Registration No. 440

Certification Test Report

CFR 47 FCC Part 90, Subpart I
CFR 47 FCC Part 15, Subpart B
Industry Canada RSS 119, Issue 9
Industry Canada ICES-003, Issue 4

ARAM Systems Ltd.
LDR220A
FCC ID: V4KLDR220A
IC: 7610A-LDR220A

Project Code CG-857

(Report CG-857-RA-1-3)
Revision: 3

November 25, 2008

Prepared for: ARAM Systems Ltd.

Author: Deniz Demirci
Senior Wireless / EMC Technologist

Approved by: Nick Kobrosly
Director of Canadian Operations

Report Summary

Test Facility:	**National Technical Systems, Canada** Product Integrity Laboratory 5151-47th Street, N.E. Calgary Alberta T3J 3R2
Accreditation Numbers:	FCC 101386 IC 3978A-1 **Accredited by Standards Council of Canada** Accredited Laboratory No. 440 Conforms with requirements of CAN−P−4D (ISO/IEC 17025) CLIENTS SERVED: All interested parties FIELDS OF TESTING: Electrical/Electronic, Mechanical/Physical ACCREDITATION DATE:: 2002−03−20 VALID TO: 2009−03−20
Applicant:	ARAM Systems Ltd. 7236 10th Street NE Calgary, AB T2E 8X3 Canada Phone #: (403) 537-2100 Fax# (403) 537-2101
Customer Representative:	Name: Tim Hladik Phone #:: (403) 537-2100 Email Address: tim.hladik@aram.com

Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Applicable FCC Rule Parts	Applicable Industry Canada Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	Transmitter Output Power	No	No	No	Title 47, PART 90 Subpart I, 90.205	RSS-119 Issue 9 5.4
B	Occupied Bandwidth	No	No	No	Title 47, PART 90 Subpart I, 90.209	RSS-Gen Issue 2 4.6.1
C	Transmitter Emission Mask	No	No	No	Title 47, PART 90 Subpart I, 90.210	RSS-119 Issue 9 5.8.1
D	Transmitter Conducted Spurious Emissions	No	No	No	Title 47, PART 90 Subpart I, 90.210	RSS-119 Issue 9 5.8.1
E	Receiver Conducted Spurious Emissions	No	No	No	Title 47, PART 15 Subpart B 15.111	RSS-119 Issue 9 5.11
F	Transmitter Radiated Spurious Emissions	No	No	No	Title 47, PART 90 Subpart I, 90.210	RSS-119 Issue 9 5.8.1
G	Receiver Radiated Spurious Emissions	No	No	No	Title 47, PART 15 Subpart B, 15.109 Class B	RSS-119 Issue 9 5.11
H	Transmitter Frequency Stability	No	No	No	Title 47, PART 90 Subpart I, 90.213	RSS-119 Issue 9 5.3
I	Radiated Emissions (Digital Devices)	No	No	No	Title 47, PART 15 Subpart B, 15.109 Class A	ICES-003 Issue 4 Class A

These tests conducted as per Microlynx ARAM LDR220A Certification Test Plan, version 1.0A are not indicated as pass fail as The ARAM LDR does not conform to the “typical” narrowband single-channel requirements for Land Mobile Radio detailed in RSS-119 and FCC Part-90. Certification will need to be on an “exception” basis as noted in Microlynx Systems Ltd. ARAM LDR220A Certification Support Document provided with this application

Prepared By: _____
Deniz Demirci
Senior Wireless / EMC Technologist

Reviewed By: gmoore Digitally signed by gmoore DN: cn=gmoore, c=US, o=nts, email=glen.moore@ntscorp.com Date: 2008.11.25 14:09:50 -07'00'
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Glen Moore
Wireless / EMC Manager

Checked By: Alex Mathews 2008.11.25 14:12:33 -07'00'
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Alex Mathews
Quality Management Representative

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Register of revisions

Revision	Date	Description of Revisions
1	November 5, 2008	Report release
2	November 24, 2008	Changes after customer review
3	November 25, 2008	Changes after customer review

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the LDR220A form ARAM systems Ltd. to FCC Title 47, PART 90 and PART 15, RSS-119 Issue 9 and ICES-003 Issue 4
Tests were conducted per Microlynx ARAM LDR220A Certification Test Plan, version 1.0A as per deviations noted in NOD-CG-857-001

