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TEST REPORT

Report Reference No. ..... :	**TRE1405009001**	**R/C…….: 40766**
FCC ID ..... :	**YAMMD65XVHF**	
Applicant's name ..... :	**Hytera Communications Co.,Ltd**	
Address.....:	HYT Tower,Hi-Tech Industrial Park North, Nanshan District, Shenzhen China	
Manufacturer.....:	Hytera Communications Co.,Ltd	
Address.....:	HYT Tower,Hi-Tech Industrial Park North, Nanshan District, Shenzhen China	
Test item description ..... :	**Digital Mobile Radio**	
Trade Mark .....:	Hytera	
Model/Type reference.....:	MD650 VHF	
Listed Model(s) .....:	MD652 VHF,MD655 VHF, MD656 VHF, MD658 VHF	
Standard ..... :	**FCC Part 90/FCC Part 2/ FCC Part 15B**	
Date of receipt of test sample……..:	May 10, 2014	
Date of testing……:	May 10, 2014- Jun 05, 2014	
Date of issue……...:	Jun 05, 2014	
Result.....……..:	**PASS**	

Compiled by		
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Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd**
Address.....:	Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China

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Contents

1. TEST STANDARDS AND TEST DESCRIPTION

1.1. Test Standards

The tests were performed according to following standards:
FCC Rules Part 90 :2013: Private land mobile radio services.
TIA/EIA 603 D:June 2010: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
FCC Part 15 Subpart B:2013 - Unintentional Radiators
FCC Part 2: 2013 Frequency allocations and radio treaty matters, general rules and regulations.

1.2. 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	PASS
FCC Part 15.109	Receiver Conducted Spurious Emssion	PASS

Remark: 1.The measurement uncertainty is not included in the test result.

2. SUMMARY

2.1. Client Information

Applicant:	Hytera Communications Co.,Ltd
Address:	HYT Tower, Hi-tech Industrial Park North,Nanshan District, Shenzhen China
Manufacturer:	Hytera Communications Co.,Ltd
Address:	HYT Tower, Hi-tech Industrial Park North,Nanshan District, Shenzhen China

2.2. Product Description

Name of EUT	Digital Mobile Radio	
Trade Mark:	Hytera	
Model/Type reference:	MD650 VHF	
Listed Model(s):	\	
Operation Frequency:	From 136 MHz to 174 MHz	
Rated Output Power:	25 Watts(43.98dBm)/1 Watts(30.00dBm)	
Support data rate:	9.6kbps	
Modilation Type:	FM for Analog Voice	
	4FSK for Digital Voice / Digital Data	
Channel Separation:	Analog Voice	12.5KHz
	Digital Voice/Data	12.5KHz
	Digital Data	12.5KHz
Antenna Type:	External	

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

Test frequency list

Modulation Type	Test Channel	Test Frequency (MHz)
Analog/FM Digital/4FSK	Lowest channel	138.5
	Middle channel	155.0
	Highest channel	173.5

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above listed frequency for testing.

2.3. 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 at maximum rated power for transmitter,powered by DC 13.60V
Op 2	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 3	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 4	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
Op 5	FM+BW12.5KHz+RX	The equipment is set with FM modulation and 12.5KHz bandwidth at receiver or standby,powered by DC 13.60V
Op 6	4FSK+BW12.5KHz+RX	The equipment is set with 4FSK modulation and 12.5KHz bandwidth receiver or standby,powered by DC 13.60V

2.4. 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. :	/

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

This submittal(s) (test report) is intended for FCC ID:YAMMD65XVHF filing to comply with FCC Part 90 rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

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 June. 01, 2012, valid time is until Jun. 01, 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 Dec. 30, 2013, valid time is until Dec. 21, 2016.

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. 23, 2013. Valid time is until Dec. 22, 2016.

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 06, 2013. Valid time is until May 05, 2016.

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
lative Humidity:	30~60 %
Air Pressure:	950~1050mba

3.4. 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.

3.5. 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	10/25/2014
EMI Test Receiver	Rohde&Schwarz	ESCS 30	100038	10/25/2014
Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	10/25/2014
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/25/2014

DC Power Conducted Emission				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Artificial Mains	Rohde&Schwarz	ESH2-Z6	100210	10/25/2014
Artificial Mains	Rohde&Schwarz	ESH2-Z6	100211	10/25/2014
EMI Test Receiver	Rohde&Schwarz	ESCS 30	100038	10/25/2014
Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	10/25/2014
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/25/2014

Modulation Characteristic				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/25/2014

Frequency Stability				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/25/2014
Signal Generator	Rohde&Schwarz	SMT03	100059	10/25/2014
Climate Chamber	ESPEC	EL-10KA	05107008	10/25/2014

Transmitter Radiated Spurious Emssion				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Ultra-Broadband Antenna	Rohde&Schwarz	HL562	100015	10/25/2014
EMI Test Receiver	Rohde&Schwarz	ESI 26	100009	10/25/2014
RF Test Panel	Rohde&Schwarz	TS / RSP	335015/ 0017	N/A
HORN ANTENNA	Rohde&Schwarz	HF906	100039	10/25/2014
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	10/25/2014
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	10/25/2014
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	10/25/2014
HORN ANTENNA	ShwarzBeck	9120D	1012	10/25/2014
HORN ANTENNA	ShwarzBeck	9120D	1011	10/25/2014
TURNTABLE	MATURO	TT2.0	----	N/A
ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A

Maximum Transmitter Power & Spurious Emssion On Antenna Port & Occupied Bandwidth & Emission Mask				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Receiver	Rohde&Schwarz	ESI 26	100009	10/25/2014
Attenuator	R&S	ESH3-22	100449	10/25/2014
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/25/2014
High-Pass Filter	Anritsu	MP526B	6220875256	10/25/2014
High-Pass Filter	Anritsu	MP526D	6220878392	10/25/2014
Spectrum Analzyer	Aglient	E4407B	MY44210775	10/25/2014
Spectrum Analzyer	Rohde&Schwarz	FSP40	1164.4391.40	10/25/2014

Transient Frequency Behavior				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Signal Generator	Rohde&Schwarz	SMT03	100059	10/25/2014
Storage Oscilloscope	Tektronix	TDS3054B	B033027	10/25/2014
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/25/2014

The calibration interval was one year.

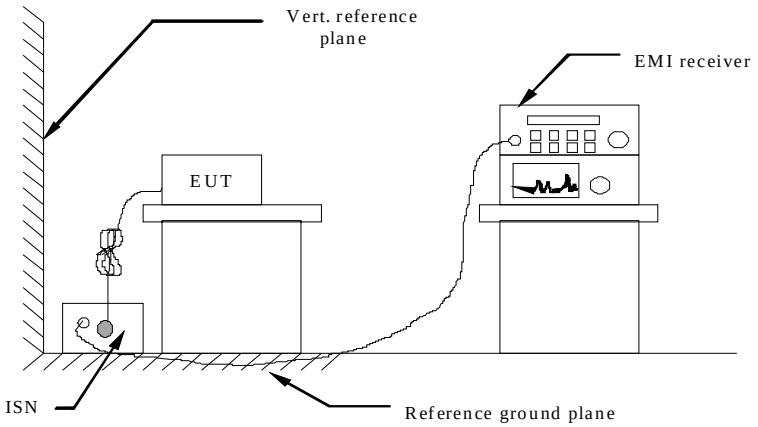
4. TEST CONDITIONS AND RESULTS

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



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 (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

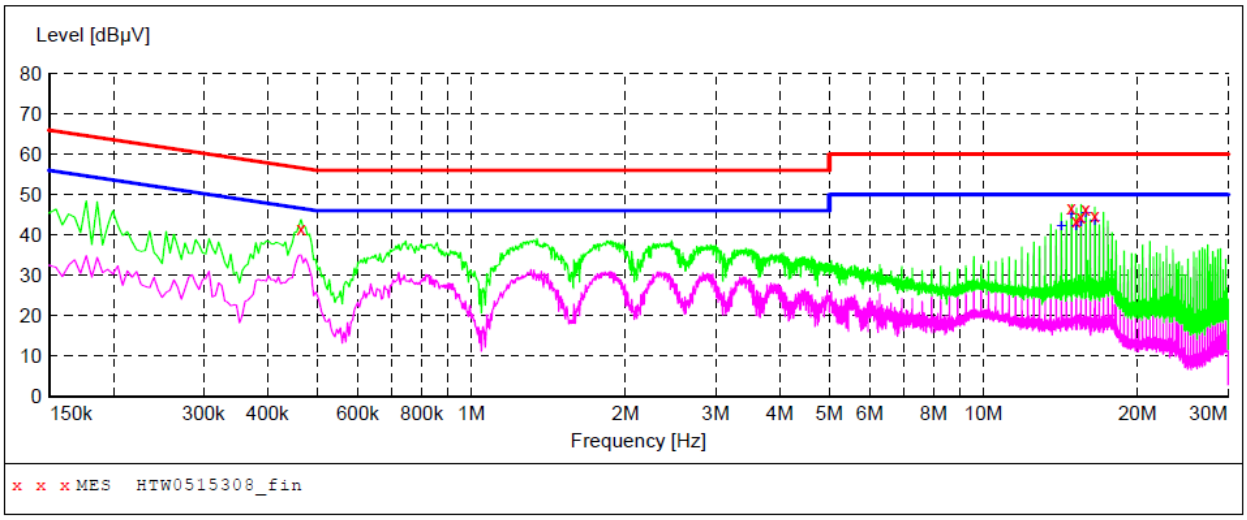
TEST RESULTS

Remark: we tested all Op 1 to Op 6, recorded worst case at Op 1 and Op 3.

Test mode:	*OP 1*	*Polarization*	+

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "HTW0515308_fin"

5/15/2014 4:49PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.465000	41.50	10.4	57	15.1	QP	+	GND
14.838000	46.60	10.3	60	13.4	QP	+	GND
15.171000	43.40	10.4	60	16.6	QP	+	GND
15.499500	44.50	10.4	60	15.5	QP	+	GND
15.828000	46.40	10.4	60	13.6	QP	+	GND
16.489500	44.70	10.4	60	15.3	QP	+	GND

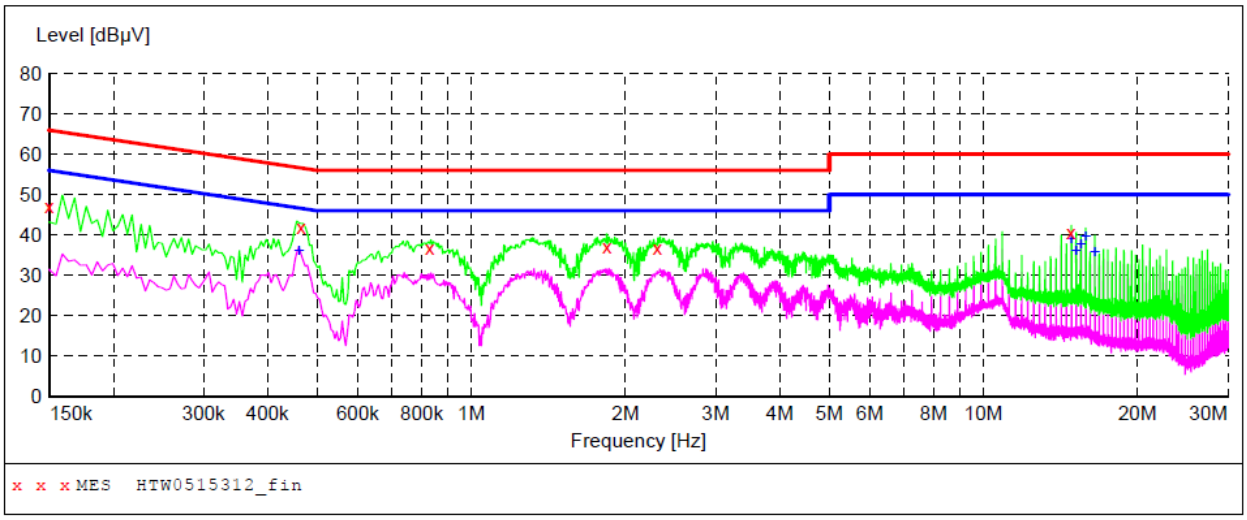
MEASUREMENT RESULT: "HTW0515308_fin2"

5/15/2014 4:49PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
14.181000	42.40	10.3	50	7.6	AV	+	GND
14.838000	45.20	10.3	50	4.8	AV	+	GND
15.171000	42.30	10.4	50	7.7	AV	+	GND
15.499500	43.20	10.4	50	6.8	AV	+	GND
15.828000	45.50	10.4	50	4.5	AV	+	GND
16.489500	43.50	10.4	50	6.5	AV	+	GND

Test mode:	*OP 1*	*Polarization*	-

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



MEASUREMENT RESULT: "HTW0515312_fin"

5/15/2014 5:02PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	47.00	10.2	66	19.0	QP	-	GND
0.465000	42.00	10.4	57	14.6	QP	-	GND
0.829500	36.80	10.1	56	19.2	QP	-	GND
1.842000	37.20	10.2	56	18.8	QP	-	GND
2.305500	36.70	10.2	56	19.3	QP	-	GND
14.833500	40.60	10.3	60	19.4	QP	-	GND

MEASUREMENT RESULT: "HTW0515312_fin2"

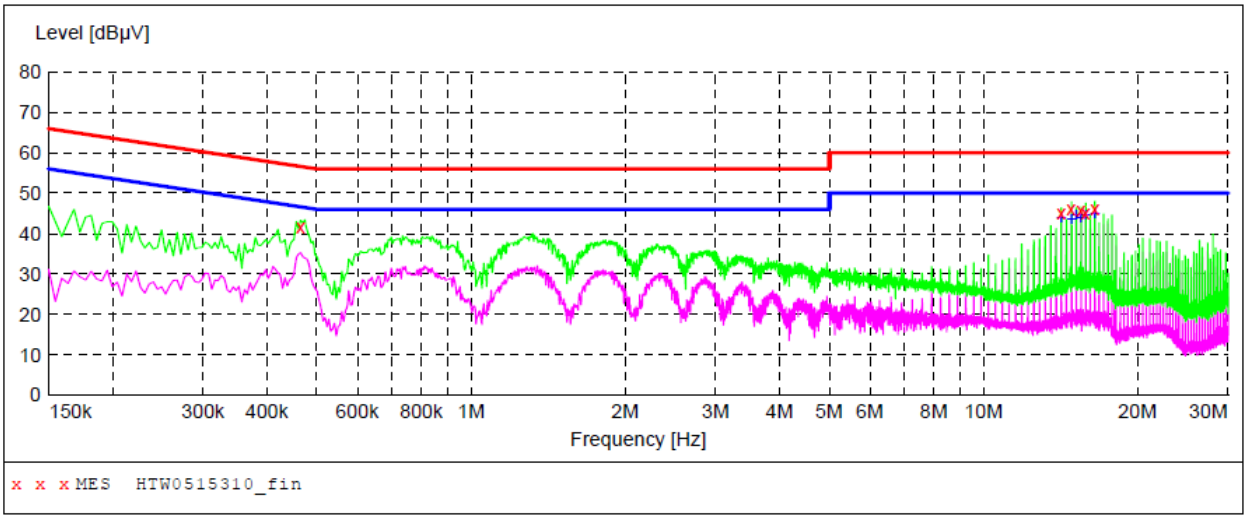
5/15/2014 5:02PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.460500	36.20	10.4	47	10.5	AV	-	GND
14.833500	39.20	10.3	50	10.8	AV	-	GND
15.166500	36.10	10.4	50	13.9	AV	-	GND
15.495000	37.60	10.4	50	12.4	AV	-	GND
15.823500	39.70	10.4	50	10.3	AV	-	GND
16.480500	35.80	10.4	50	14.2	AV	-	GND

Test mode:	*OP 3*	*Polarization*	+

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "HTW0515310_fin"

5/15/2014 4:57PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.465000	41.60	10.4	57	15.0	QP	+	GND
14.176500	45.20	10.3	60	14.8	QP	+	GND
14.838000	46.10	10.3	60	13.9	QP	+	GND
15.495000	45.70	10.4	60	14.3	QP	+	GND
15.828000	45.00	10.4	60	15.0	QP	+	GND
16.485000	46.20	10.4	60	13.8	QP	+	GND

MEASUREMENT RESULT: "HTW0515310_fin2"

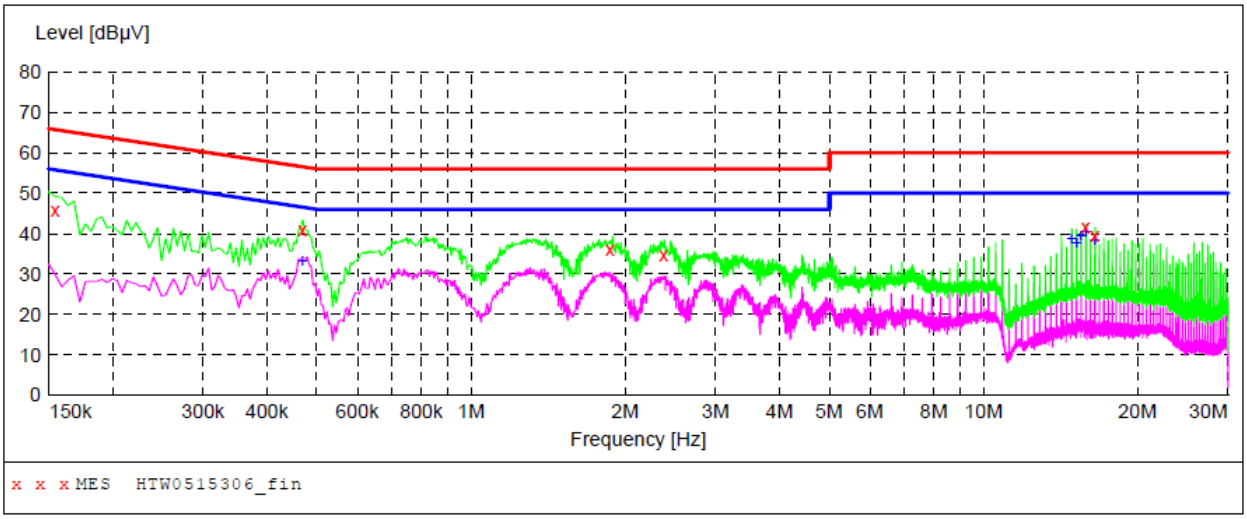
5/15/2014 4:57PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
14.176500	44.20	10.3	50	5.8	AV	+	GND
14.833500	43.90	10.3	50	6.1	AV	+	GND
15.166500	44.70	10.4	50	5.3	AV	+	GND
15.495000	44.20	10.4	50	5.8	AV	+	GND
15.823500	44.90	10.4	50	5.1	AV	+	GND
16.485000	45.10	10.4	50	4.9	AV	+	GND

Test mode:	*OP 3*	*Polarization*	-

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "HTW051506_fin"

5/15/2014 4:40PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	45.90	10.2	66	19.9	QP	-	GND
0.469500	40.80	10.4	57	15.7	QP	-	GND
1.869000	36.00	10.2	56	20.0	QP	-	GND
2.377500	34.90	10.2	56	21.1	QP	-	GND
15.832500	41.80	10.4	60	18.2	QP	-	GND
16.494000	39.70	10.4	60	20.3	QP	-	GND

MEASUREMENT RESULT: "HTW0515306_fin2"

5/15/2014 4:40PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.469500	33.30	10.4	47	13.2	AV	-	GND
14.842500	38.80	10.3	50	11.2	AV	-	GND
15.175500	37.90	10.4	50	12.1	AV	-	GND
15.504000	39.60	10.4	50	10.4	AV	-	GND
15.832500	40.50	10.4	50	9.5	AV	-	GND
16.494000	38.40	10.4	50	11.6	AV	-	GND

4.2. Maximum Transmitter Power

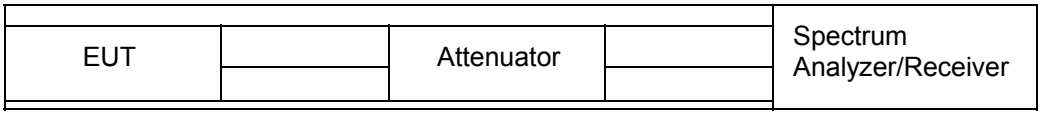
TEST APPLICABLE

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 bellow:
If the power output is adjustable, measurements shall be made for the highest and lowest power levels.
The EUT connect to the Receiver through 20 dB attenuator.
Measurement with Spectrum Analyzer FSP40 conducted, external power supply with 13.60 V stabilized supply voltage.

