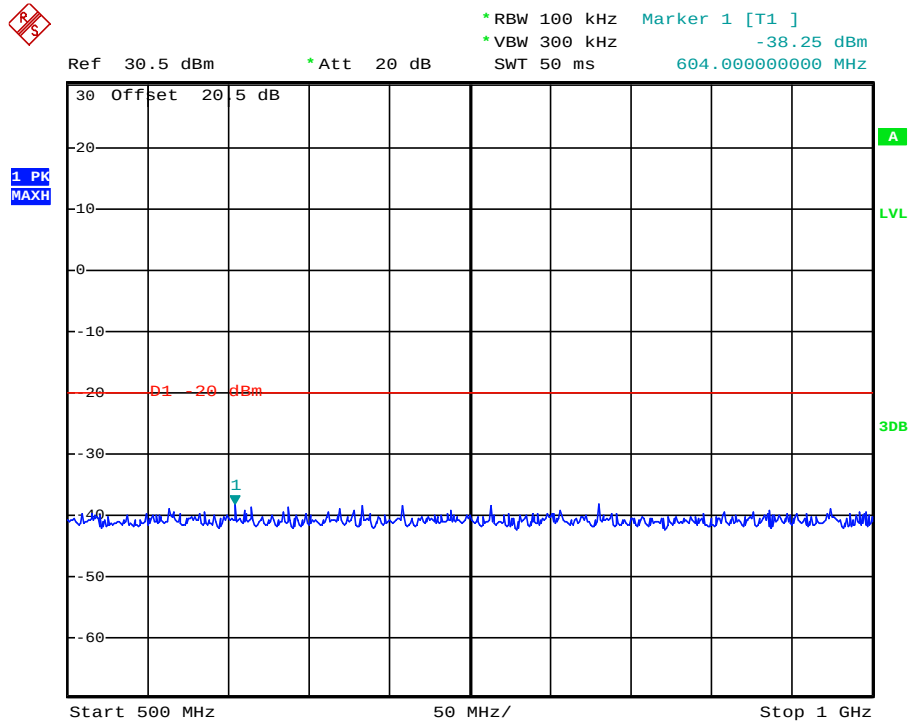


Date: 23.OCT.2013 12:47:57

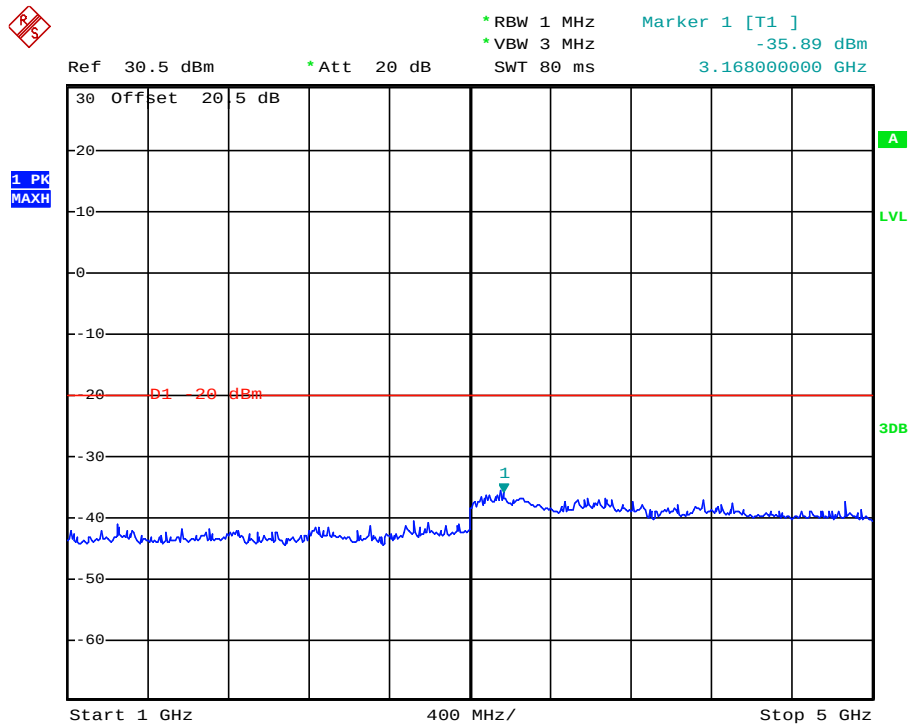
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 1	Ch2	435.0	329.86	-23.71	3168.00	-25.89	-20.00



Date: 23.OCT.2013 12:18:48

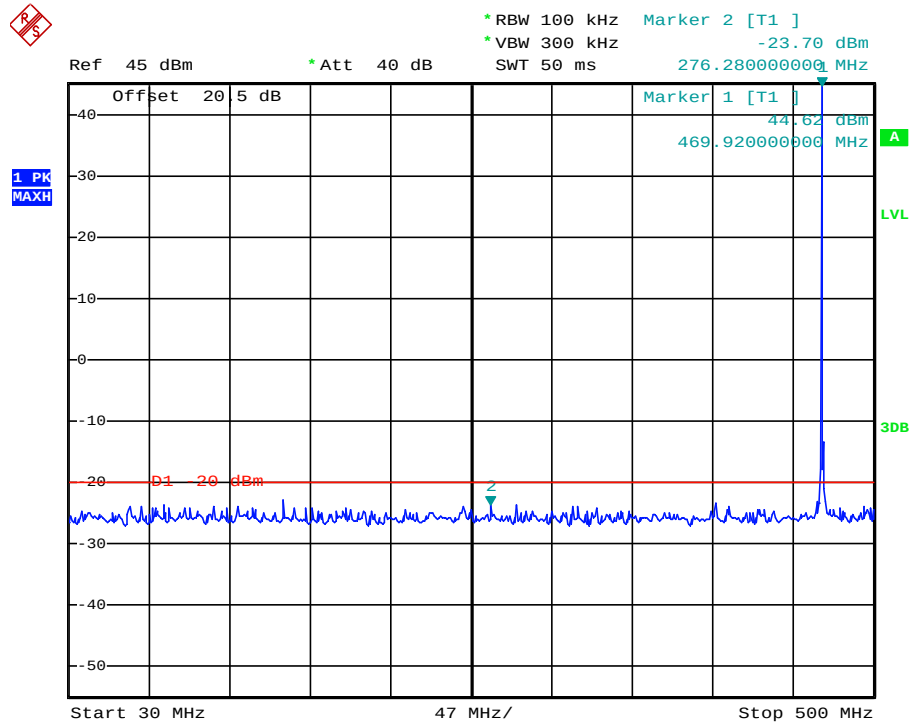


Date: 22.OCT.2013 16:27:28

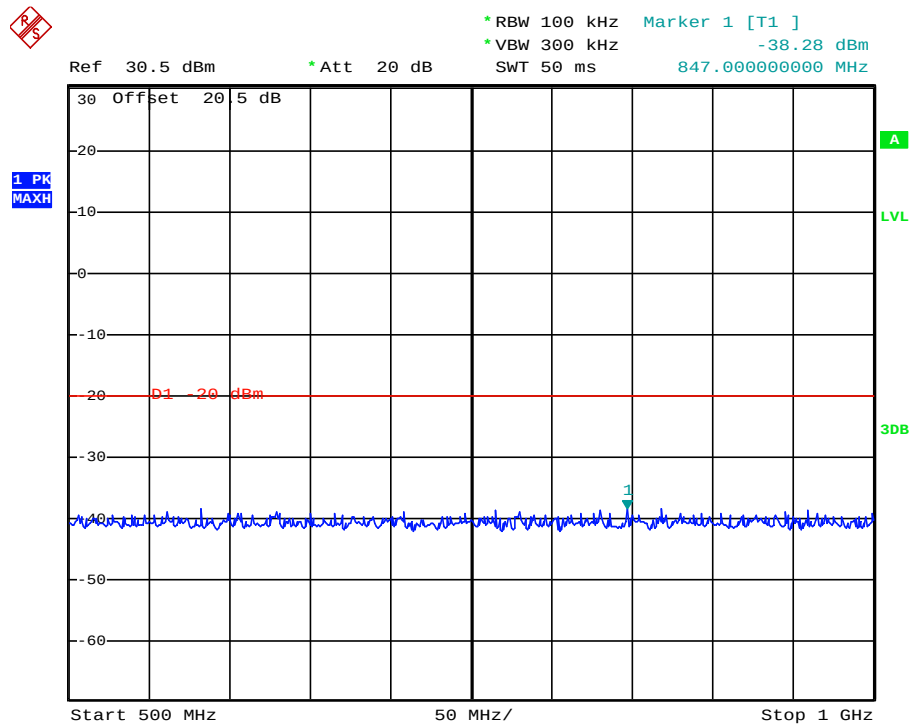


Date: 22.OCT.2013 16:27:01

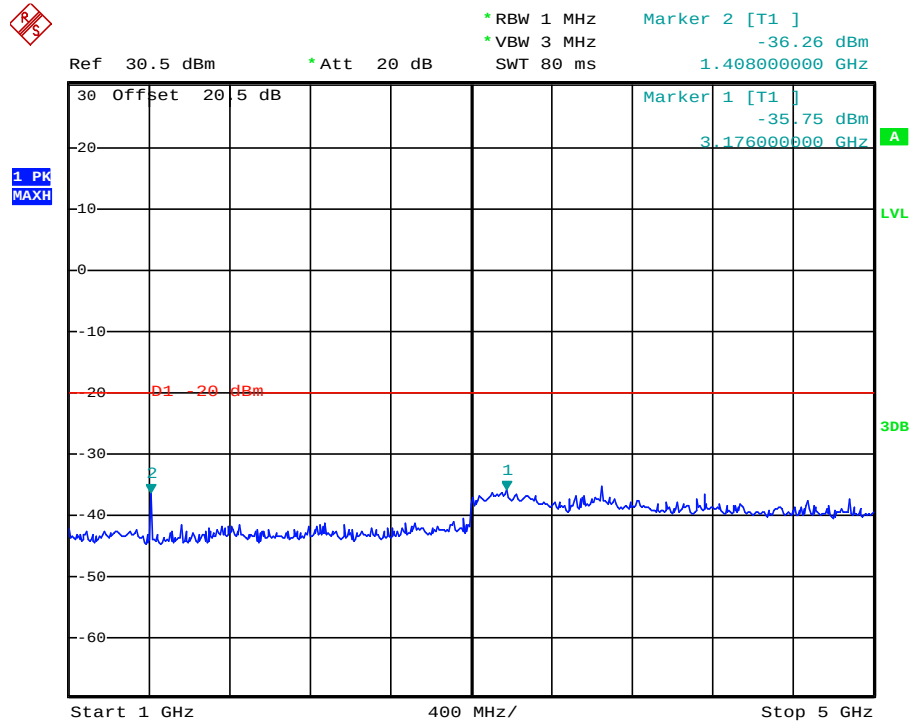
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 1	Ch3	469.5	276.28	-23.70	3176.00	-35.75	-20.00



Date: 22.OCT.2013 16:33:43

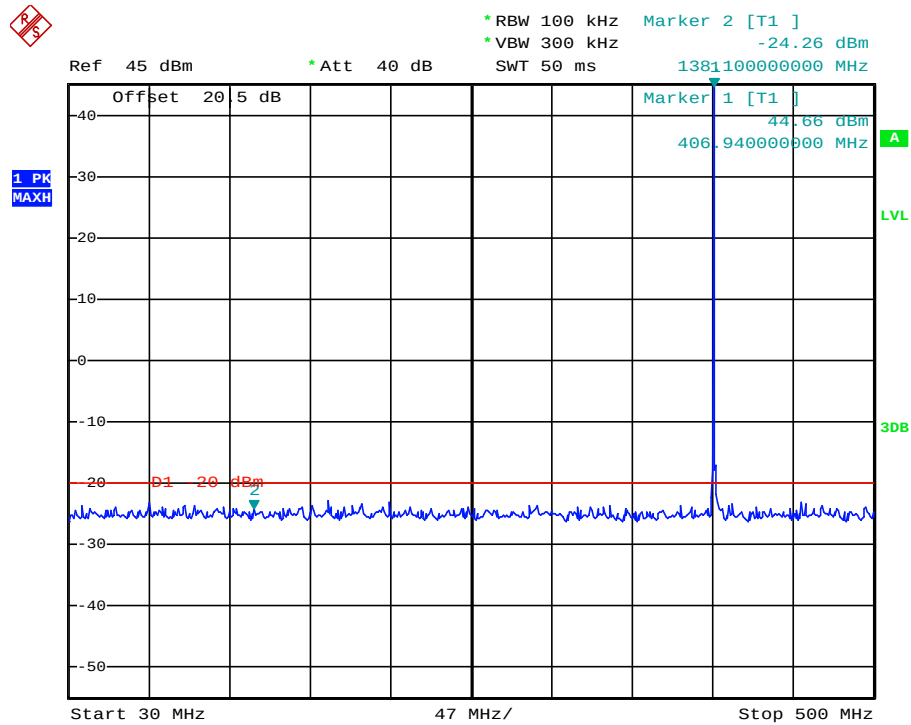


Date: 22.OCT.2013 16:34:20

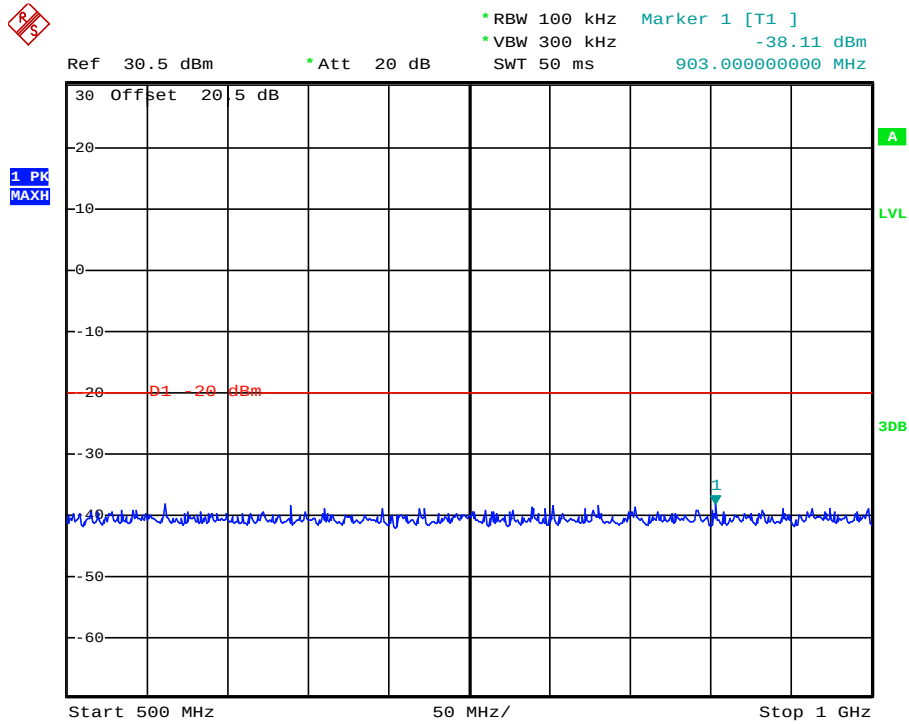


Date: 22.OCT.2013 16:34:59

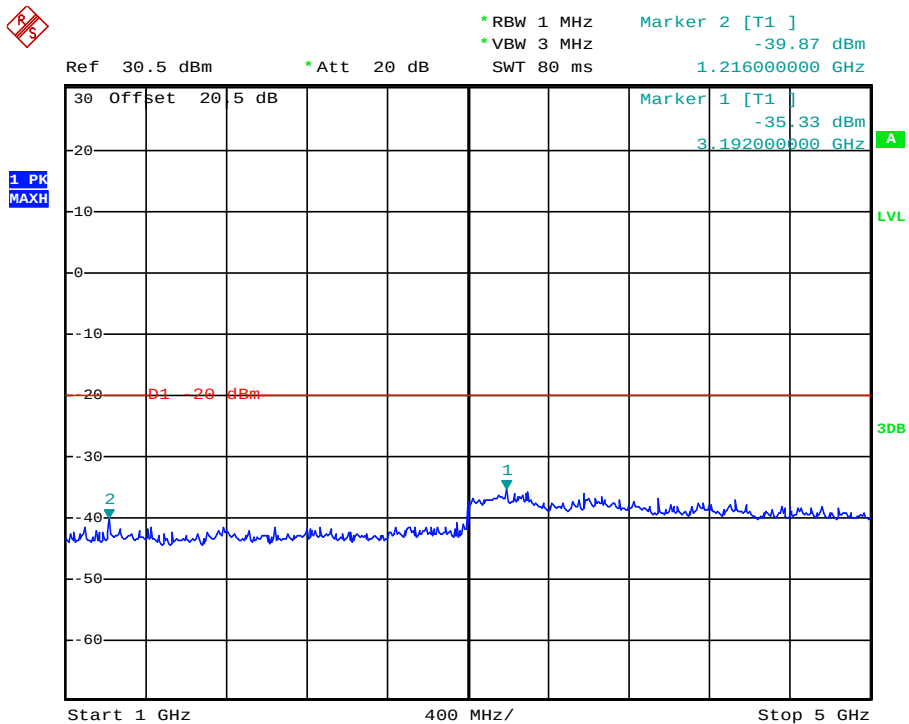
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 2	Ch1	406.5	138.10	-24.26	3192.00	-35.33	-20.00



Date: 23.OCT.2013 15:42:39

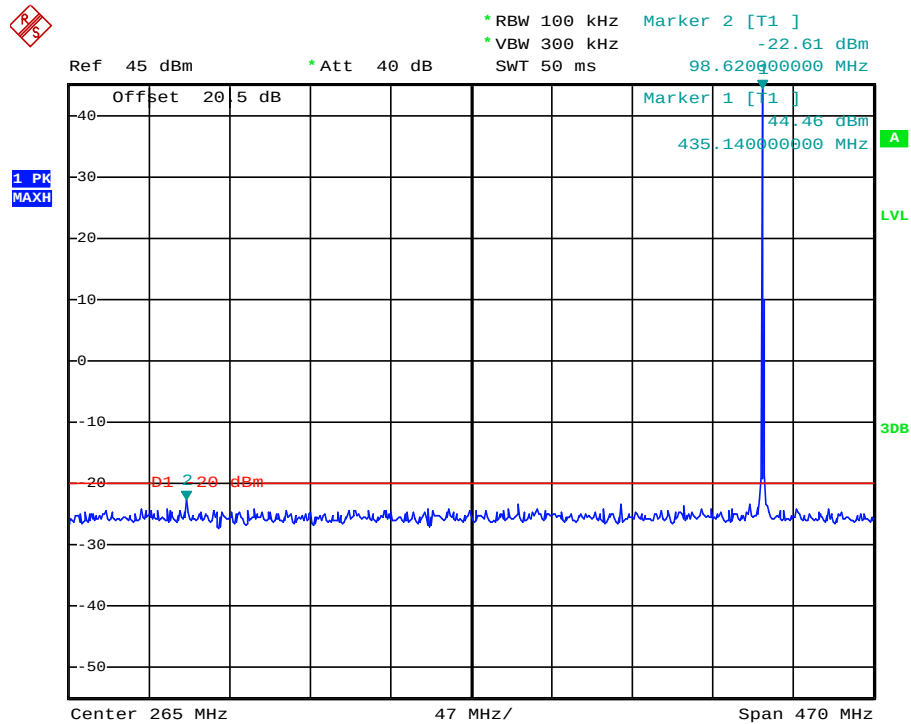


Date: 23.OCT.2013 15:43:35

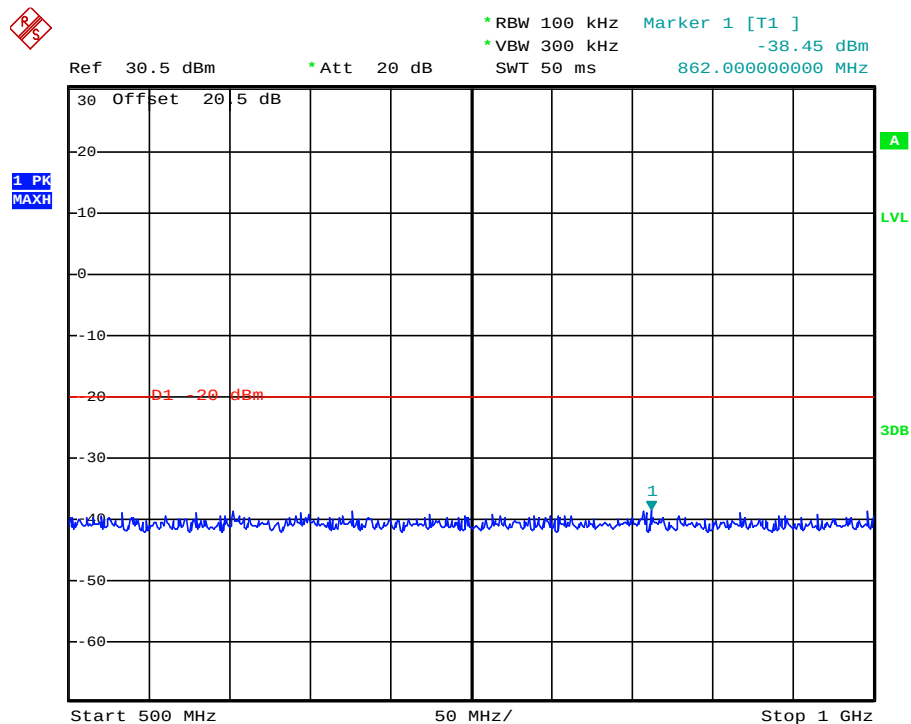


Date: 23.OCT.2013 15:44:01

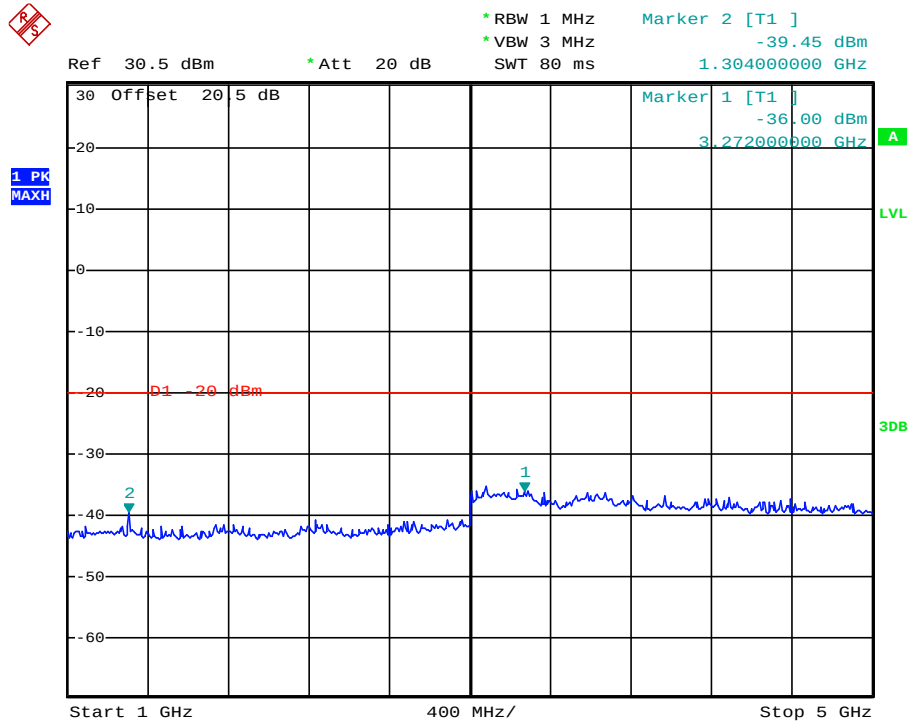
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 2	Ch2	435.0	98.62	-22.61	3272.00	-36.00	-20.00



Date: 23.OCT.2013 15:41:44

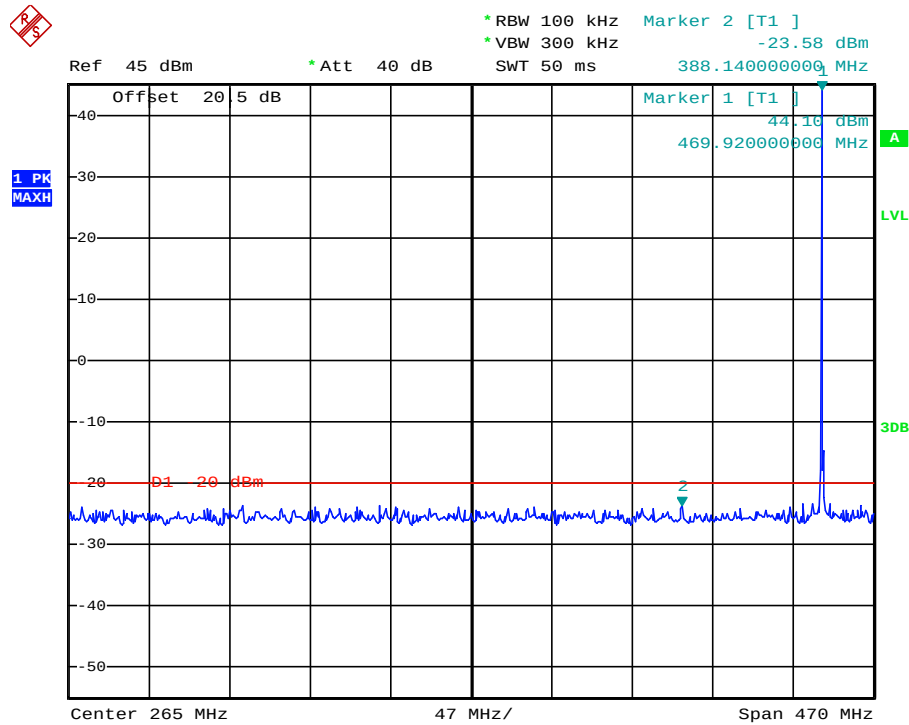


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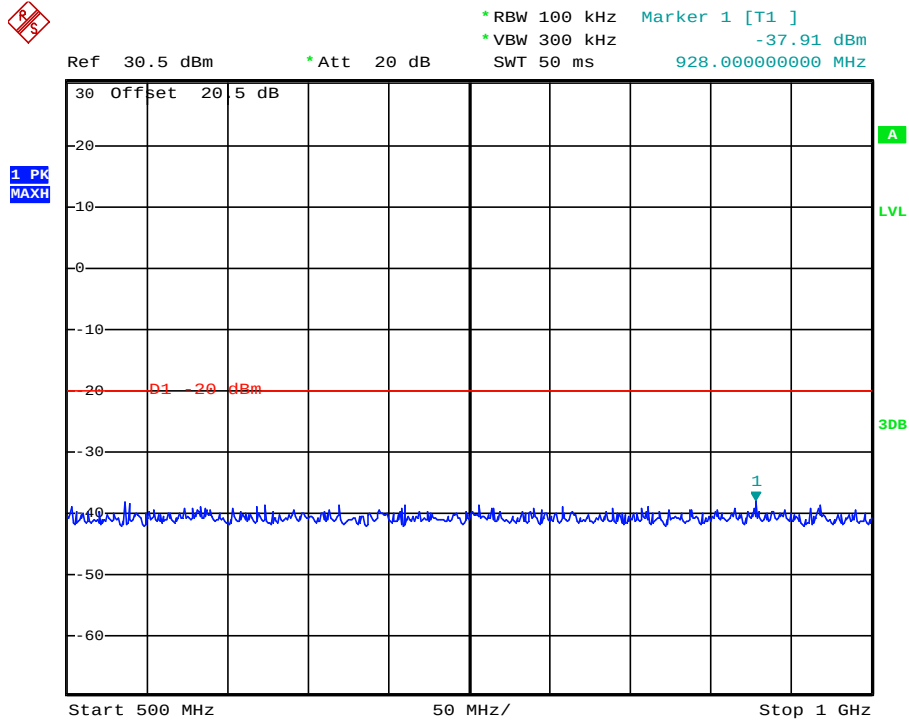