2.0 EUT

2.1 DESCRIPTION OF EUT

	Name	Model	Revision	Serial Number
EUT	Long Distance Radio LDR220A	LDR220A	0	N/A
Classification	TNB-Licensed Non-Broadcast Station transmitter			
Size (mm)	305x137x169			
Weight (kg)	4.8			
Power	24 V SLA battery pack. 4 battery connectors			
Current Draw (mA)	253			
Frequency Range	217.171592 MHz to 219.829812 MHz			
Modulation	BPSK for packet setup, OQPSK for payload BPSK at 276.48 kbps OQPSK at 552.96 kbps			
Channel Plan	For any given application all radios operate on the same channel using Time Division Duplex. 6 channels Preset 1: 217.171592 MHz, Preset 2: 217.522678 MHz Preset 3: 217.873763 MHz, Preset 4: 219.127641 MHz Preset 5: 219.478727 MHz Preset 6: 219.829812 MHz			
RF Power Output	2 Watts (33 dBm), 5 Watts (37 dBm)			
RF Connector	N Type Female			
Antenna	Suitable External antennas Omni-directional; Antenex B2003 (3 dB), GAM SS-220 Yagi Antennas; Antenex YS2165 (9.2 dBd), SINCLAIR SY206EB (9.5 dBd)			

General Functional Description	The purpose of this radio system is to provide a rugged VHF data link between various components of the ARAM seismic data acquisition system. Emphasis is placed on the "Vibroseis" market, where mobile excitation source equipment needs to be connected with the greater data acquisition network and the Central Recording Unit (CRU). The actual seismic spread can cover over 100 square kilometers over many different types of terrain, making the need for a long distance, (24 km line of sight), radio that is very robust. Typically the vibrators operate in groups of 4 , and each vibrator generates about 125 kbits/sec of information, making the overall payload bandwidth at least 500 kbits/sec The amount of data is such that narrow radio channels cannot be used. Multiple contiguous channels must be combined in order to achieve the data throughput. To achieve maximum radio range, operation is in the 200 MHz VHF band. The nature of the use of the LDR is such that operation in a particular area is usually temporary. It may be used for a week or so in an area while seismic exploration is performed, then deployed elsewhere.
Physical Description	The LDR consists of a number of circuit boards inside a rugged metal enclosure. The enclosure is sealed to provide both environmental protection and electromagnetic shielding. 

2.1.1 SET UP CONFIGURATION

Quantity	EUT Description	P/N	S/N	Rev
1	LDR220A	N/A	N/A	N/A
1	24 V SLA battery pack	N/A	N/A	N/A

2.2 EUT CABLE LIST

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
3	DC Power Cable / Serial Communication	Battery Pack	EUT	Shielded	Power Cable	3
1	DC Power Cable / Serial Communication	EUT	Unterminated	Shielded	Power Cable	3
2	Data Cable	EUT	Unterminated	Shielded	Data Cable	3

2.3 EUT FREQUENCY LIST

Module	Signal	Frequency (MHz)
Switch Mode Power Supply	Power Supply	0.1
Master Reference Clock	VCTCXO	14.7456
Receiver IF	IF	70
Transmit Local Oscillator	Tx LO	217 to 220
Demodulator Local oscillator	Demodulator LO	139.933
Receiver LO	Rx LO	287 to 290 (70 MHz above the receive frequency)

2.4 EUT SOFTWARE

Software Name	Software Release Number	Software Configuration
N/A	N/A	N/A

2.5 MODE OF OPERATION DURING TESTS

See related appendices.

3.0 SUPPORT EQUIPMENT

3.1 CO-LOCATED SUPPORT EQUIPMENT/ASSEMBLIES

Position	Qty	Description	P/N	Serial Number
Notebook Computer	1	Temp. connection for EUT setup	N/A	N/A

4.0 TEST ENVIRONMENT

4.1 NORMAL TEST CONDITIONS

Temperature: 20 – 23 °C
Relative Humidity: 28 – 35 %
Atmospheric pressure: 883 – 890 mbar
Nominal test voltage: 120 VAC 60Hz

The values are the limits registered during the test period.

APPENDICES

APPENDIX A: TRANSMITTER OUTPUT POWER

A.1. Base Standard & Test Basis

Base Standard	FCC Title 47, PART 90 Subpart I, 90.205 RSS-119 Issue 9, 5.4
Test Basis	FCC Title 47, PART 90 Subpart I, 90.205 RSS-119 Issue 9, 5.4
Test Method	ANSI TIA-603-C-2004, 2.2.1

A.2. Specifications

90.205 Power and antenna height limits:
Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation. Except where otherwise specifically provided for, the maximum power that will be authorized to applicants whose license applications for new stations are filed after August 18, 1995 is as follows:
217–220 MHz. Limitations on power and antenna heights are specified in §90.259
90.259 Assignment and use of frequencies in the bands 216–220 MHz and 1427–1432 MHz:
(a) 216–220 MHz band. (1) Frequencies in the 216–220 MHz band may be assigned to applicants that establish eligibility in the Industrial/Business Pool.
(4) In the 217–220 MHz band, the maximum transmitter output power is 2 watts. The maximum antenna height above average terrain (HAAT) is 152 m (500 feet).
(5) In the 217–220 MHz band, base, mobile, and operational fixed operations are permitted.