TEST CONFIGURATION



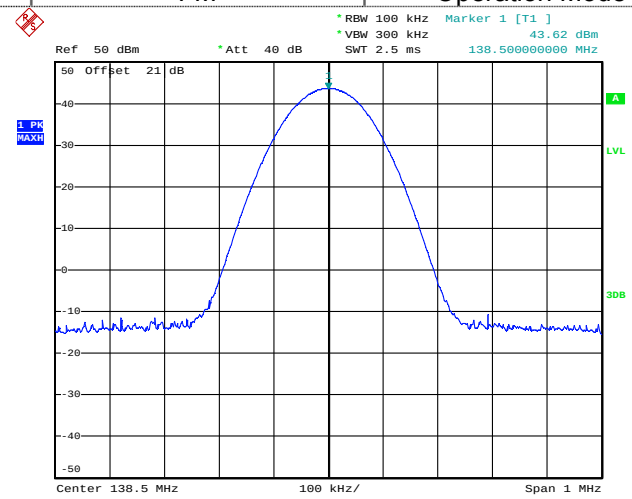
The EUT was directly connected to a RF Communication
Test set by a 20 dB attenuator

TEST RESULTS

Modulation Type	Channel Sparation	Operation Mode	Test Channel	Test Frequency (MHz)	Test Results (dBm)
Analog/FM	12.5KHz	Op 1	Ch1	138.5	43.62
			Ch2	155.0	44.13
			Ch3	173.5	44.30
		Op 2	Ch1	138.5	30.52
			Ch2	155.0	30.31
			Ch3	173.5	30.46
Digital/4FSK	12.5KHz	Op 5	Ch1	138.5	43.66
			Ch2	155.0	44.62
			Ch3	173.5	44.46
		Op 6	Ch1	138.5	30.66
			Ch2	155.0	30.36
			Ch3	173.5	30.14
Limit	**The output power shall be within ±1.0 dB of the manufacturer's rated power.**				
Test Results	**PASS**				

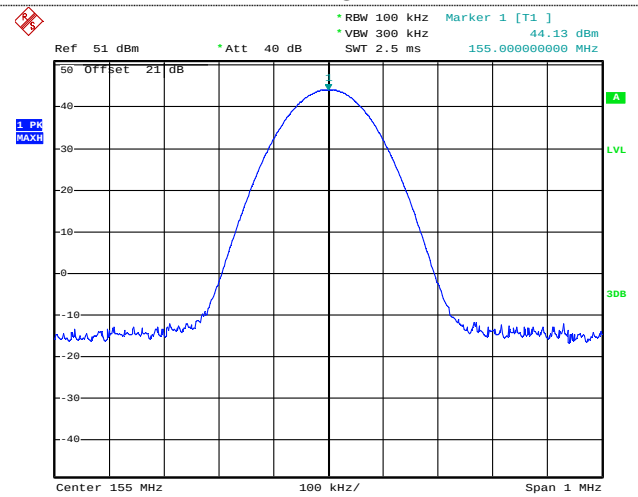
Test plot as follows:

Modulation Type	FM	Operation Mode	Op 1



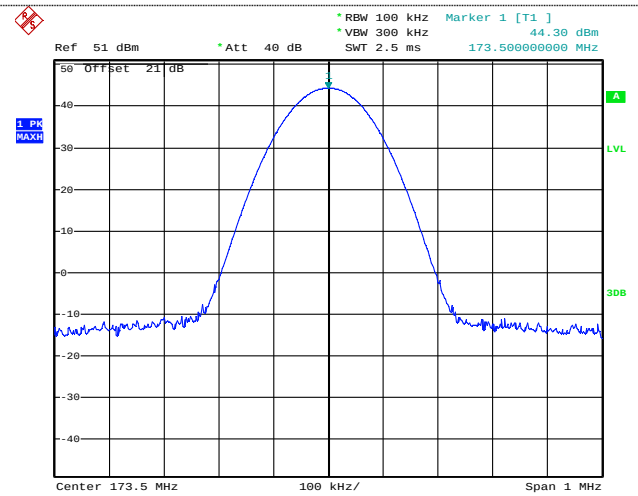
Date: 3.JUL.2014 15:53:37

CH1



Date: 4.JUN.2014 15:30:16

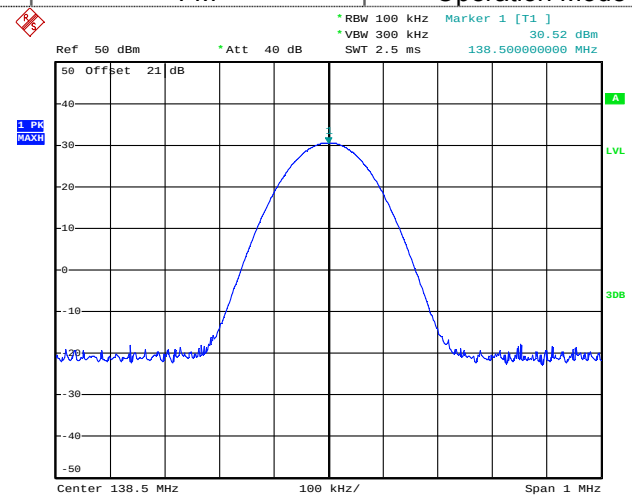
CH2



Date: 4.JUN.2014 15:30:33

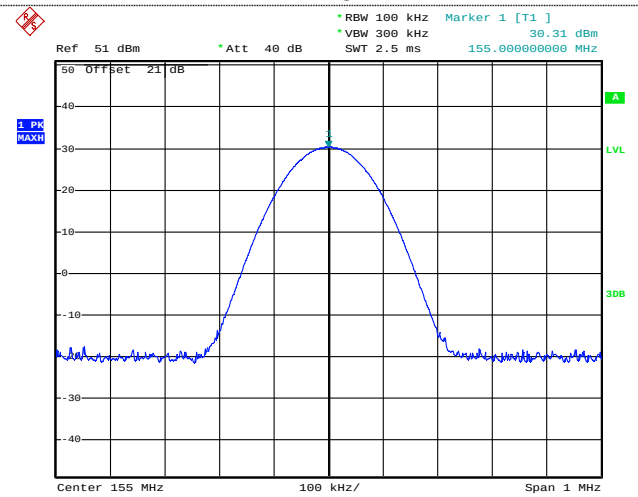
CH3

Modulation Type	FM	Operation Mode	Op 2



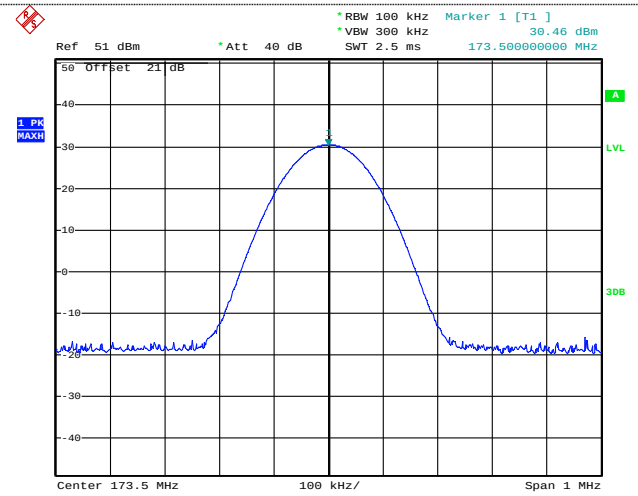
Date: 3.JUL.2014 16:04:37

CH1



Date: 4.JUN.2014 15:32:33

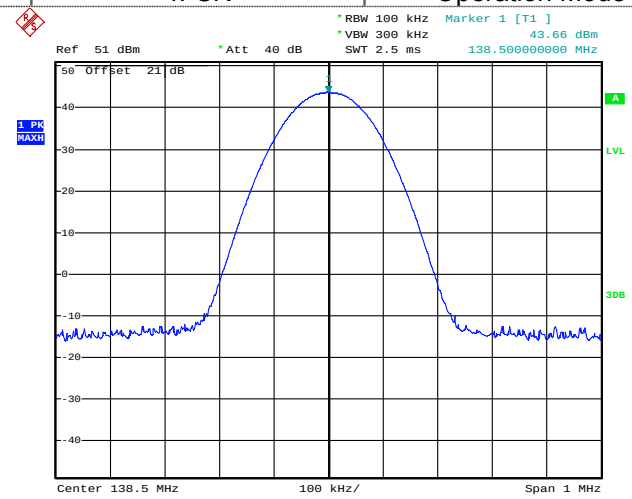
CH2



Date: 4.JUN.2014 15:50:30

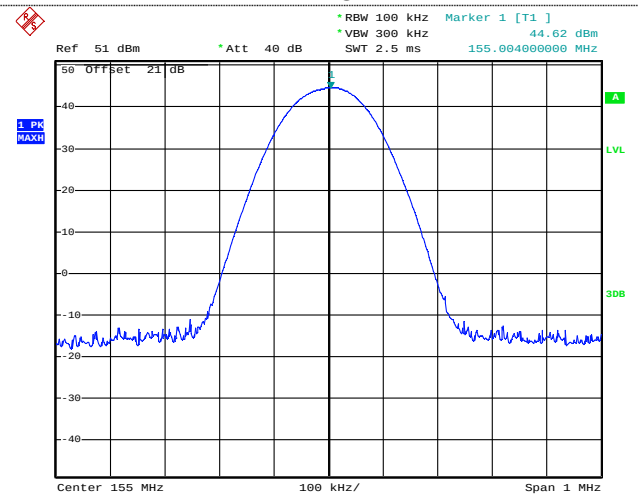
CH3

Modulation Type	4FSK	Operation Mode	Op 3



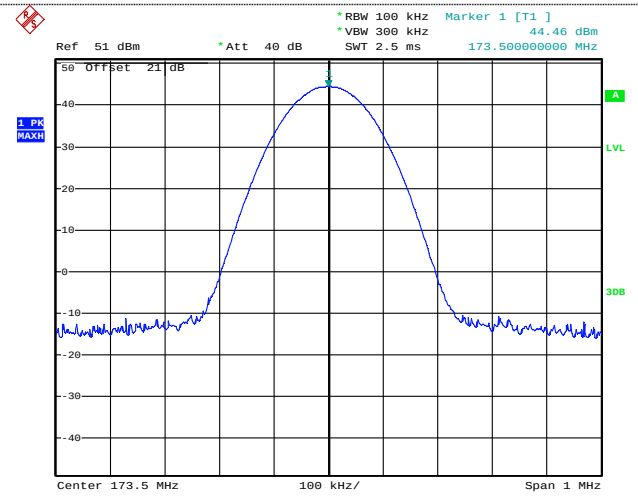
Date: 3.JUL.2014 16:19:31

CH1



Date: 4.JUN.2014 15:39:33

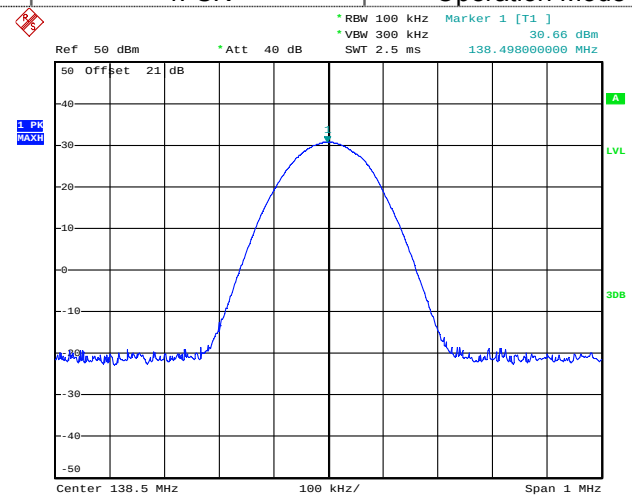
CH2



Date: 4.JUN.2014 15:39:59

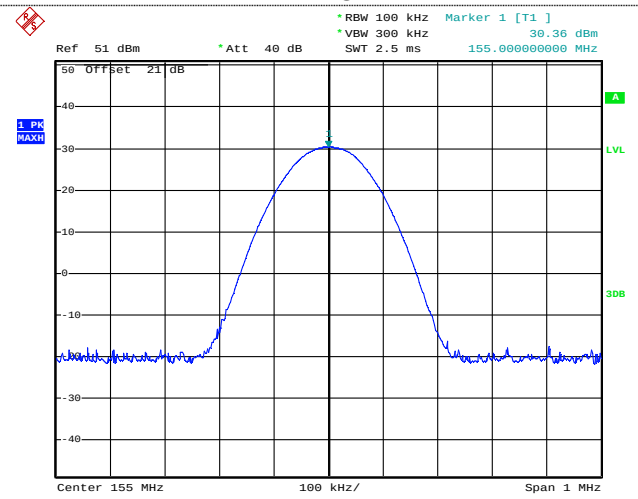
CH3

Modulation Type	4FSK	Operation Mode	Op 4



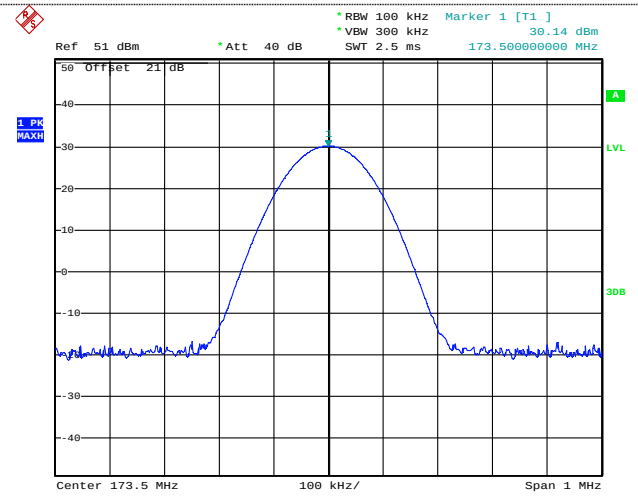
Date: 3.JUL.2014 16:28:40

CH1



Date: 4.JUN.2014 15:40:25

CH2



Date: 4.JUN.2014 15:50:55

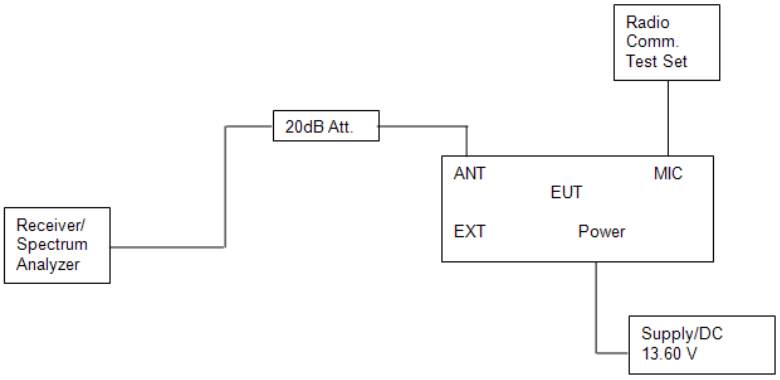
CH3

4.3. 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 f0 to 5.625 kHz removed from f0: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd -2.88 kHz) dB.
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

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

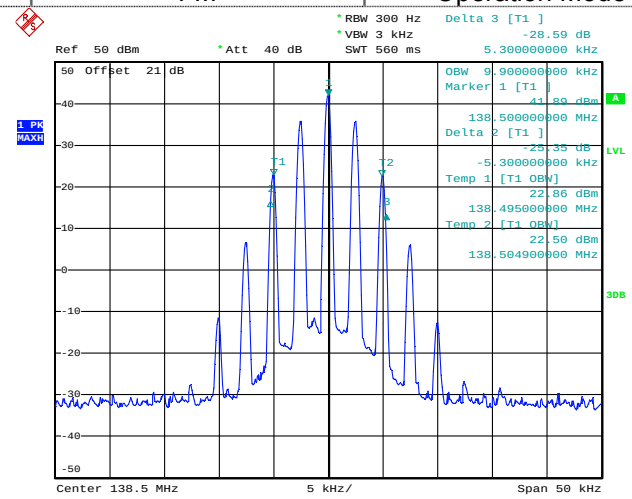
Remark:We tested Op 1 to Op 4,reocrded worst case at Op 1,Op 3

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	138.5	9.90	10.60
			Ch2	155.0	9.90	10.60
			Ch3	174.5	9.90	10.60
Digital/4FSK	12.5KHz	Op 3	Ch1	138.5	7.40	10.40
			Ch2	155.0	7.60	9.70
			Ch3	174.5	7.70	9.90
Limit			**11.25KHz for 12.5KHz Channel Separtion**			
Test Results			**PASS**			

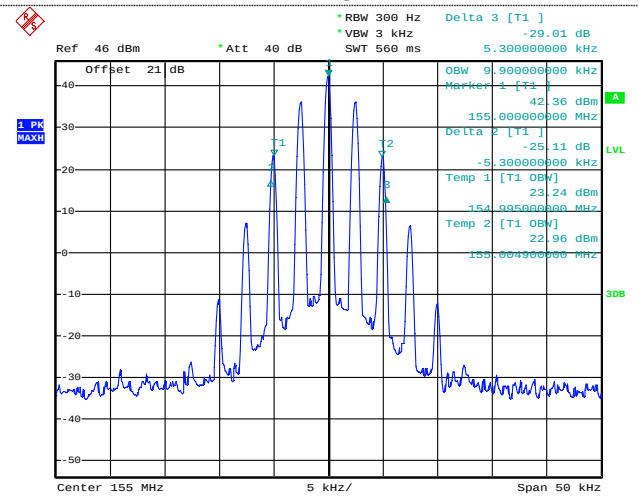
Test plot as follows:

Modulation Type	FM	Operation Mode	Op 1



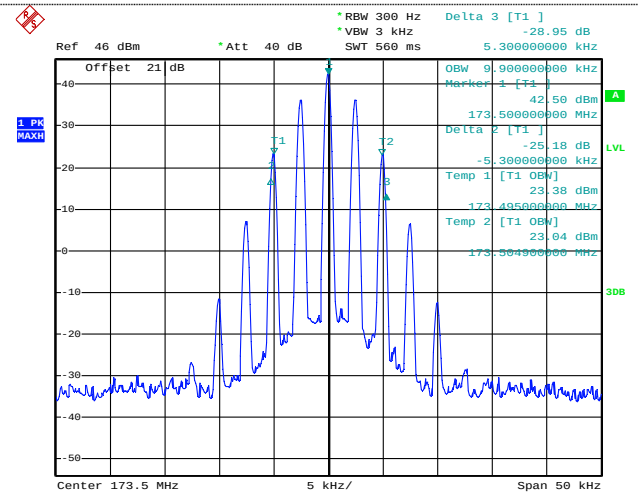
Date: 3.JUL.2014 15:30:20

CH1



Date: 4.JUN.2014 17:31:19

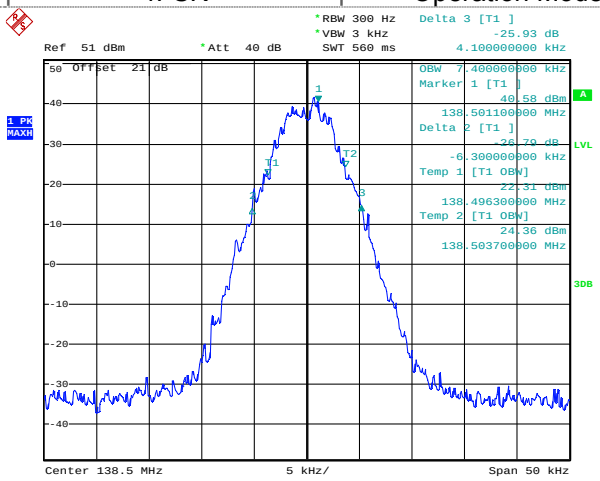
CH2



Date: 4.JUN.2014 17:31:50

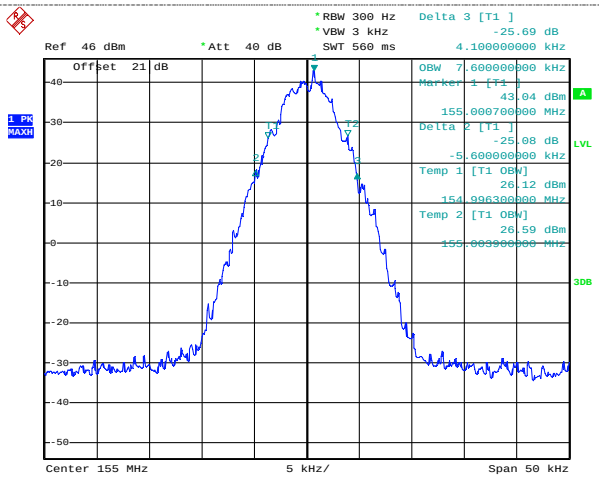
CH3

Modulation Type	4FSK	Operation Mode	Op 3



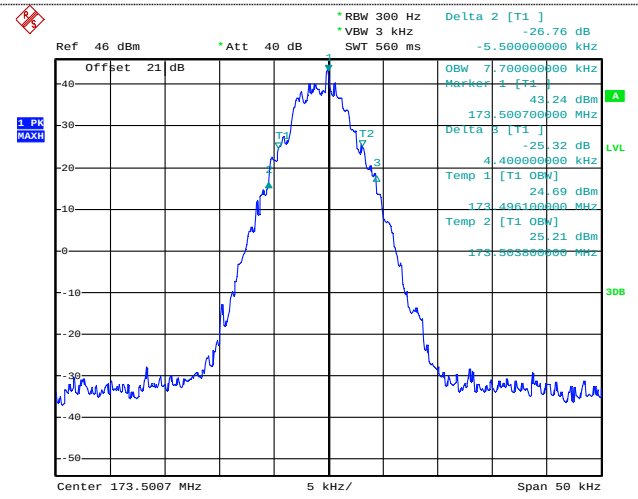
Date: 3.JUL.2014 16:20:59

CH1



Date: 4.JUN.2014 17:51:02

CH2



Date: 4.JUN.2014 17:49:21

CH3

4.2.2 Emission Mask

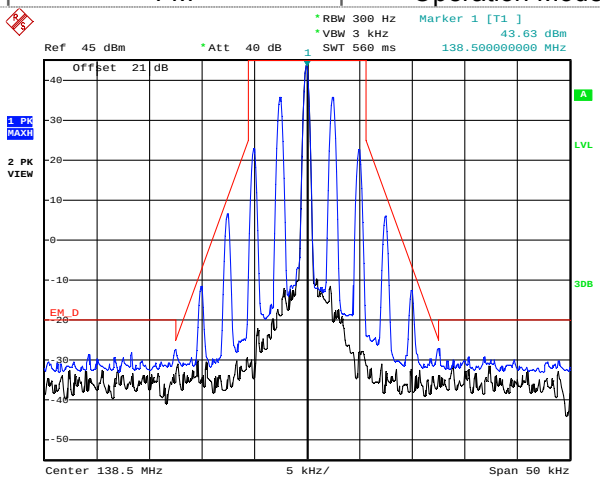
Modulation Type	Channel Sparation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)
Analog/FM	12.5KHz	Op 1	Ch1	138.5	D	300
			Ch2	155.5	D	300
			Ch3	173.5	D	300
Digital/4FSK	12.5KHz	Op3	Ch1	138.5	D	300
			Ch2	155.5	D	300
			Ch3	173.5	D	300
Test Results			**PASS**			

Test plot as follows:

Note:

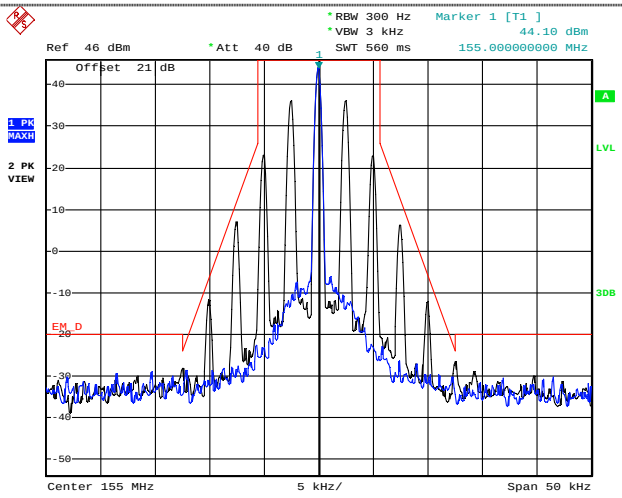
Referred as the attached plot herein after.The Blue curve represents unmodulated signal.The Black curve represents modulated signal.