Date: 23.OCT.2013 15:44:33

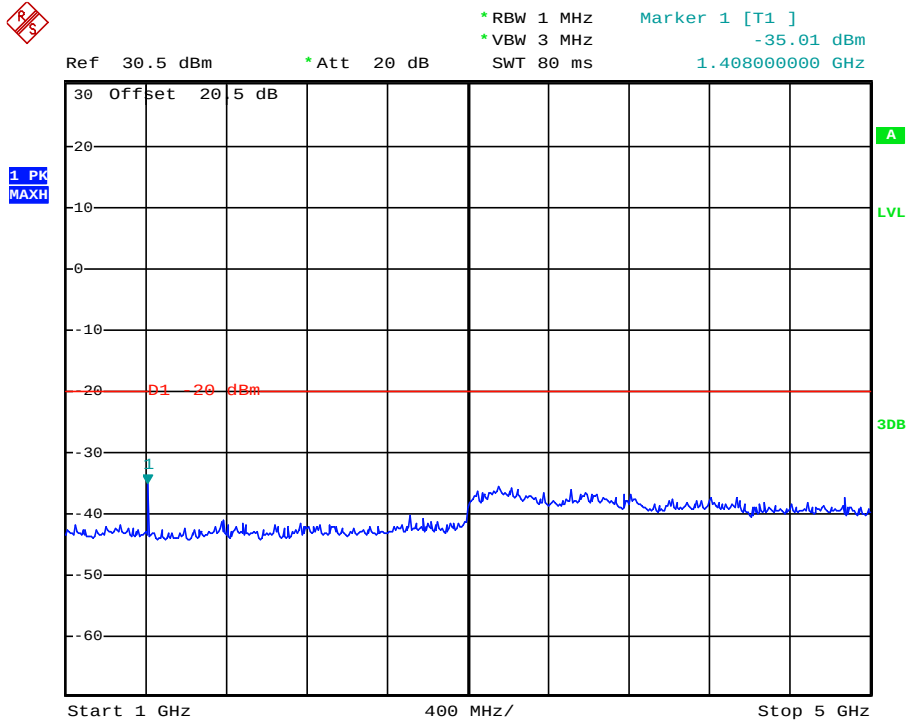
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 2	Ch3	469.5	388.14	-23.58	1408.00	-35.01	-20.00



Date: 23.OCT.2013 15:41:18

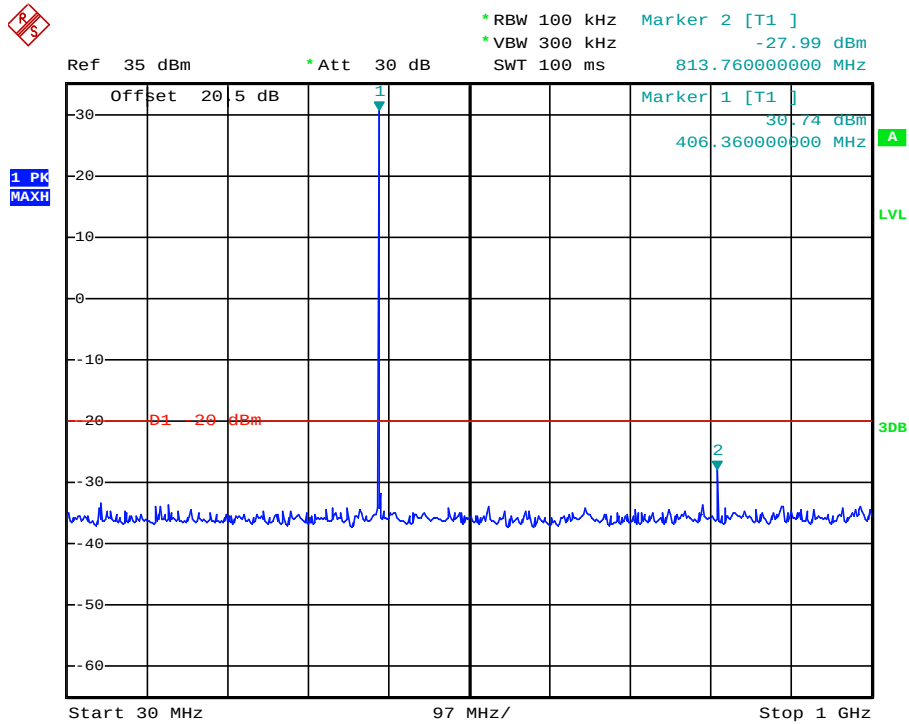


Date: 23.OCT.2013 15:45:13

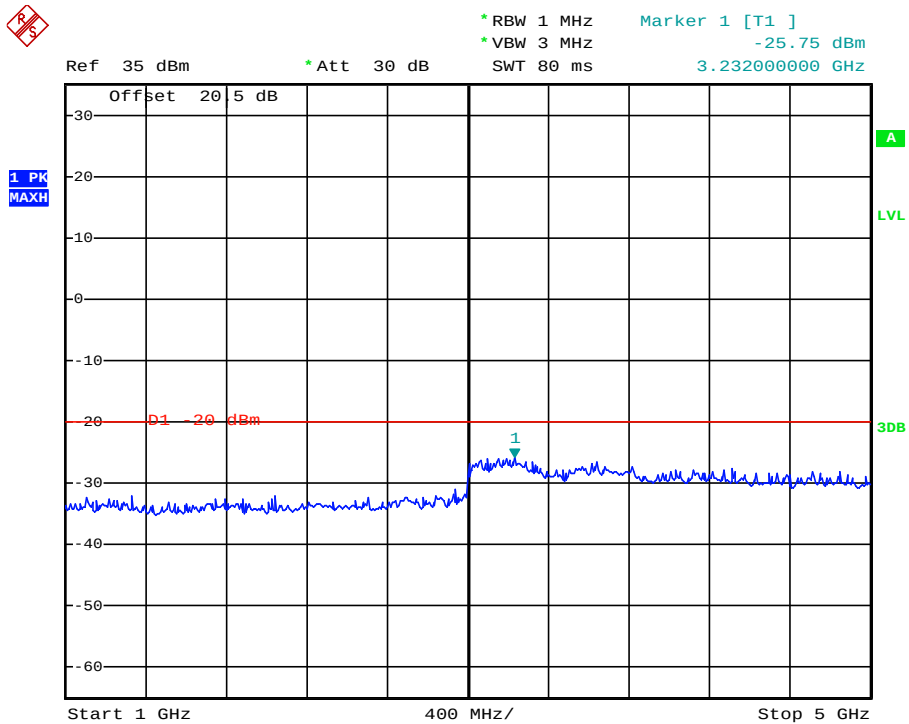


Date: 23.OCT.2013 15:45:35

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 3	Ch1	406.5	813.76	-27.99	3232.00	-25.75	-20.00

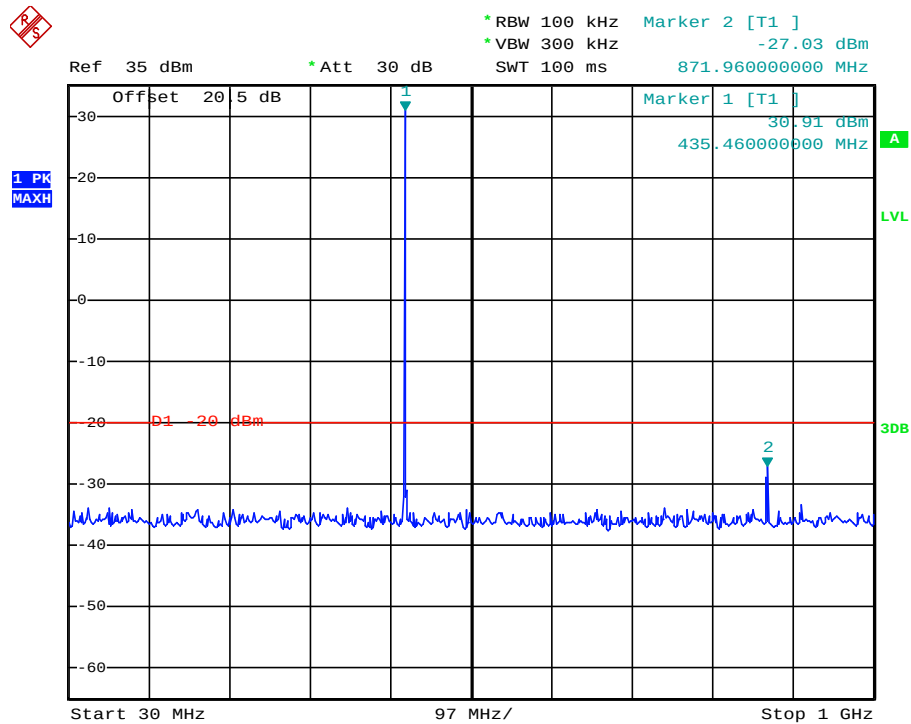


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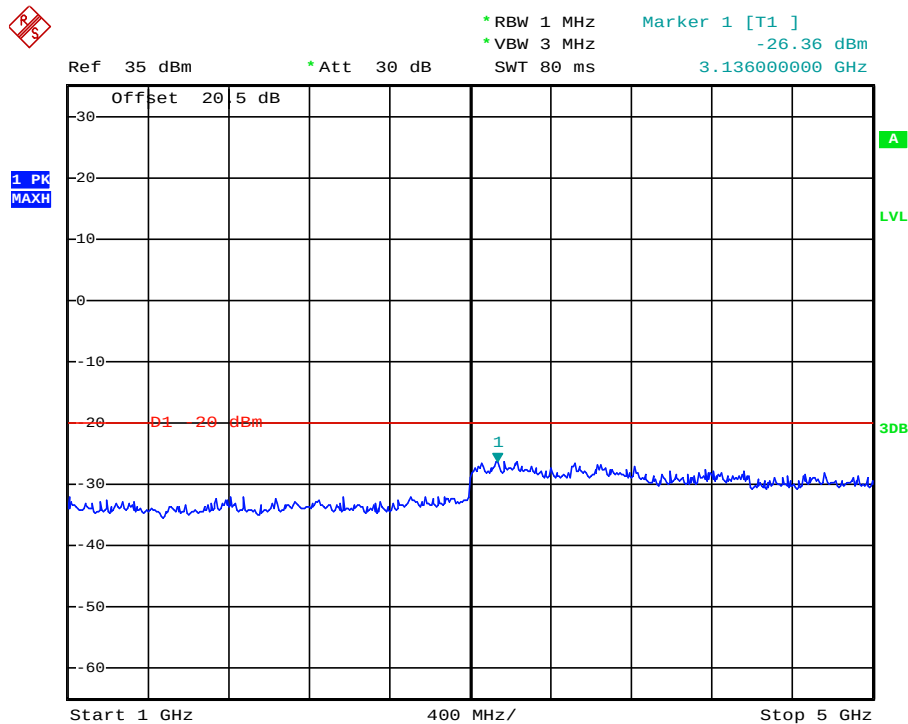


Date: 22.OCT.2013 12:54:12

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 3	Ch2	435.0	871.96	-27.03	3136.00	-26.36	-20.00

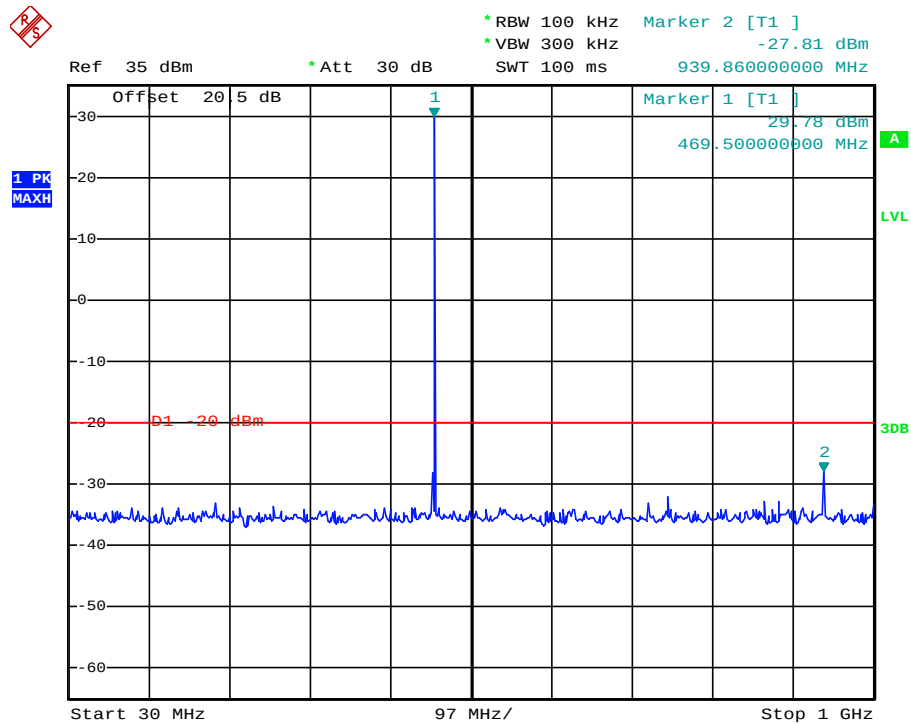


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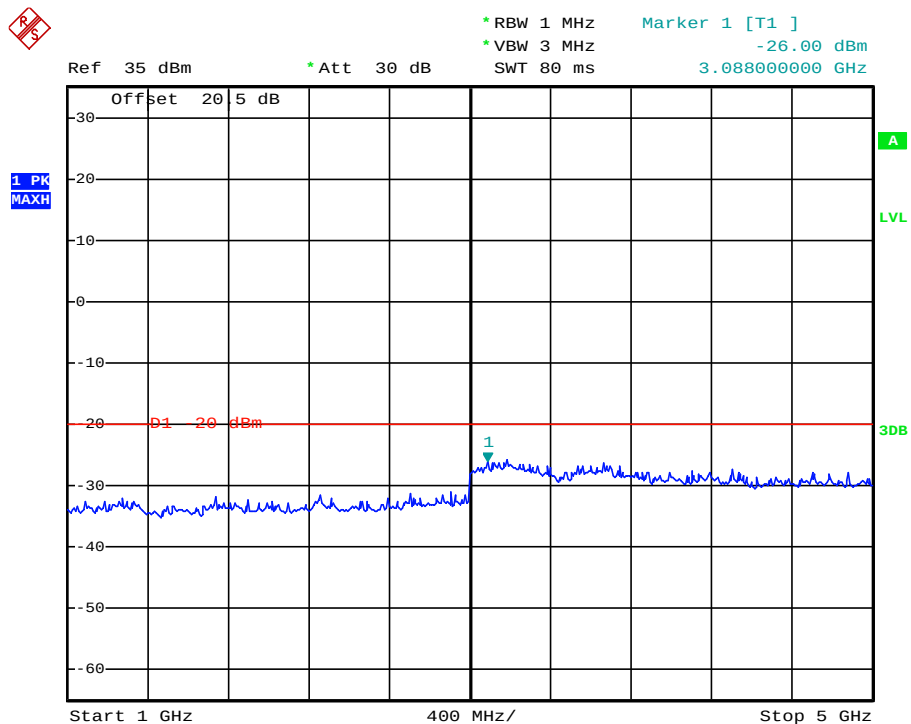


Date: 22.OCT.2013 12:52:41

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 3	Ch3	469.5	939.86	-27.81	3088.00	-26.00	-20.00

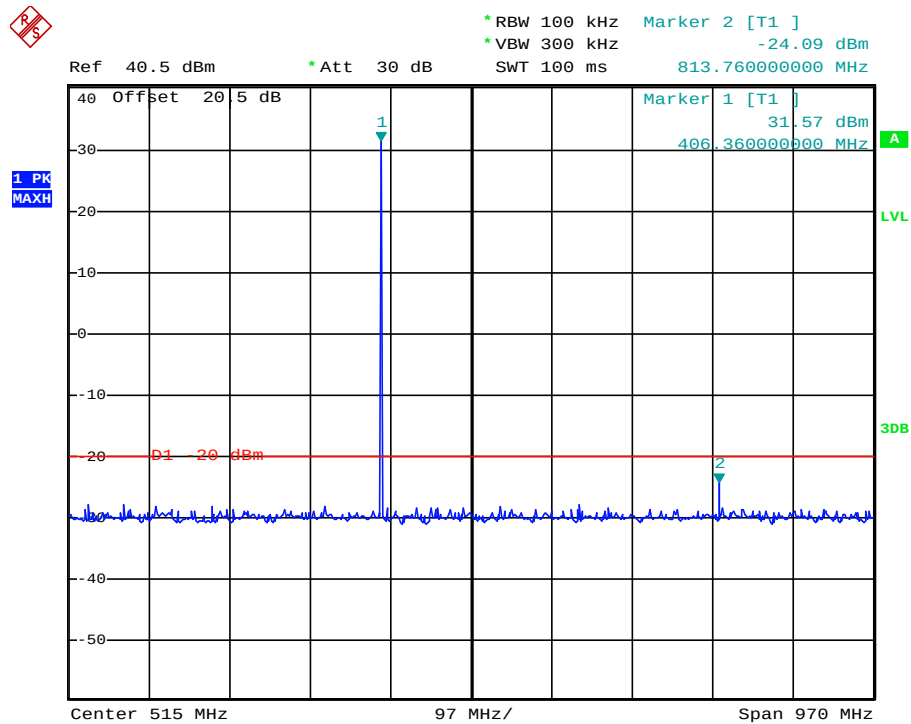


Date: 22.OCT.2013 12:50:47

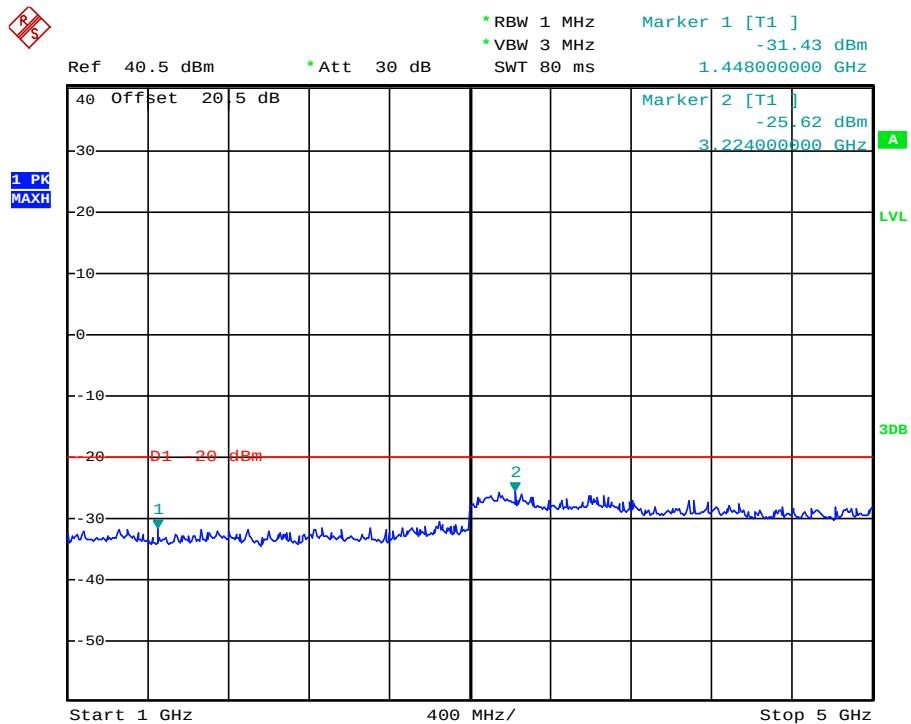


Date: 22.OCT.2013 12:51:36

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 4	Ch1	406.5	813.76	-24.09	3224.00	-25.62	-20.00

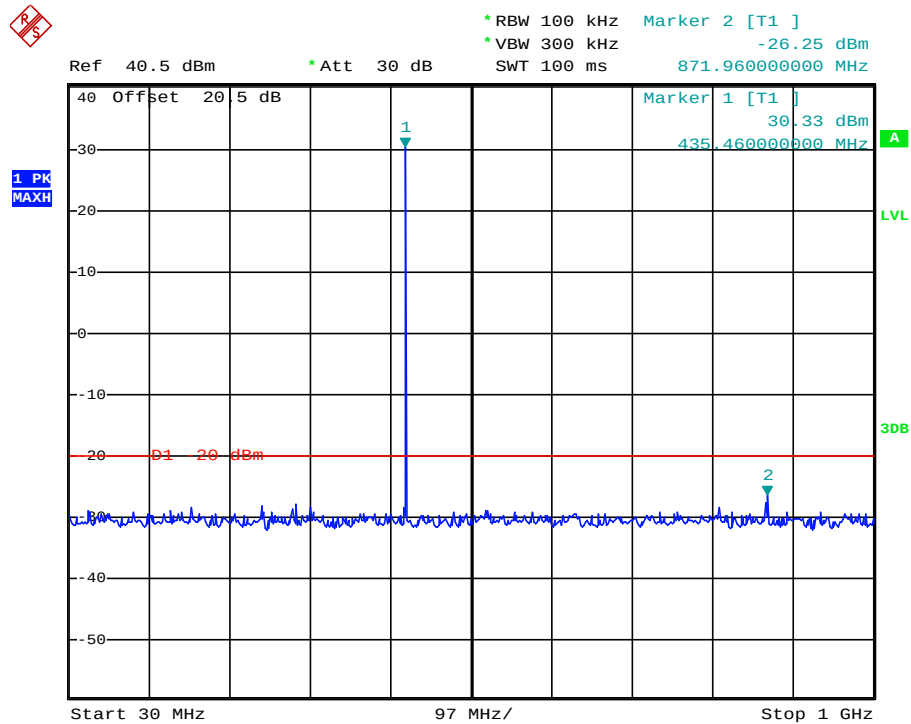


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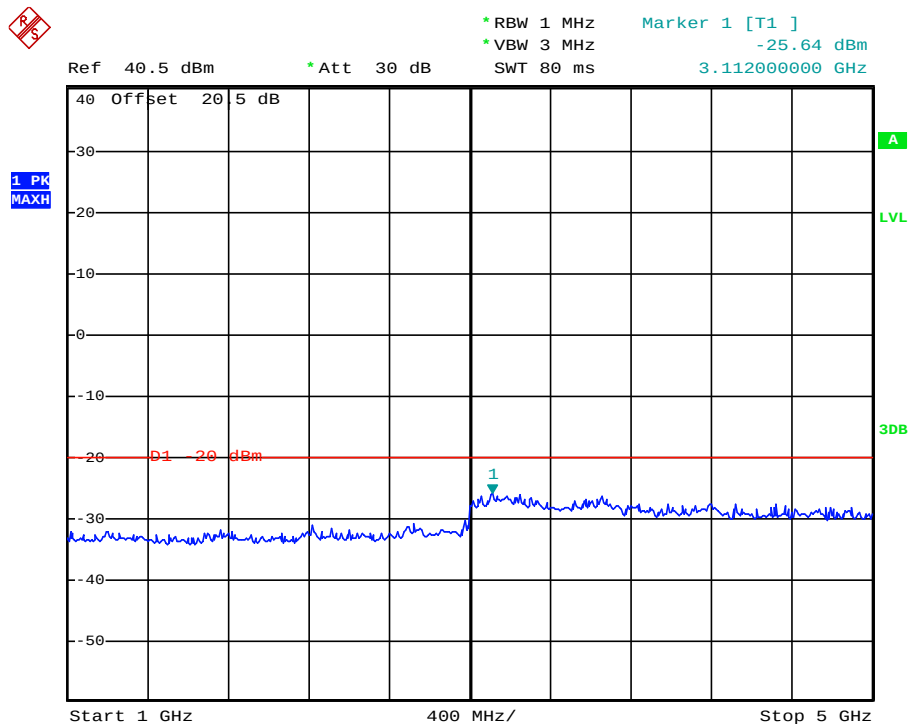


Date: 23.OCT.2013 15:37:29

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 4	Ch2	435.0	871.96	-26.25	3112.00	-25.64	-20.00