RSS 119 Issue 9, 5.4.3:
217-218 MHz and 219-220 MHz Equipment using these two bands may be certified to the transmitter powers listed in Section 5.4.1 but are generally licensed for less than 5 watts.

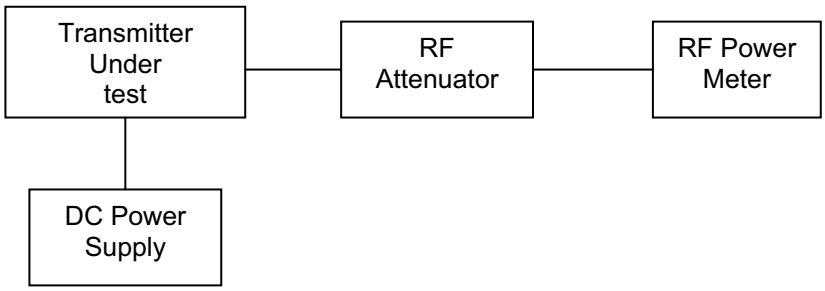
A.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

A.4. Test Procedure

Conducted average power measurement, using power meter and 30 dB attenuator.

A.5. Test Setup



A.6. Operating Mode During Test

EUT is in 2 Watts and 5 Watts Transmit power settings with QPSK Modulation
Transmit frequencies;
Preset 1: 217.171592 MHz
Preset 3: 217.873763 MHz
Preset 4: 219.127641 MHz
Preset 6: 219.829812 MHz

A.7. Test Results

Channel Definition	Frequency (MHz)	Transmitter Output Power (2 Watts setting) (dBm)	Transmitter Output Power (5 Watts setting) (dBm)
Preset 1	217.171592	32.98	36.96
Preset 3	217.873763	33.05	36.98
Preset 4	219.127641	33.15	37.05
Preset 6	219.829812	33.19	37.08

A.8. Sample Calculation

None

A.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name:	Glen Moore	Deniz Demirci
Function:	Wireless / EMC Manager	Senior Wireless / EMC Technologist

A.10. Test date

Test started: October 20, 2008 Ended: October 20, 2008

APPENDIX B: OCCUPIED BANDWIDTH

B.1. Base Standard & Test Basis

Base Standard	FCC Title 47, PART 90 Subpart I, 90.209 RSS-Gen Issue 2 4.6.1
Test Basis	FCC Title 47, PART 90 Subpart I, 90.209 RSS-Gen Issue 2 4.6.1
Test Method	FCC Title 47, PART 2 Subpart J, 2.1049 RSS-Gen Issue 2 4.6.1

B.2. Specifications

90.209:

(a) Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant. In those cases where §2.202 of this chapter does not provide a formula for the computation of necessary bandwidth, the occupied bandwidth, as defined in part 2 of this chapter, may be used in lieu of the necessary bandwidth.

(b) The maximum authorized single channel bandwidth of emission corresponding to the type of emission specified in §90.207 is as follows:

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
216–220	6.25	20/11.25/6

RSS-Gen Issue 2, 4.6.1:

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

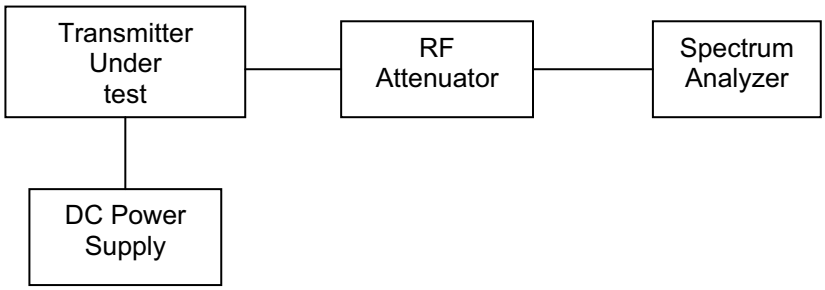
B.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

B.4. Test Procedure

Conducted RF measurement, using 30 dB attenuator, RF cables and spectrum analyzer.