Modulation Type	FM	Operation Mode	Op 1



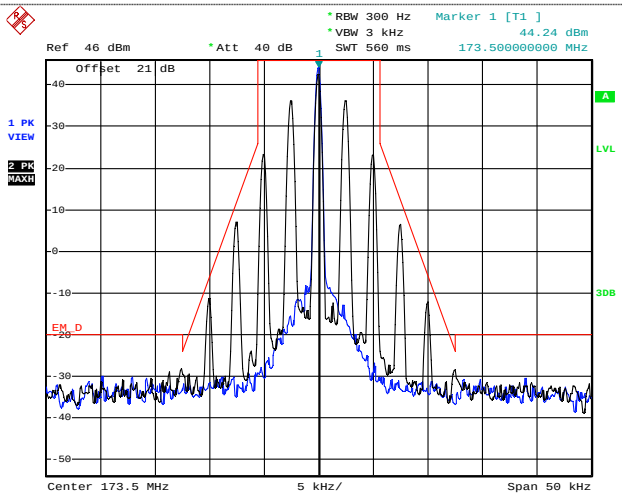
Date: 3.JUL.2014 15:43:34

CH1



Date: 4.JUN.2014 17:30:17

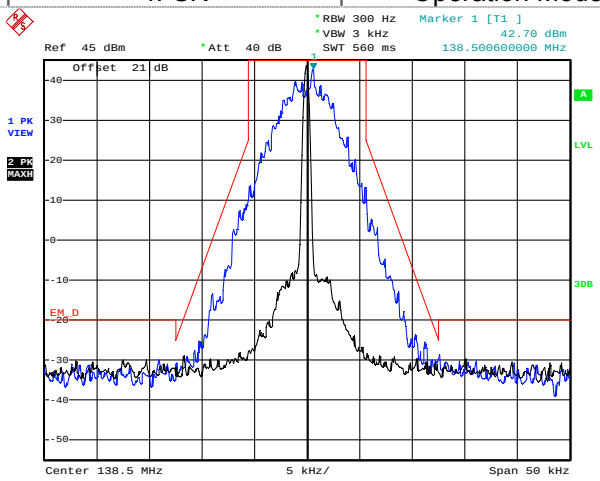
CH2



Date: 4.JUN.2014 17:32:27

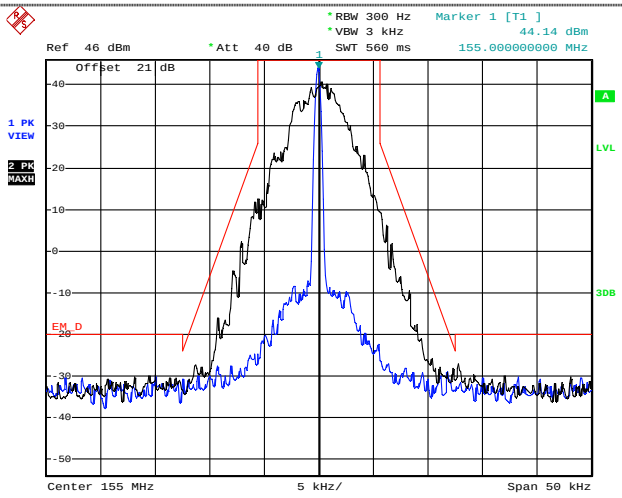
CH3

Modulation Type	4FSK	Operation Mode	Op 3



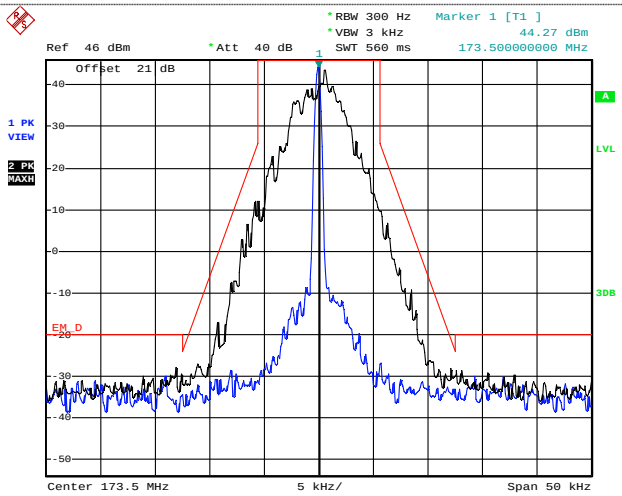
Date: 3.JUL.2014 16:24:00

CH1



Date: 4.JUN.2014 17:46:05

CH2



Date: 4.JUN.2014 17:47:14

CH3

4.4. Modulation Charcateristics

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

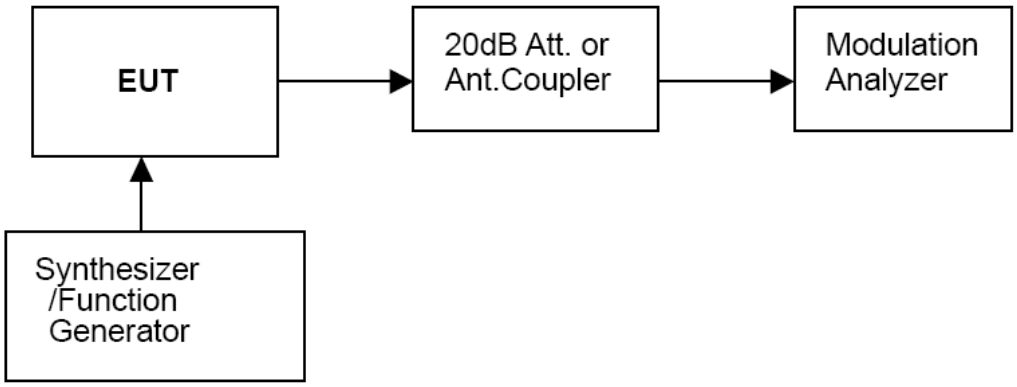
Modulation Limit

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 =20log10 (Deviation of test frequency/Deviation of 1 KHz reference).

TEST CONFIGURATION



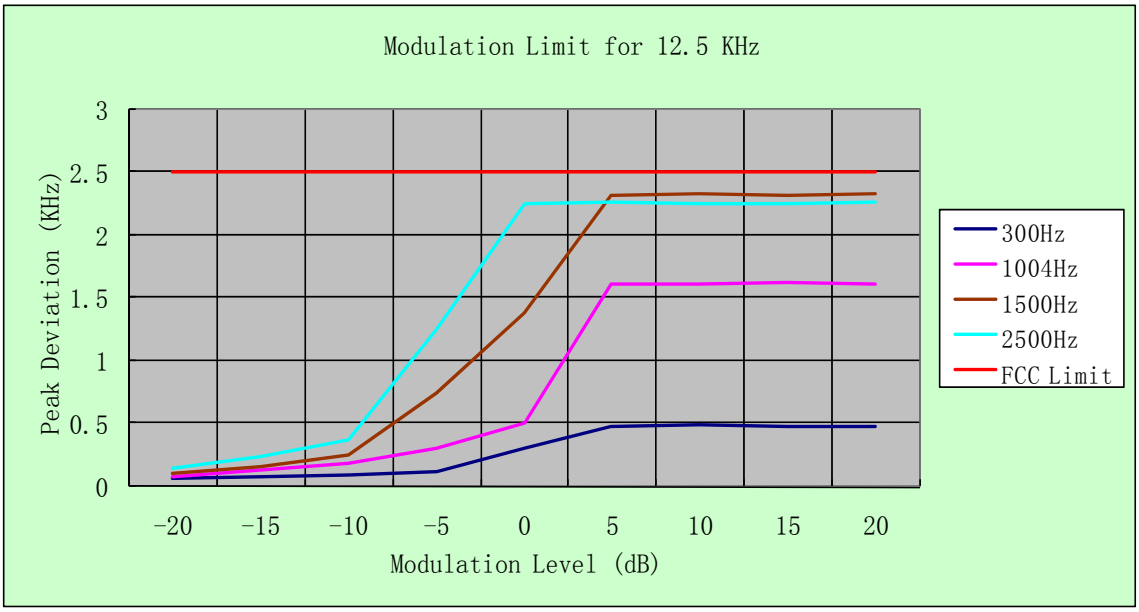
TEST RESULTS

Remark:We tested Op 1 to Op 2.recorded worst case at Op 1.

a).Modulation Limit:

Op1				
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	0.06	0.08	0.11	0.15
-15	0.07	0.13	0.16	0.24
-10	0.09	0.19	0.26	0.38
-5	0.12	0.31	0.75	1.26
0	0.30	0.50	1.39	2.26
+5	0.48	1.61	2.32	2.27
+10	0.49	1.61	2.33	2.26
+15	0.48	1.62	2.32	2.25
+20	0.47	1.61	2.33	2.27

Plot:



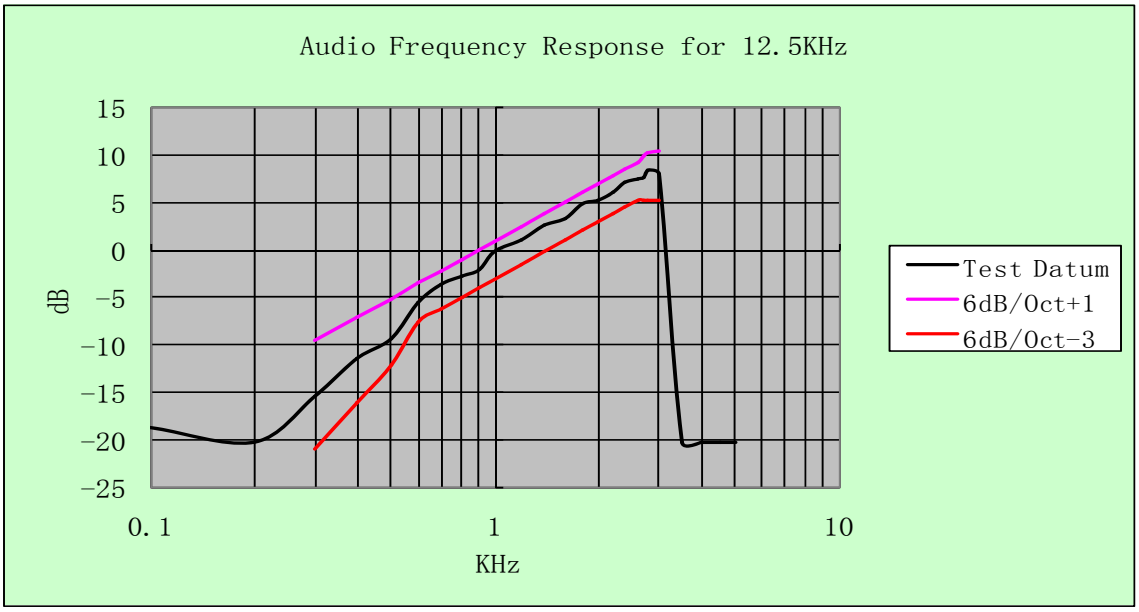
b). Audio Frequency Response:

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.

Note:
1. Not applicable to new standard. However, tests are conducted under IC's recommendation.
2. The Audio Frequency Response is identical for 12.5 KHz and 25KHz channel separation

Op 1			
Frequency (KHz)	Frequency Deviation (KHz)	1KHz Refenerce Deviation (KHz)	Audio Frequency Response (dB)
0.1	0.06	0.51	-18.59
0.2	0.05	0.51	-20.17
0.3	0.09	0.51	-15.32
0.4	0.14	0.51	-11.33
0.5	0.18	0.51	-9.21
0.6	0.27	0.51	-5.41
0.7	0.34	0.51	-3.50
0.8	0.38	0.51	-2.66
0.9	0.40	0.51	-2.02
1.0	0.51	0.51	0.00
1.2	0.59	0.51	1.21
1.4	0.69	0.51	2.65
1.6	0.76	0.51	3.43
1.8	0.91	0.51	5.00
2.0	0.95	0.51	5.38
2.2	1.03	0.51	6.08
2.4	1.16	0.51	7.13
2.6	1.21	0.51	7.51
2.7	1.23	0.51	7.66
2.8	1.36	0.51	8.50
3.0	1.29	0.51	8.08
3.5	0.05	0.51	-20.17
4.0	0.05	0.51	-20.17
4.5	0.05	0.51	-20.17
5.0	0.05	0.51	-20.17

Plot:



4.5. Frequency Stability Test

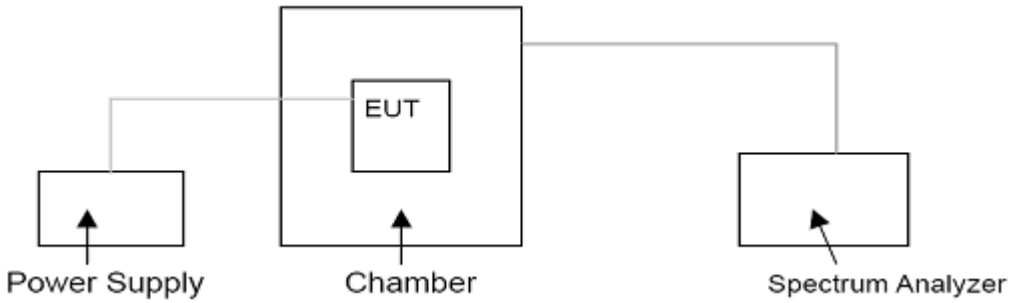
TEST APPLICABLE

1 According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30℃ to +60℃ centigrade.
2 According to FCC Part 2 Section 2.1055 (d) (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 2.5 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 4,recorded worst case at Op 1,Op 3

Op 1					
Channel Separation	Test conditions		Frequency error (ppm)		
	Voltage (V)	Temp (℃)	138.50	155.00	173.50
12.5KHz	13.6	-30	0.98	1.02	1.01
		-20	0.82	1.01	1.01
		-10	0.79	0.81	0.84
		0	0.75	0.77	0.81
		10	0.78	0.82	0.80
		20	0.65	0.76	0.78
		30	0.79	0.74	0.76
		40	0.83	0.81	0.81
		50	1.02	0.85	0.85
	11.56 (85% Rated)	20	0.88	0.70	0.78
	15.64(115% Rated)	20	0.81	0.84	0.75
Limit			2.5 ppm		

Op 3					
Channel Separation	Test conditions		Frequency error (ppm)		
	Voltage (V)	Temp (℃)	138.50	155.00	173.50
12.5KHz	13.6	-30	1.01	1.02	1.02
		-20	0.81	1.01	1.00
		-10	0.79	0.79	0.87
		0	0.74	0.76	0.80
		10	0.78	0.81	0.82
		20	0.54	0.75	0.77
		30	0.87	0.75	0.75
		40	0.93	0.82	0.82
		50	1.02	0.86	0.86
	11.56 (85% Rated)	20	0.87	0.75	0.77
	15.64(115% Rated)	20	0.78	0.88	0.77
Limit			2.5 ppm		

4.6. Transmitter Frequency Behavior

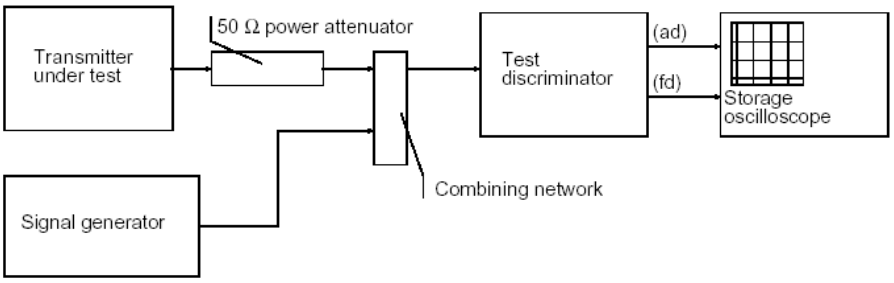
TEST APPLICABLE

Section 90.214
Transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

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

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

TEST 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:

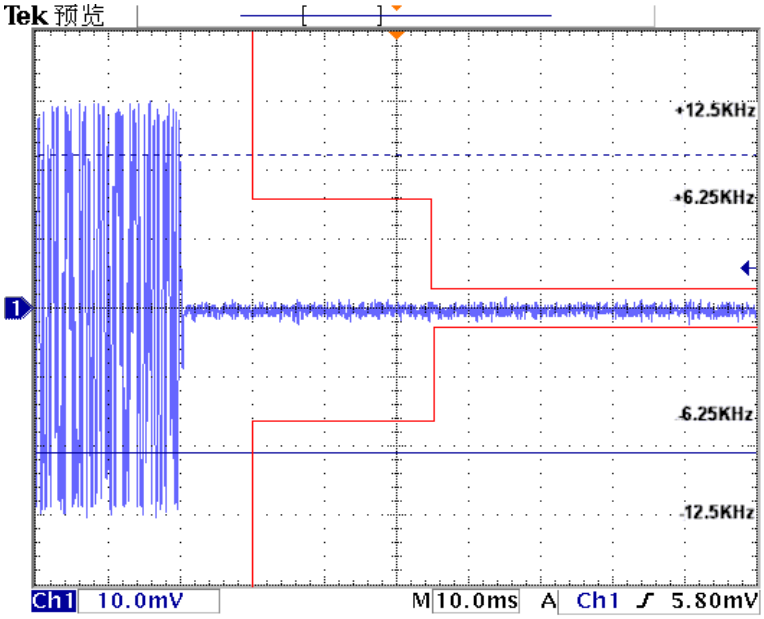
1. Connect DUT into Test discriminator and Storage Oscilloscope and keep DUT stats ON;
2. Inut 1KHz signal into DUT;
3. Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a single-shot turn-on of the transmitter signals;
4. Keep DUT in OFF state and Key the PTT;
5. 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;
6. Adjust the modulation domain anzlyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transmitter of the transmitter signal.
7. Keep the digital portable radio in ON state and Unkey the PTT;
8. 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

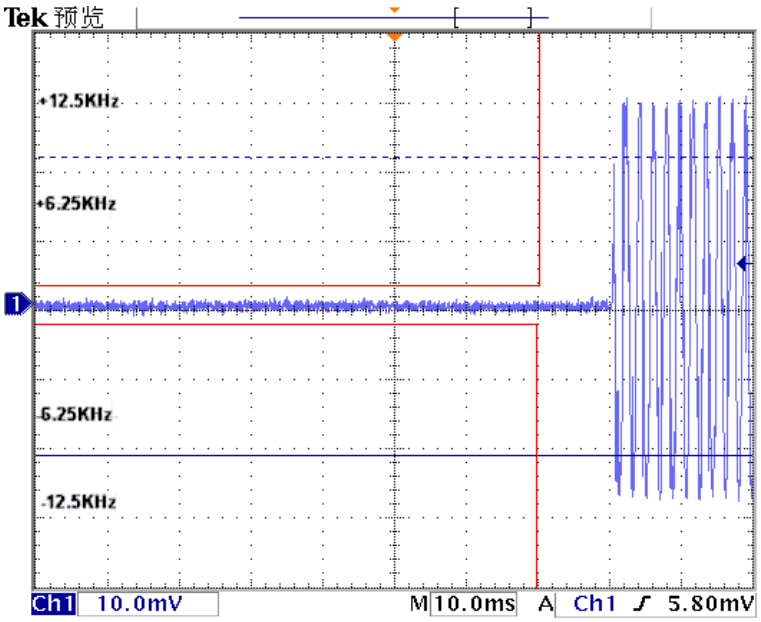
Please refer to the following plots.

Modulation Type: FM

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

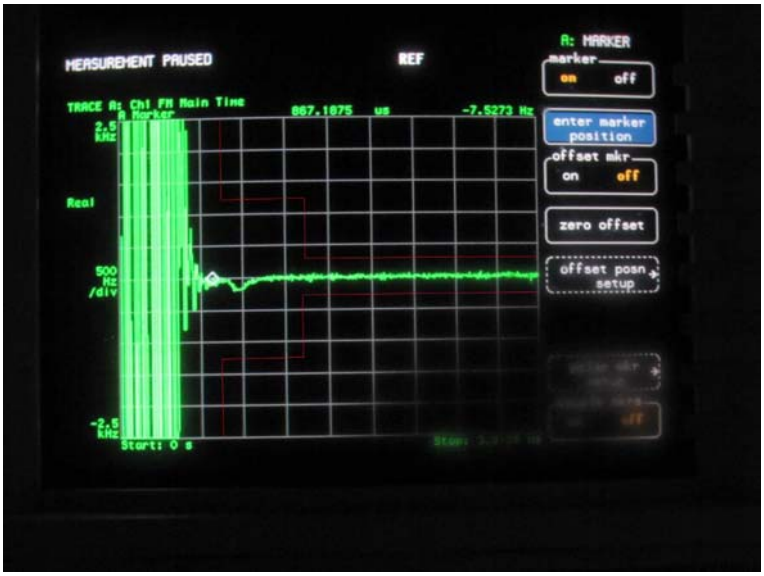


Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation------On – Off

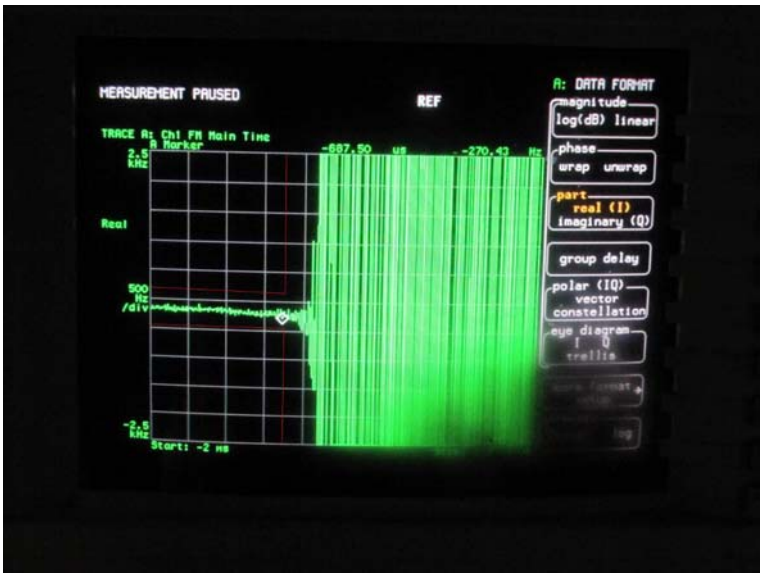


Modulation Type: 4FSK

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



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



4.7. Spurious Emssion on Antenna Port

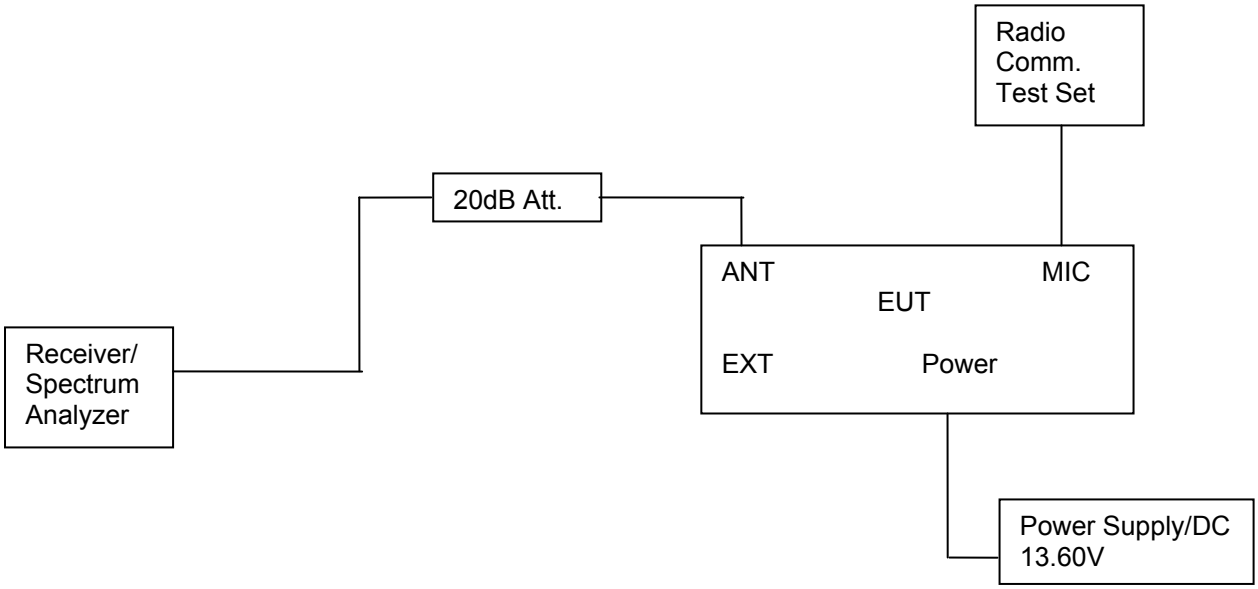
TEST APPLICABLE

The same as Section 4.3

TEST PROCEDURE

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to show any out of band emission up to 10th. Harmonic for the lower and the highest frequency range. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz,while set RBW=1MHz.VBW=3MHz from the 1GHz to 10^{th} Harmonic.
The audio input was set to 0 to get the unmodulated carrier, the resulting picture is print out for each channel separation.