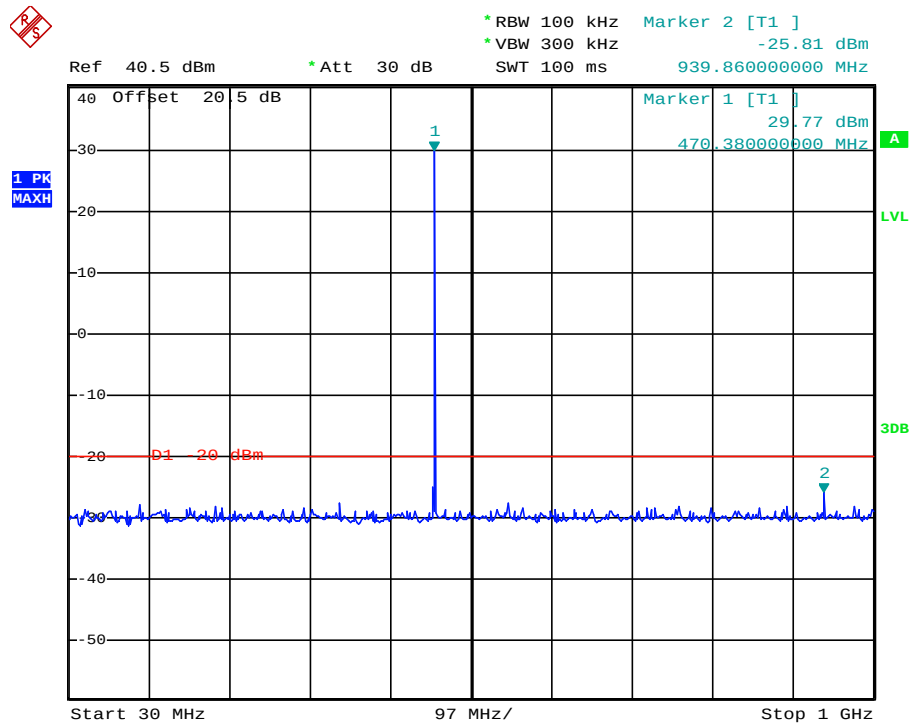


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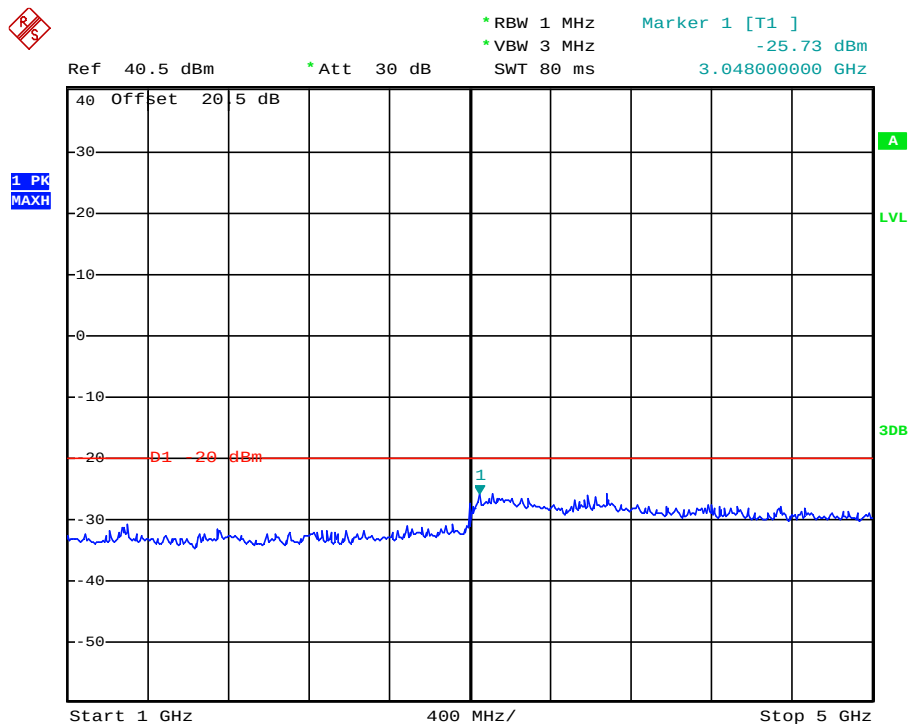


Date: 23.OCT.2013 15:37:55

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 4	Ch3	469.5	939.86	-25.81	3048.00	-25.73	-20.00

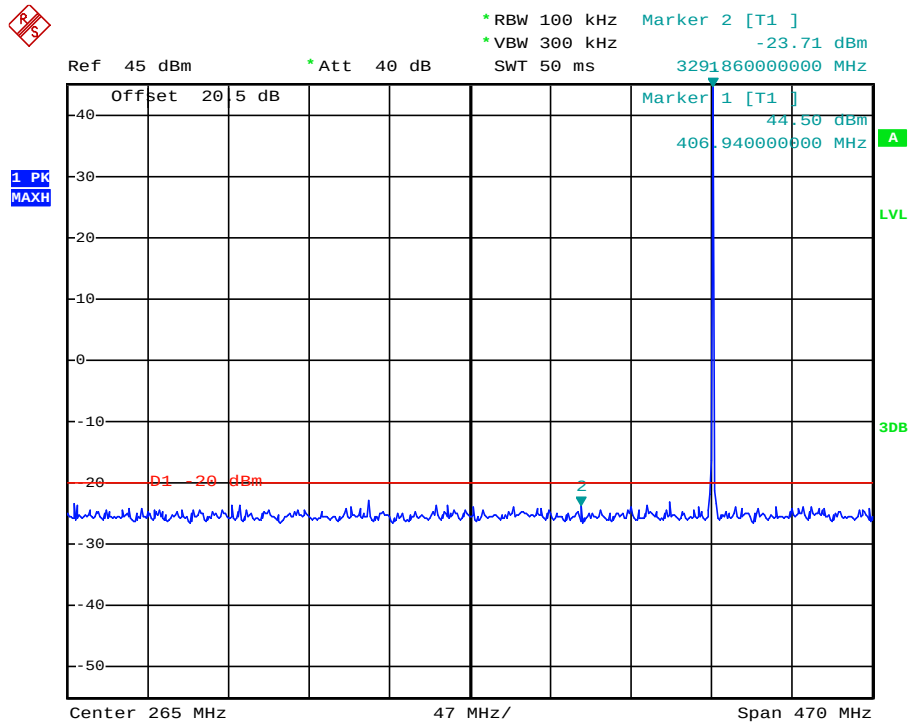


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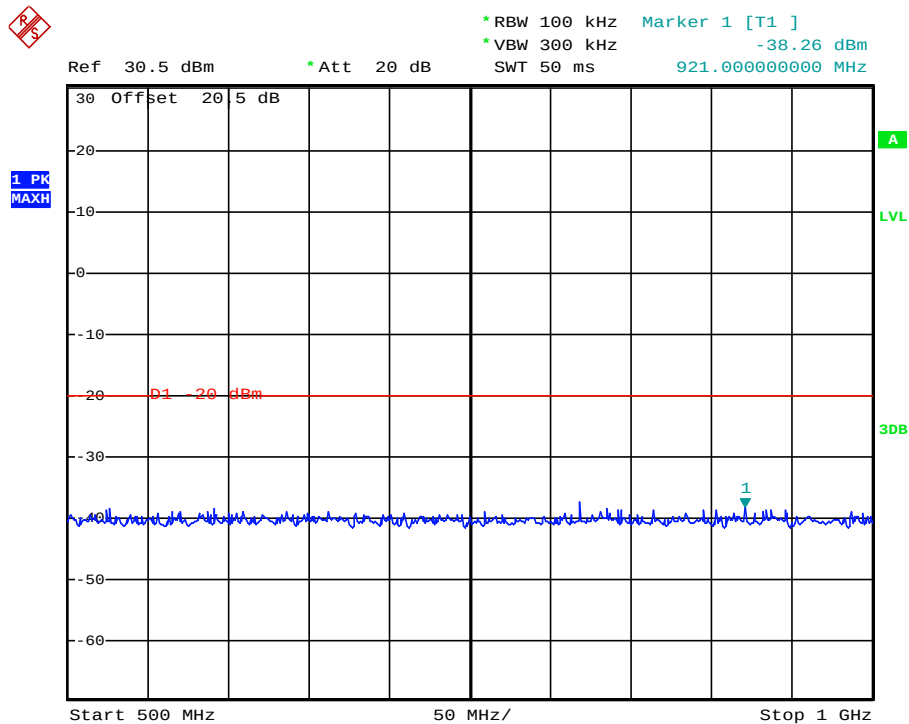


Date: 23.OCT.2013 15:39:42

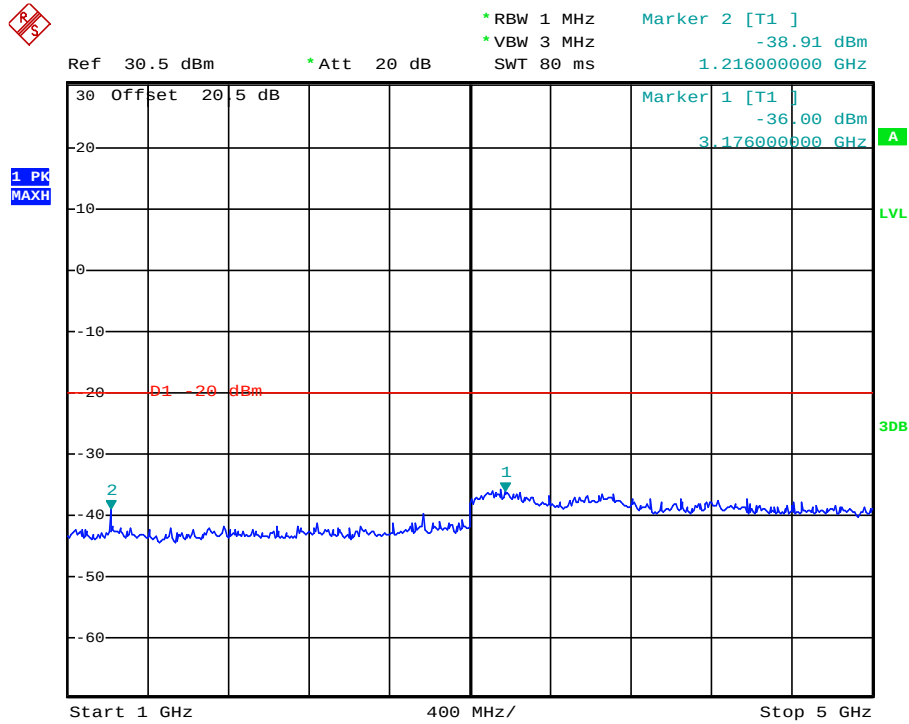
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 5	Ch4	406.5	329.86	-23.71	3176.00	-36.00	-20.00



Date: 23.OCT.2013 12:18:48

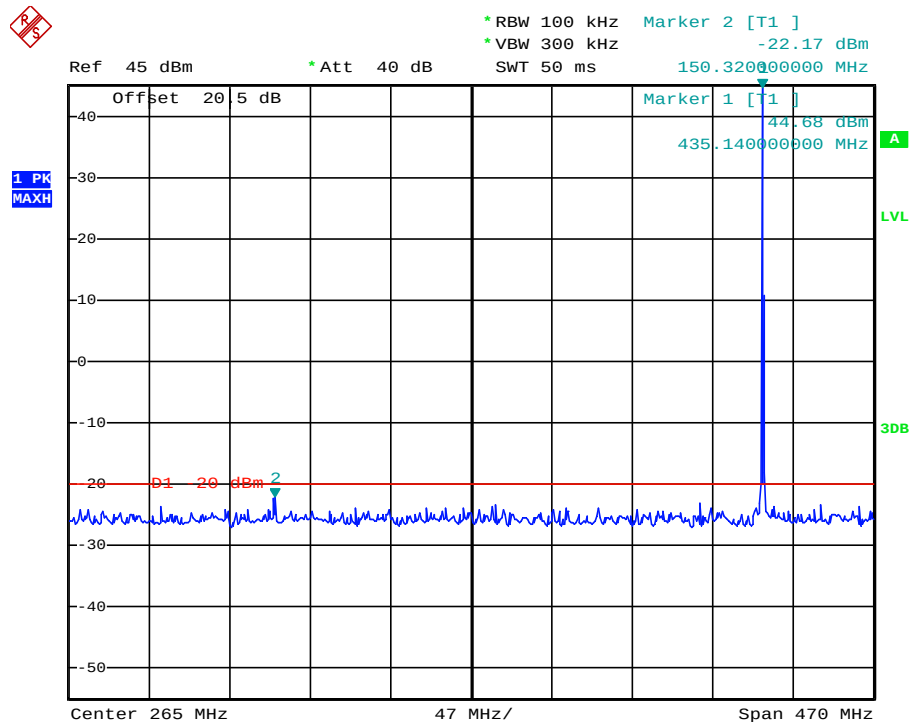


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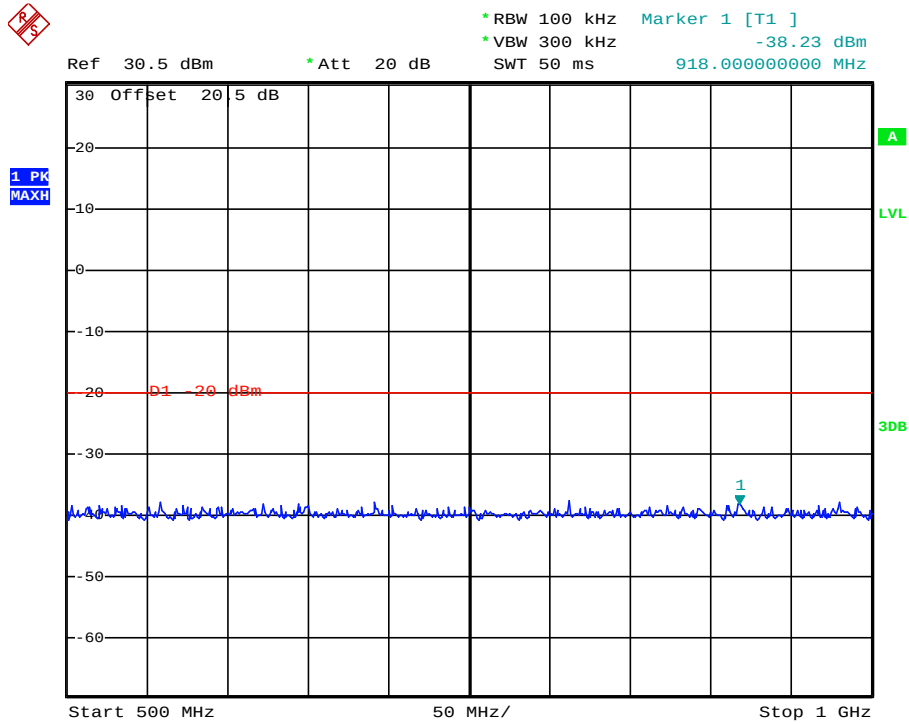


Date: 23.OCT.2013 12:16:48

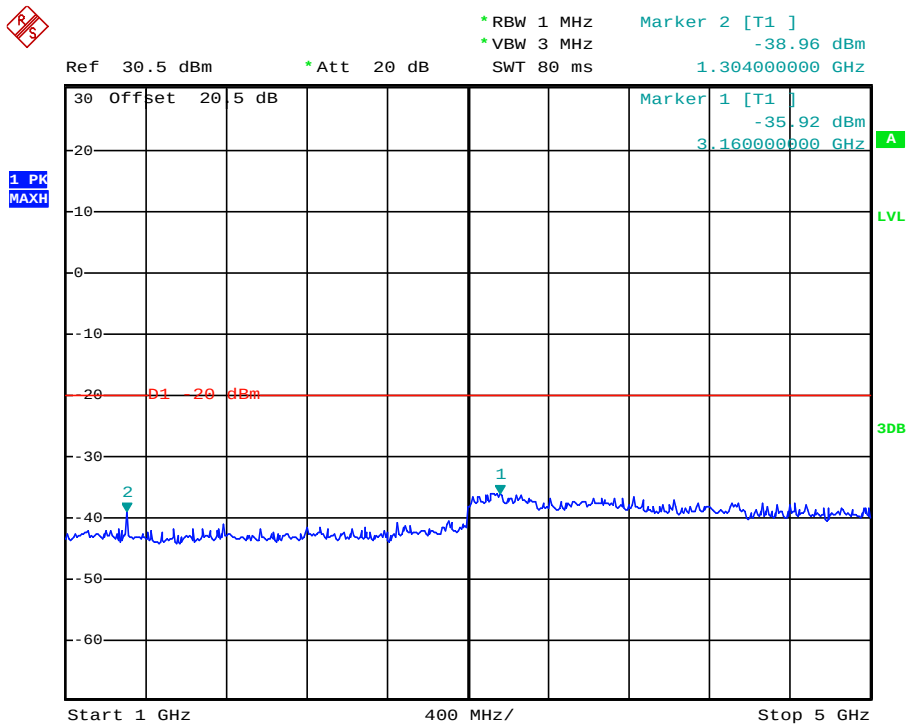
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 5	Ch5	435.0	150.32	-22.17	3160.00	-35.92	-20.00



Date: 23.OCT.2013 12:19:32

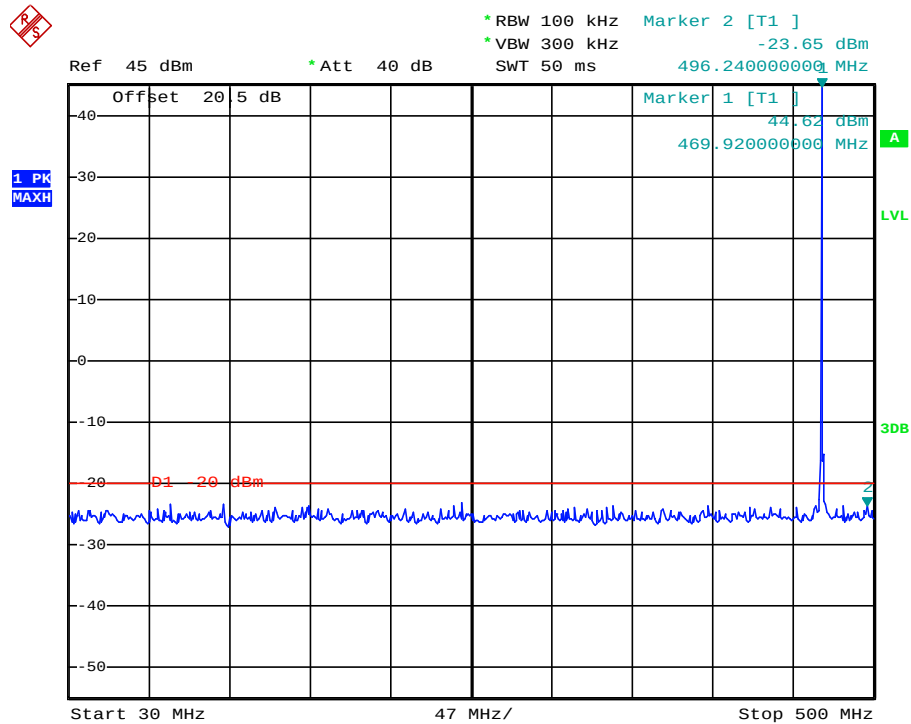


Date: 23.OCT.2013 12:20:43

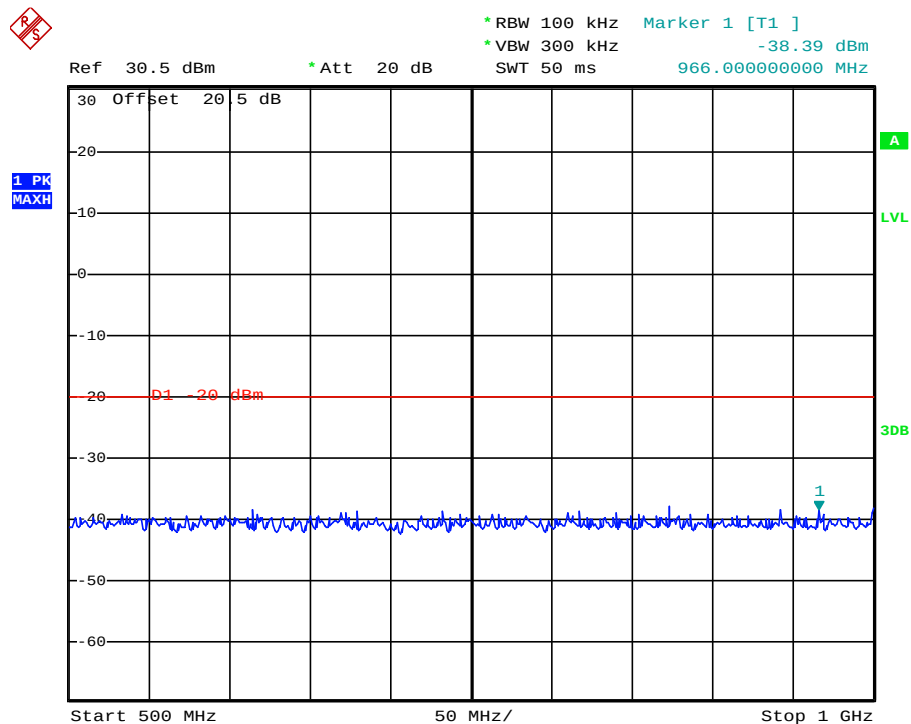


Date: 23.OCT.2013 12:13:50

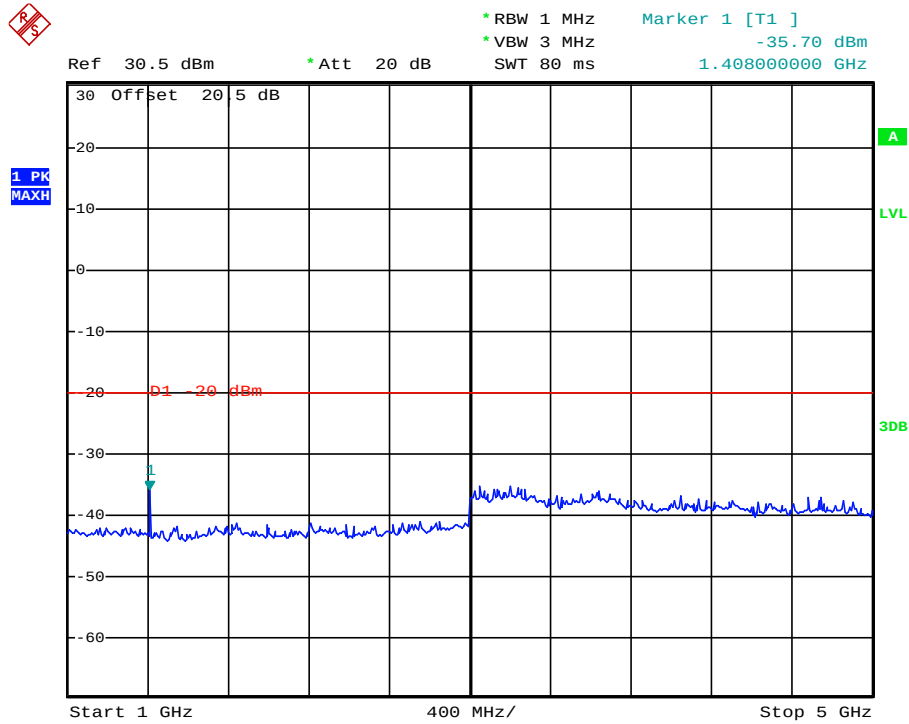
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 5	Ch6	469.5	496.24	-23.65	1408.00	-35.70	-20.00



Date: 23.OCT.2013 12:22:20

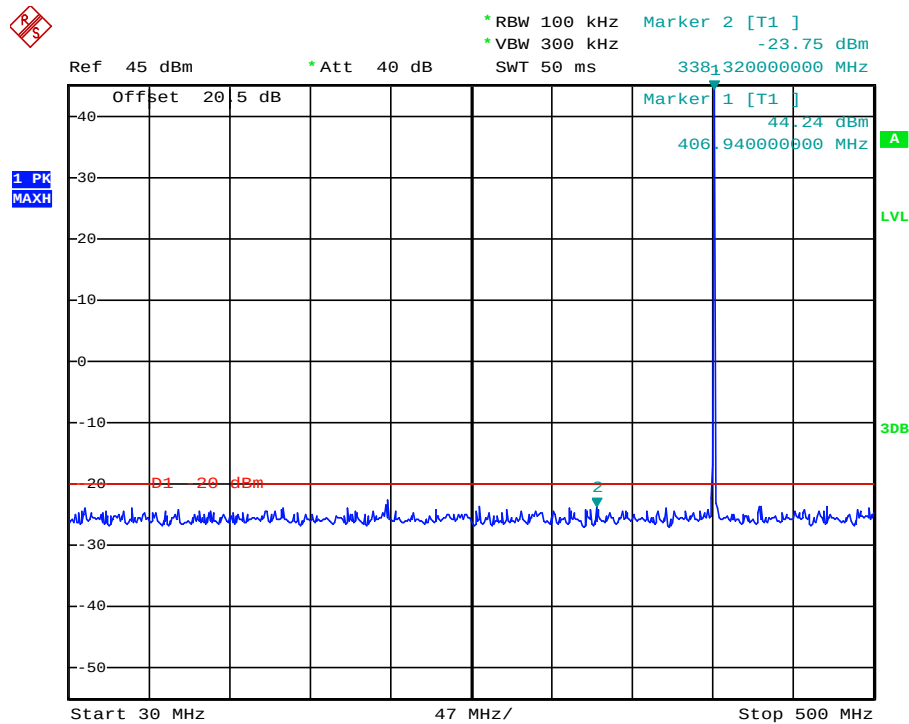


Date: 23.OCT.2013 12:21:00

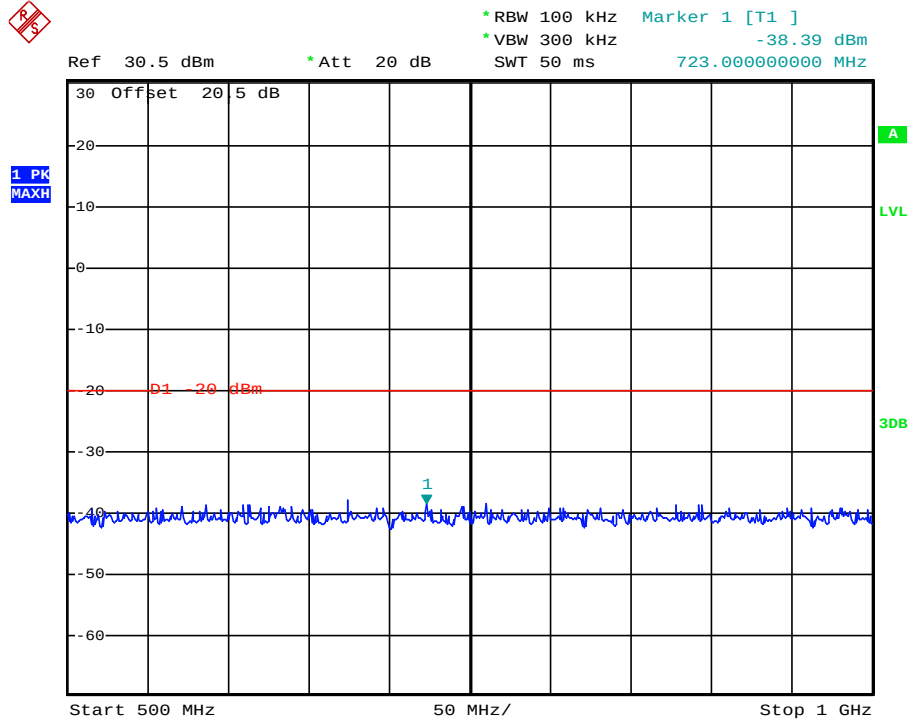


Date: 23.OCT.2013 12:12:58

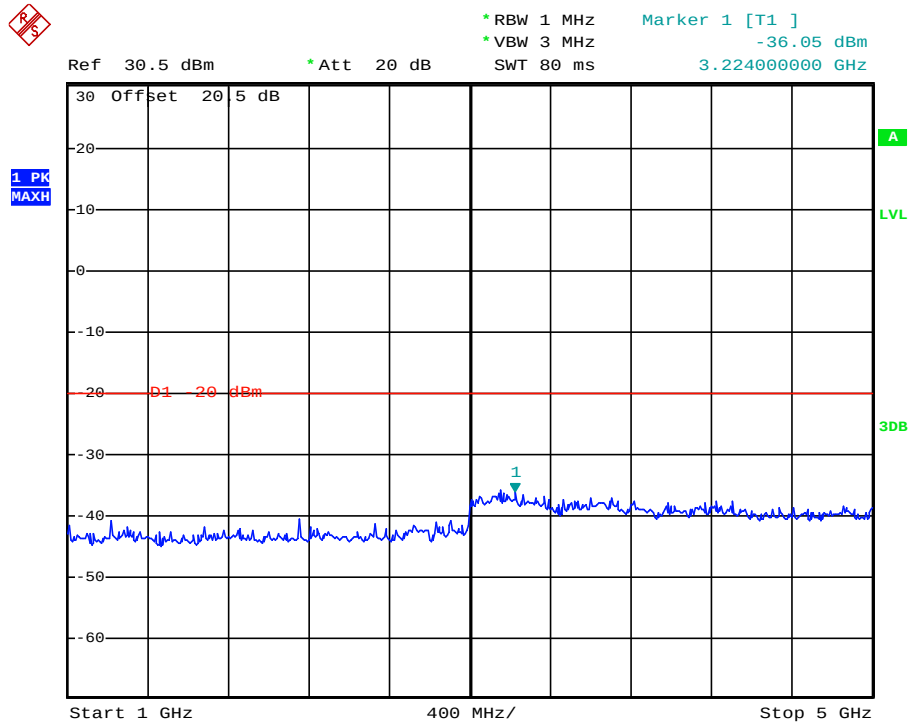
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 6	Ch4	406.5	338.32	-23.75	3224.00	-36.05	-20.00