B.5. Test Setup



B.6. Operating mode during test

EUT is in 2 Watts and 5 Watts Transmit power with QPSK Modulation
Transmit frequencies;
Preset 1: 217.171592 MHz
Preset 3: 217.873763 MHz
Preset 4: 219.127641 MHz
Preset 6: 219.829812 MHz

B.7. Test Results

Channel Definition	Frequency (MHz)	Occupied Bandwidth at 2 Watts Transmit Power (kHz)	Occupied Bandwidth at 5 Watts Transmit Power (kHz)
Preset 1	217.171592	470.942	480.962
Preset 3	217.873763	470.942	480.962
Preset 4	219.127641	470.942	480.962
Preset 6	219.829812	470.942	480.962

B.8. Observations

None

B.9. Deviations from Normal Operating Mode During Test

None

B.10. Sample Calculation

None

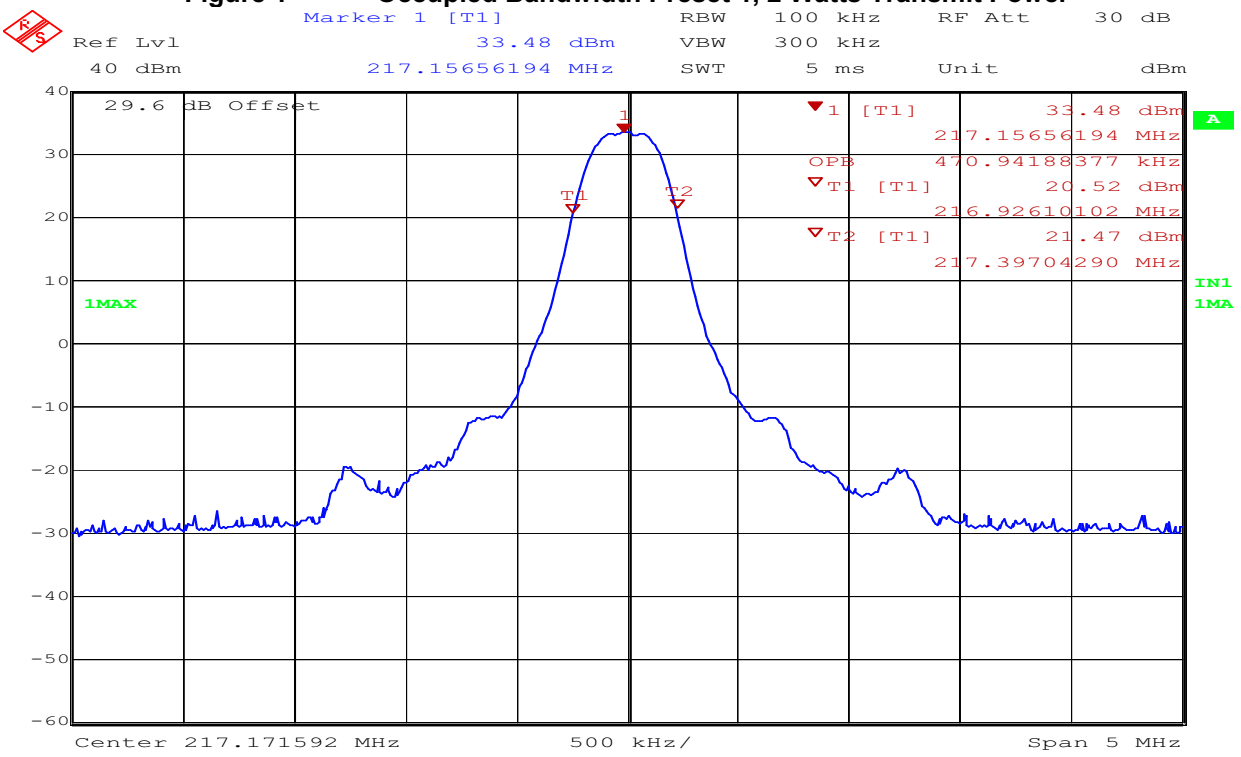
B.11. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