TEST CONFIGURATION



LIMIT

Modulation Type: FM

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (12.5 kHz bandwidth only): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least:
Low: 50 + 10 log (Pwatts) = 50 + 10 log (28.12) =64.49 dB
High: 50 + 10 log (Pwatts) = 50 + 10 log (29.85) =64.75 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 (Pwatts) = 50 + 10 log (28.58) =54.56 dB
High: 50 + 10 log (Pwatts) = 50 + 10 log (29.85) =64.75 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

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

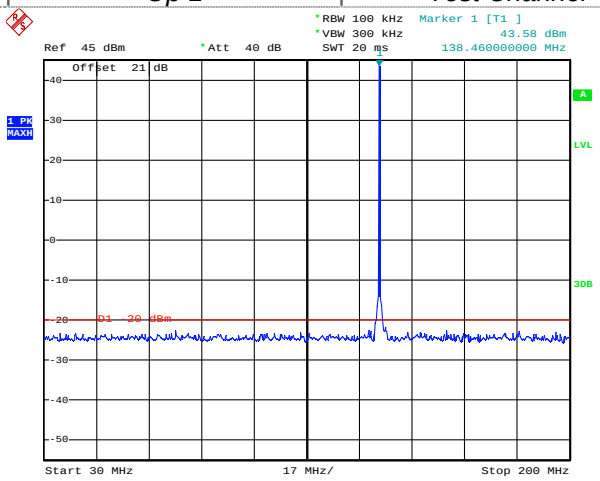
TEST RESULTS

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	138.5	276.8	-43.30	3358.00	-45.38
	Ch2	155.0	465.50	-42.38	3148.00	-43.86
	Ch3	173.5	520.00	-45.89	3178.00	-44.70
Op 2	Ch1	138.5	547.20	-47.46	3202.00	-44.74
	Ch2	155.0	309.48	-28.24	3616.00	-44.45
	Ch3	173.5	366.34	-25.09	3142.00	-44.15
Op 3	Ch1	138.5	276.80	-44.45	3184.00	-44.18
	Ch2	155.0	308.80	-43.89	3178.00	-44.05
	Ch3	173.5	520.00	-46.14	3166.00	-44.02
Op 4	Ch1	138.5	415.36	-31.65	3280.00	-43.91
	Ch2	155.0	309.48	-29.38	3550.00	-44.92
	Ch3	173.5	346.34	-24.84	3172.00	-43.17
Limit			**-20dBm for 12.5KHz Channel Separtion**			
			-13dBm for 25KHz Channel Separtion			
Test Results			**PASS**			

Note:
1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 4GHz.

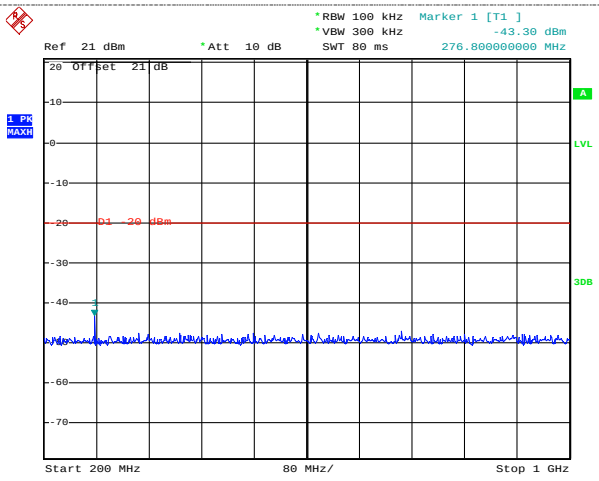
Test plot as follows:

Operation Mode	Op 1	Test Channel	Ch 1



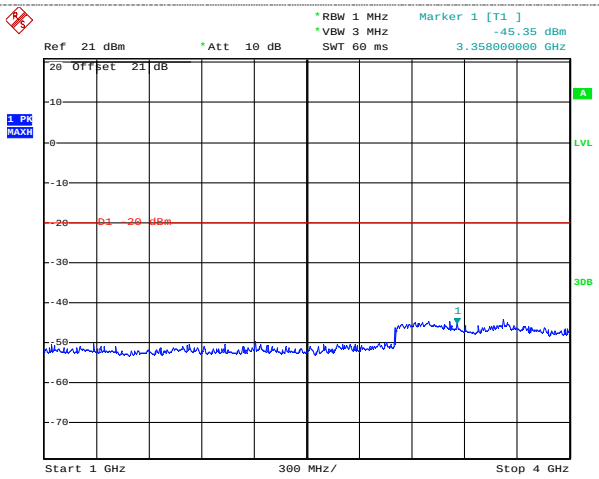
Date: 3.JUL.2014 15:47:11

30MHz-200MHz



Date: 3.JUL.2014 15:50:44

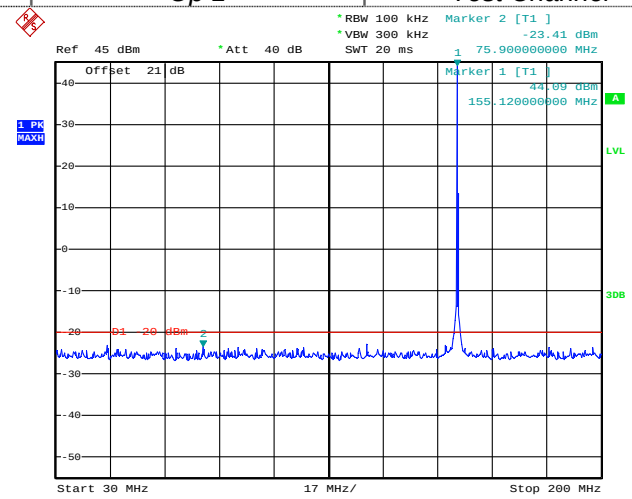
200MHz-1GHz



Date: 3.JUL.2014 15:51:29

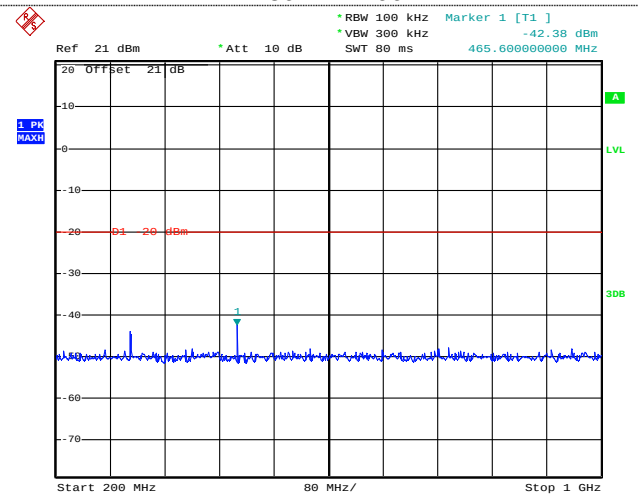
1GHz-4GHz

Operation Mode	Op 1	Test Channel	Ch 2



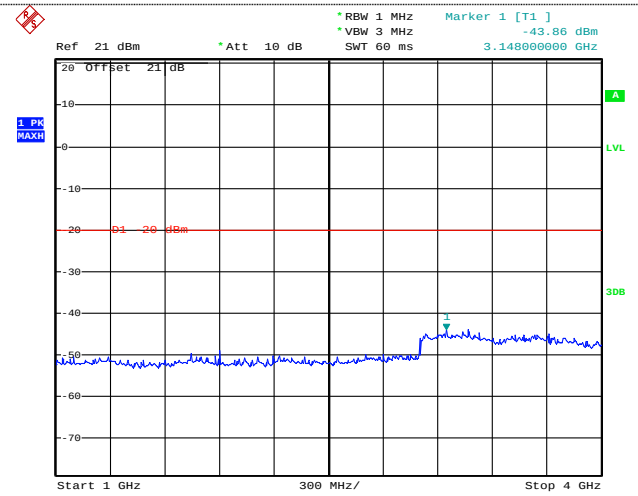
Date: 4.JUN.2014 16:19:23

30MHz-200MHz



Date: 4.JUN.2014 16:29:16

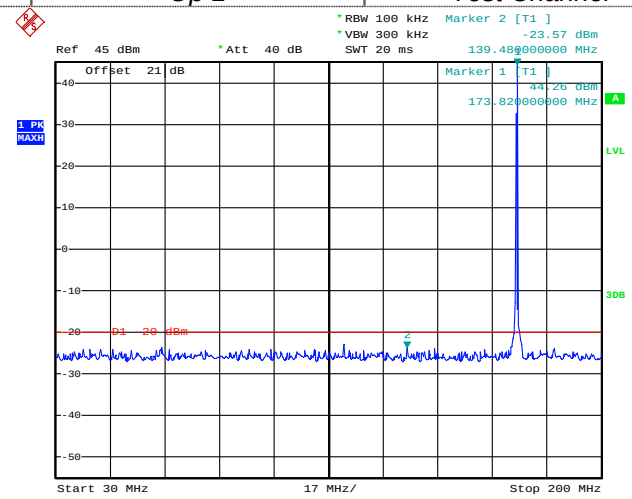
200MHz-1GHz



Date: 4.JUN.2014 16:29:00

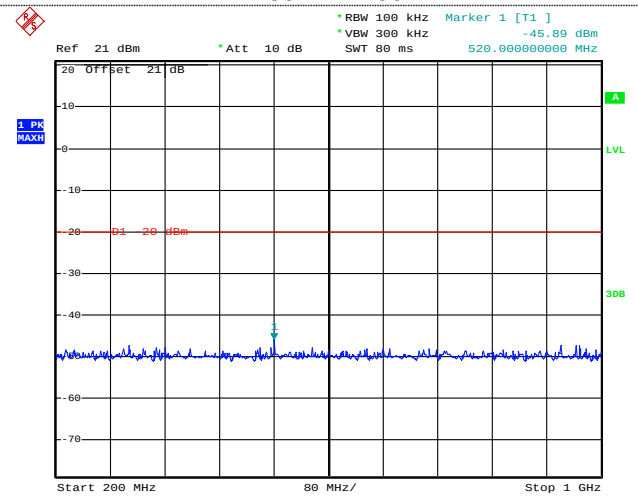
1GHz-4GHz

Operation Mode	Op 1	Test Channel	Ch 3



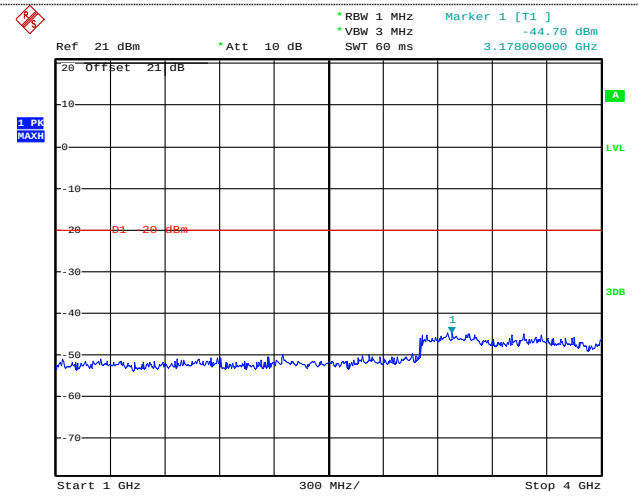
Date: 4.JUN.2014 16:19:35

30MHz-200MHz



Date: 4.JUN.2014 16:29:40

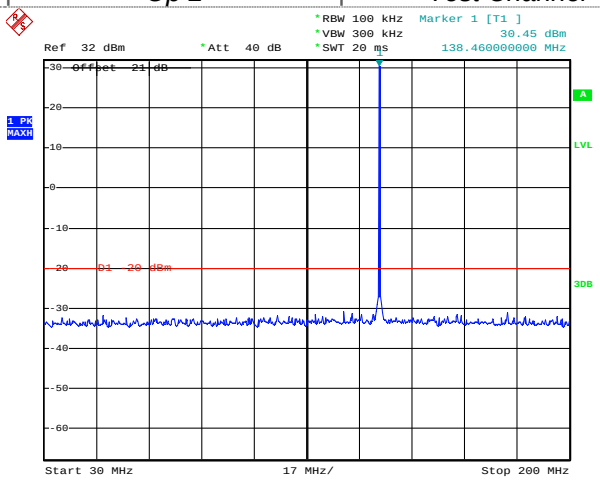
200MHz-1GHz



Date: 4.JUN.2014 16:29:54

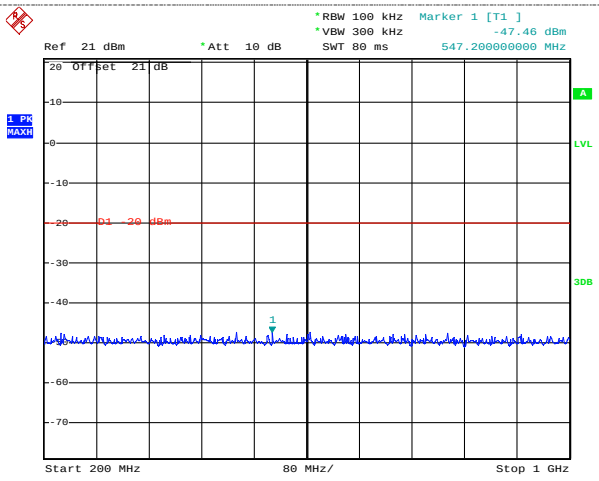
1GHz-4GHz

Operation Mode	Op 2	Test Channel	Ch 1



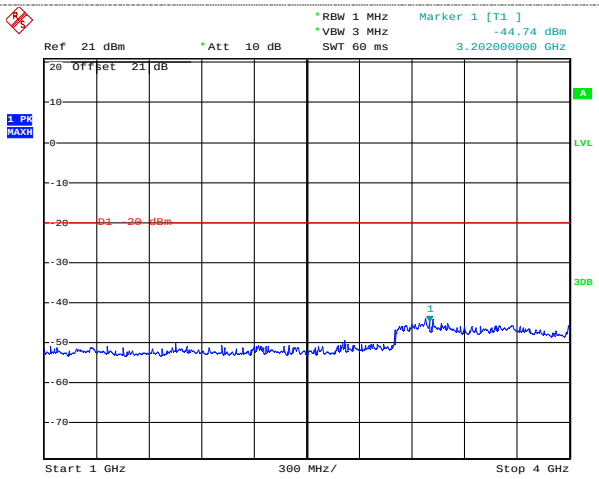
Date: 3.JUL.2014 16:10:14

30MHz-200MHz



Date: 3.JUL.2014 16:11:36

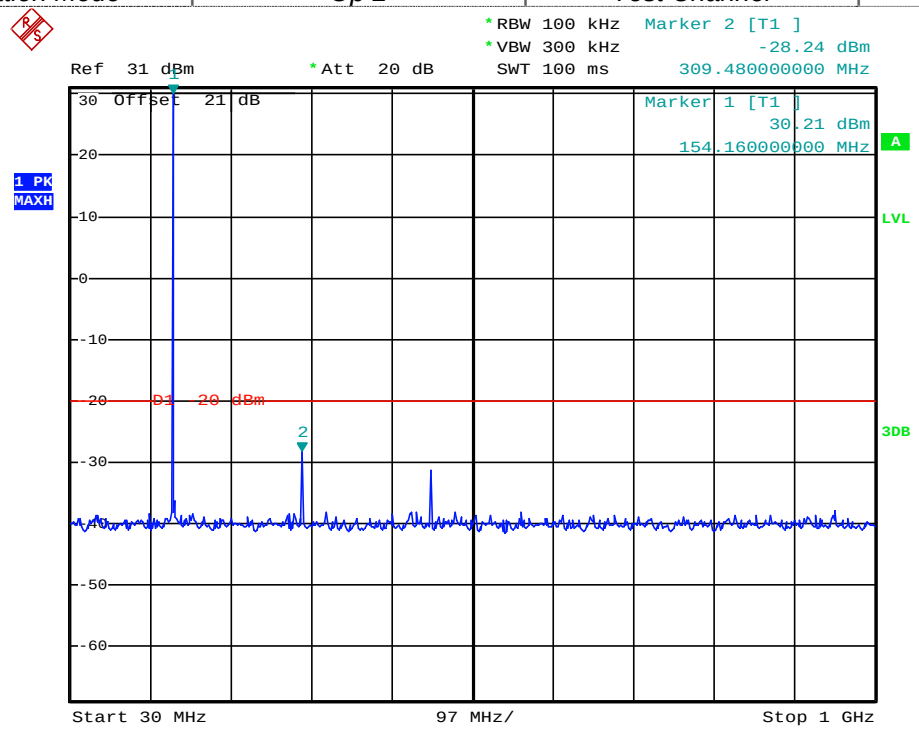
200MHz-1GHz



Date: 3.JUL.2014 16:11:56

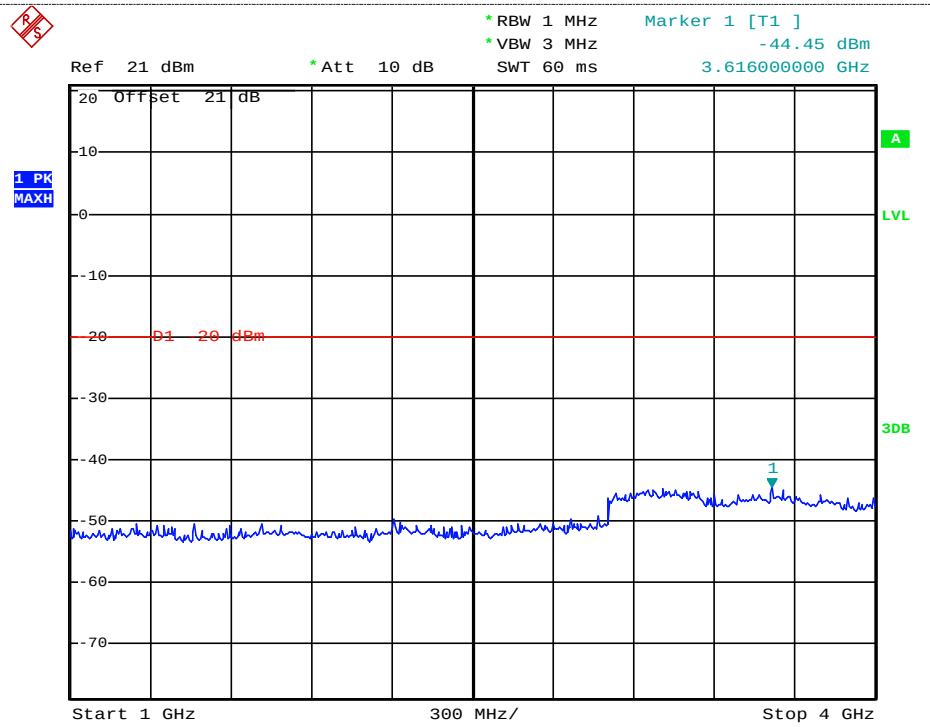
1GHz-4GHz

Operation Mode	Op 2	Test Channel	Ch 2



Date: 4.JUN.2014 16:24:58

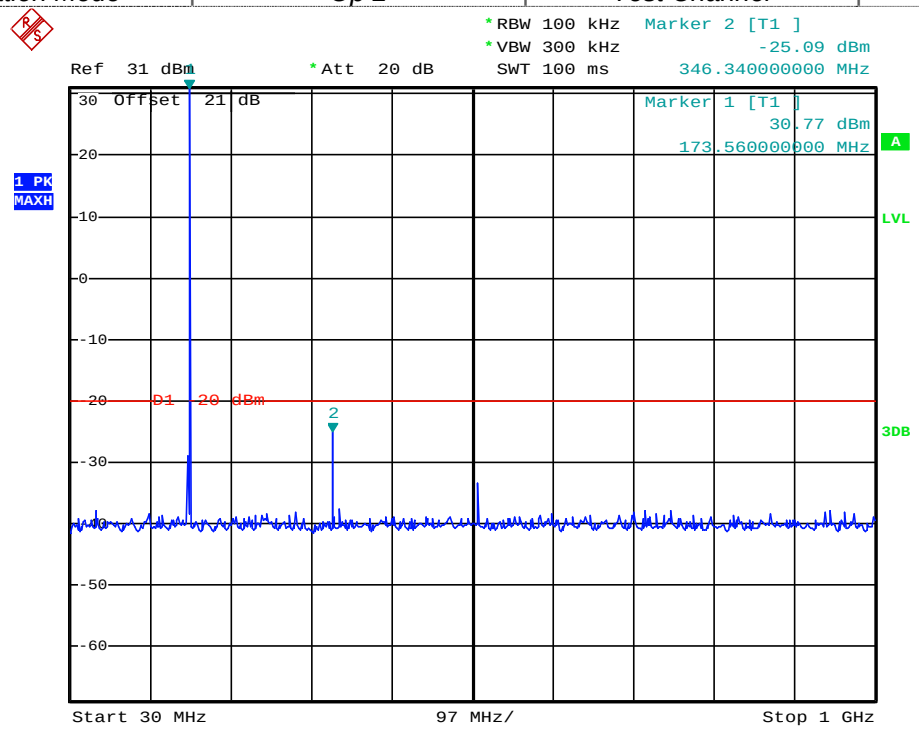
30MHz-1GHz



Date: 4.JUN.2014 16:30:17

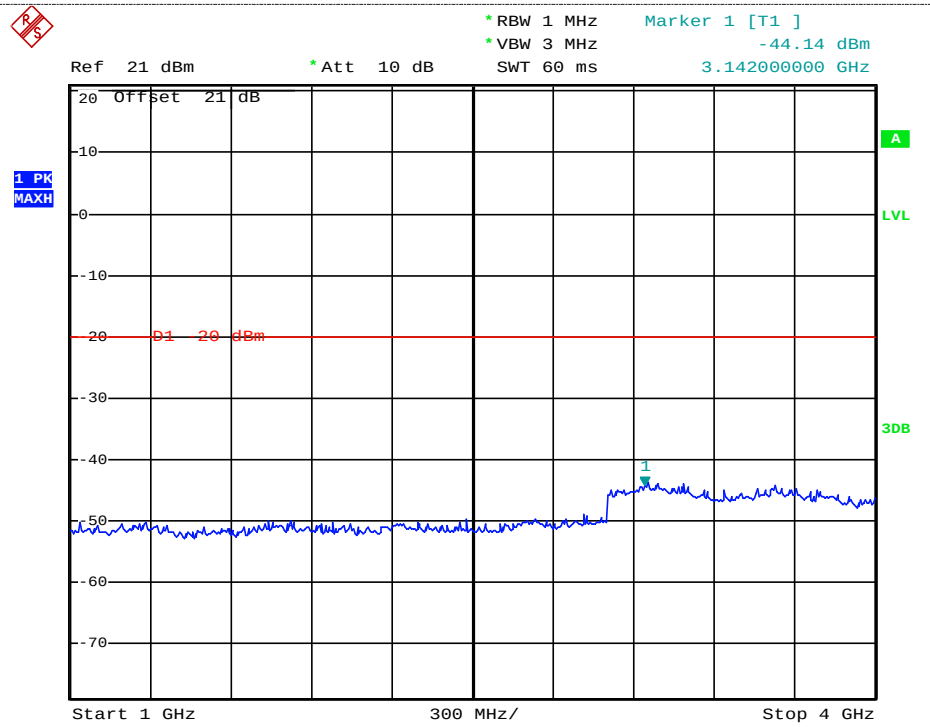
1GHz-4GHz

Operation Mode	Op 2	Test Channel	Ch 3



Date: 4.JUN.2014 16:25:09

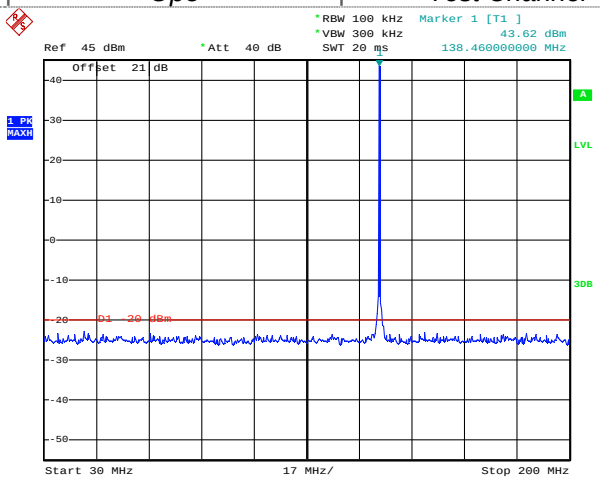
30MHz-1GHz



Date: 4.JUN.2014 16:31:25

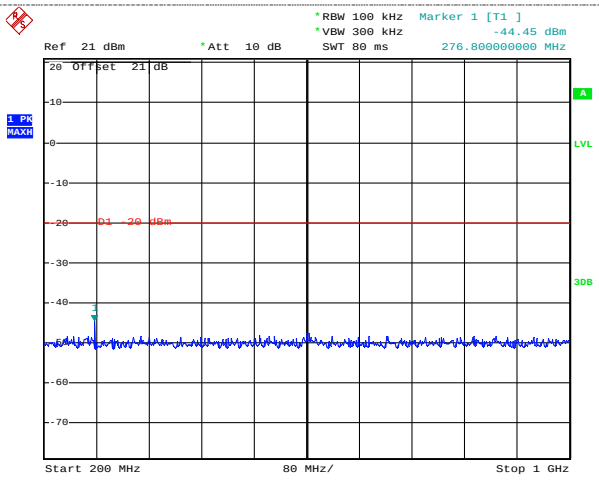
1GHz-4GHz

Operation Mode	Op3	Test Channel	Ch 1



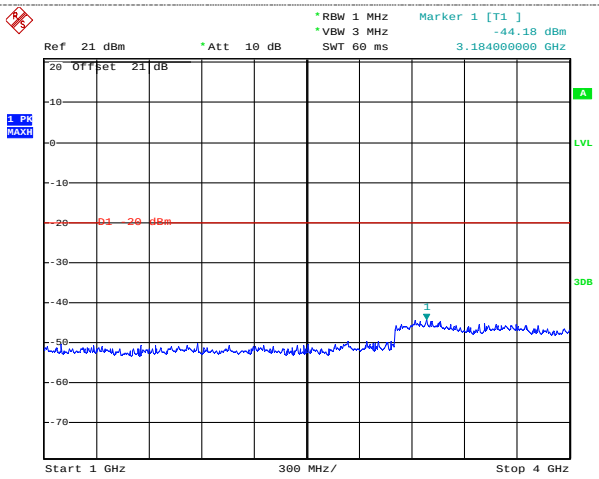
Date: 3.JUL.2014 16:25:31

30MHz-200MHz



Date: 3.JUL.2014 16:26:18

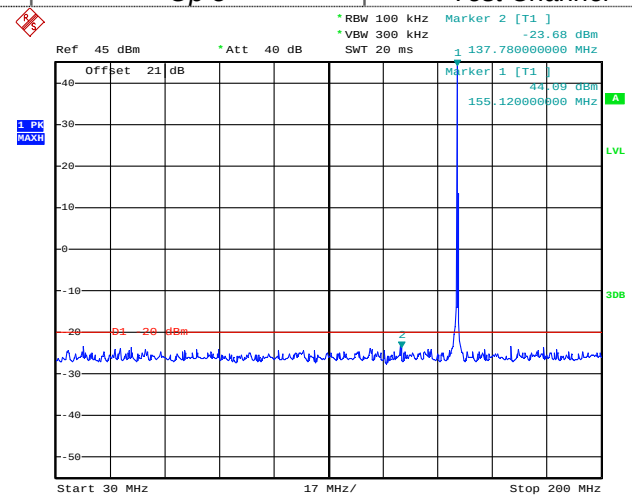
200MHz-1GHz



Date: 3.JUL.2014 16:26:48

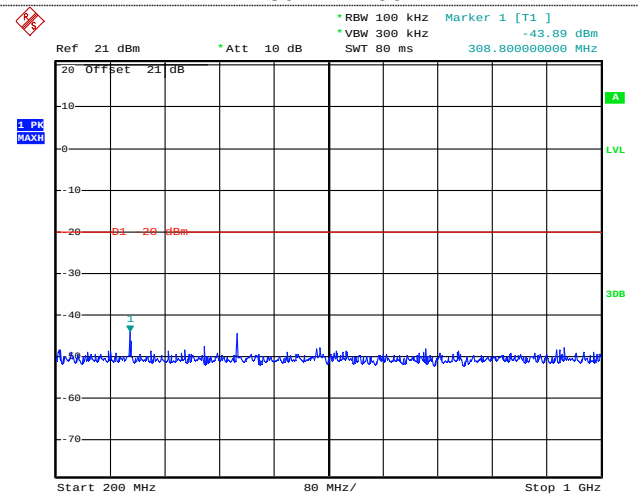
1GHz-4GHz

Operation Mode	Op 3	Test Channel	Ch 2



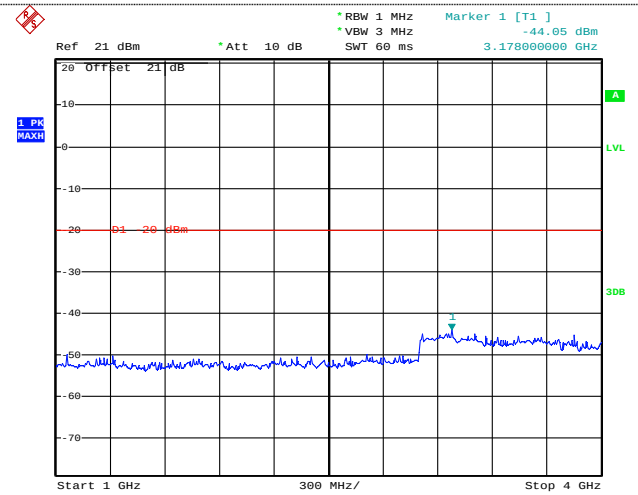
Date: 4.JUN.2014 16:21:49

30MHz-200MHz



Date: 4.JUN.2014 16:34:50

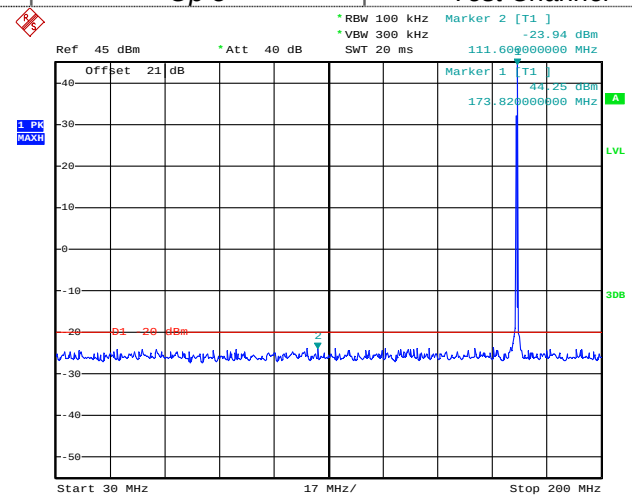
200MHz-1GHz



Date: 4.JUN.2014 16:34:36

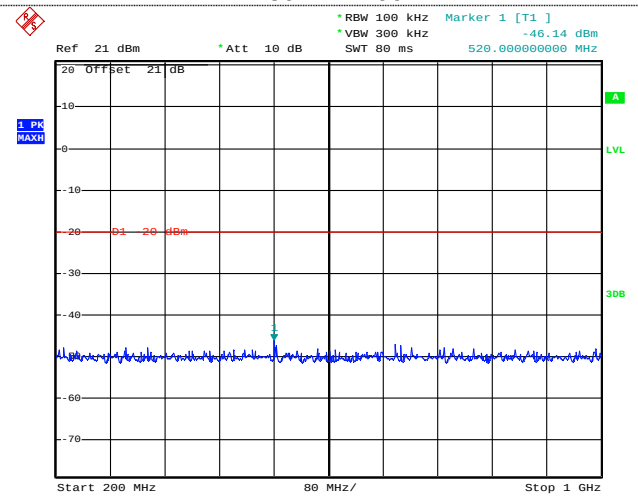
1GHz-4GHz

Operation Mode	Op 3	Test Channel	Ch 3



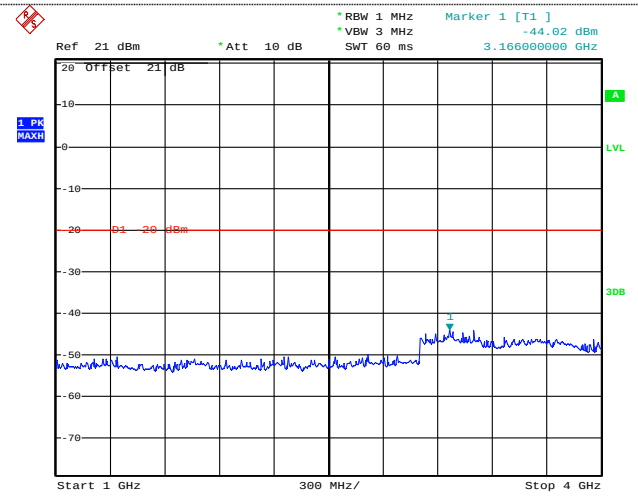
Date: 4.JUN.2014 16:22:01

30MHz-200MHz



Date: 4.JUN.2014 16:34:58

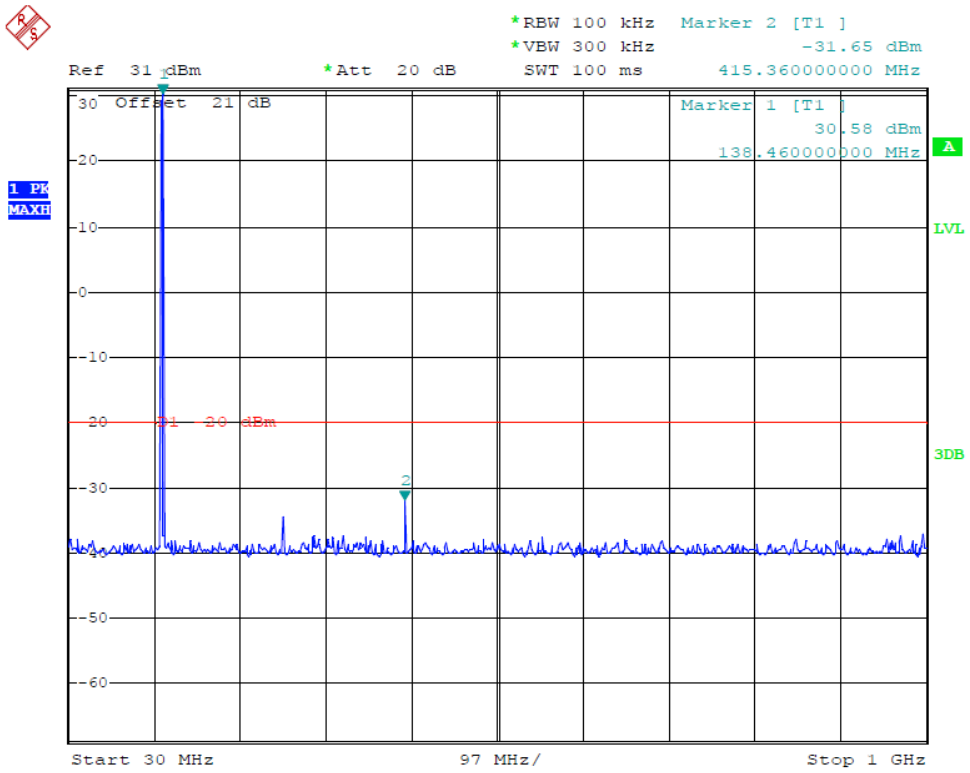
200MHz-1GHz



Date: 4.JUN.2014 16:35:10

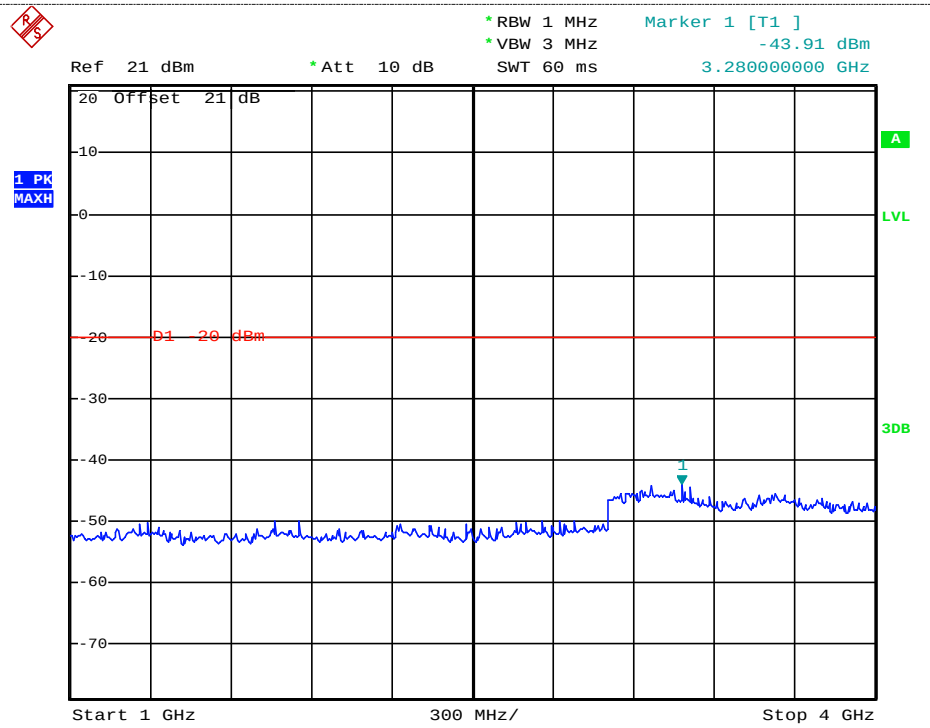
1GHz-4GHz

Operation Mode	Op 4	Test Channel	Ch 1



Date: 3.JUL.2014 16:56:48

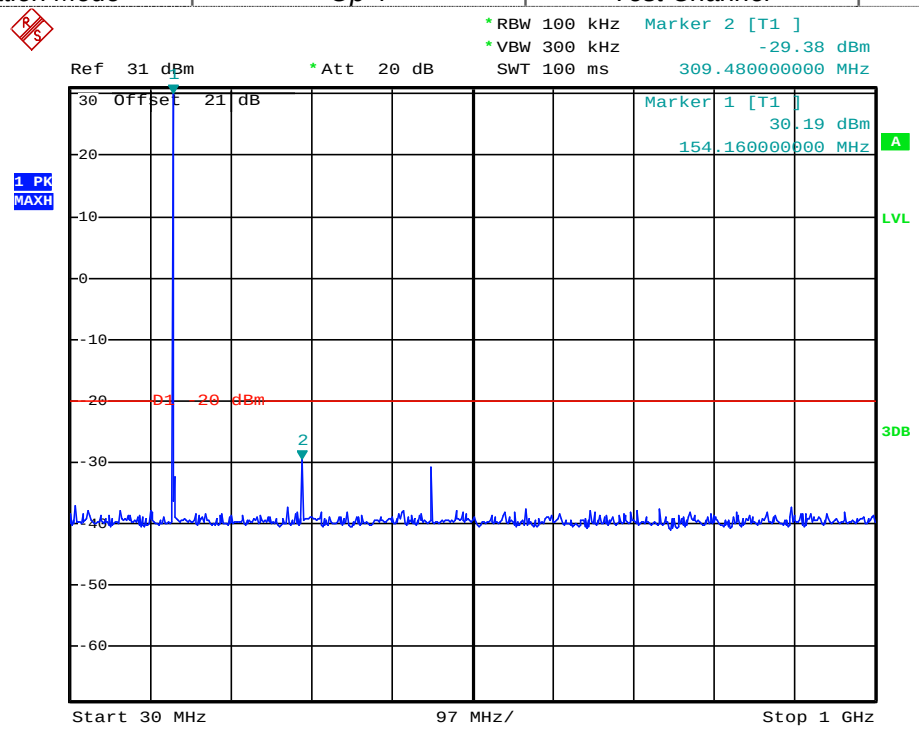
30MHz-1GHz



Date: 4.JUN.2014 16:35:29

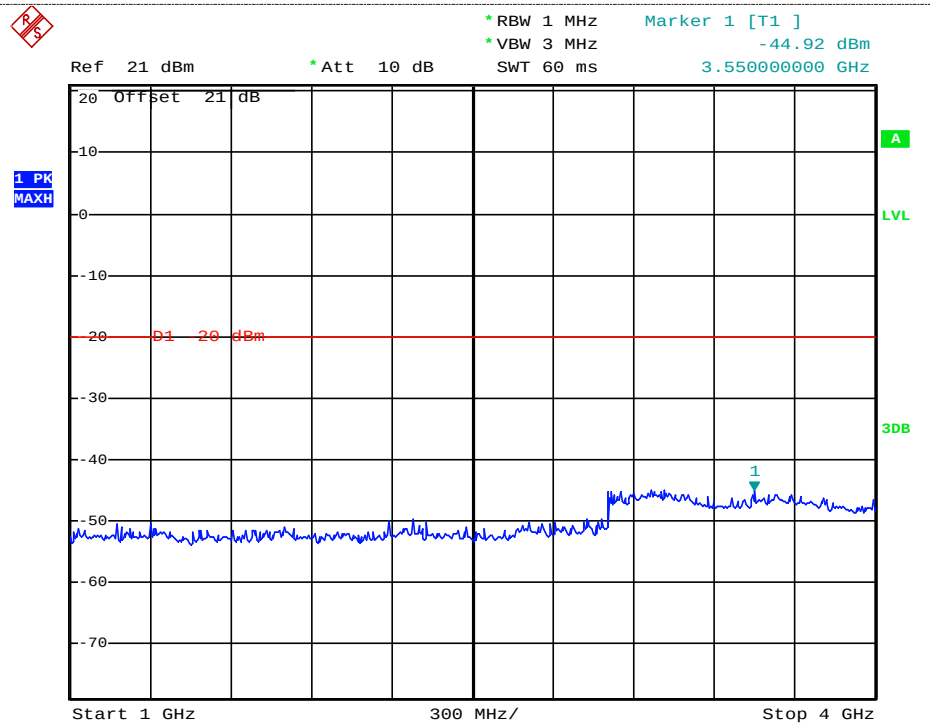
1GHz-4GHz

Operation Mode	Op 4	Test Channel	Ch 2



Date: 4.JUN.2014 16:24:15

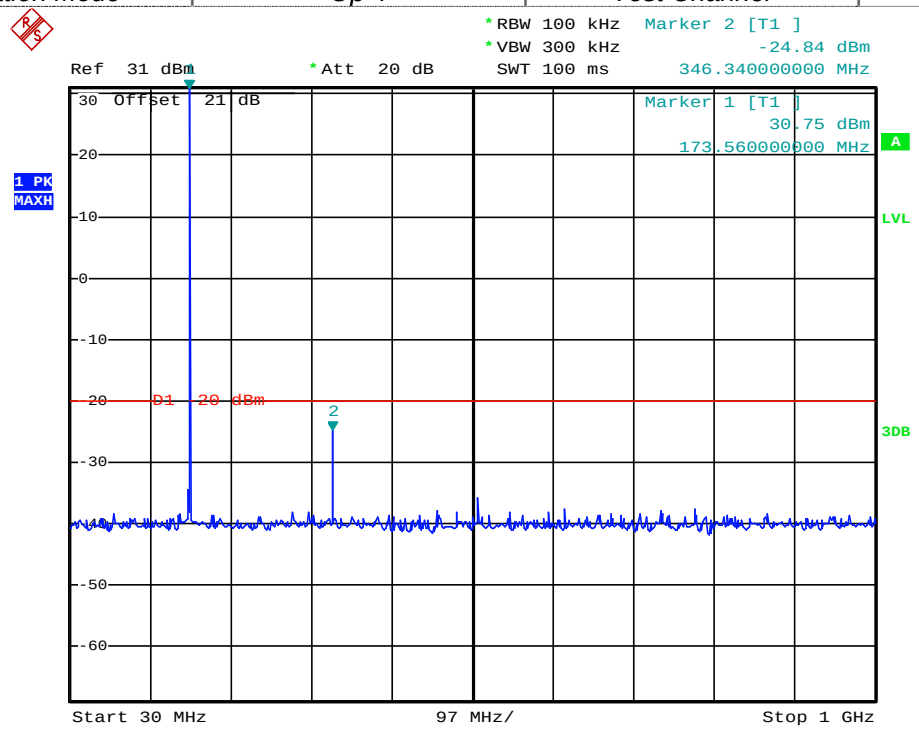
30MHz-1GHz



Date: 4.JUN.2014 16:35:39

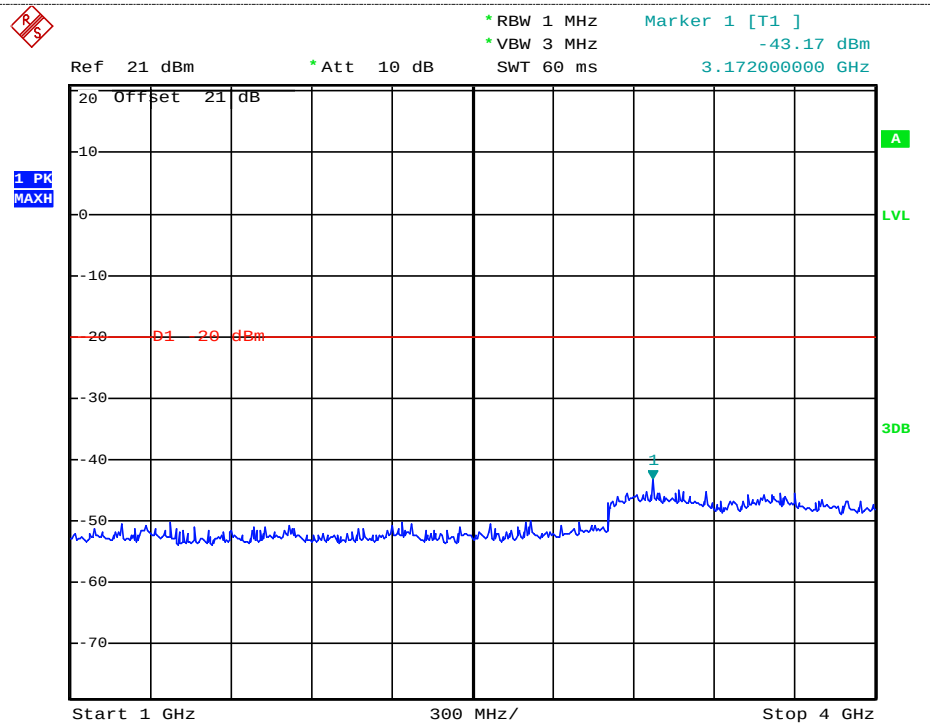
1GHz-4GHz

Operation Mode	Op 4	Test Channel	Ch 3



Date: 4.JUN.2014 16:24:25

30MHz-1GHz



Date: 4.JUN.2014 16:35:45

1GHz-4GHz

4.8. Transmitter Radiated Spurious Emssion

TEST APPLICABLE

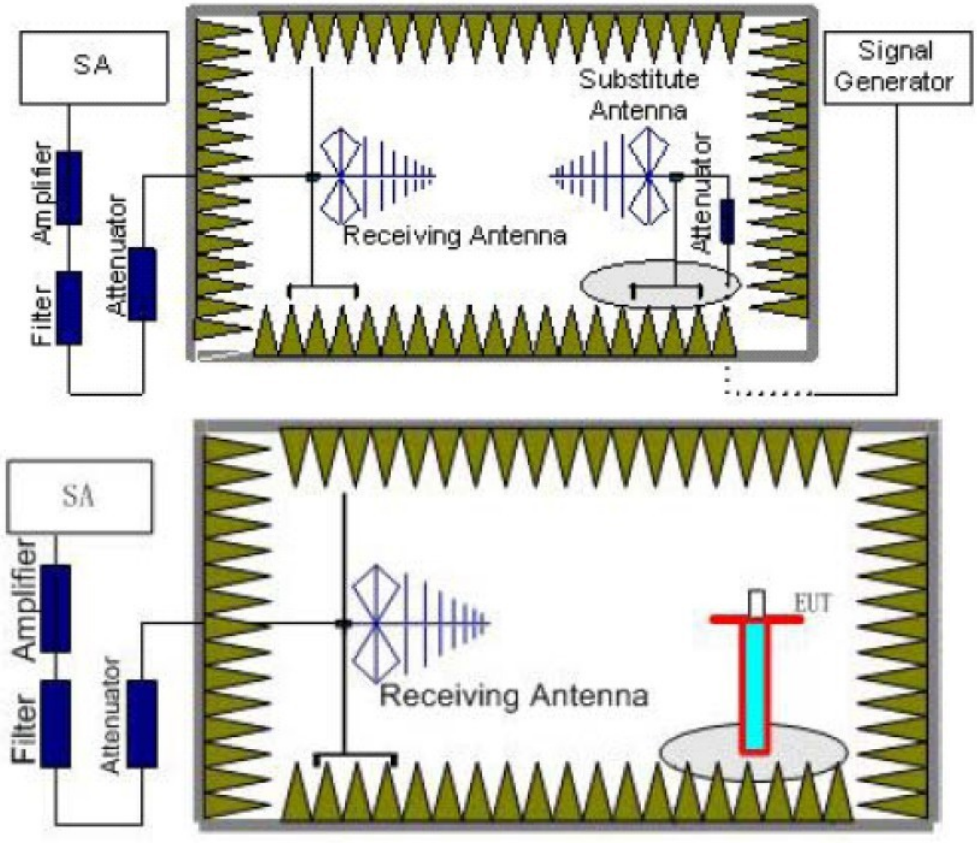
According to the TIA/EIA 603 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:

1 On any frequency removed from the center of the authorized bandwidth fo to 5.625 KHz removed from fo: Zero dB
2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) fo of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB
3 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) fo of more than 12.5 KHz: At least 50+10 log (P) dB or 70 dB, which ever is lesser attenuation.

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

1 On any frequency removed from the assigned frequency by more than 50 percent, but no more than 100 percent of the authorized bandwidth: At least 25 dB.
2 On any frequency removed from the assigned frequency by more than 100 percent, but no more than 250 percent of the authorized bandwidth: At least 35 dB.
3 On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43+10Log (P) dB.

TEST CONFIGURATION



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:
   Power(EIRP)=P_{Mea}- P_{Ag} - P_{cl} - G_a
   We used SMF100A micowave signal generator which signal level can up to 33dBm,so we not used power Amplifier for substituation test; The measurement results are amend as described below:
   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-2.15dBi.

LIMIT

Modulation Type: FM

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (12.5 kHz bandwidth only): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least:
Low: 50 + 10 log (Pwatts) = 50 + 10 log (28.12) =64.49 dB
High: 50 + 10 log (Pwatts) = 50 + 10 log (29.85) =64.75 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 (Pwatts) = 50 + 10 log (28.58) =54.56 dB
High: 50 + 10 log (Pwatts) = 50 + 10 log (29.85) =64.75 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

TEST RESULTS

Remark:We tested Op 1 to Op 4.recorded worst case at Op 1 and Op 3.

Op 1							
Frequency (MHz)	**P_{Mea} (dBm)**	**Path Loss**	**Antenna Gain**	**Correction (dB)**	**Peak ERP(dBm)**	**Limit (dBm)**	**Polarization**
Ch1/138.5MHz							
277.00	-45.20	0.32	6.38	2.15	-41.29	-20.00	H
415.50	-47.11	0.44	7.35	2.15	-42.35	-20.00	H
554.00	-51.50	0.56	8.05	2.15	-46.16	-20.00	H
…	…	…	…	…	…	…	H
277.00	-44.64	0.32	6.38	2.15	-40.73	-20.00	V
415.50	-48.62	0.44	7.35	2.15	-43.86	-20.00	V
554.00	-52.10	0.56	8.05	2.15	-46.76	-20.00	V
…	…	…	…	…	…	…	V
Ch2/155.0MHz							
310.00	-45.51	0.35	6.88	2.15	-41.13	-20.00	H
465.00	-48.47	0.46	7.89	2.15	-43.19	-20.00	H
620.00	-50.69	0.58	7.81	2.15	-45.61	-20.00	H
…	…	…	…	…	…	…	H
310.00	-44.68	0.35	6.88	2.15	-40.30	-20.00	V
465.00	-49.75	0.46	7.89	2.15	-44.47	-20.00	V
620.00	-51.35	0.58	7.81	2.15	-46.27	-20.00	V
…	…	…	…	…	…	…	V
Ch3/173.5MHz							
347.00	-44.35	0.37	7.68	2.15	-39.19	-20.00	H
520.50	-47.38	0.49	7.91	2.15	-42.11	-20.00	H
694.00	-49.35	0.61	8.28	2.15	-43.83	-20.00	H
…	…	…	…	…	…	…	H
347.00	-43.69	0.37	7.68	2.15	-38.53	-20.00	V
520.50	-48.57	0.49	7.91	2.15	-43.30	-20.00	V
694.00	-50.22	0.61	8.28	2.15	-44.70	-20.00	V
…	…	…	…	…	…	…	V

Note: 1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 4 GHz.
3. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.

Op 3							
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
Ch1/138.5MHz							
277.00	-44.35	0.32	6.38	2.15	-40.44	-20.00	H
415.50	-46.48	0.44	7.35	2.15	-41.72	-20.00	H
554.00	-50.39	0.56	8.05	2.15	-45.05	-20.00	H
…	…	…	…	…	…	…	H
277.00	-45.67	0.32	6.38	2.15	-41.76	-20.00	V
415.50	-47.47	0.44	7.35	2.15	-42.71	-20.00	V
554.00	-51.66	0.56	8.05	2.15	-46.32	-20.00	V
…	…	…	…	…	…	…	V
Ch2/155.0MHz							
310.00	-45.26	0.35	6.88	2.15	-40.88	-20.00	H
465.00	-47.39	0.46	7.89	2.15	-42.11	-20.00	H
620.00	-51.65	0.58	7.81	2.15	-46.57	-20.00	H
…	…	…	…	…	…	…	H
310.00	-44.32	0.35	6.88	2.15	-39.94	-20.00	V
465.00	-48.49	0.46	7.89	2.15	-43.21	-20.00	V
620.00	-50.74	0.58	7.81	2.15	-45.66	-20.00	V
…	…	…	…	…	…	…	V
Ch3/173.5MHz							
347.00	-43.98	0.37	7.68	2.15	-38.82	-20.00	H
520.50	-46.79	0.49	7.91	2.15	-41.52	-20.00	H
694.00	-48.69	0.61	8.28	2.15	-43.17	-20.00	H
…	…	…	…	…	…	…	H
347.00	-43.36	0.37	7.68	2.15	-38.20	-20.00	V
520.50	-48.59	0.49	7.91	2.15	-43.32	-20.00	V
694.00	-51.72	0.61	8.28	2.15	-46.20	-20.00	V
…	…	…	…	…	…	…	V

Note: 1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 4 GHz.
3. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.

4.9. Receiver Conducted Spurious Emssion

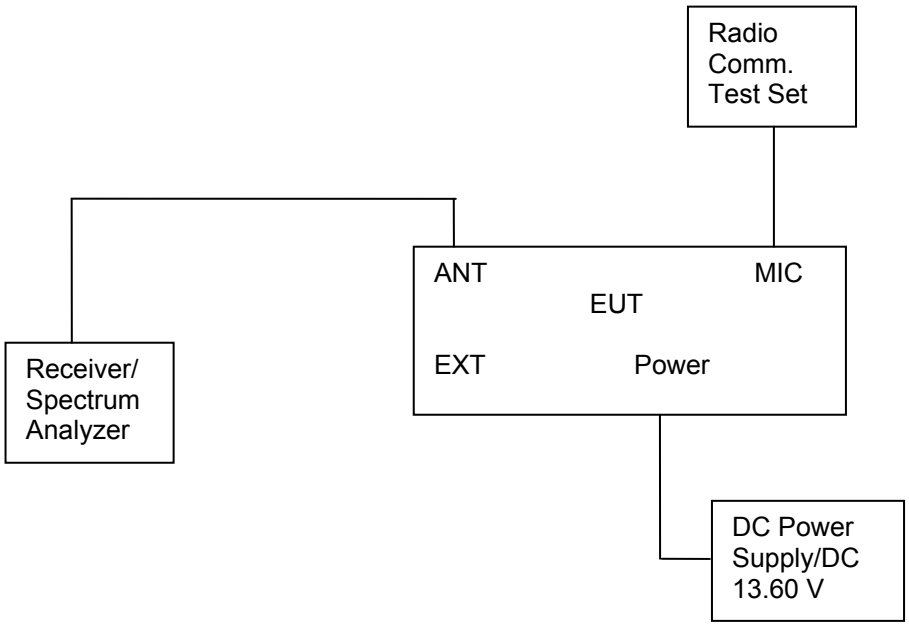
TEST APPLICABLE

The same as Section 4.4

TEST PROCEDURE

The spectrum analyzer was connected to the RF output power of the EUT, the EUT was setup in receiving mode; The RBW of the spectrum analyzer was set to 100 kHz and the VBW set to 300 KHz below the test frequency 1GHz. While the RBW of the spectrum analyzer was set to the 1MHz and VBW set to the 3MHz from 1GHz to the 10^{th} harmonic.

TEST CONFIGURATION



LIMIT

The power at the antenna terminal shall not exceed 2.0 nanowatts (-57dBm).

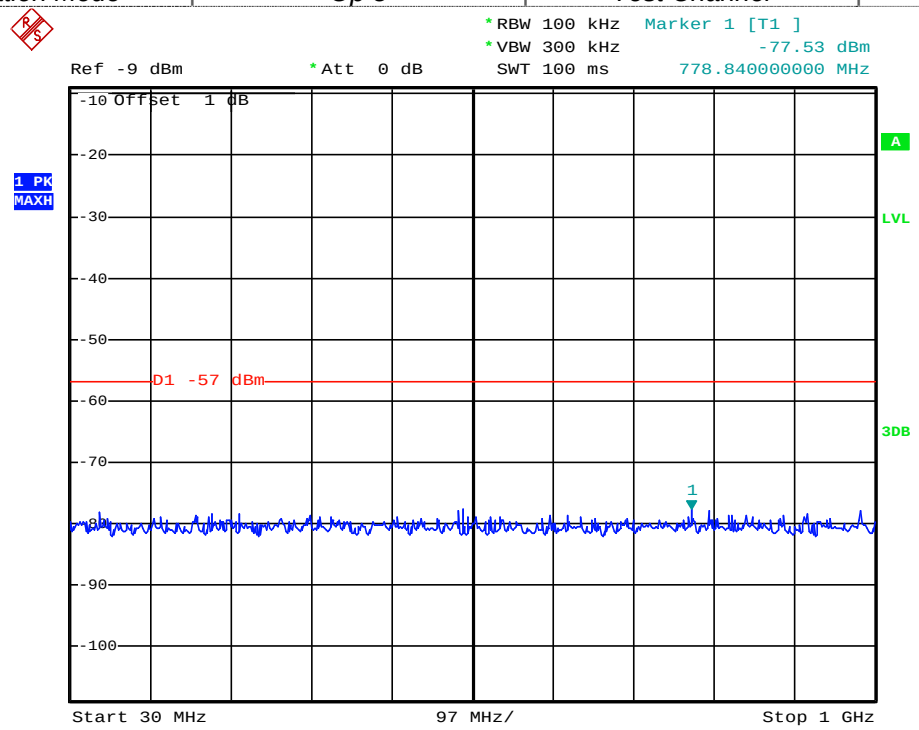
TEST RESULTS

The Receiver Conducted Spurious Emssions Measurement (standby mode) is performed from 30 MHz to the 4GHz.

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 5	Ch1	138.5	778.84	-77.53	3544.00	-74.20
	Ch2	155.0	996.12	-77.59	3154.00	-74.02
	Ch3	173.5	757.50	-77.47	3088.00	-74.35
Op 6	Ch1	138.5	751.68	-77.53	3228.00	-74.10
	Ch2	155.0	730.34	-77.91	3070.00	-74.99
	Ch3	173.5	825.40	-77.52	3172.00	-74.36
Limit			**-57dBm for 12.5KHz Channel Separtion**			
Test Results			**PASS**			

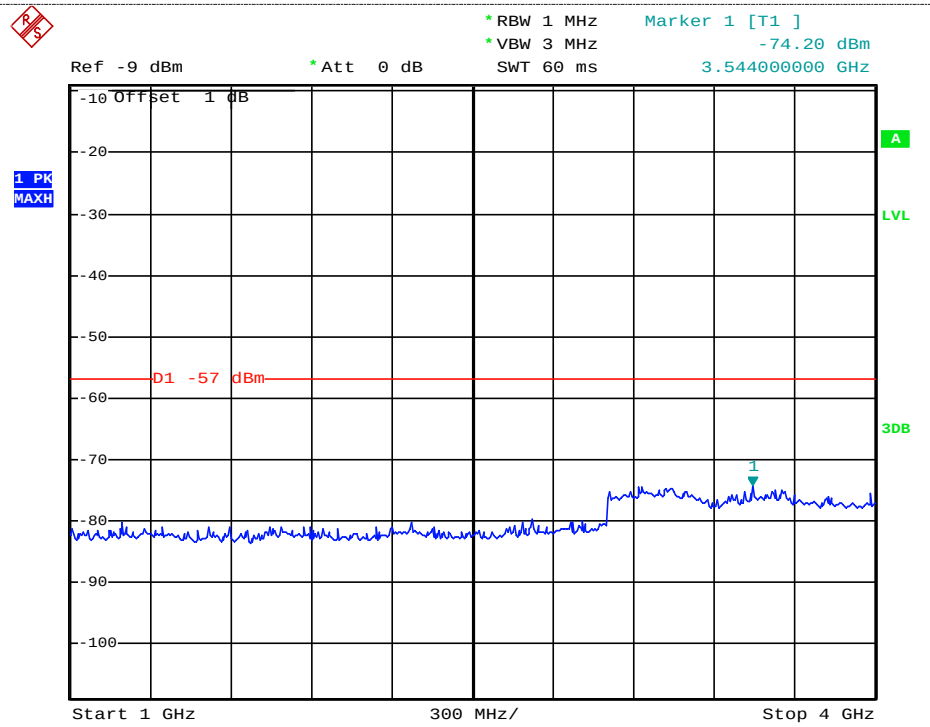
Note:
1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 4GHz.