Date: 23.OCT.2013 16:34:15

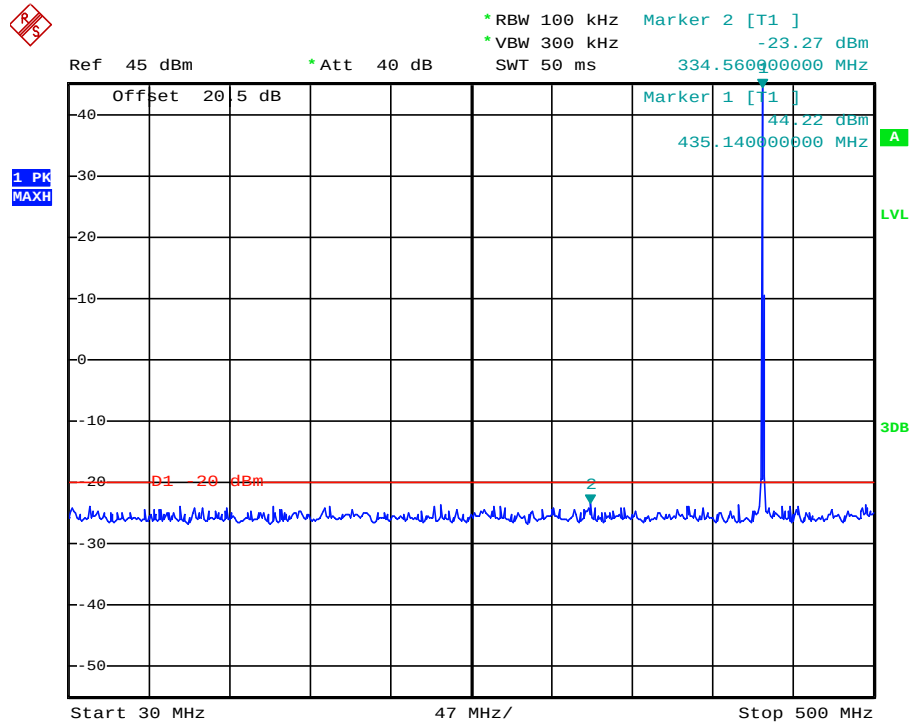


Date: 23.OCT.2013 16:35:22

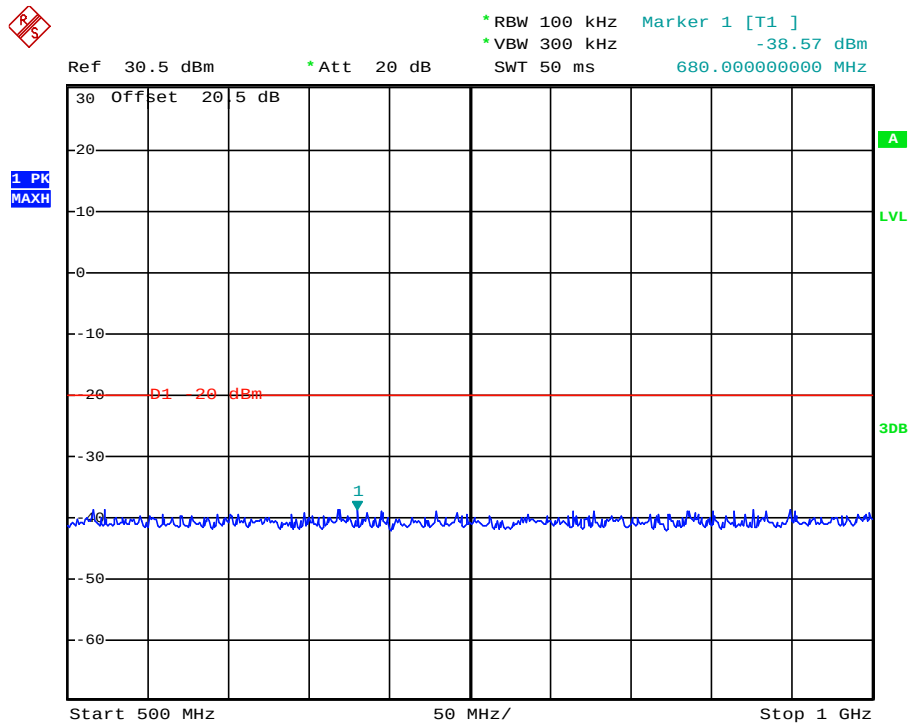


Date: 23.OCT.2013 16:35:36

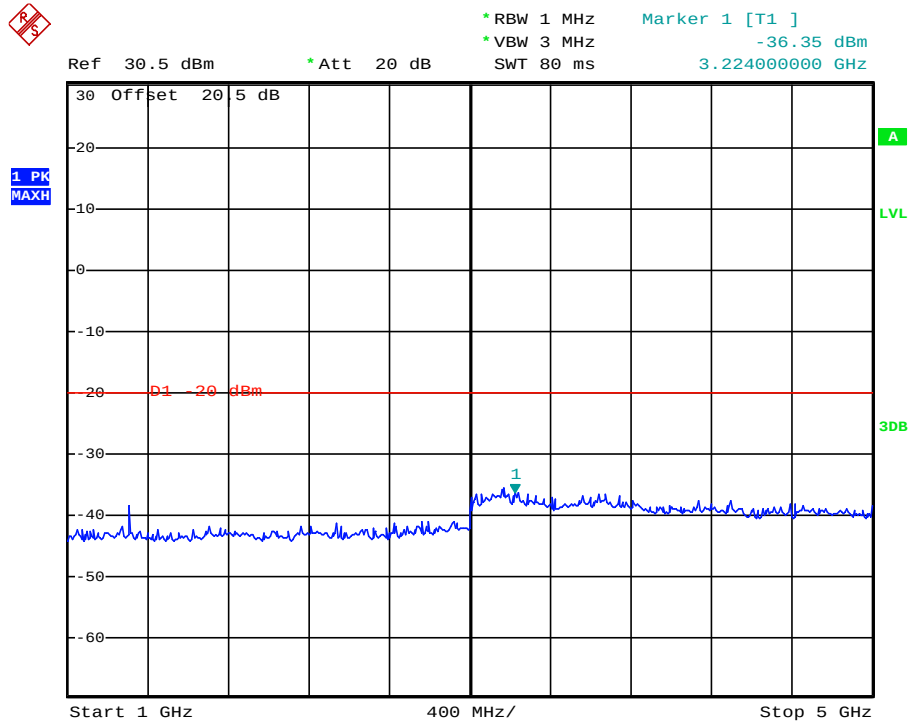
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 6	Ch5	435.0	334.56	-23.27	3224.00	-36.35	-20.00



Date: 23.OCT.2013 16:33:26

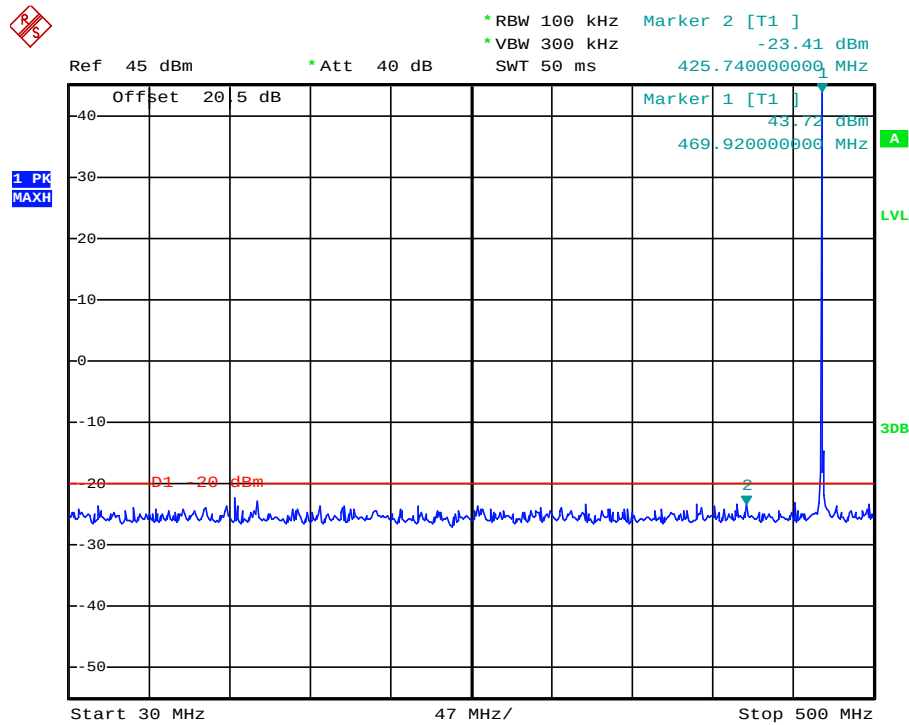


Date: 23.OCT.2013 16:36:29

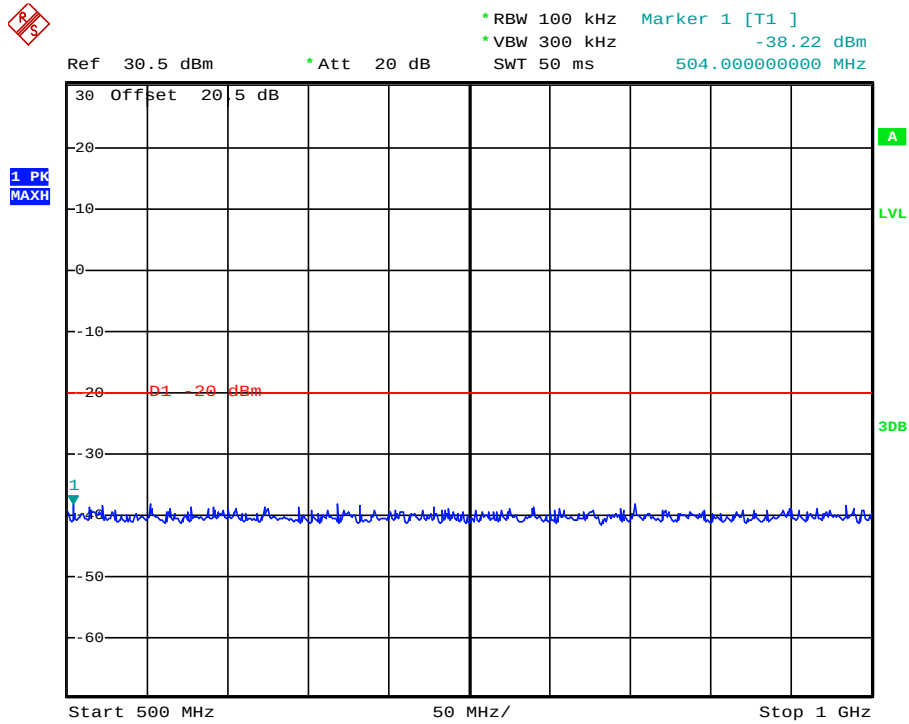


Date: 23.OCT.2013 16:36:10

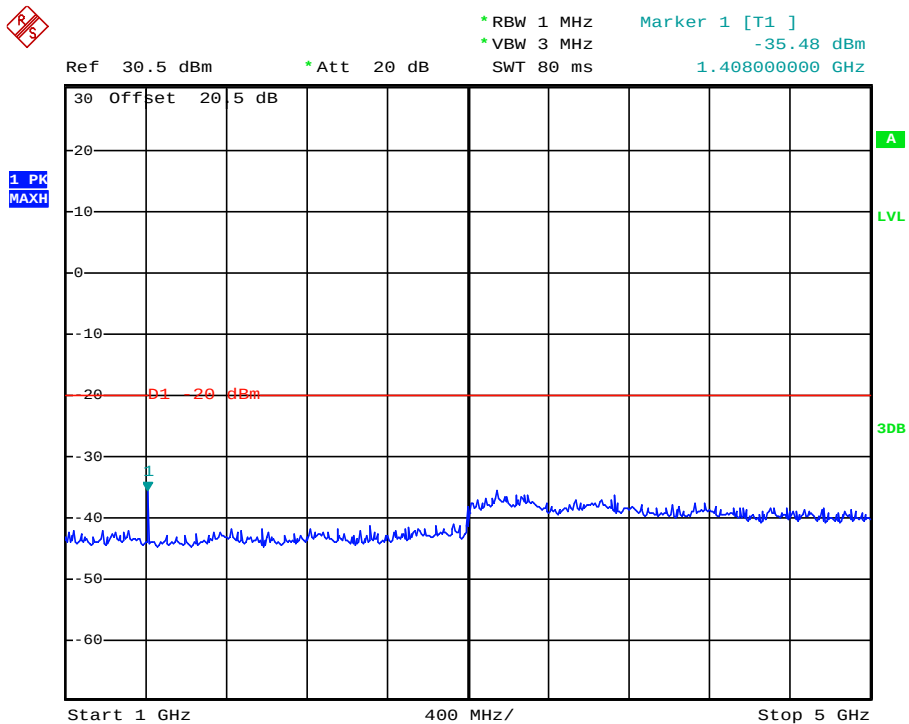
Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 6	Ch6	469.5	425.74	-23.41	1408.00	-35.48	-20.00



Date: 23.OCT.2013 16:32:49

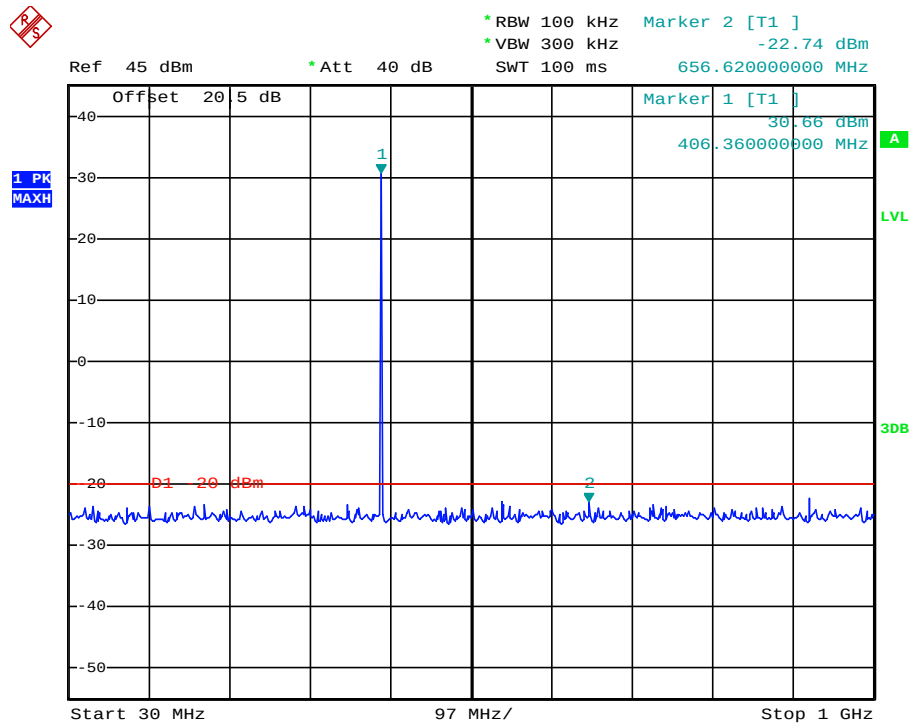


Date: 23.OCT.2013 16:37:06

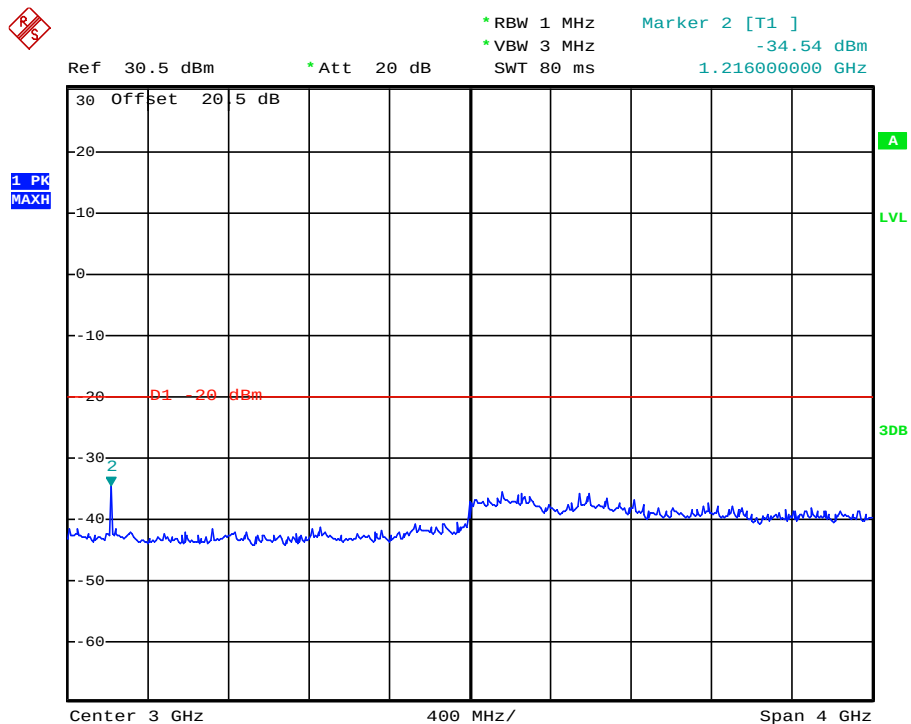


Date: 23.OCT.2013 16:37:21

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 7	Ch4	406.5	656.62	-22.74	1216.00	-34.54	-20.00

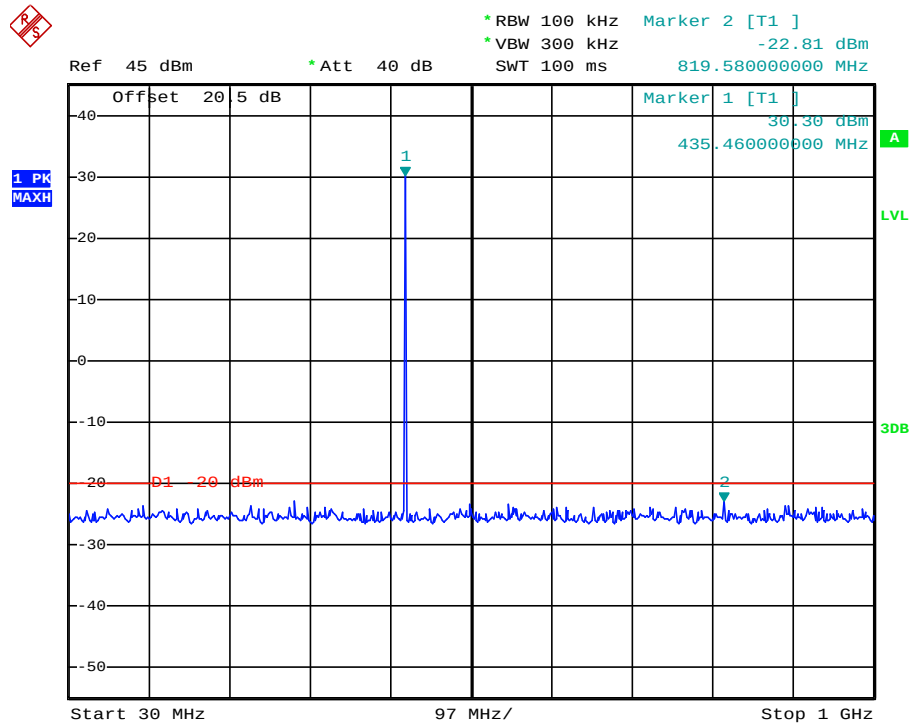


Date: 23.OCT.2013 12:05:20

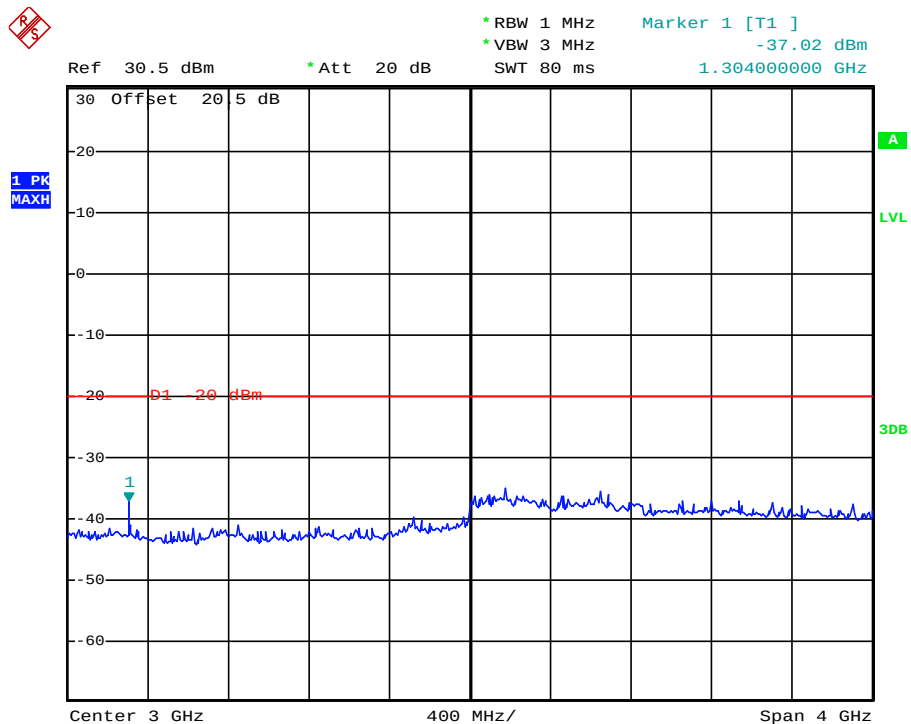


Date: 23.OCT.2013 12:06:13

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 7	Ch5	435.0	819.58	-22.81	1304.00	-37.02	-20.00