B.12. Test date

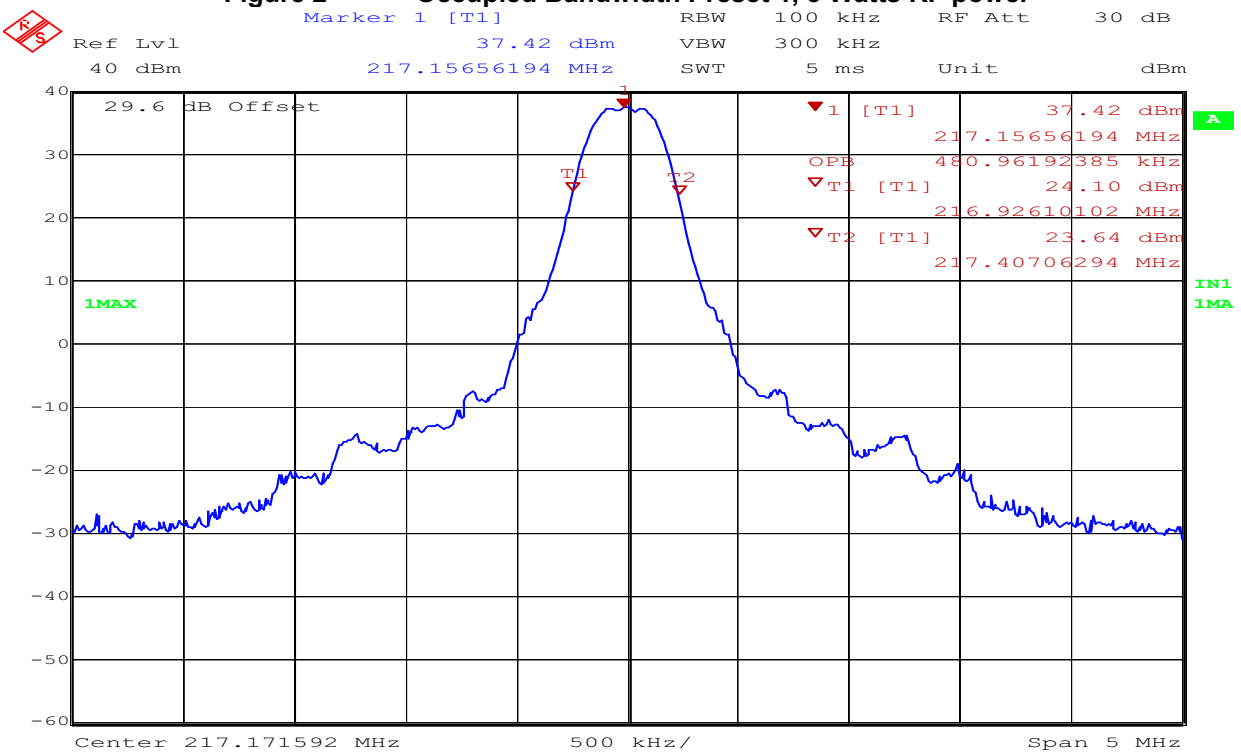
Test started: October 20, 2008 Ended: October 22, 2008

Figure 1 Occupied Bandwidth Preset 1, 2 Watts Transmit Power



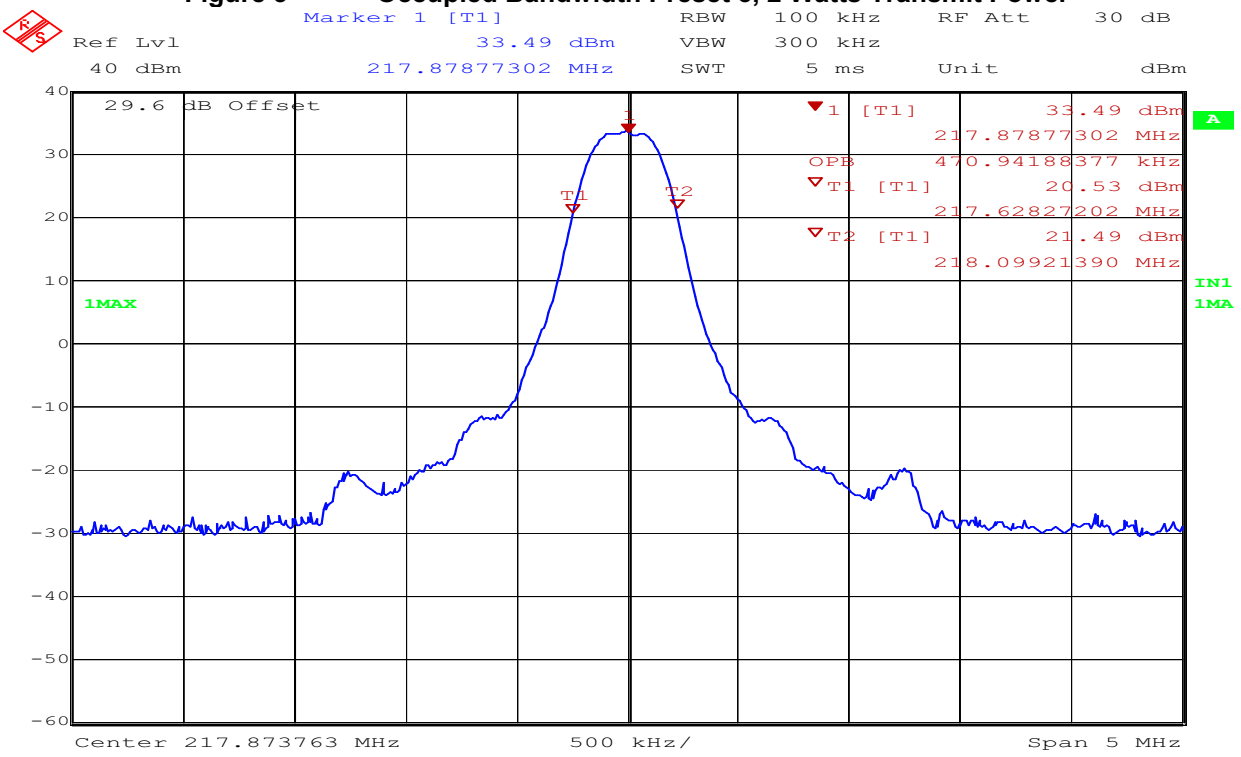
Comment A: Preset 1, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:10:27