Operation Mode	Op 5	Test Channel	Ch 1



Date: 4.JUN.2014 16:39:12

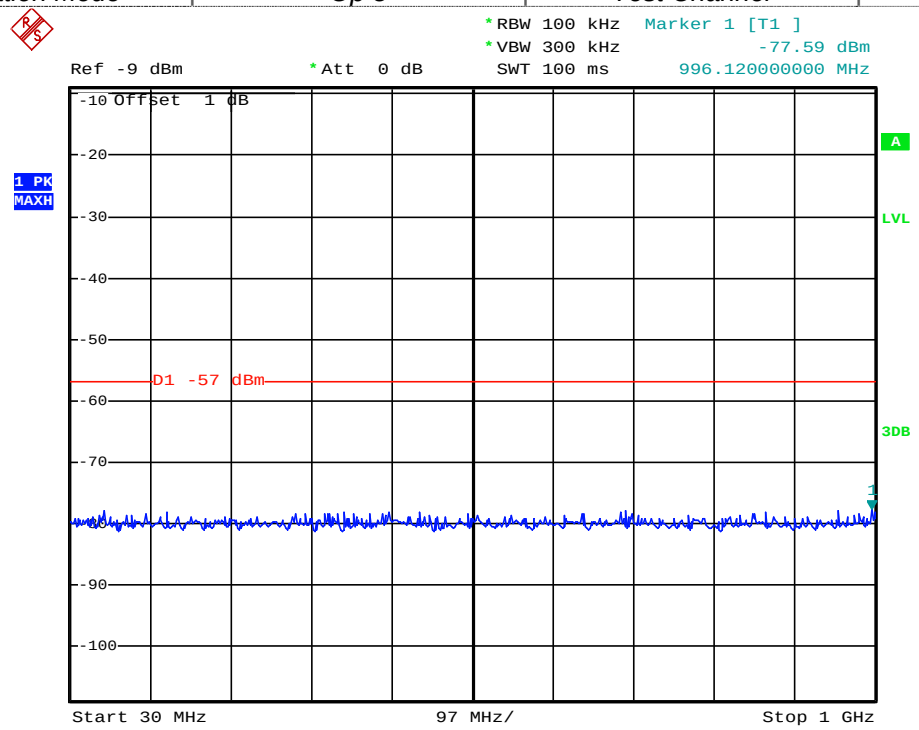
30MHz-1GHz



Date: 4.JUN.2014 16:39:01

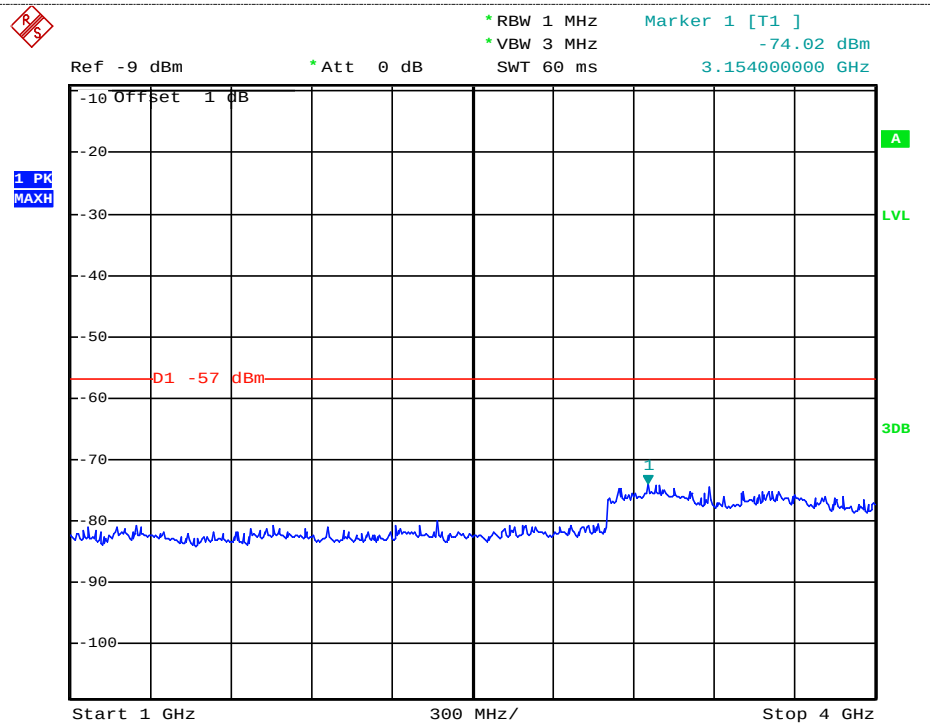
1GHz-6GHz

Operation Mode	Op 5	Test Channel	Ch 2



Date: 4.JUN.2014 16:39:28

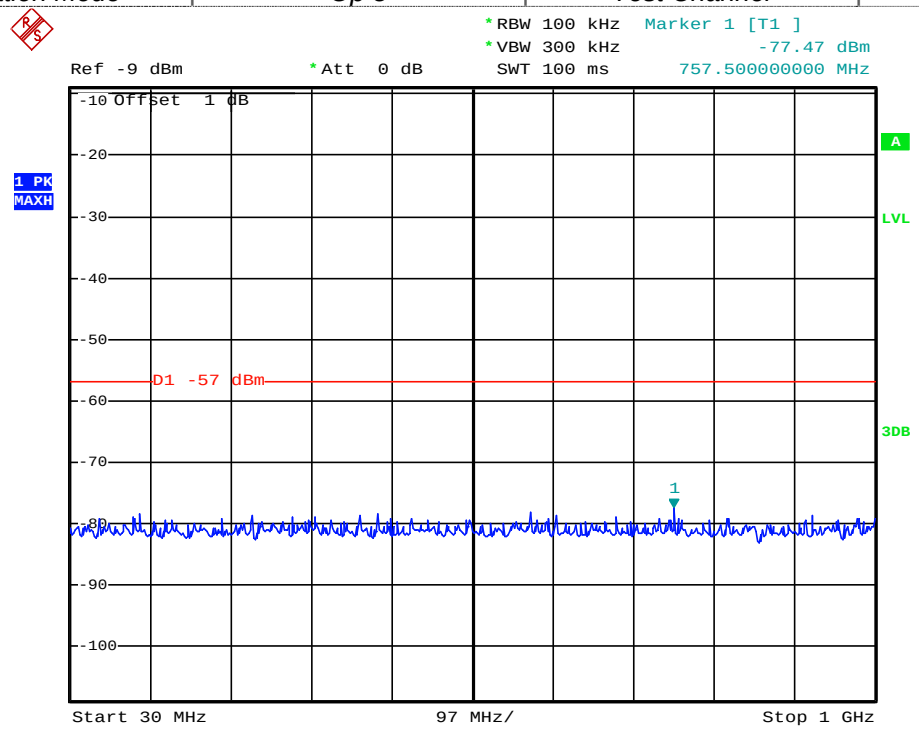
30MHz-1GHz



Date: 4.JUN.2014 16:39:42

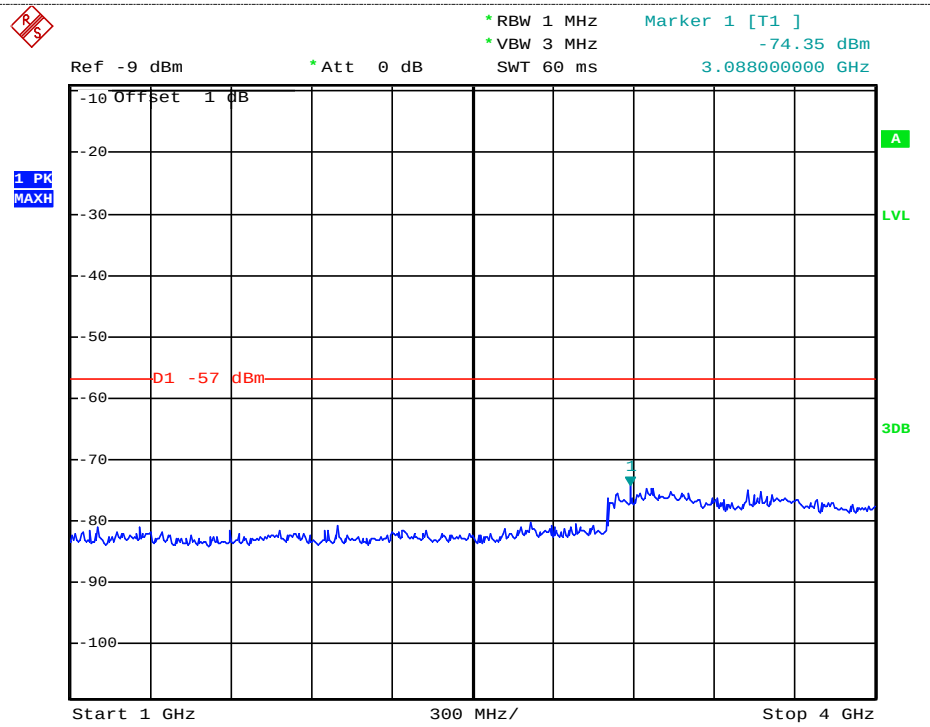
1GHz-6GHz

Operation Mode	Op 5	Test Channel	Ch 3



Date: 4.JUN.2014 16:40:02

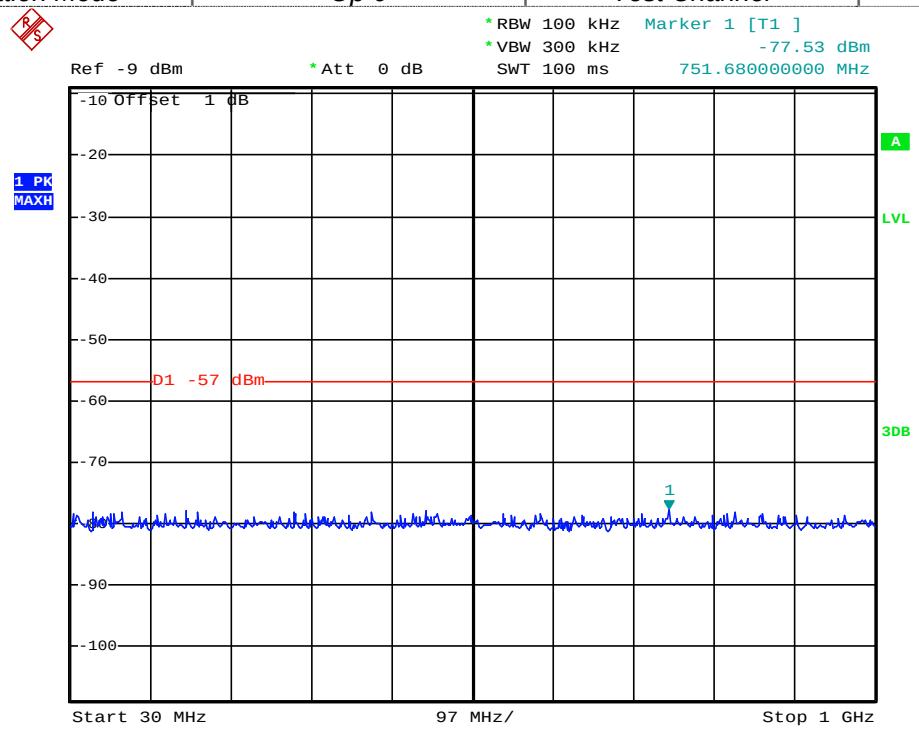
30MHz-1GHz



Date: 4.JUN.2014 16:39:49

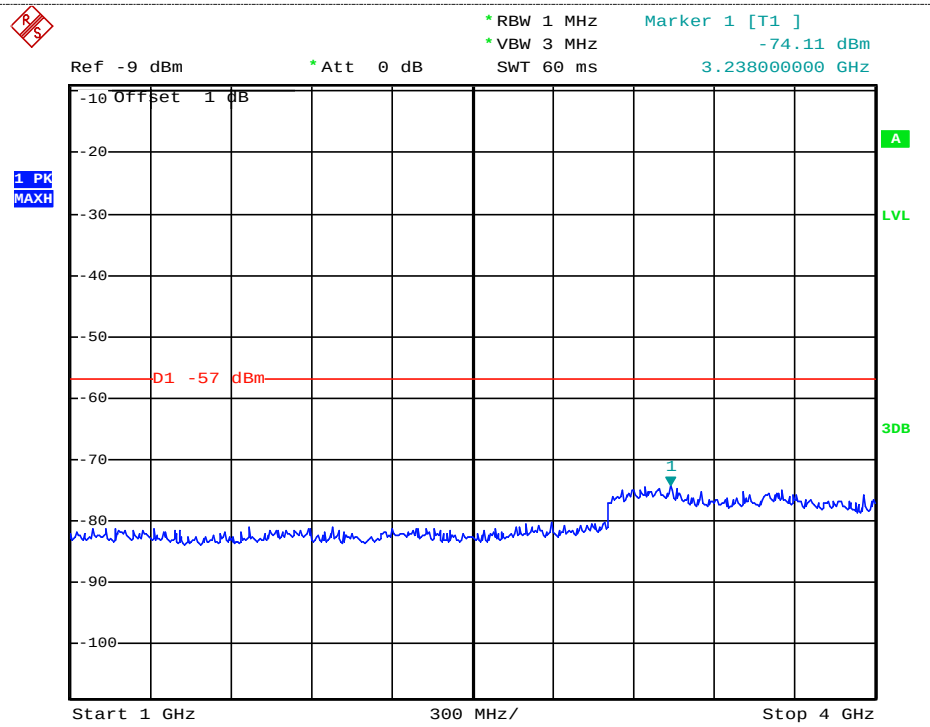
1GHz-6GHz

Operation Mode	Op 6	Test Channel	Ch 1



Date: 4.JUN.2014 16:46:08

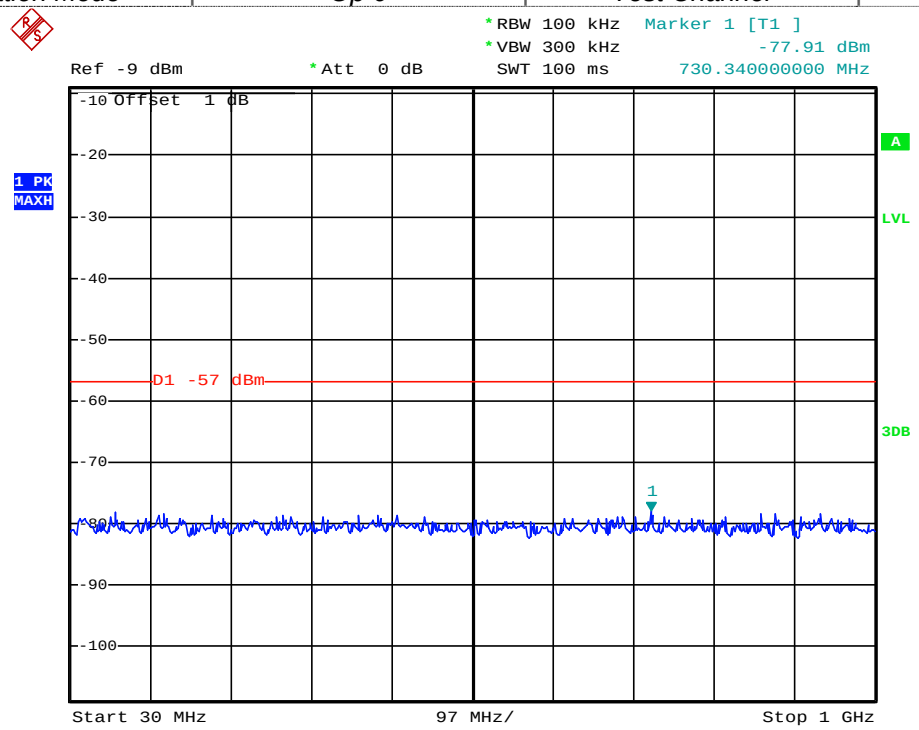
30MHz-1GHz



Date: 4.JUN.2014 16:44:15

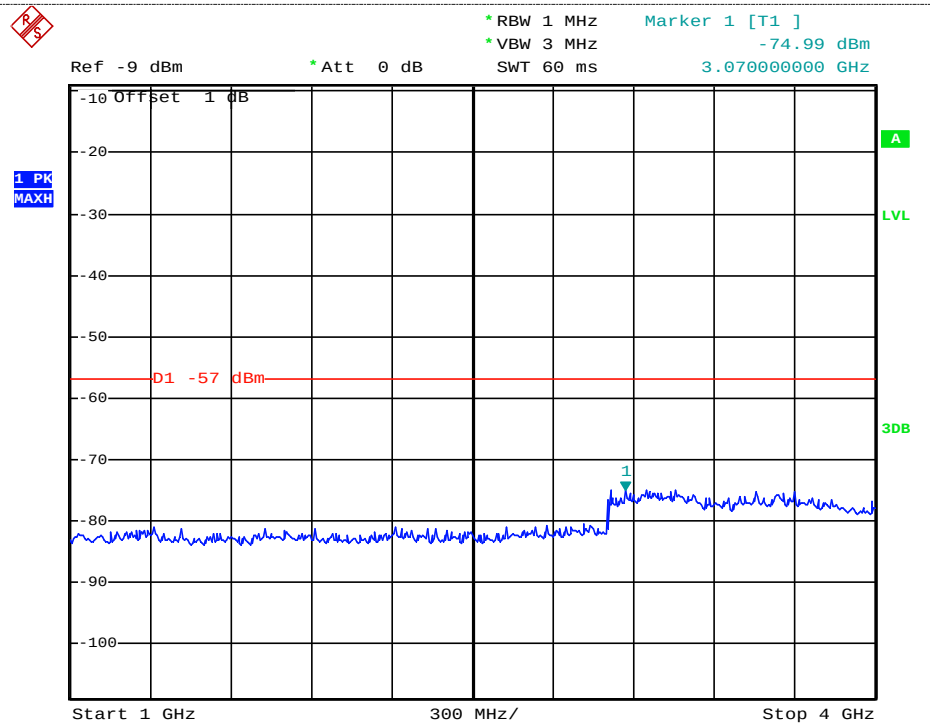
1GHz-6GHz

Operation Mode	Op 6	Test Channel	Ch 2



Date: 4.JUN.2014 16:46:14

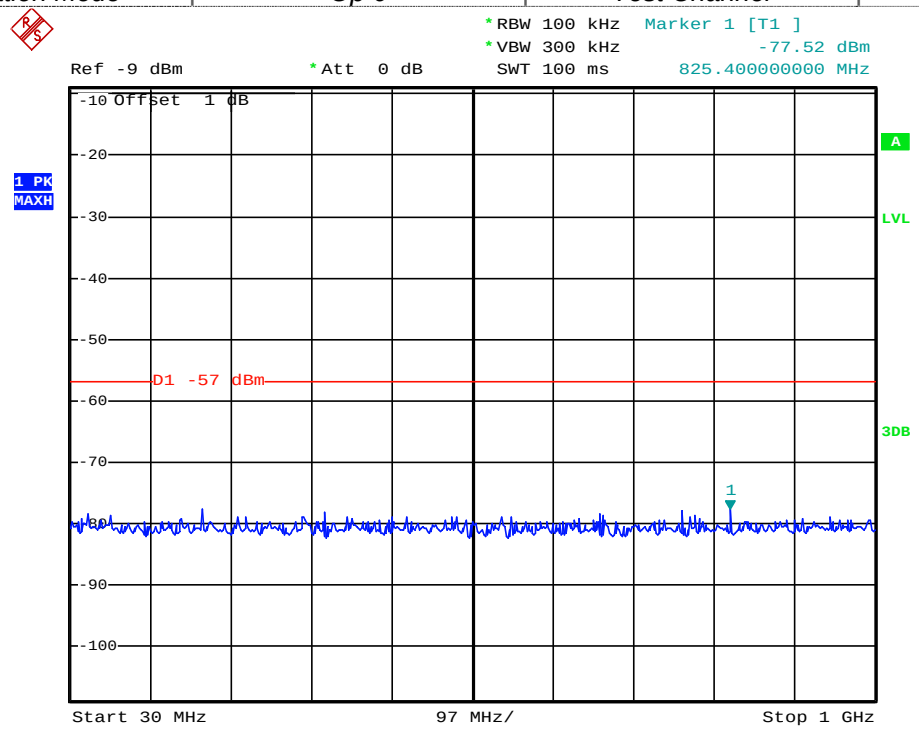
30MHz-1GHz



Date: 4.JUN.2014 16:44:22

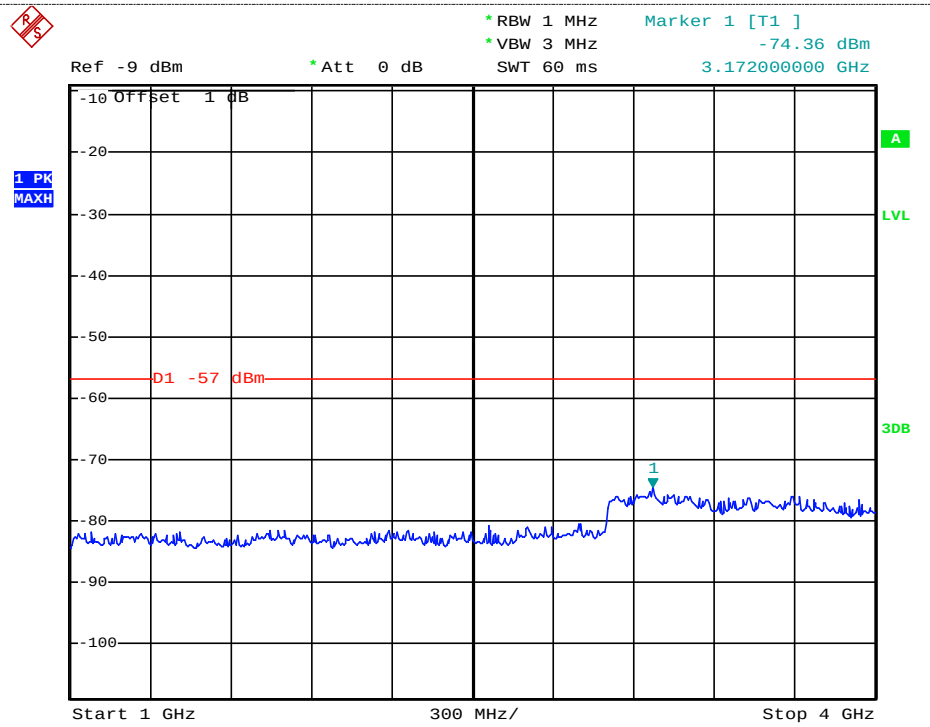
1GHz-6GHz

Operation Mode	Op 6	Test Channel	Ch 3



Date: 4.JUN.2014 16:46:20

30MHz-1GHz



Date: 4.JUN.2014 16:44:28

1GHz-6GHz

4.10. Receiver Radiated Spurious Emssion

TEST APPLICABLE

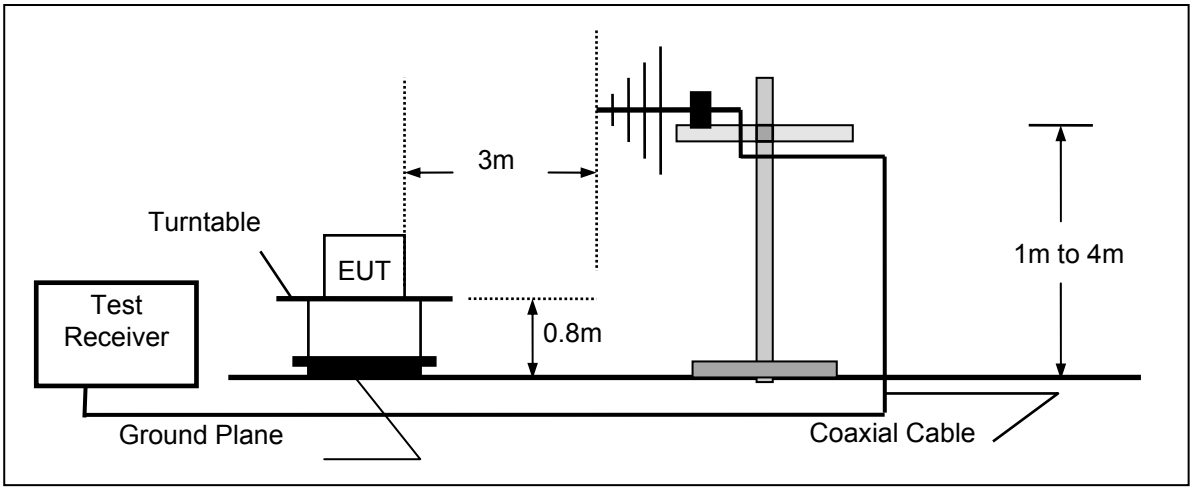
The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL – AG