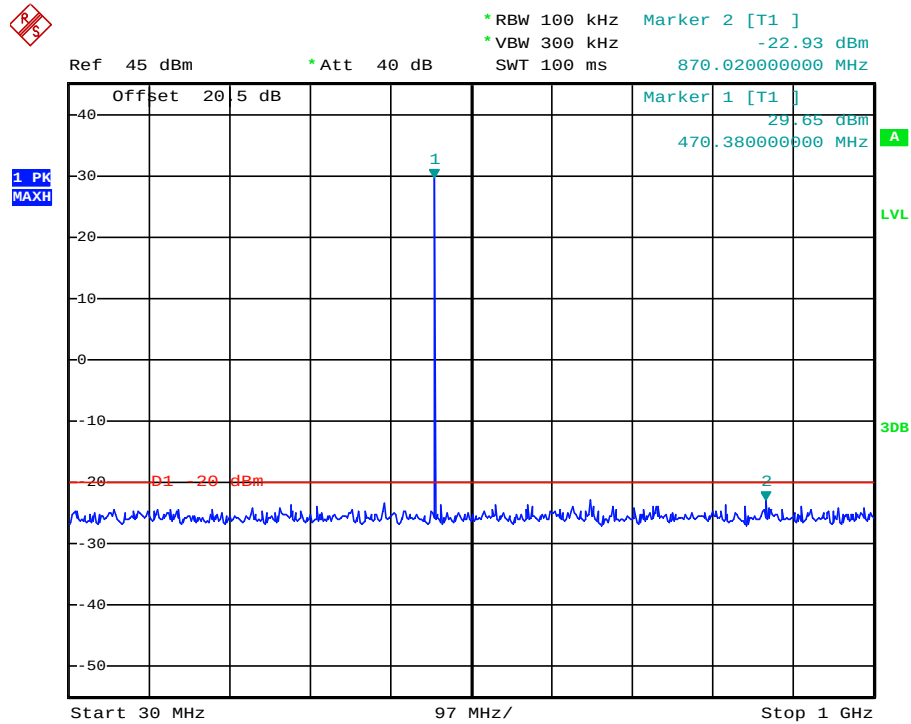


Date: 23.OCT.2013 12:07:43

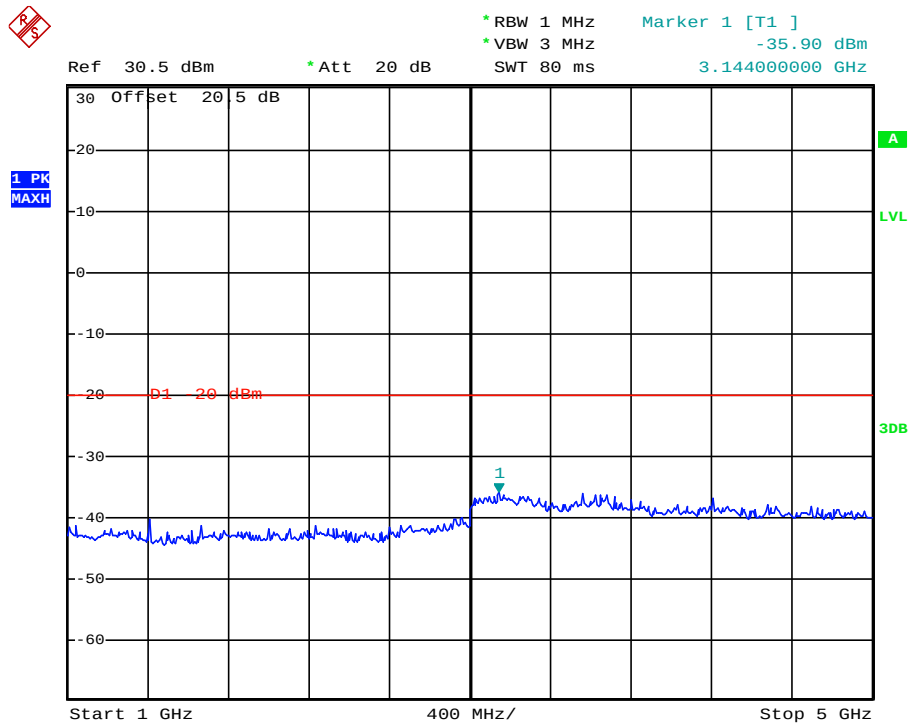


Date: 23.OCT.2013 12:06:59

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 7	Ch6	469.5	870.02	-22.93	3144.00	-35.90	-20.00

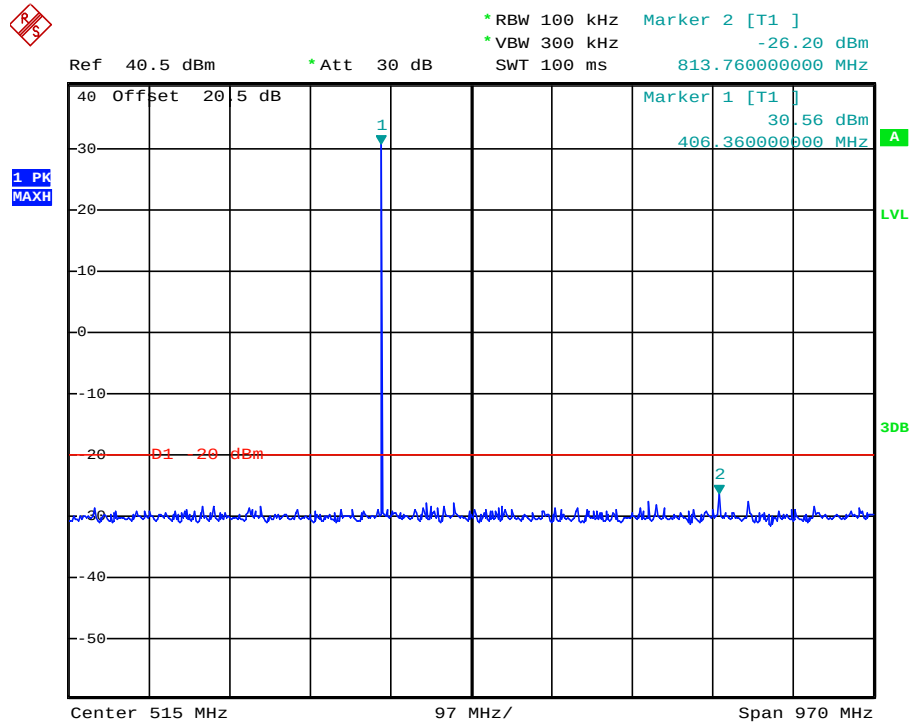


Date: 23.OCT.2013 12:08:20

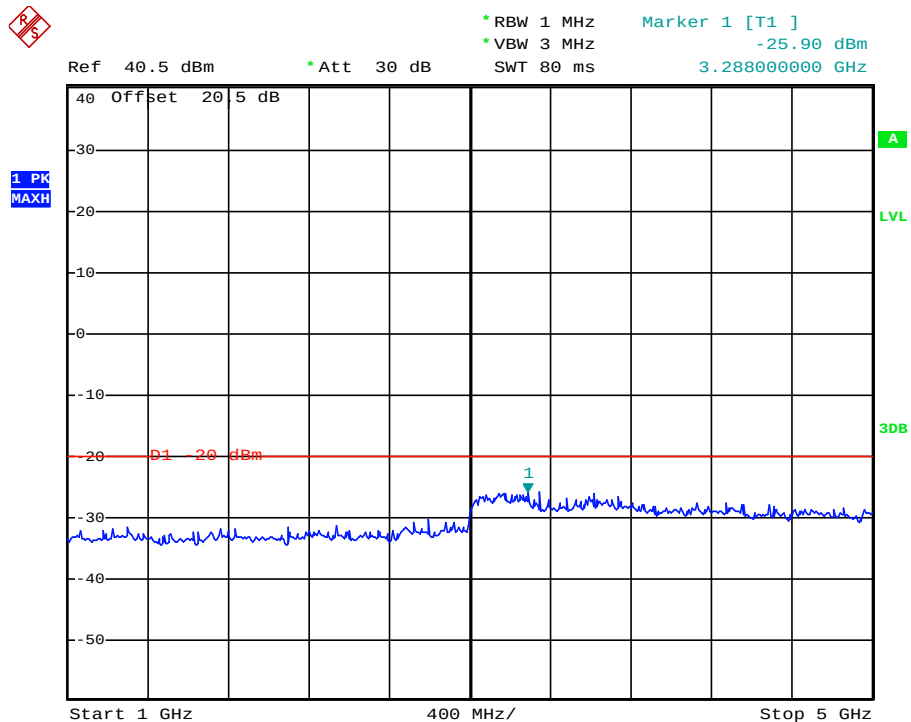


Date: 23.OCT.2013 12:08:48

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 8	Ch4	406.5	813.76	-26.20	3288.00	-25.90	-20.00

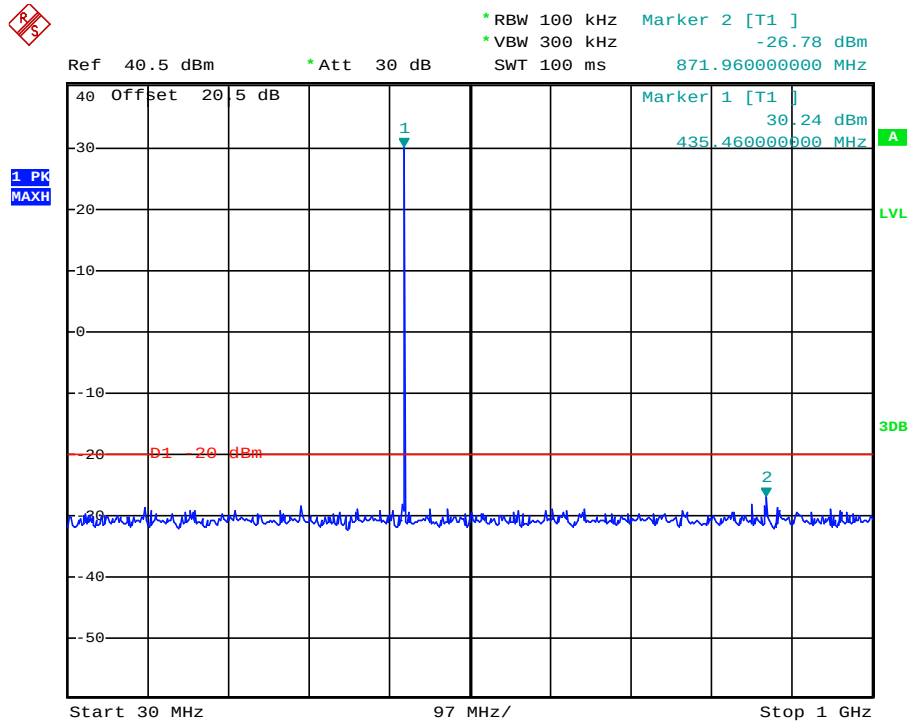


Date: 23.OCT.2013 16:29:10

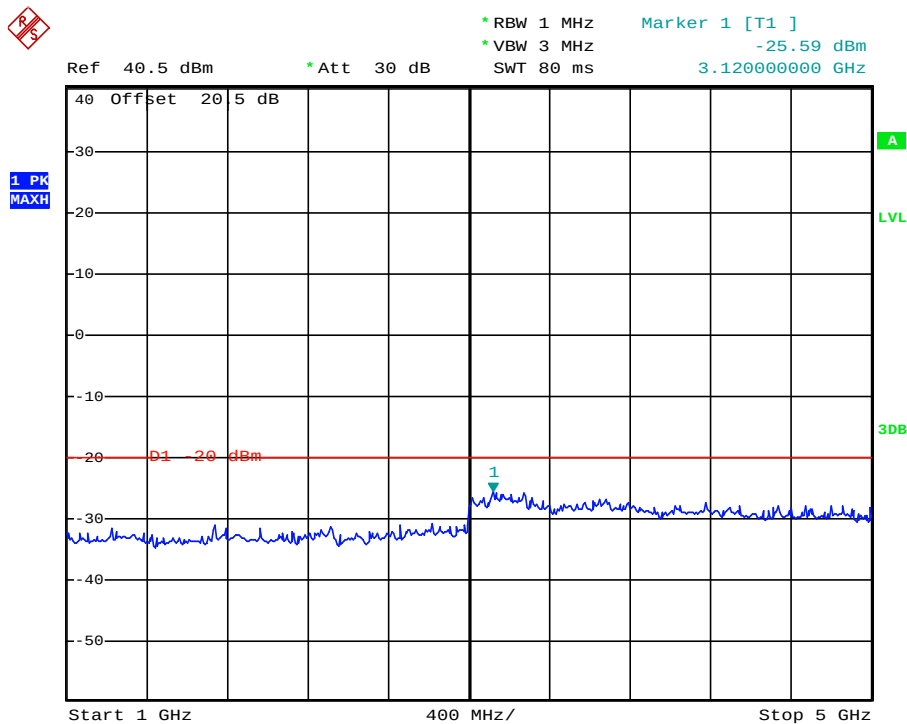


Date: 23.OCT.2013 16:29:33

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 8	Ch5	435.0	871.96	-26.78	3120.00	-25.59	-20.00

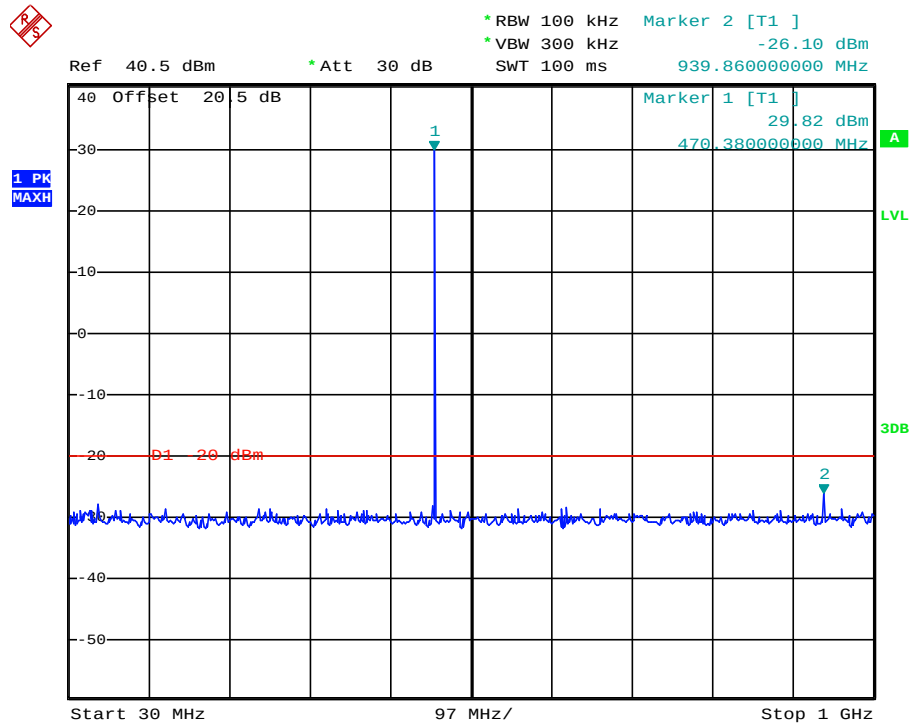


Date: 23.OCT.2013 16:30:43

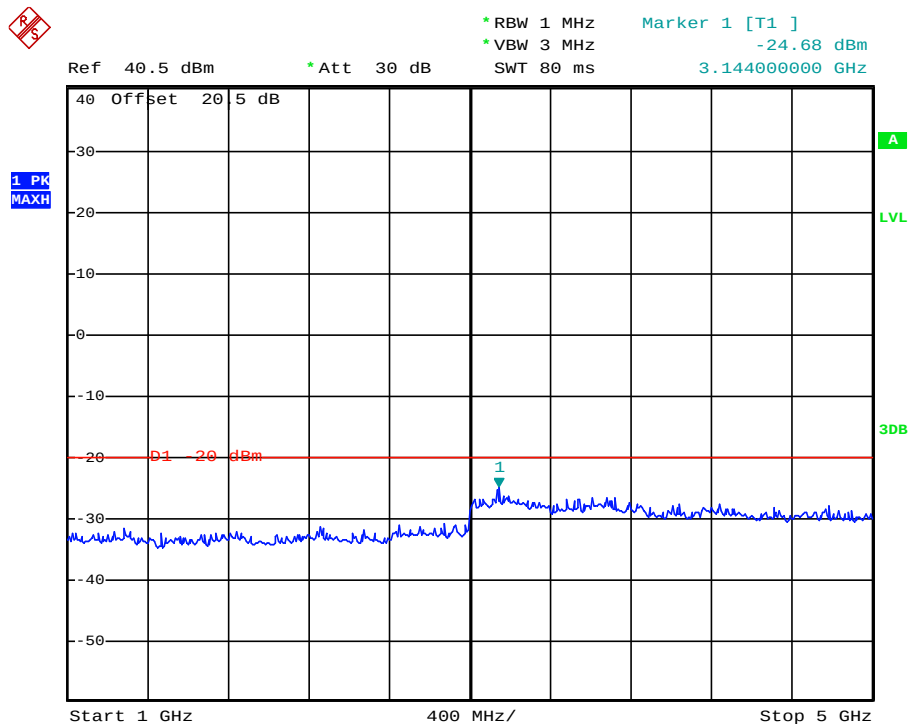


Date: 23.OCT.2013 16:30:20

Operation Mode	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		Limit (dBm)
			Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
Op 8	Ch6	469.5	939.86	-26.10	3144.00	-24.68	-20.00



Date: 23.OCT.2013 16:31:18



Date: 23.OCT.2013 16:31:36

4.5. Modulation Characteristics

TEST APPLICABLE

According to CFR47 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

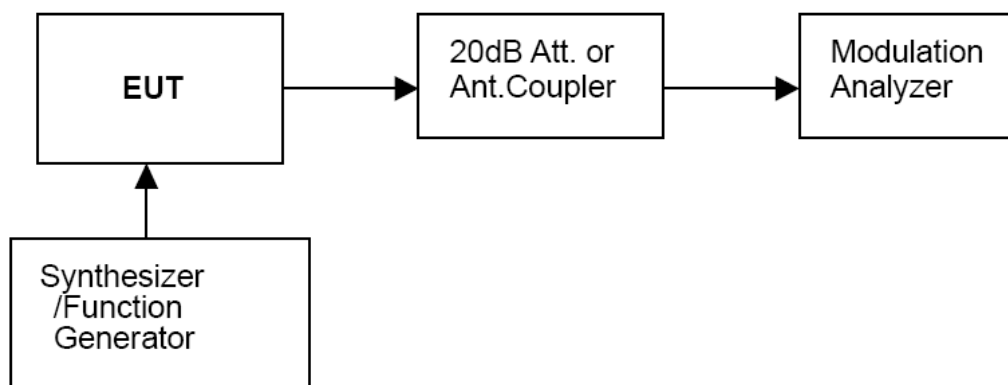
Modulation Limit

- 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 = $20\log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1 KHz reference})$.

TEST CONFIGURATION



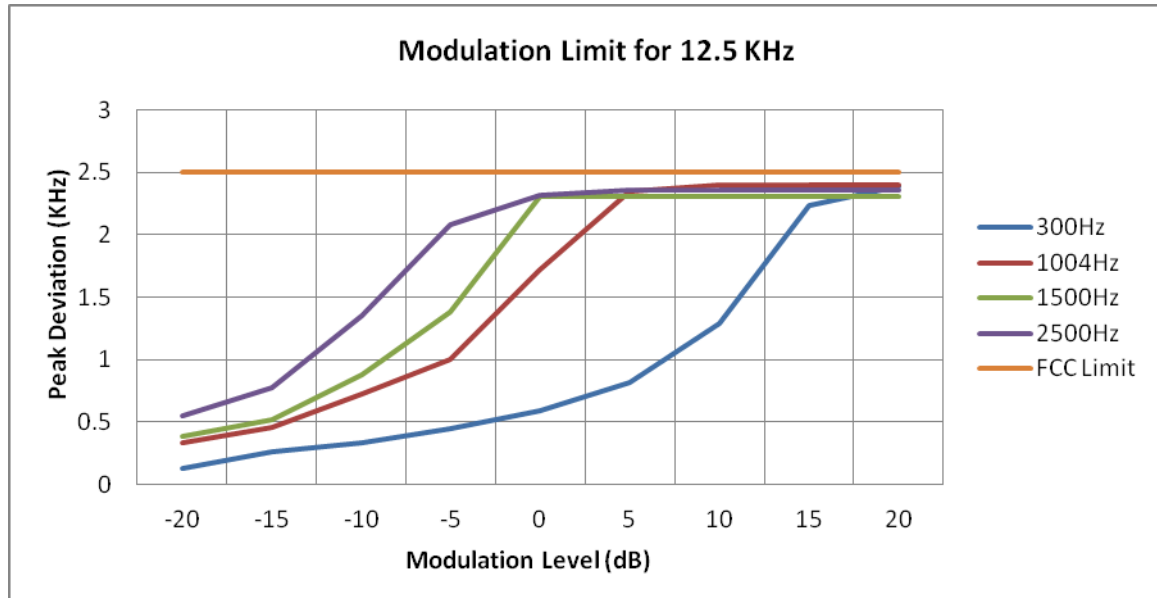
TEST RESULTS

Remark: We tested Op 1 to Op 4. recorded worst case at Op 1.

Modulation Type: FM

12.5 KHz Channel Separation

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (KHz)	Peak Freq. Deviation At 1004 Hz (KHz)	Peak Freq. Deviation At 1500 Hz (KHz)	Peak Freq. Deviation At 2500 Hz (KHz)
-20	0.13	0.33	0.39	0.55
-15	0.26	0.46	0.52	0.78
-10	0.33	0.72	0.88	1.35
-5	0.45	1.00	1.38	2.08
0	0.59	1.72	2.31	2.32
+5	0.82	2.35	2.31	2.36
+10	1.29	2.40	2.31	2.36
+15	2.24	2.40	2.31	2.36
+20	2.39	2.40	2.31	2.36

**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) for 12.5 KHz channel separation is 2.80mv.

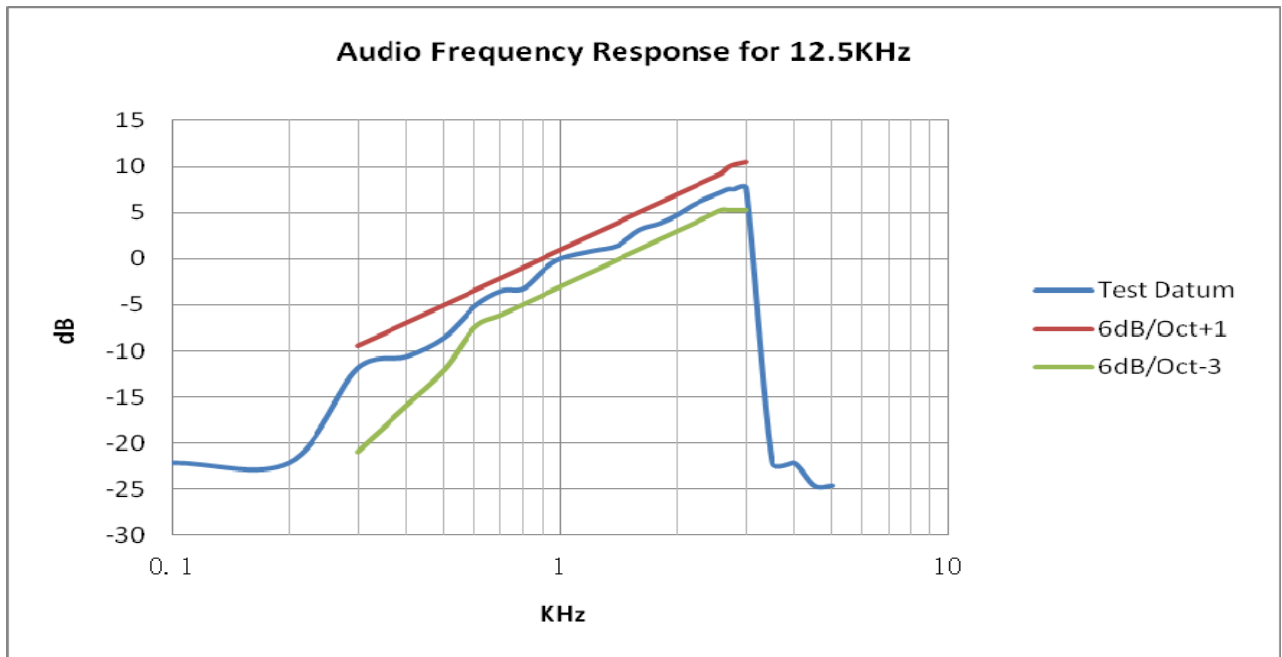
Note:

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 Refenerce Deviation (KHz)	Audio Frequency Response (dB)
0.1	0.04	0.51	-22.11
0.2	0.04	0.51	-22.11
0.3	0.13	0.51	-11.87
0.4	0.15	0.51	-10.63
0.5	0.19	0.51	-8.58
0.6	0.28	0.51	-5.2
0.7	0.34	0.51	-3.52
0.8	0.35	0.51	-3.27
0.9	0.44	0.51	-1.28
1.0	0.51	0.51	0
1.2	0.56	0.51	0.82
1.4	0.60	0.51	1.42
1.6	0.73	0.51	3.12

1.8	0.79	0.51	3.81
2.0	0.88	0.51	4.74
2.2	1.00	0.51	5.85
2.4	1.09	0.51	6.60
2.6	1.17	0.51	7.22
2.7	1.21	0.51	7.51
2.8	1.21	0.51	7.51
3.0	1.23	0.51	7.65
3.5	0.04	0.51	-22.11
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: 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 Test

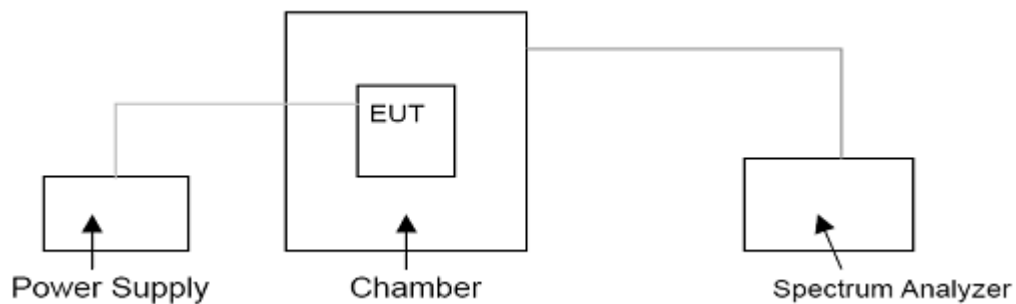
TEST APPLICABLE

- 1 According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to +60°C 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.
- 4 According to §90.213, the frequency stability limit is 1.5 ppm for 12.5KHz 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 CONFIGURATION



TEST LIMITS

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

Frequency Range (MHz)	Channel Bandwidth (KHz)	Frequency Tolerance (ppm)		
		Fixed and Base Stations	Mobile Stations	
			> 2 W	≤ 2 W
150-174 MHz	6.25	1.0	2.0	2.0
	12.5	2.5	5.0	5.0
	25	5.0	5.0	50.0*
421-512 MHz	6.25	0.5	1.0	1.0
	12.5	1.5	2.5	2.5
	25	2.5	5.0	5.0

- Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.
- Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.