Figure 2 Occupied Bandwidth Preset 1, 5 Watts RF power



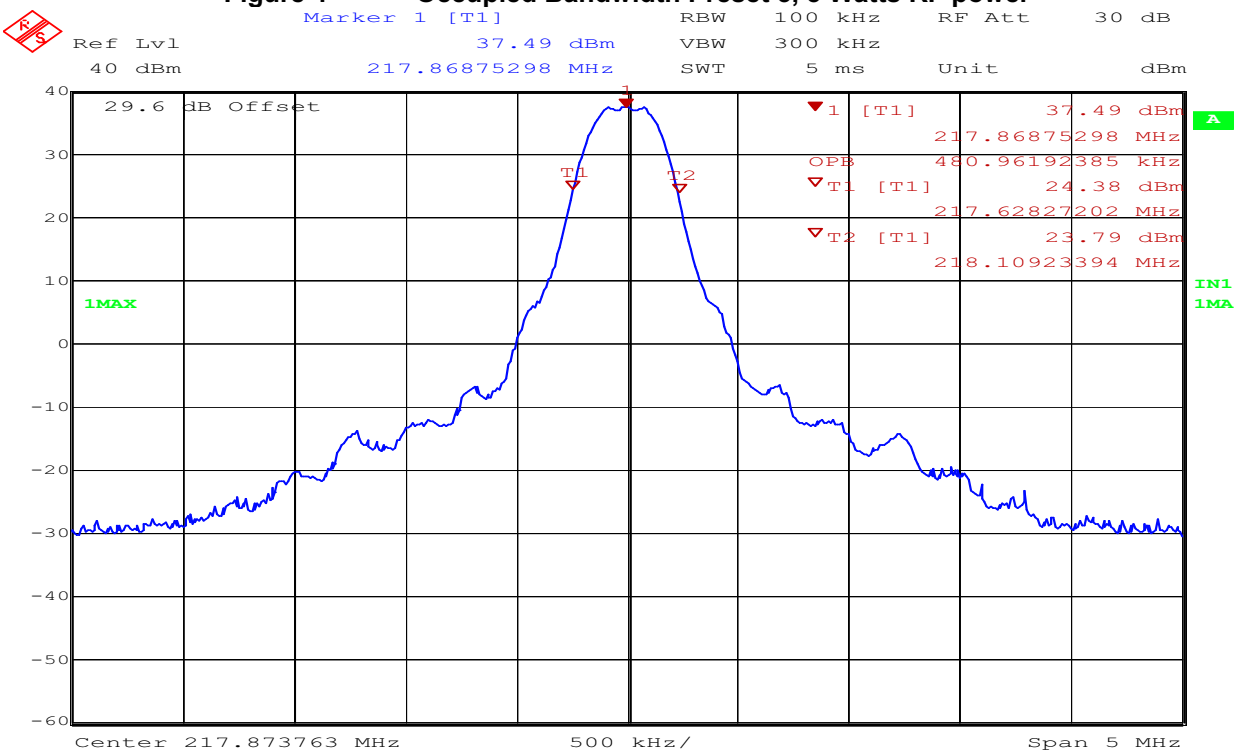
Comment A: Preset 1, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:05:27