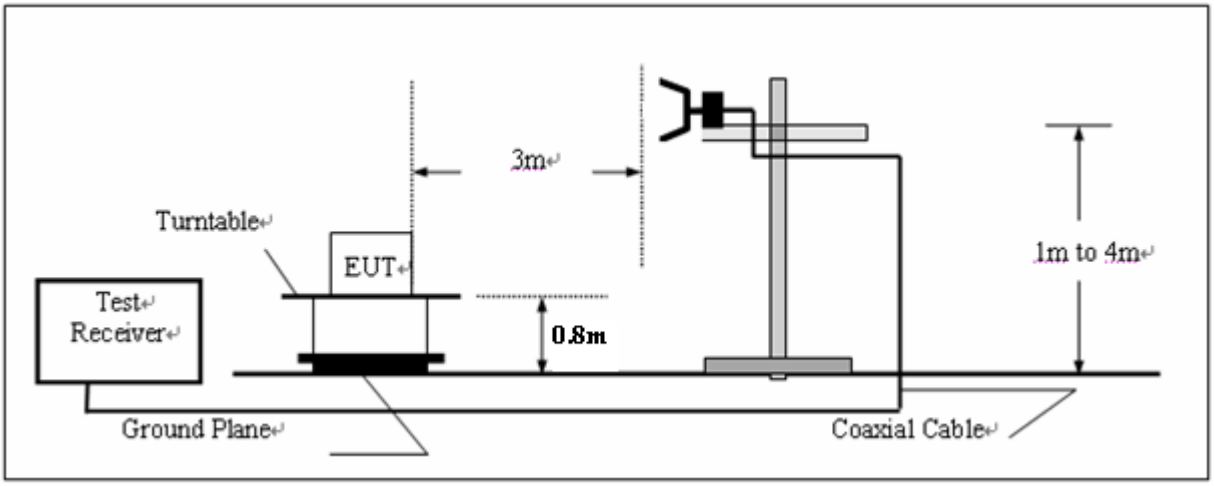
Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

TEST CONFIGURATION

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



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



TEST PROCEDURE

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

RECEIVER RADIATED SPOUIOUS LIMIT

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

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

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

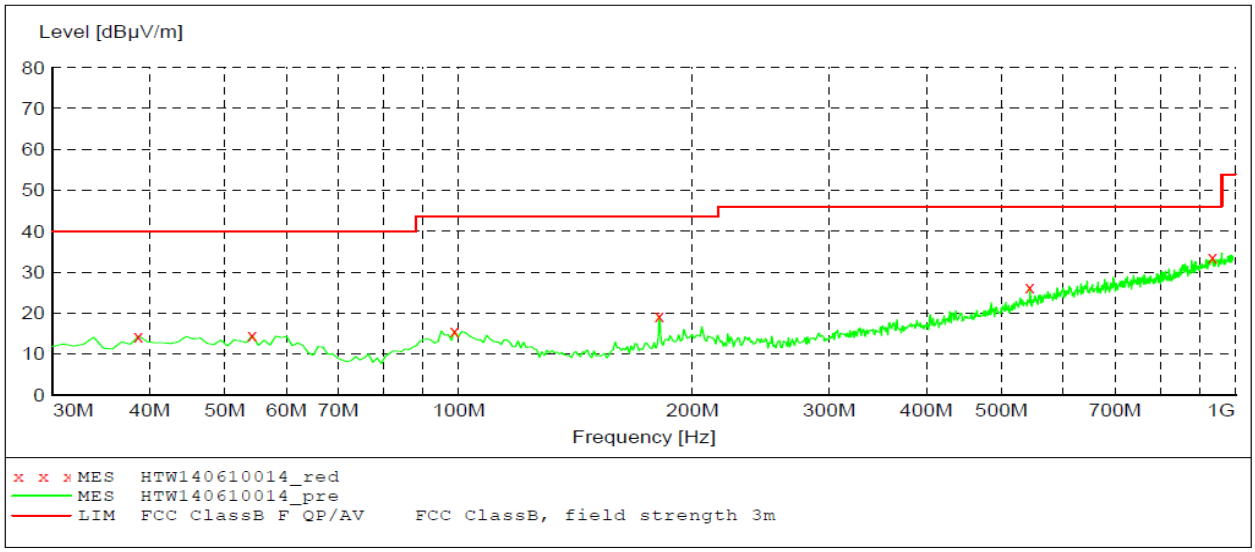
TEST RESULTS

Remak:

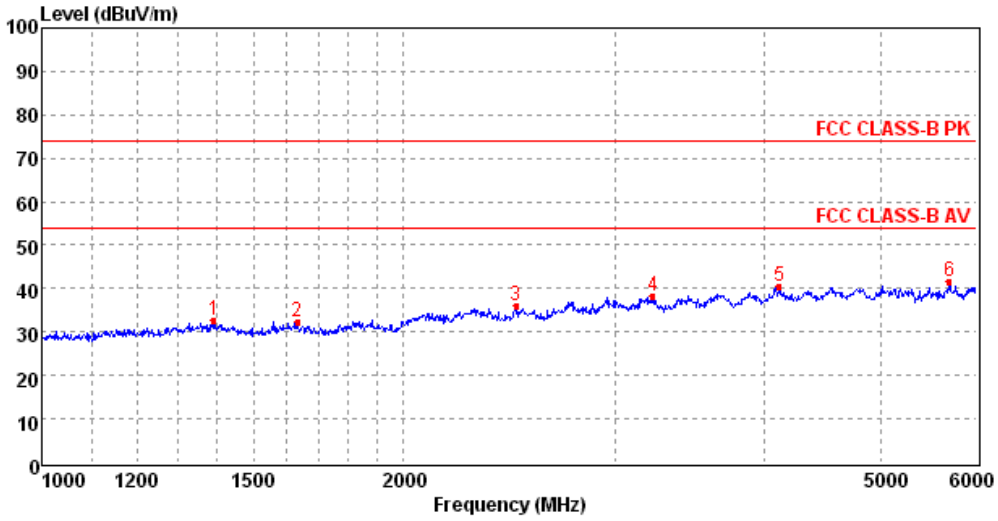
1.The Radiated Measurement (Standby mode /Receiver mode) are performed to the three channels (the high channel, the middle channel and the low channel), the datum recorded below is the worst case for each channel separation;and the EUT shall be scanned from 30 MHz to the 5th harmonic of the highest oscillator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

2.Test performed at Op 5 , Op 6 operation mode respectively.And the datum append below is the worst case at High channel of each operation mode

Op5			
Test Frequency:	173.5MHz	Polarity:	*Horizontal*

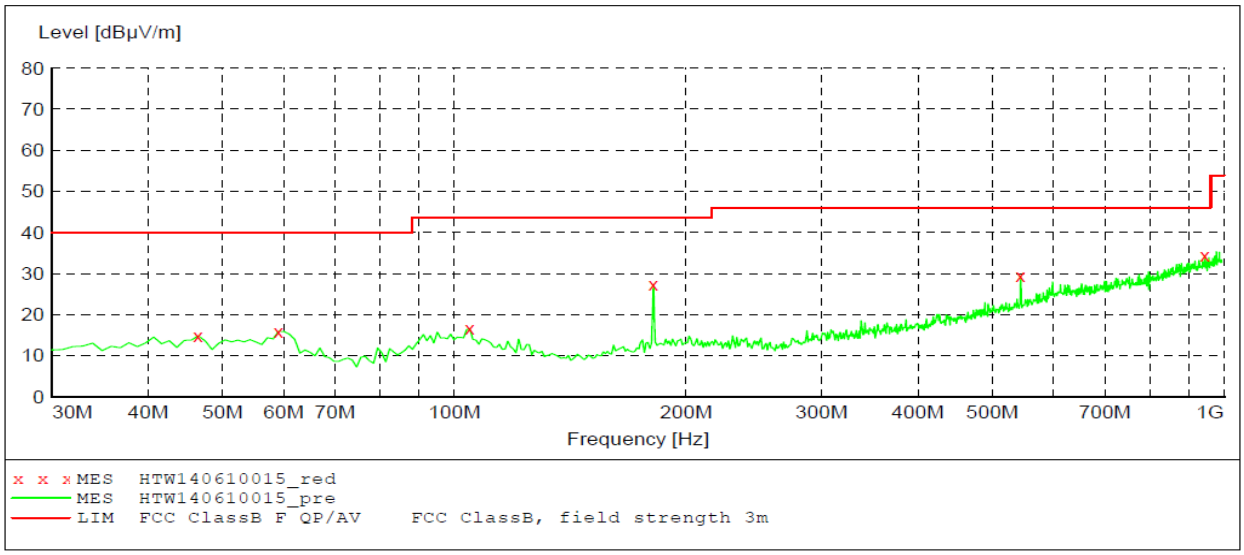


Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
38.730000	14.40	-15.3	40.0	25.6	PK	100.0	286.00	HORIZONTAL
54.250000	14.60	-15.4	40.0	25.4	PK	100.0	66.00	HORIZONTAL
98.870000	15.70	-13.8	43.5	27.8	PK	100.0	80.00	HORIZONTAL
181.320000	19.40	-15.8	43.5	24.1	PK	100.0	286.00	HORIZONTAL
544.100000	26.30	-5.5	46.0	19.7	PK	100.0	327.00	HORIZONTAL
935.010000	33.60	3.2	46.0	12.4	PK	100.0	22.00	HORIZONTAL

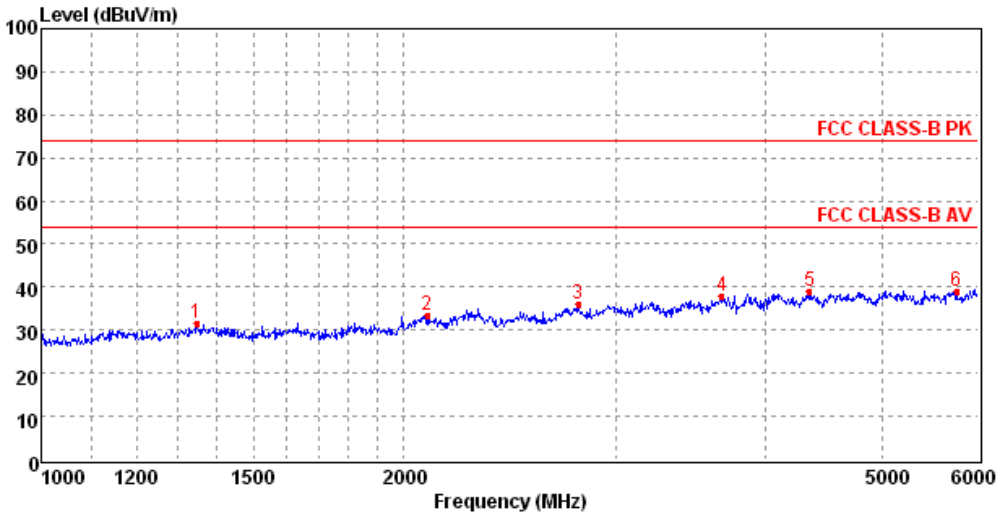


Mark	Frequency MHz	Level dBuv/m	Factor dB	Reading dBuv/m	Limit dBuv/m	Margin dB	Polarization	Det.
1	1390.53	32.58	-8.08	40.66	74.00	41.42	HORIZONTAL	Peak
2	1630.93	32.51	-8.38	40.89	74.00	41.49	HORIZONTAL	Peak
3	2480.41	36.03	-5.22	41.25	74.00	37.97	HORIZONTAL	Peak
4	3227.83	38.45	-2.84	41.29	74.00	35.55	HORIZONTAL	Peak
5	4111.13	40.46	0.03	40.43	74.00	33.54	HORIZONTAL	Peak
6	5696.20	41.66	3.62	38.04	74.00	32.34	HORIZONTAL	Peak

Op 5			
Test Frequency:	173.5MHz	Polarity:	Vertical

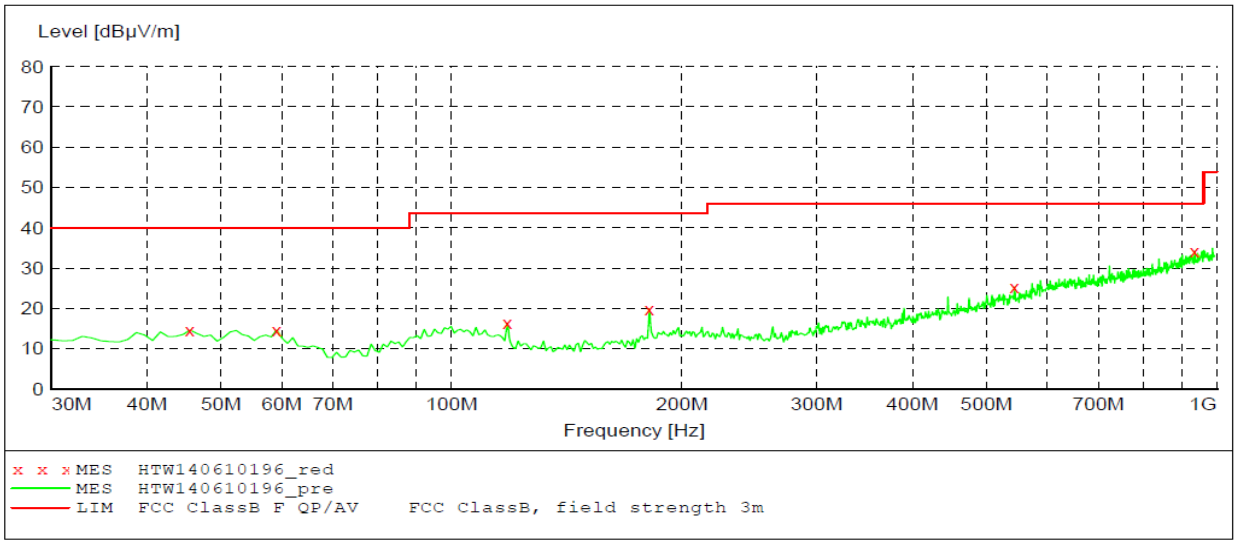


Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
46.490000	14.80	-15.1	40.0	25.2	PK	100.0	0.00	VERTICAL
59.100000	16.00	-15.6	40.0	24.0	PK	100.0	312.00	VERTICAL
104.690000	16.60	-14.1	43.5	26.9	PK	100.0	254.00	VERTICAL
181.320000	27.40	-15.8	43.5	16.1	PK	100.0	180.00	VERTICAL
544.100000	29.50	-5.5	46.0	16.5	PK	100.0	166.00	VERTICAL
944.710000	34.30	3.3	46.0	11.7	PK	100.0	166.00	VERTICAL

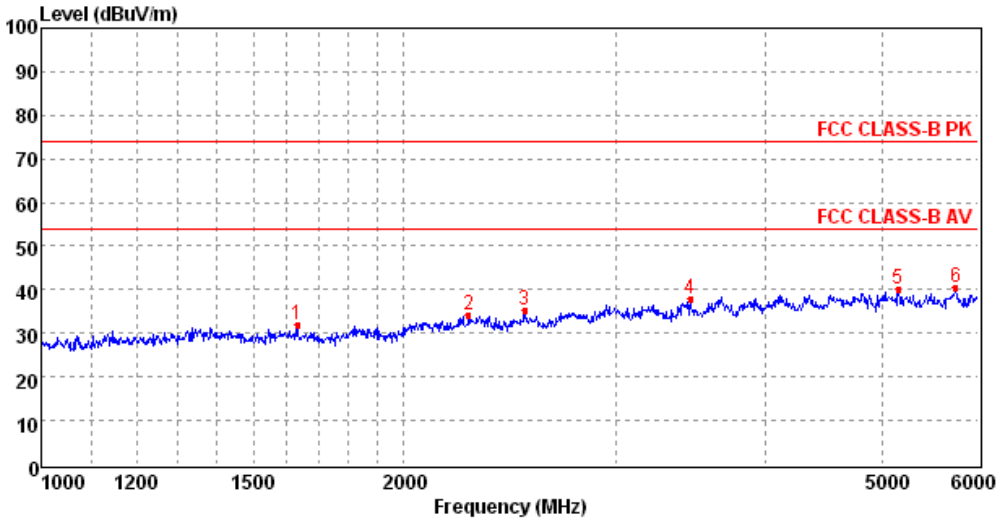


Mark	Frequency MHz	Level dBuv/m	Factor dB	Reading dBuv/m	Limit dBuv/m	Margin dB	Polarization	Det.
1	1346.40	31.51	-8.02	39.53	74.00	42.49	VERTICAL	Peak
2	2092.18	33.49	-5.99	39.48	74.00	40.51	VERTICAL	Peak
3	2791.78	36.24	-3.85	40.09	74.00	37.76	VERTICAL	Peak
4	3678.88	38.02	-1.50	39.52	74.00	35.98	VERTICAL	Peak
5	4345.94	39.04	0.73	38.31	74.00	34.96	VERTICAL	Peak
6	5757.76	39.14	3.90	35.24	74.00	34.86	VERTICAL	Peak

Op6			
Test Frequency:	173.5MHz	Polarity:	*Horizontal*

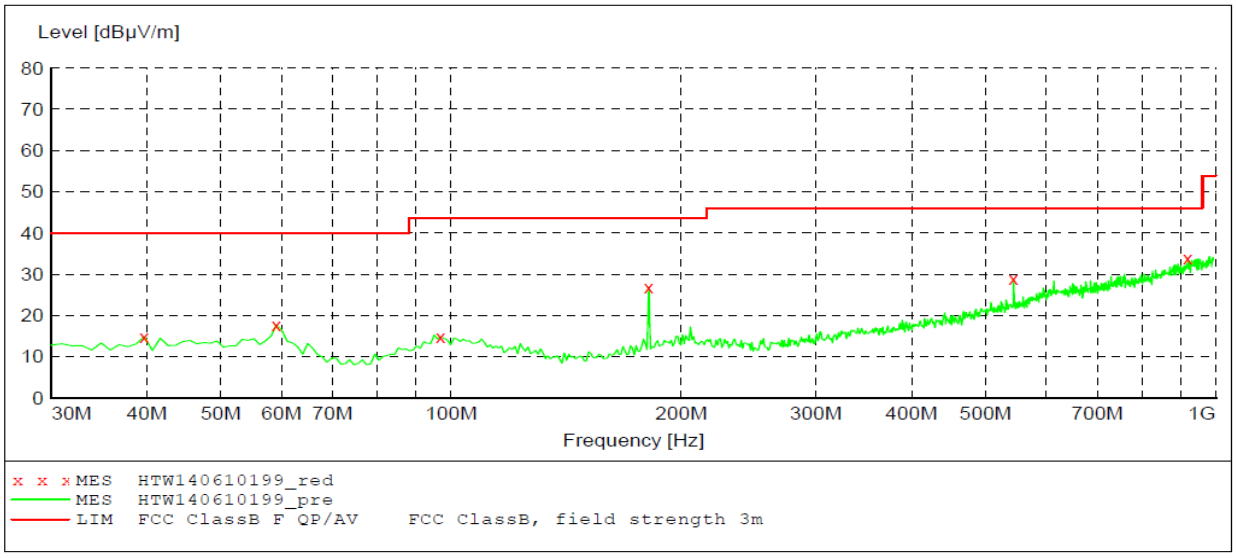


Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
45.520000	14.60	-15.0	40.0	25.4	PK	100.0	138.00	HORIZONTAL
59.100000	14.70	-15.6	40.0	25.3	PK	100.0	41.00	HORIZONTAL
118.270000	16.40	-16.2	43.5	27.1	PK	100.0	309.00	HORIZONTAL
181.320000	19.90	-15.8	43.5	23.6	PK	100.0	335.00	HORIZONTAL
544.100000	25.30	-5.5	46.0	20.7	PK	100.0	53.00	HORIZONTAL
935.010000	34.30	3.2	46.0	11.7	PK	100.0	127.00	HORIZONTAL

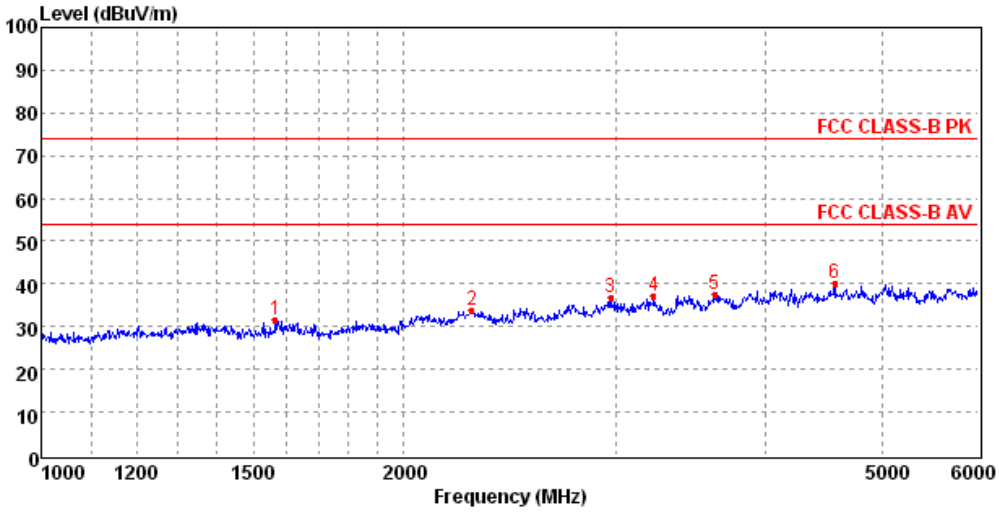


Mark	Frequency MHz	Level dBuv/m	Factor dB	Reading dBuv/m	Limit dBuv/m	Margin dB	Polarization	Det.
1	1630.93	31.88	-8.38	40.26	74.00	42.12	HORIZONTAL	Peak
2	2263.79	34.14	-4.97	39.11	74.00	39.86	HORIZONTAL	Peak
3	2520.73	35.28	-5.15	40.43	74.00	38.72	HORIZONTAL	Peak
4	3461.46	37.89	-2.49	40.38	74.00	36.11	HORIZONTAL	Peak
5	5152.39	40.26	2.87	37.39	74.00	33.74	HORIZONTAL	Peak
6	5747.46	40.49	3.85	36.64	74.00	33.51	HORIZONTAL	Peak

Op 6			
Test Frequency:	173.5MHz	Polarity:	Vertical



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
39.700000	14.90	-15.1	40.0	25.1	PK	100.0	127.00	VERTICAL
59.100000	17.70	-15.6	40.0	22.3	PK	100.0	196.00	VERTICAL
96.930000	14.80	-14.1	43.5	28.7	PK	100.0	35.00	VERTICAL
181.320000	27.00	-15.8	43.5	16.5	PK	100.0	185.00	VERTICAL
544.100000	28.90	-5.5	46.0	17.1	PK	100.0	318.00	VERTICAL
919.490000	34.00	3.0	46.0	12.0	PK	100.0	104.00	VERTICAL



Mark	Frequency MHz	Level dBuv/m	Factor dB	Reading dBuv/m	Limit dBuv/m	Margin dB	Polarization	Det.
1	1565.09	31.63	-8.37	40.00	74.00	42.37	VERTICAL	Peak
2	2280.08	34.01	-4.98	38.99	74.00	39.99	VERTICAL	Peak
3	2972.46	36.72	-3.34	40.06	74.00	37.28	VERTICAL	Peak
4	3227.83	37.06	-2.84	39.90	74.00	36.94	VERTICAL	Peak
5	3626.53	37.41	-1.67	39.08	74.00	36.59	VERTICAL	Peak
6	4561.36	40.25	1.28	38.97	74.00	33.75	VERTICAL	Peak

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