TEST RESULTS

Remark: We tested Op 1 to Op 8, recorded worst case at Op 1, Op 2, Op 7 and Op 8

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(℃)	406.5	435	469.5
Op 1	12.5KHz	120	-30	1.01	1.01	0.97
			-20	0.98	0.94	0.91
			-10	0.82	0.90	0.86
			0	0.79	0.85	0.76
			10	0.77	0.75	0.71
			20	0.75	0.72	0.69
			30	0.75	0.77	0.69
			40	0.81	0.86	0.78
			50	0.88	0.89	0.83
		102 (85% Rated)	20	0.79	0.77	0.69
		138(115% Rated)	20	0.75	0.75	0.72
Limit			1.5 ppm			
Test Results			PASS			

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(°C)	406.5	435	469.5
Op 2	12.5KHz	13.6	-30	1.03	1.01	0.99
			-20	0.99	0.96	0.91
			-10	0.86	0.87	0.86
			0	0.81	0.83	0.77
			10	0.81	0.78	0.73
			20	0.75	0.72	0.69
			30	0.77	0.72	0.72
			40	0.83	0.81	0.78
			50	0.89	0.89	0.85
		11.56 (85% Rated)	20	0.77	0.75	0.69
		15.64(115% Rated)	20	0.77	0.75	0.69
Limit		1.5 ppm				
Test Results		PASS				

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(℃)	406.5	435	469.5
Op 5	12.5KHz	120	-30	1.01	1.00	0.97
			-20	0.95	0.94	0.90
			-10	0.85	0.87	0.84
			0	0.85	0.87	0.79
			10	0.79	0.76	0.71
			20	0.77	0.72	0.67
			30	0.77	0.72	0.69
			40	0.82	0.79	0.81
			50	0.89	0.86	0.85
		102 (85% Rated)	20	0.77	0.75	0.72
		138(115% Rated)	20	0.77	0.75	0.72
Limit			1.5 ppm			
Test Results			PASS			

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(℃)	406.5	435	469.5
Op 6	12.5KHz	13.6	-30	1.01	0.99	0.96
			-20	0.96	0.93	0.91
			-10	0.88	0.84	0.84
			0	0.85	0.82	0.76
			10	0.82	0.76	0.72
			20	0.77	0.72	0.69
			30	0.77	0.72	0.72
			40	0.85	0.83	0.79
			50	0.92	0.90	0.85
		11.56 (85% Rated)	20	0.77	0.72	0.69
		15.64(115% Rated)	20	0.77	0.75	0.69
Limit			1.5 ppm			
Test Results			PASS			

4.7. Maximum Transmitter Power

TEST APPLICABLE

Per FCC Part 2.1046 and Part 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 below:

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

The EUT connect to the Receiver through 20 dB attenuator.

Measurement with Spectrum Analyzer FSP40 conducted, external power supply with 13.60 V or AC 120V/60Hz stabilized supply voltage.

TEST CONFIGURATION

EUT		Attenuator		Spectrum Analyzer/Receiver

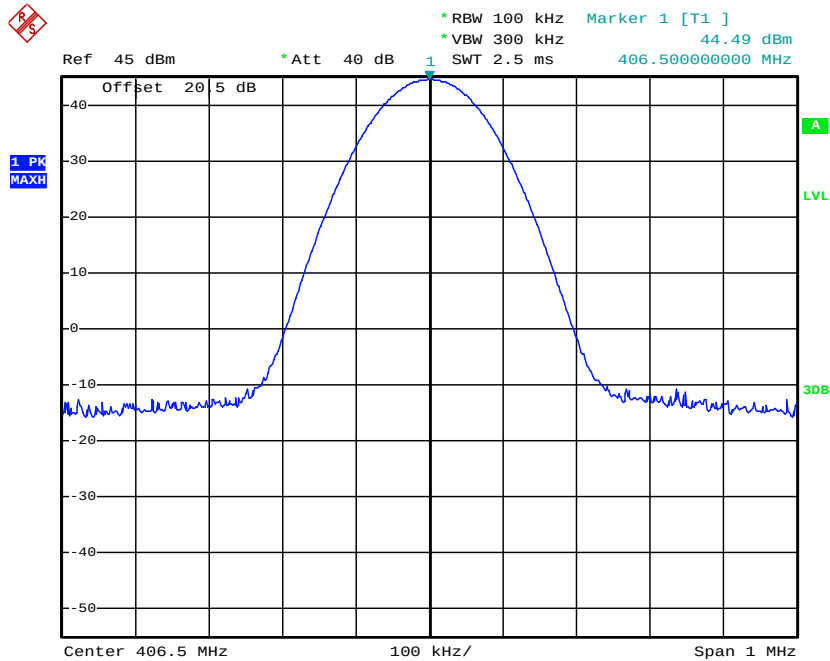
The EUT was directly connected to a RF Communication
Test set by a 20 dB attenuator

TEST RESULTS

Modulation Type	Channel Sparation	Operation Mode	Test Channel	Test Frequency (MHz)	Test Results (dBm)
Analog/FM	12.5KHz	Op 1	Ch1	406.5	44.49
			Ch2	435.0	44.71
			Ch3	469.5	44.75
		Op 2	Ch1	406.5	44.49
			Ch2	435.0	44.56
			Ch3	469.5	44.30
		Op 3	Ch1	406.5	30.41
			Ch2	435.0	30.67
			Ch3	469.5	29.87
		Op 4	Ch1	406.5	30.73
			Ch2	435.0	30.43
			Ch3	469.5	30.00
Digital/4FSK	12.5KHz	Op 5	Ch4	406.5	44.56
			Ch5	435.0	44.75
			Ch6	469.5	44.74
		Op 6	Ch4	406.5	44.35
			Ch5	435.0	44.38
			Ch6	469.5	43.97
		Op 7	Ch4	406.5	30.69
			Ch5	435.0	30.40
			Ch6	469.5	30.09
		Op 8	Ch4	406.5	30.67
			Ch5	435.0	30.36
			Ch6	469.5	29.98
Limit	The limit is dependent upon the station's antenna HAAT and required service area.				
Test Results		PASS			

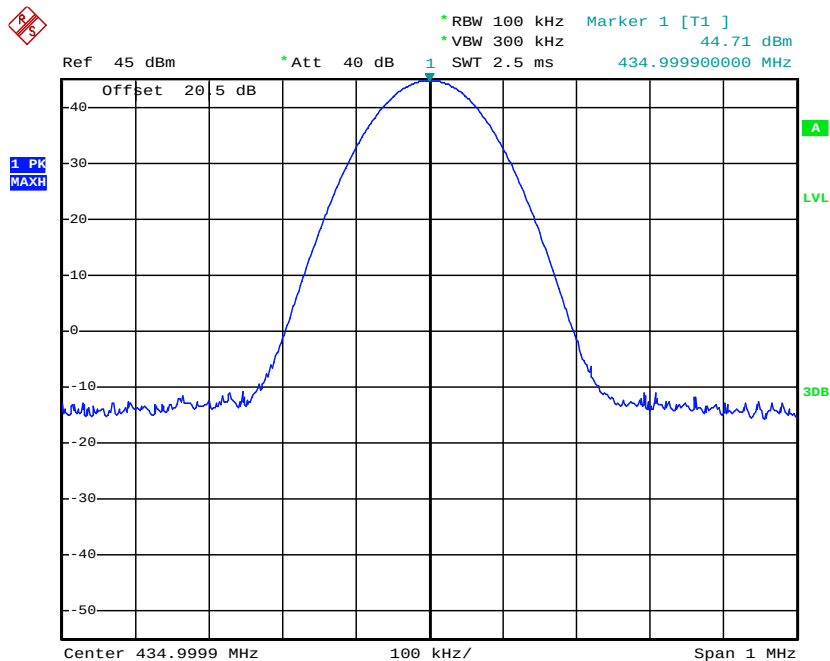
Plots of Transmitter Power Measurement

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 1	Ch1	406.5	25	44.49	Varies	PASS



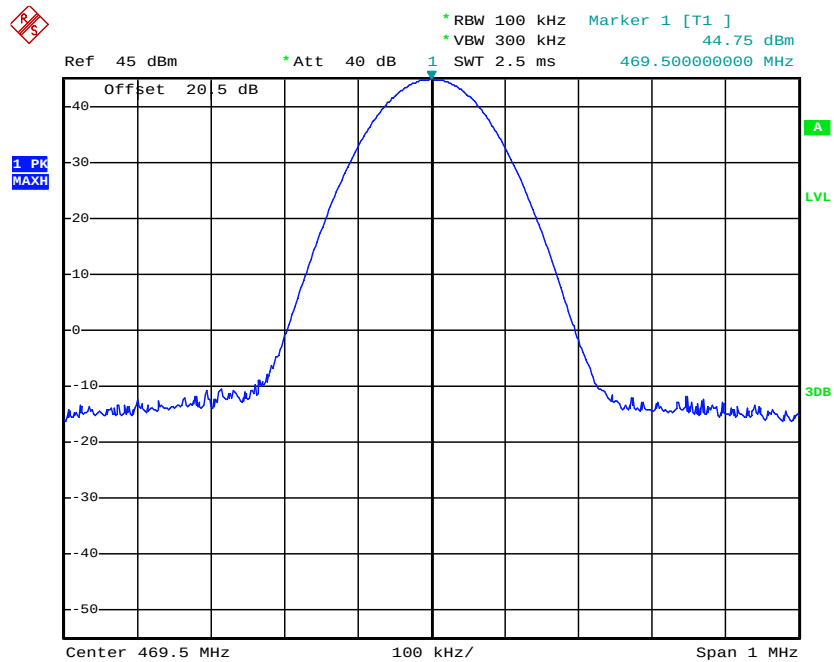
Date: 22.OCT.2013 12:08:40

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 1	Ch2	435.0	25	44.71	Varies	PASS



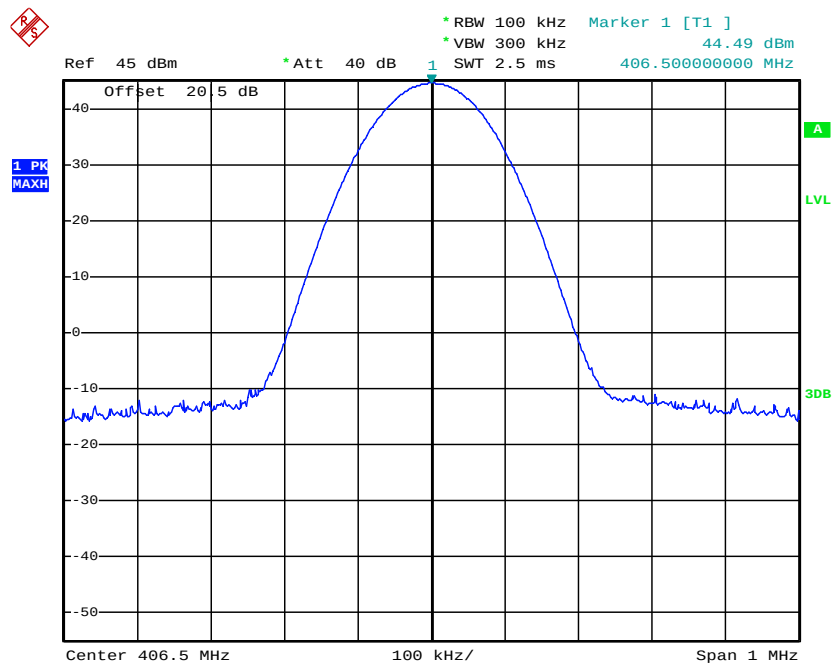
Date: 22.OCT.2013 12:36:19

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 1	Ch3	469.5	25	44.75	Varies	PASS



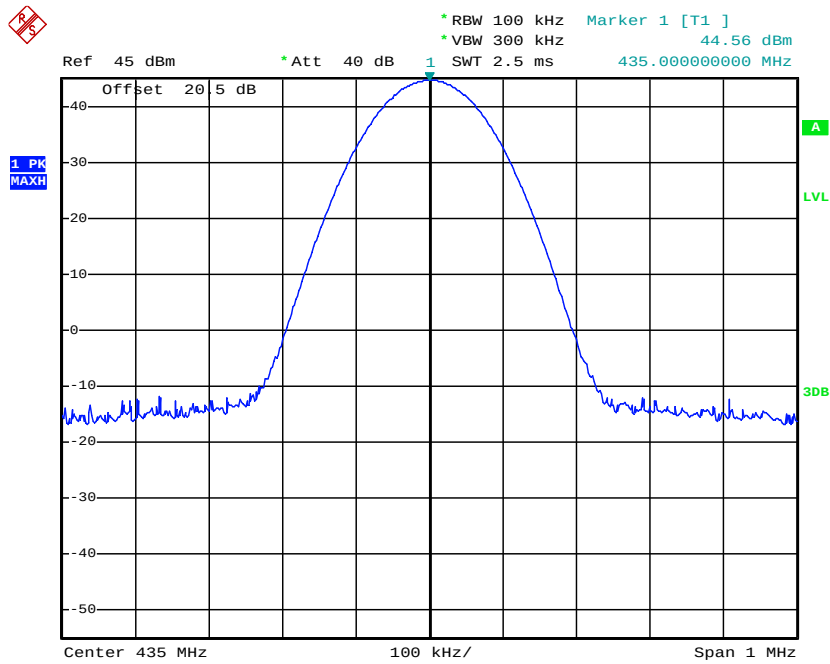
Date: 22.OCT.2013 12:45:41

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 2	Ch1	406.5	25	44.49	Varies	PASS



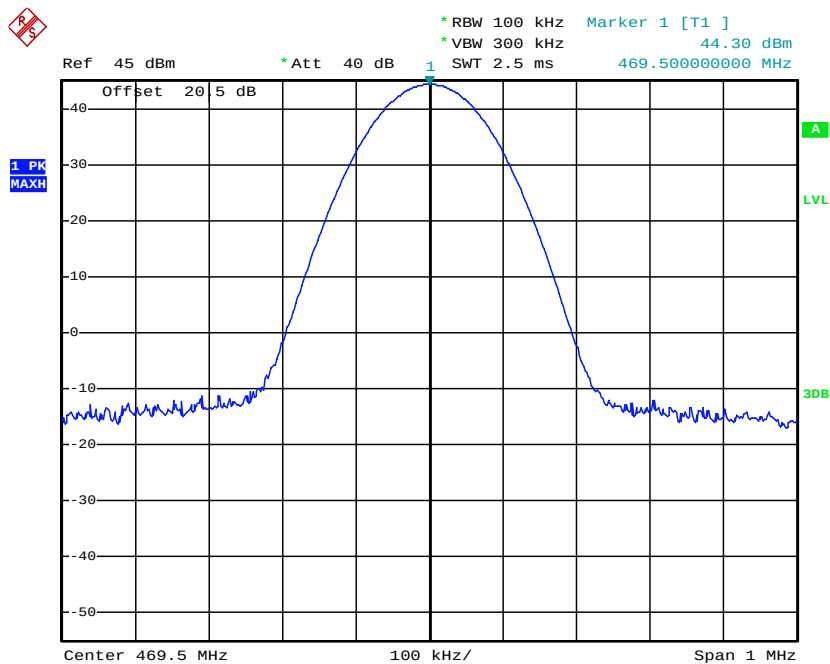
Date: 23.OCT.2013 15:32:06

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 2	Ch2	435.0	25	44.56	Varies	PASS



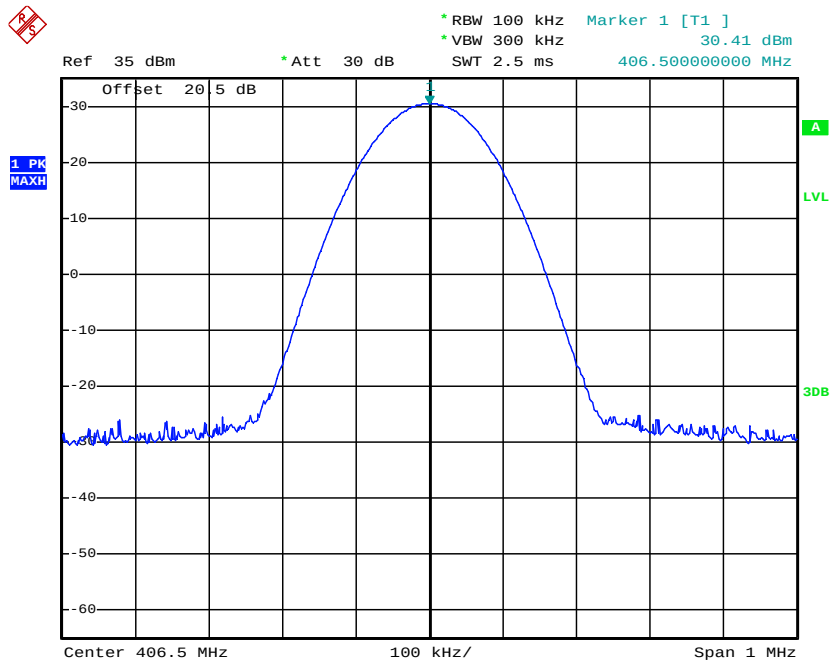
Date: 23.OCT.2013 15:32:29

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 2	Ch3	469.5	25	44.30	Varies	PASS



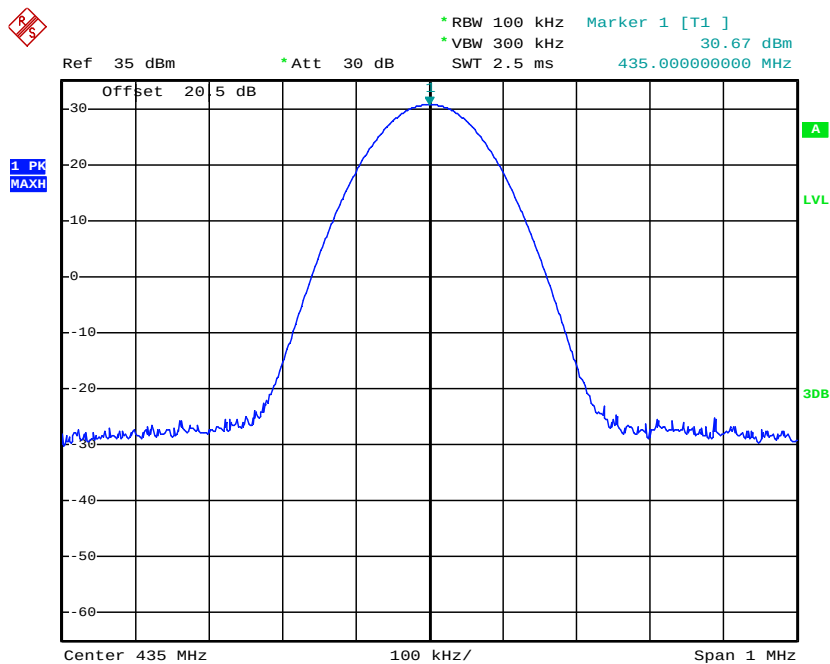
Date: 23.OCT.2013 15:32:58

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 3	Ch1	406.5	1	29.87	Varies	PASS



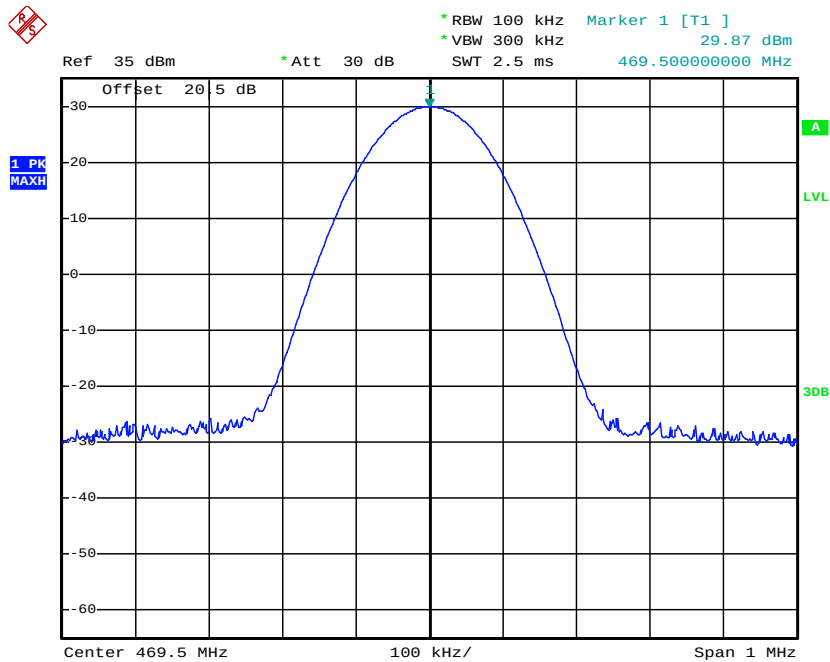
Date: 22.OCT.2013 13:01:19

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 3	Ch2	435.0	1	30.67	Varies	PASS



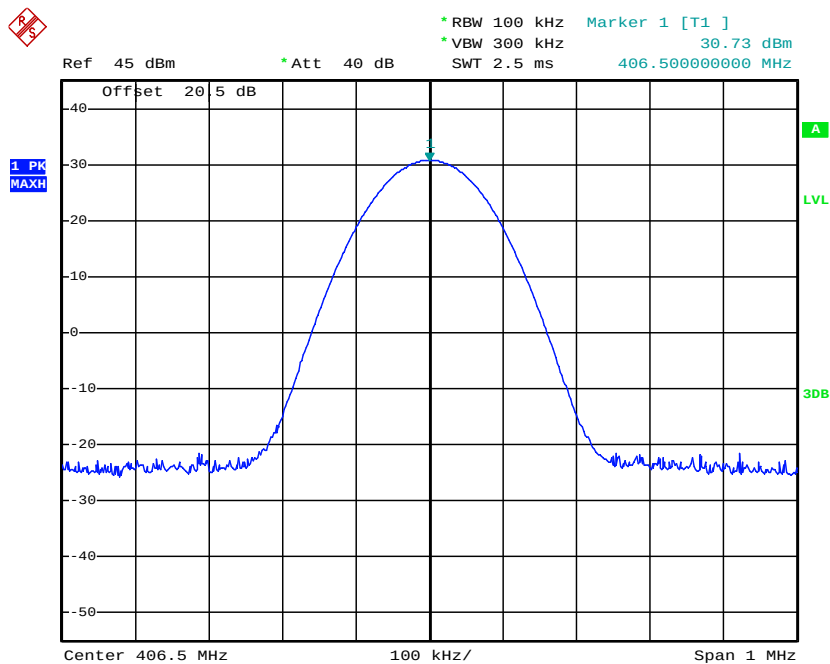
Date: 22.OCT.2013 13:00:09

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 3	Ch3	469.5	1	29.87	Varies	PASS



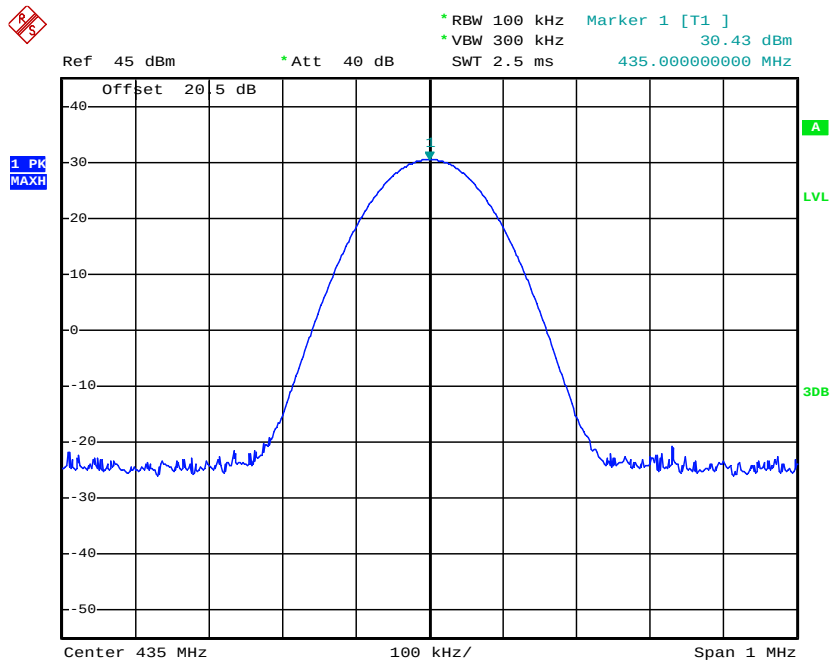
Date: 22.OCT.2013 12:50:04

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 4	Ch1	406.5	1	30.73	Varies	PASS



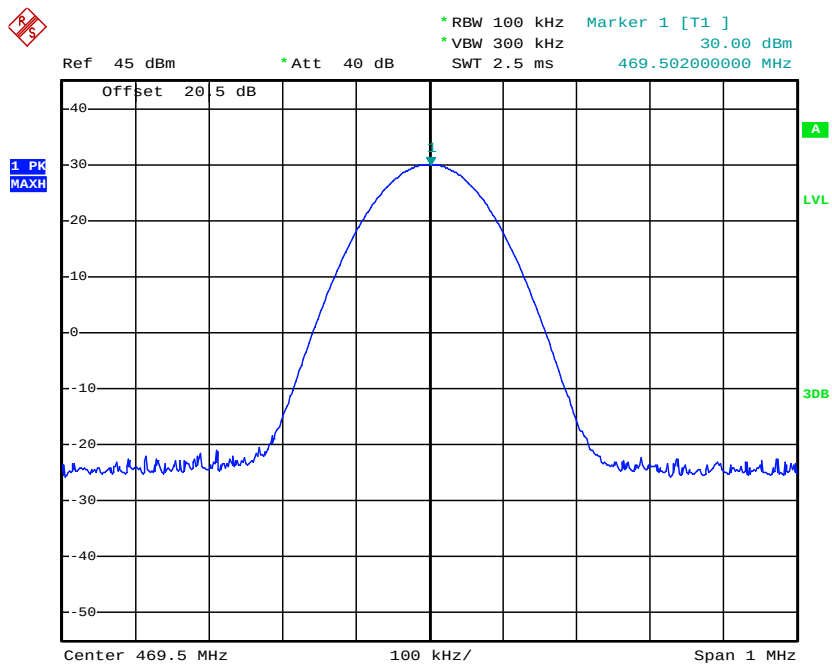
Date: 23.OCT.2013 15:33:46

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 4	Ch2	435.0	1	30.43	Varies	PASS