Figure 3 Occupied Bandwidth Preset 3, 2 Watts Transmit Power



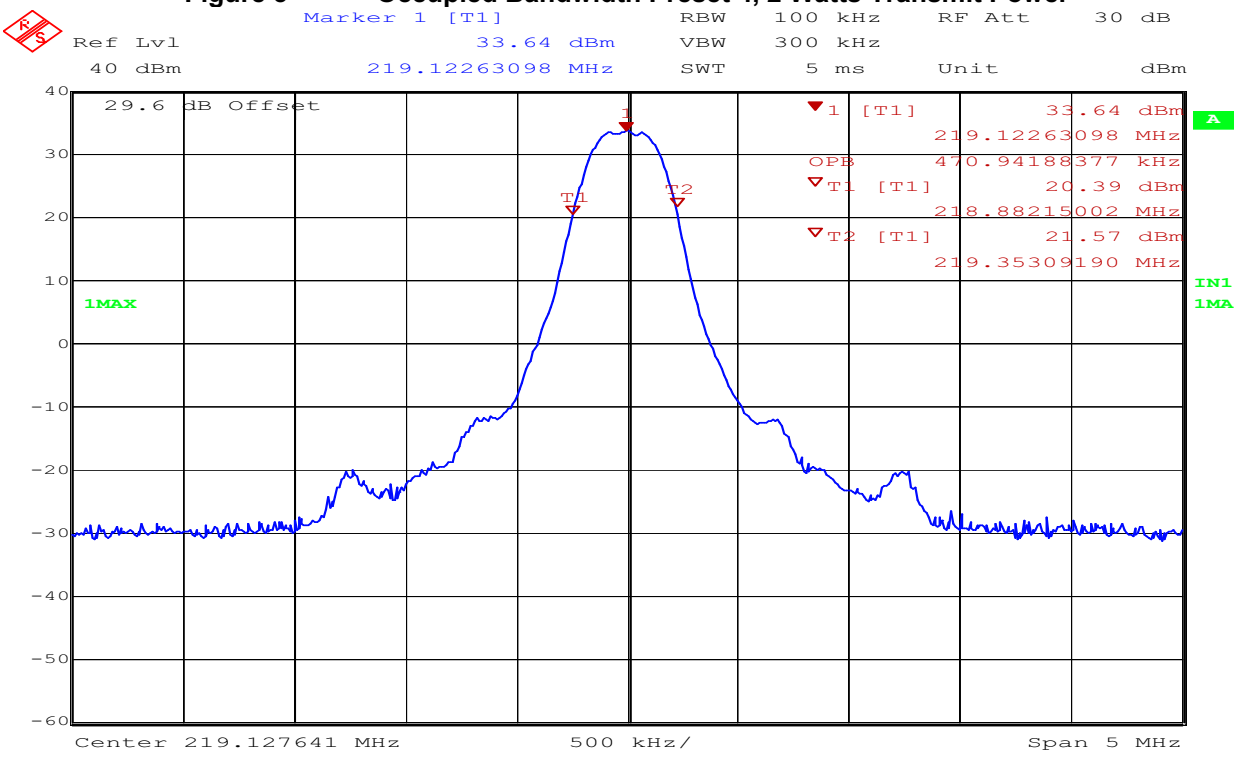
Comment A: Preset 3, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:15:52

Figure 4 Occupied Bandwidth Preset 3, 5 Watts RF power



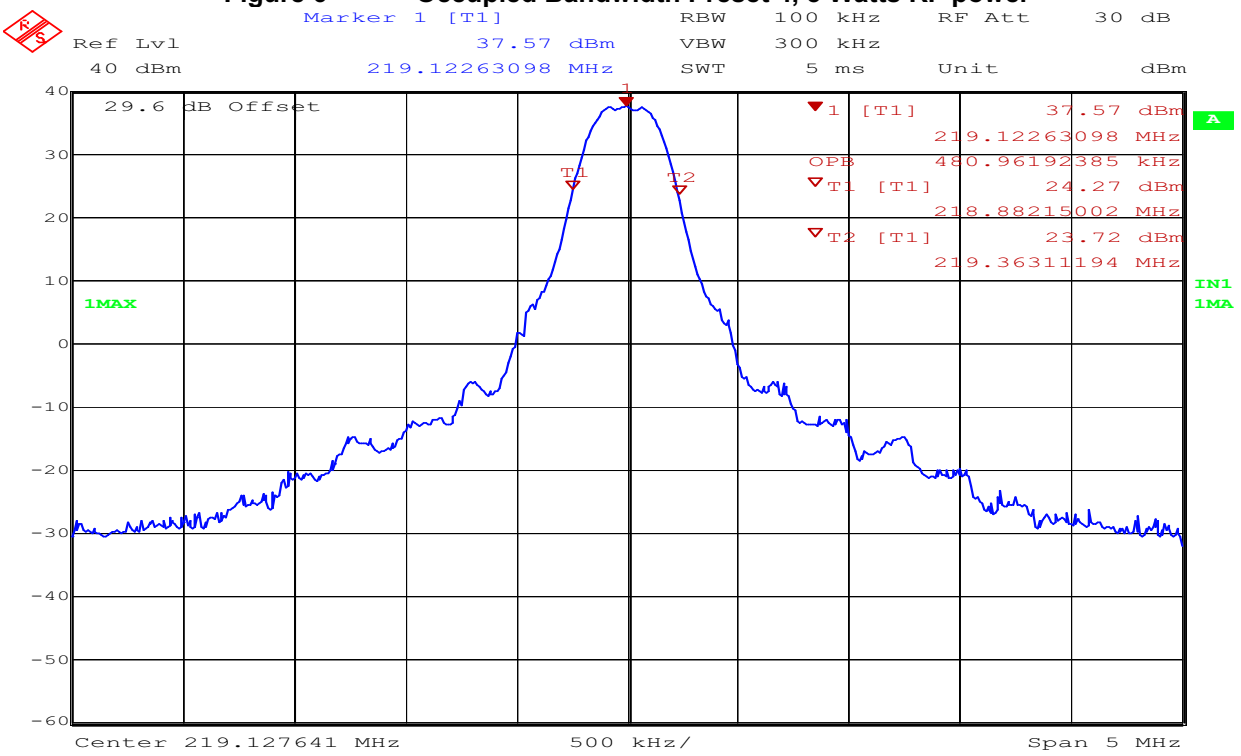
Comment A: Preset 3, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:12:58