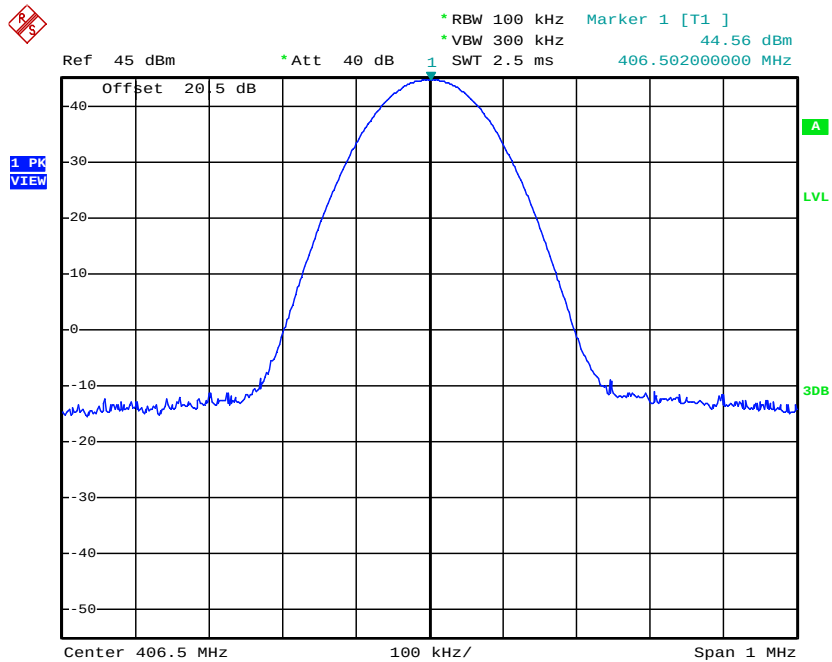
Date: 23.OCT.2013 15:34:28

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
FM	12.5KHz	Op 4	Ch3	469.5	1	30.00	Varies	PASS



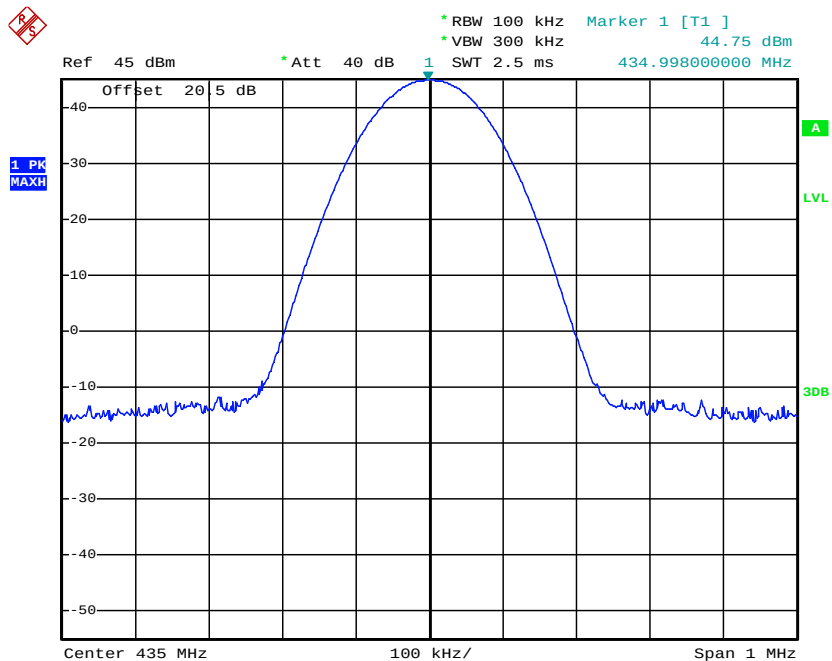
Date: 23.OCT.2013 15:35:07

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 5	Ch4	406.5	25	44.56	Varies	PASS



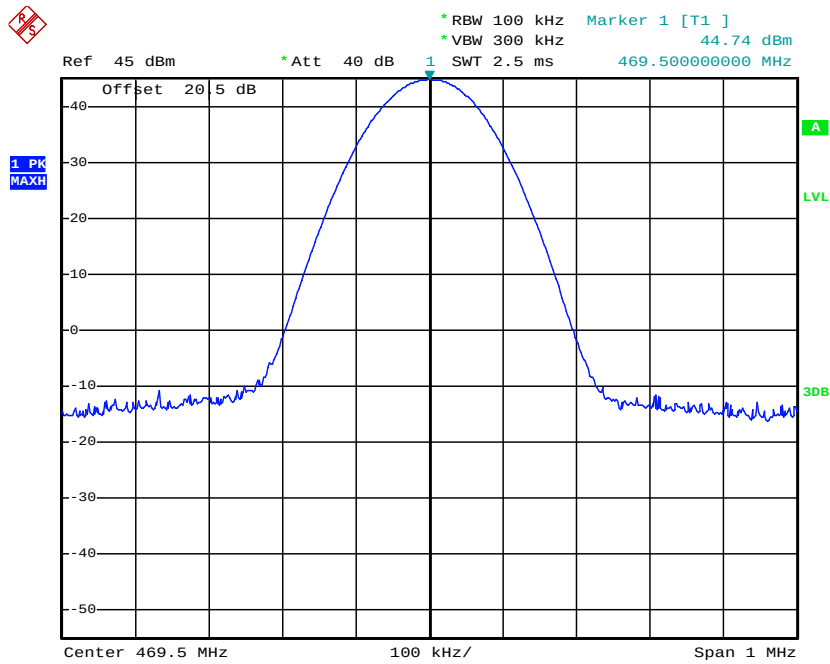
Date: 23.OCT.2013 11:57:10

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 5	Ch5	435.0	25	44.75	Varies	PASS



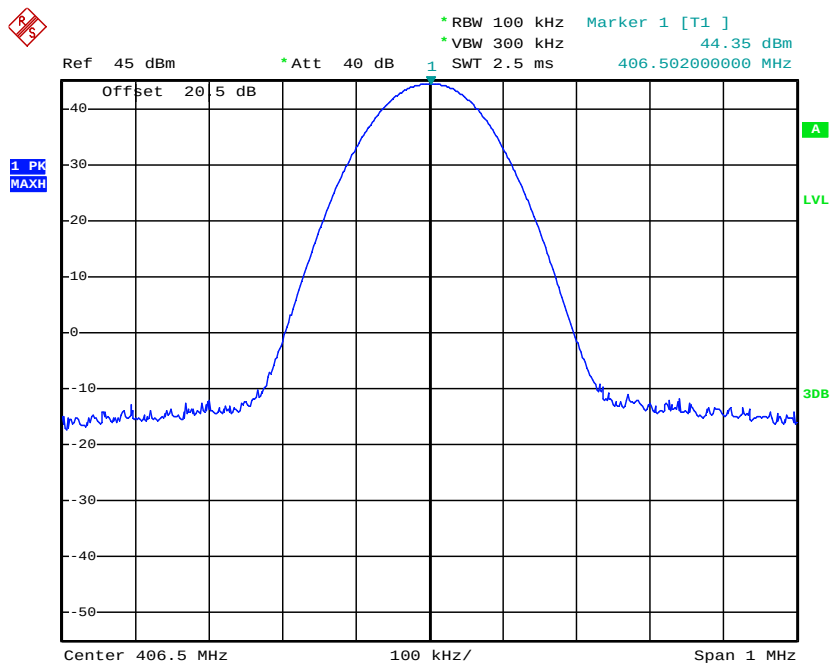
Date: 23.OCT.2013 11:57:53

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 5	Ch6	469.5	25	44.74	Varies	PASS



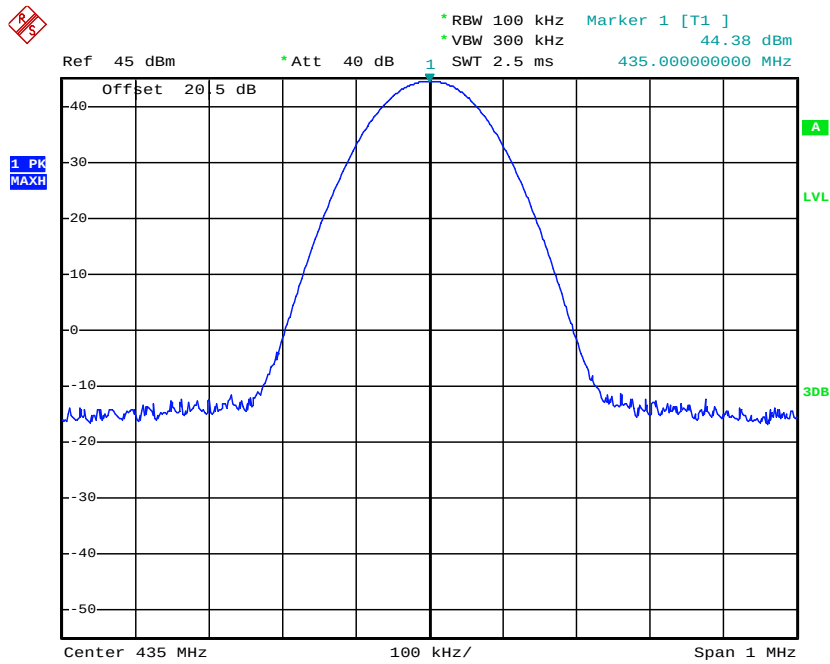
Date: 23.OCT.2013 12:00:35

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 6	Ch4	406.5	25	44.35	Varies	PASS



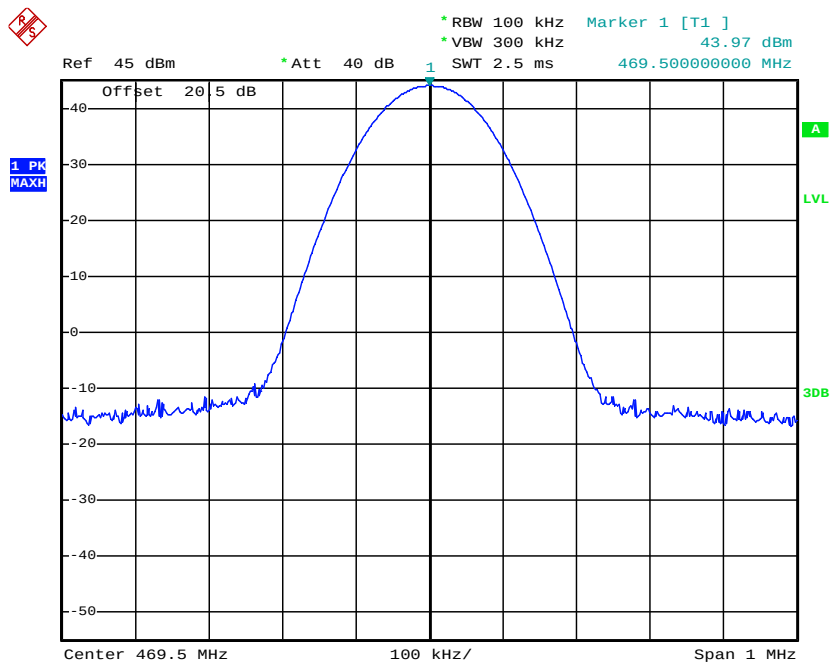
Date: 23.OCT.2013 15:54:55

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 6	Ch5	435.0	25	44.38	Varies	PASS



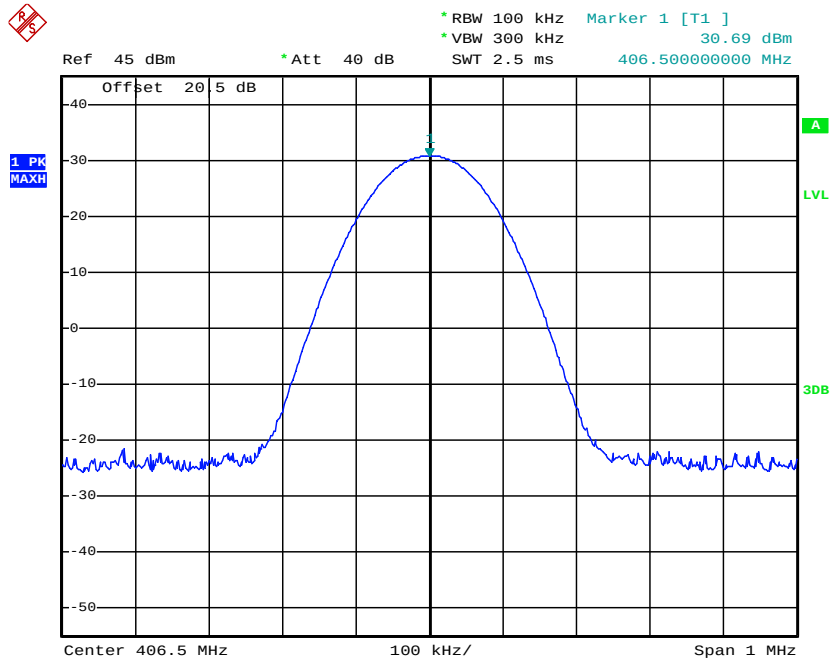
Date: 23.OCT.2013 15:55:32

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 6	Ch5	469.5	25	43.97	Varies	PASS



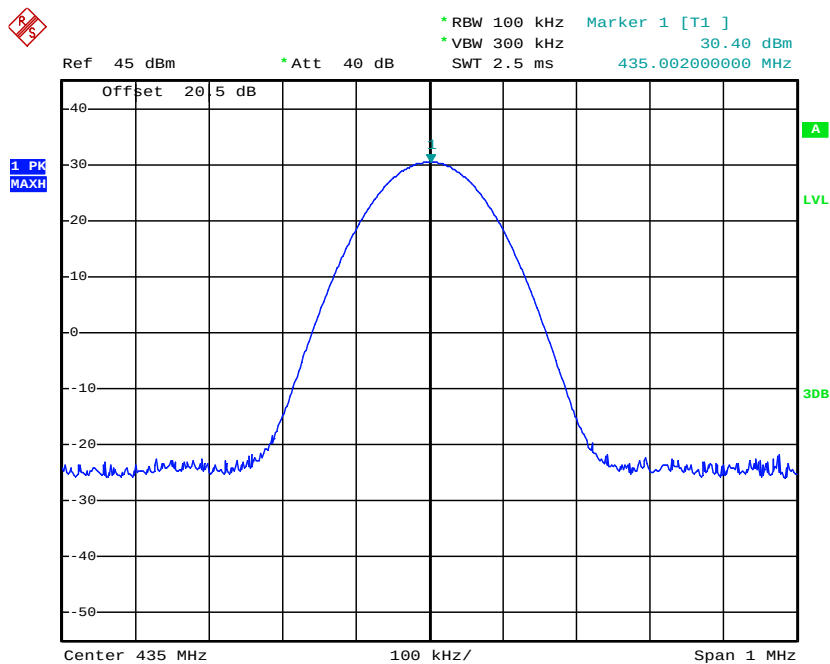
Date: 23.OCT.2013 15:56:09

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 7	Ch4	406.5	1	30.69	Varies	PASS



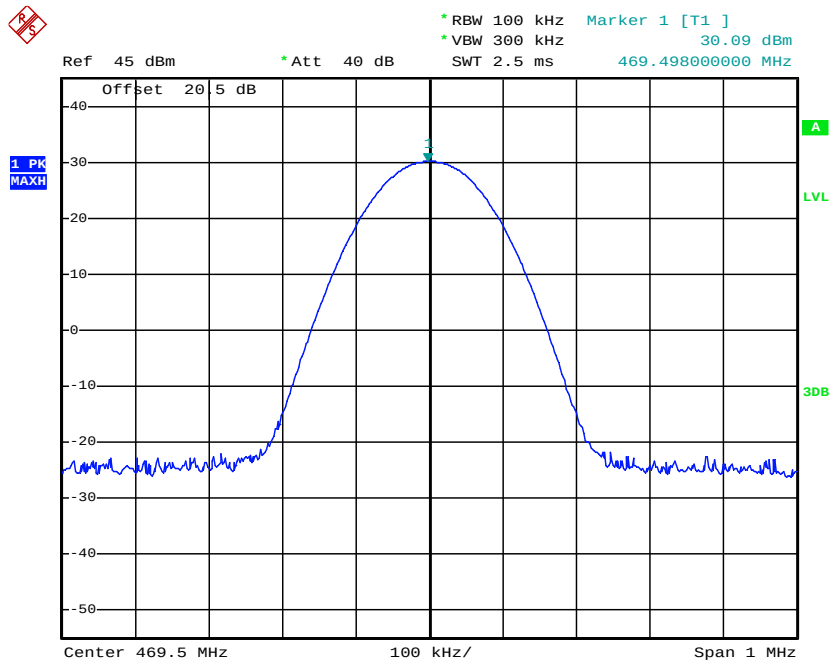
Date: 23.OCT.2013 12:03:52

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 7	Ch5	435.0	1	30.40	Varies	PASS



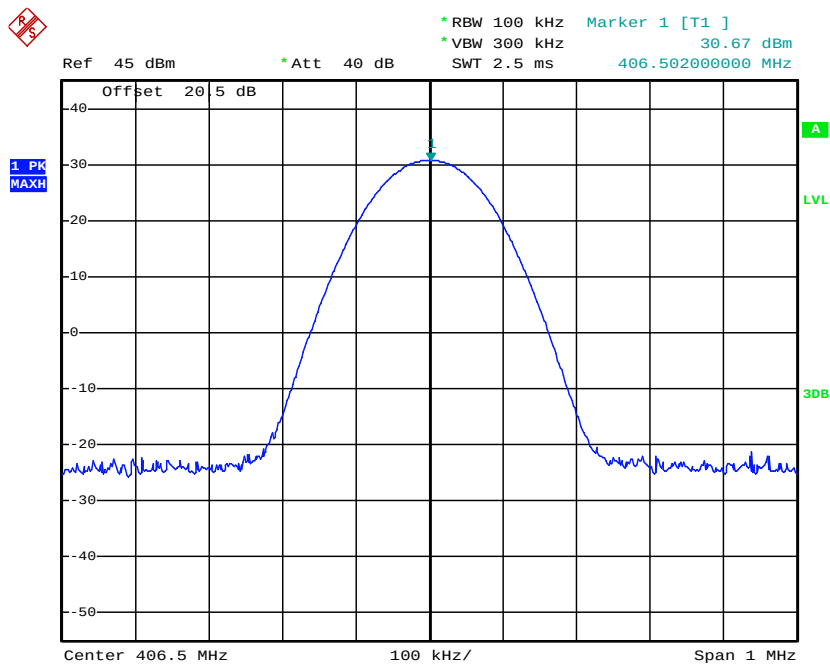
Date: 23.OCT.2013 12:03:12

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 7	Ch6	469.5	1	30.09	Varies	PASS



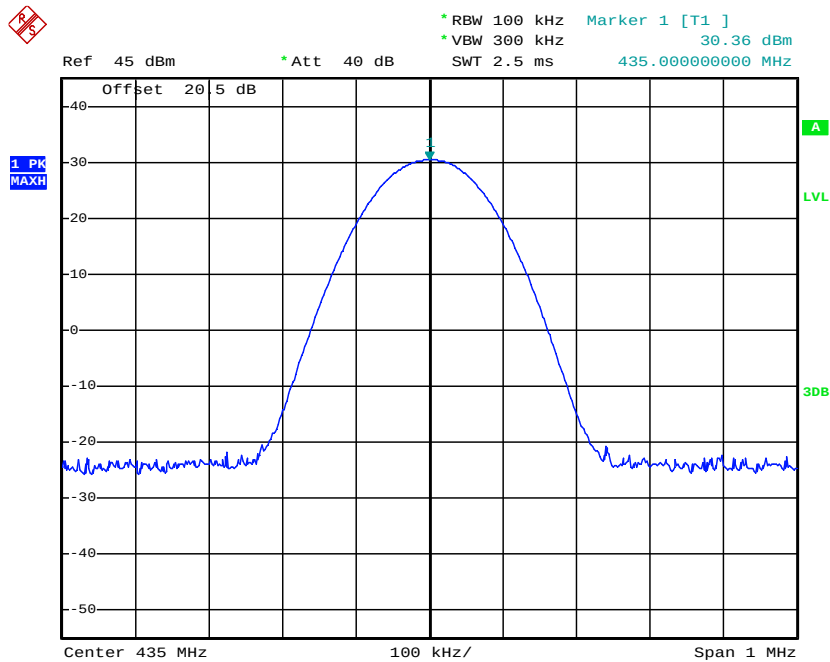
Date: 23.OCT.2013 12:01:17

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 8	Ch4	406.5	1	30.67	Varies	PASS



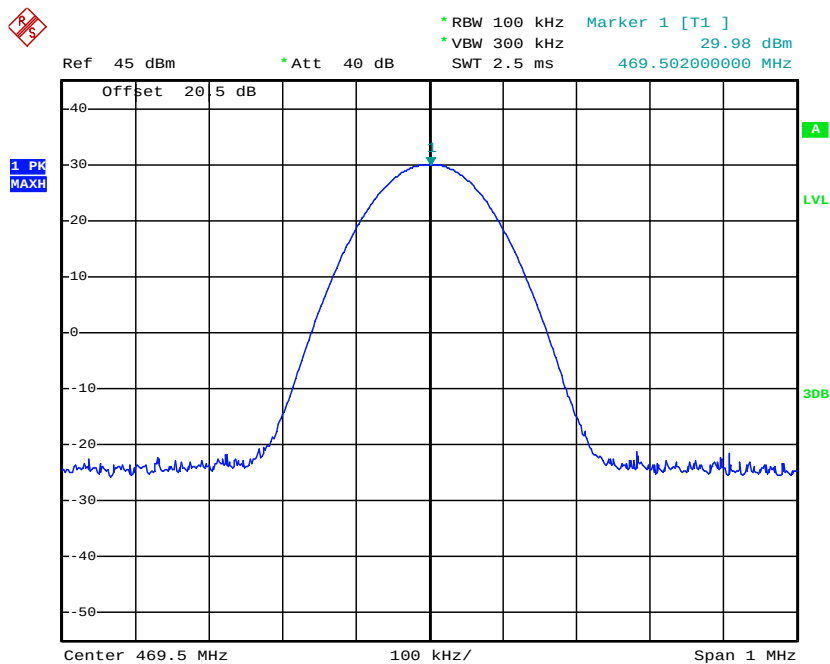
Date: 23.OCT.2013 15:57:53

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 8	Ch5	435.0	1	30.36	Varies	PASS



Date: 23.OCT.2013 15:57:19

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Rated Power (Watt)	Measurement (dBm)	Limit	Results
4FSK	12.5KHz	Op 8	Ch6	469.5	1	29.98	Varies	PASS



Date: 23.OCT.2013 15:56:46

4.8. Transmitter Frequency Behavior

TEST APPLICABLE

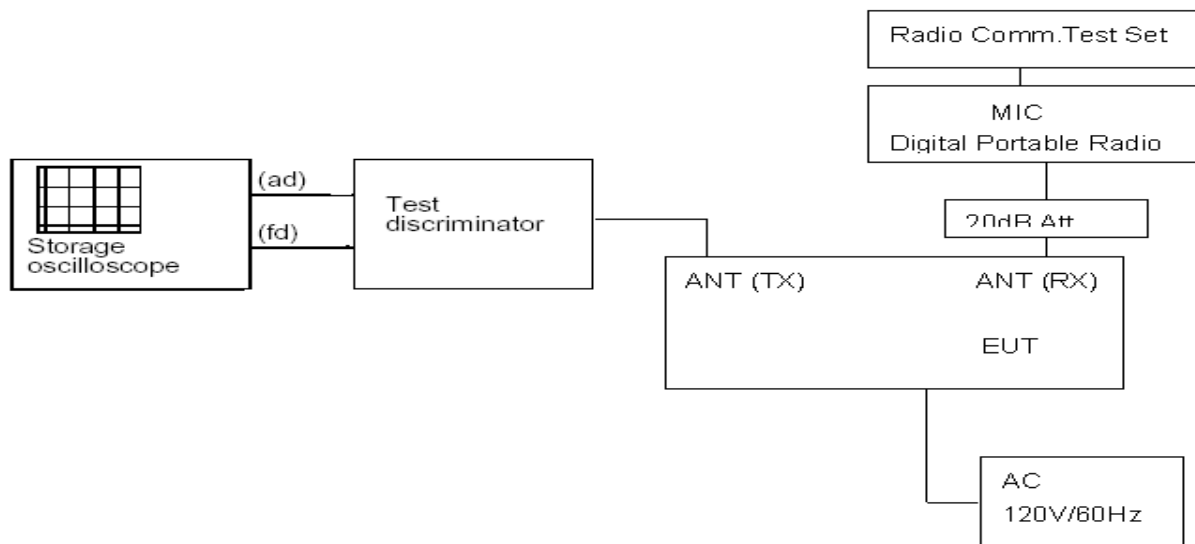
Section 90.214

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

- 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.
- 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.
- Difference between the actual transmitter frequency and the assigned transmitter frequency.
- 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 CONFIGURATION



TEST PROCEDURE

According to TIA/EIA-603 2.2.19 requirement. As for the product different from PTT, we use test steps as follows:

- Use Digital portable radio which manufactured by Victel Global Communications Corporation Limited which uses same protocol as the DUT connect to RX antenna by 20dB Att in order to avoid damaging DUT;
- Connect DUT into Test discriminator and Storage Oscilloscope and keep DUT stats ON;

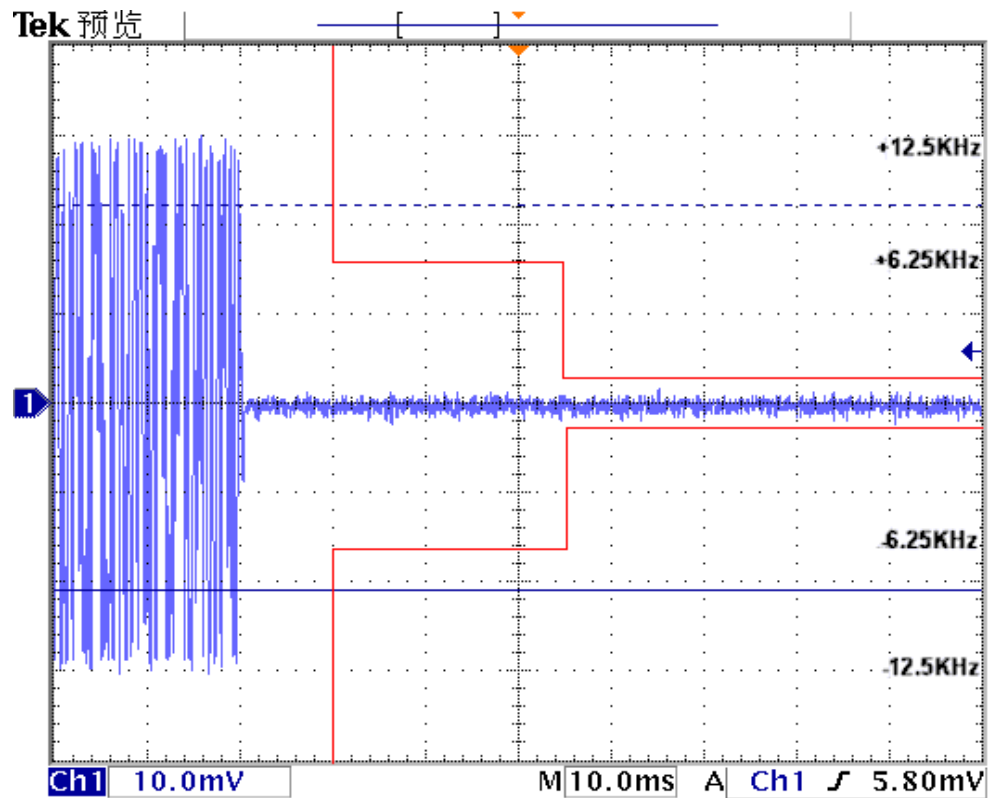
3. Input 1KHz signal into digital portable radio;
4. Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a single-shot turn-on of the transmitter signals;
5. Keep the digital portable radio in OFF state and Key the PTT of digital portable radio;
6. Observe the stored oscilloscope of modulation domain analyzer. The signal trace shall be maintained within the allowable limits during the periods t_1 and t_2 , and shall also remain within limits following t_2 ;
7. Adjust the modulation domain analyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transmitter of the transmitter signal.
8. Keep the digital portable radio in ON state and Unkey the PTT of digital portable radio;
9. Observe the stored oscilloscope of modulation domain analyzer. The signal trace shall be maintained within the allowable limits during the period t_3 .

TEST RESULTS

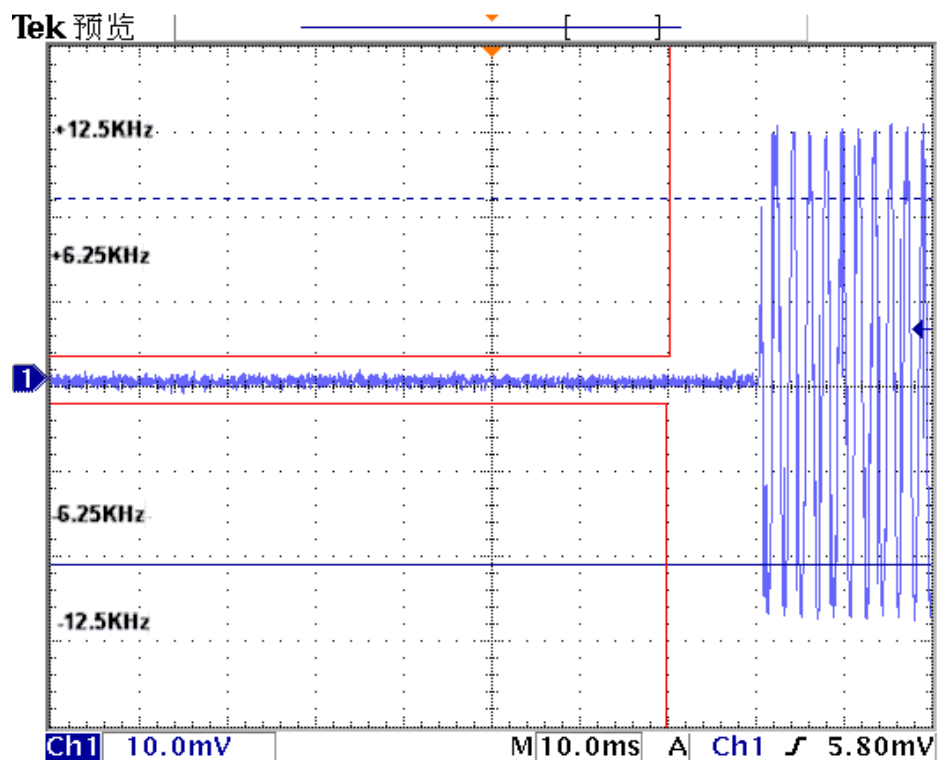
Please refer to the following plots.

Modulation Type: FM

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

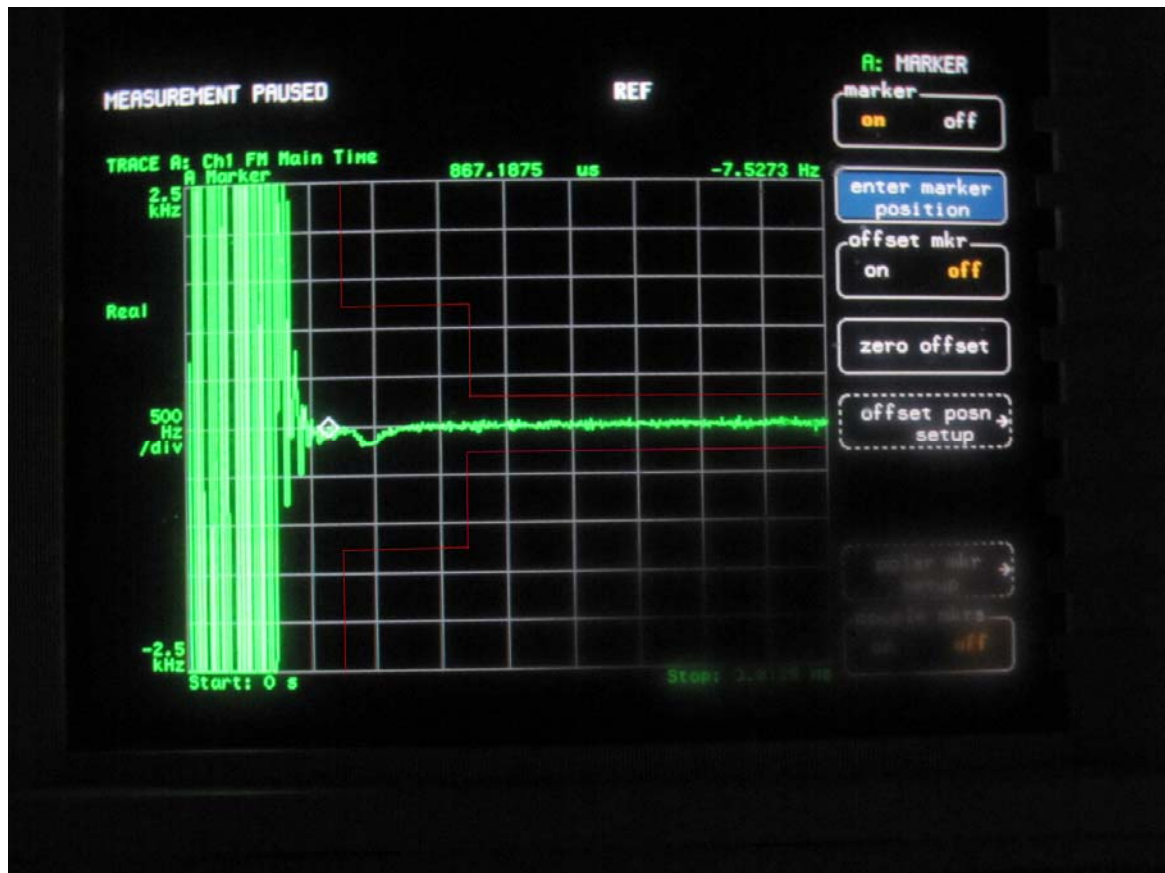


Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----On – Off

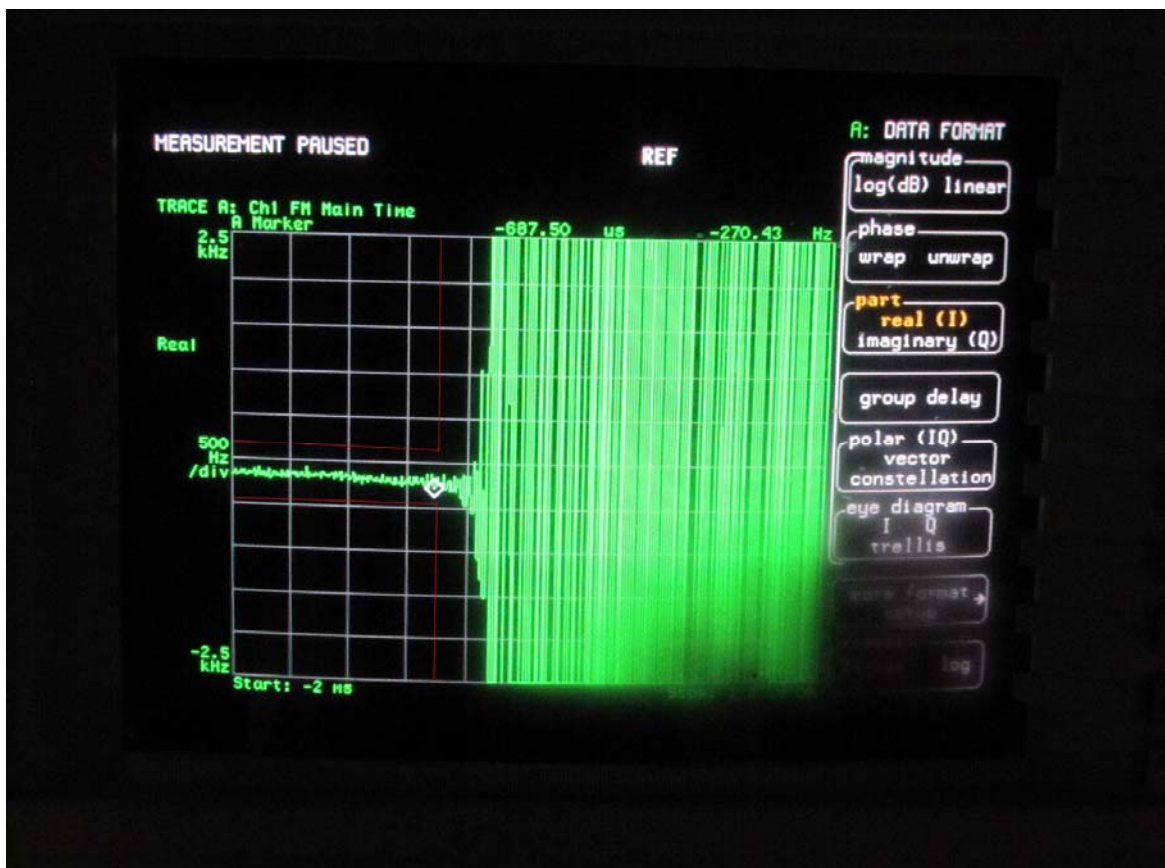


Modulation Type: 4FSK

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



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



5. Test Setup Photos of the EUT



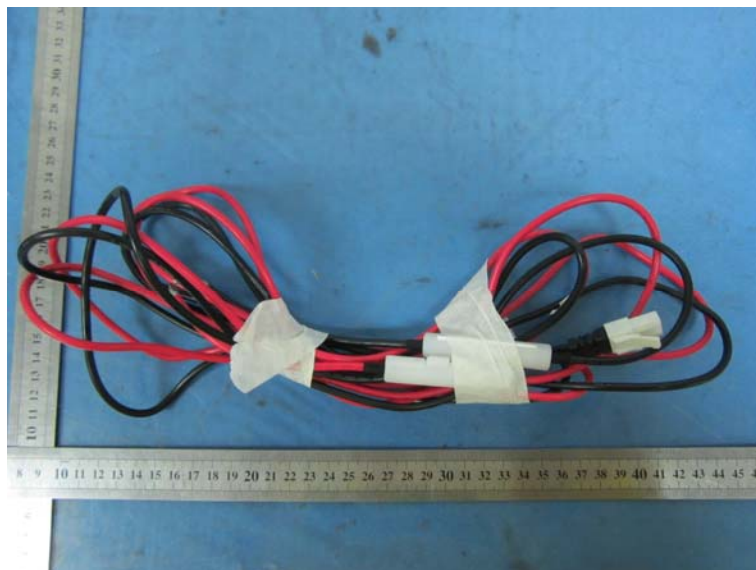


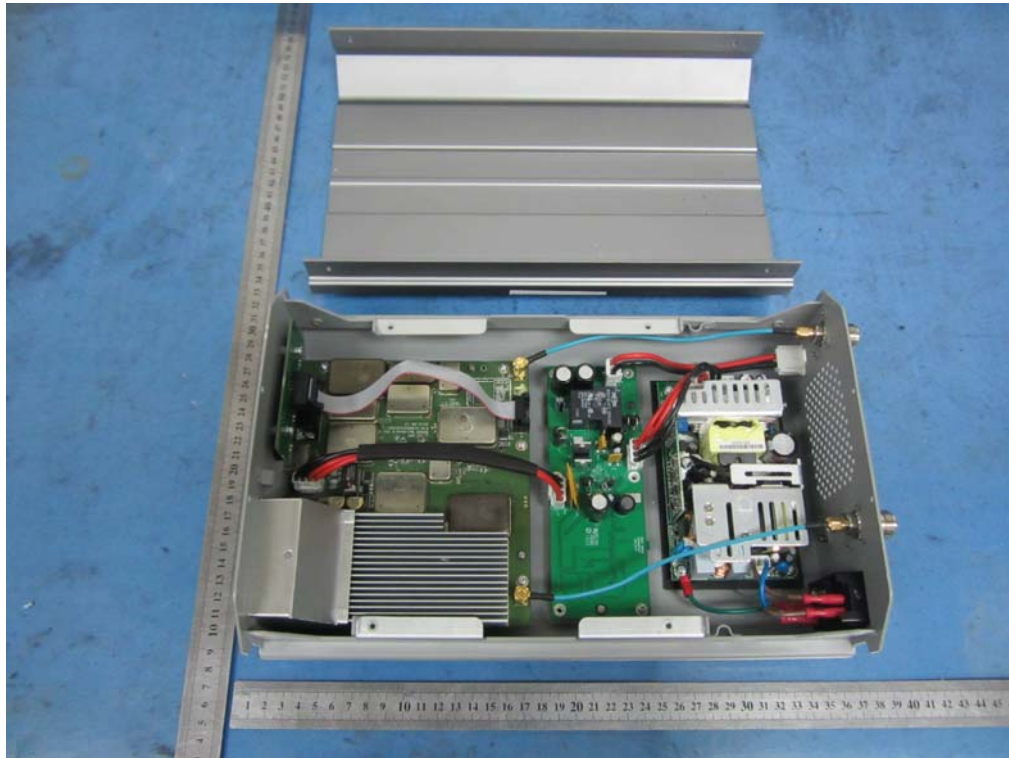
6. External and Internal Photos of the EUT

External photos of the EUT

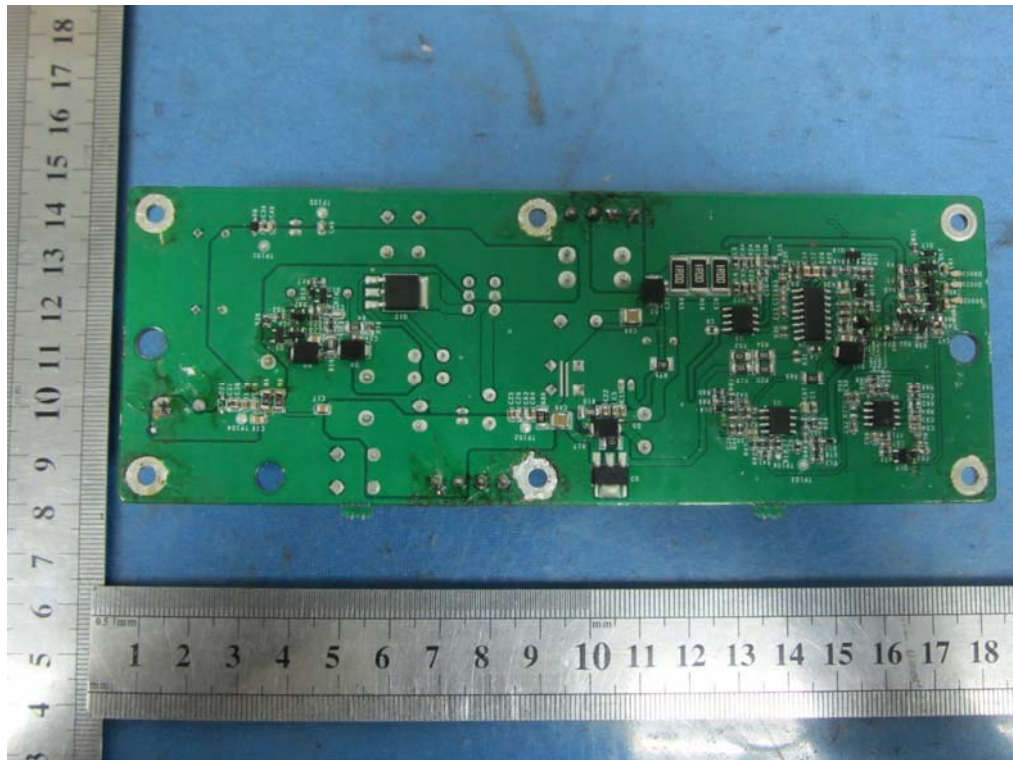


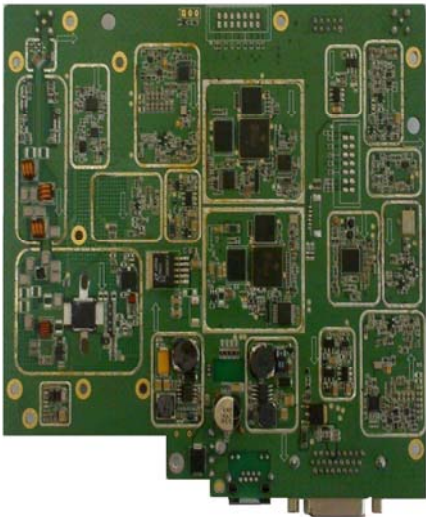
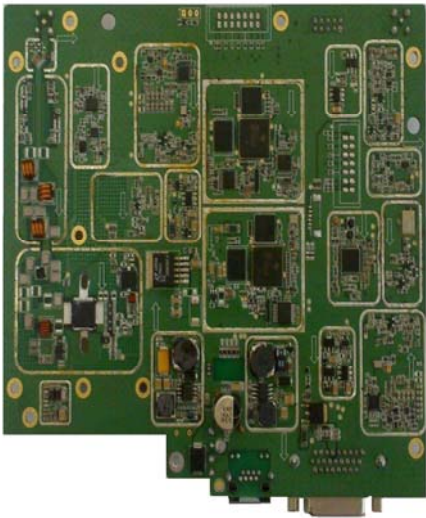


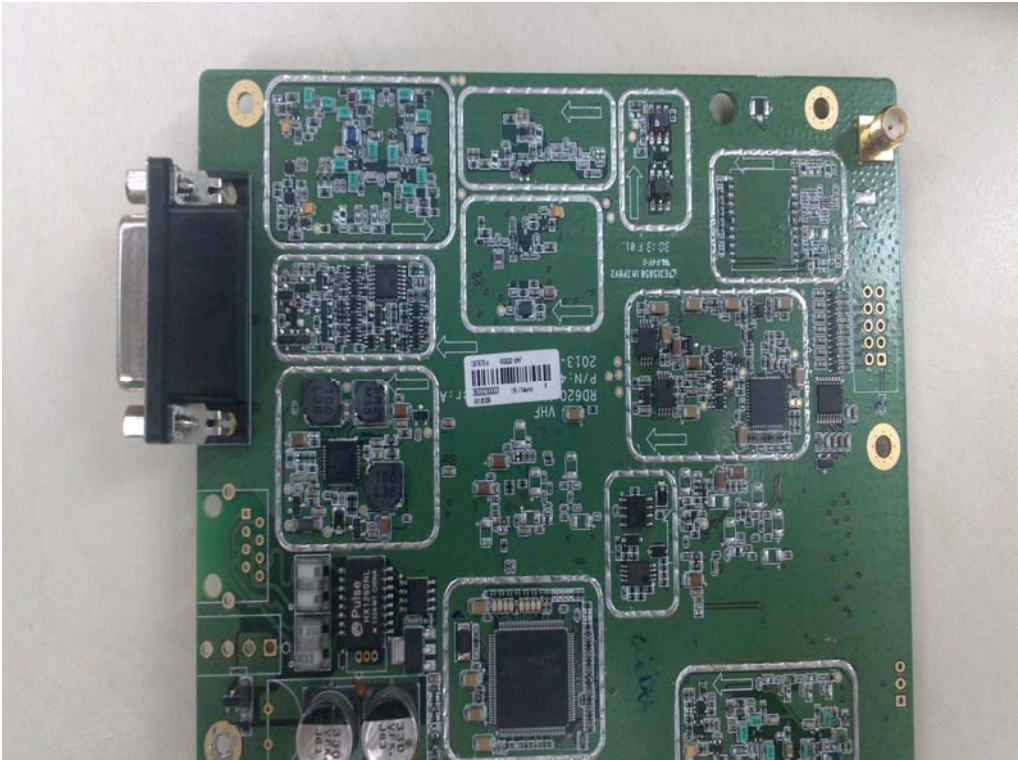


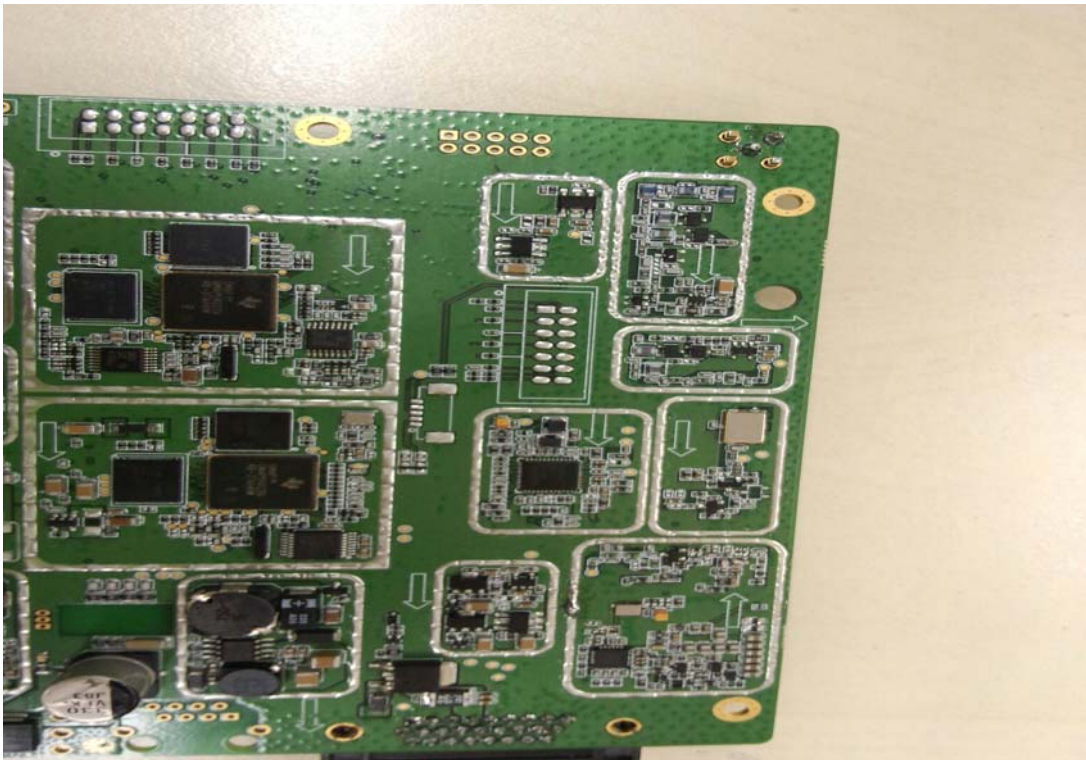
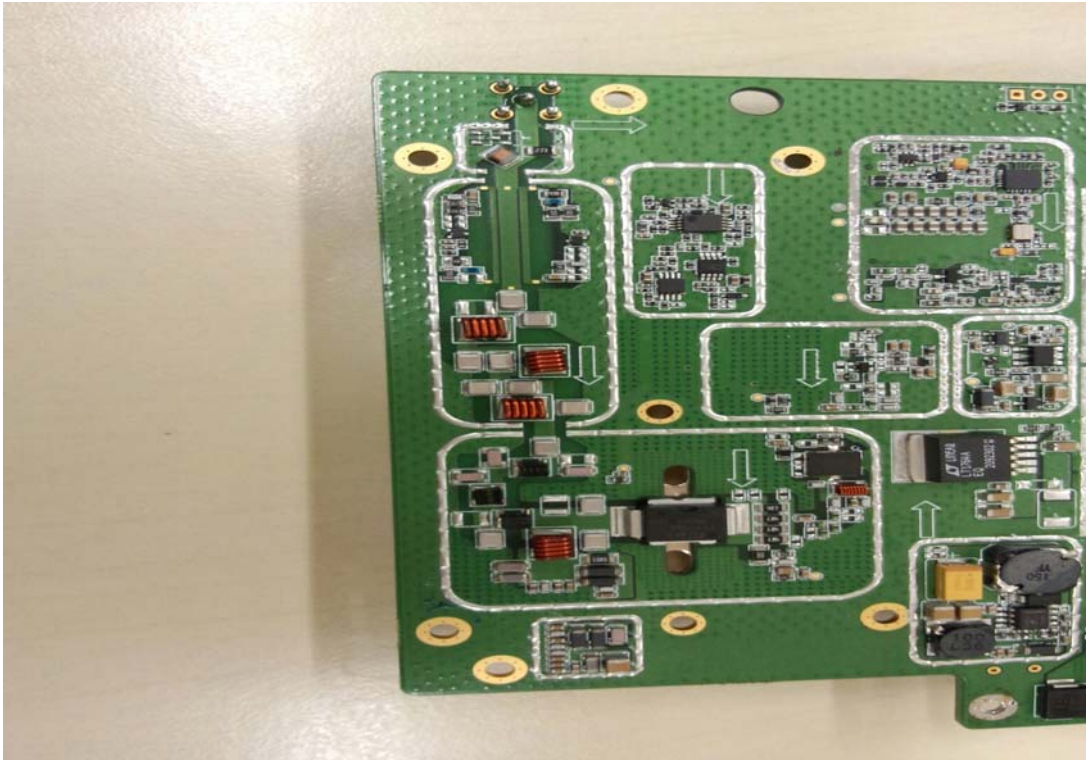
Internal photos of the EUT











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