Figure 5 Occupied Bandwidth Preset 4, 2 Watts Transmit Power



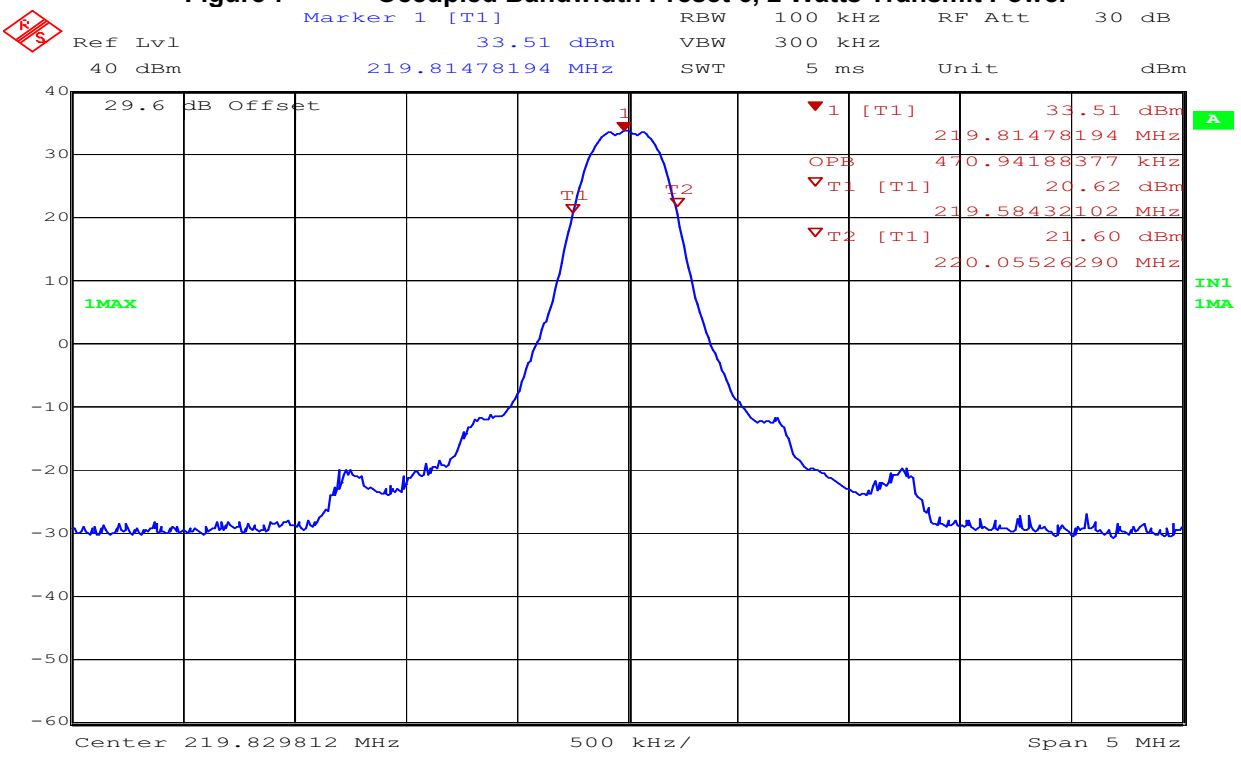
Comment A: Preset 4, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:19:25

Figure 6 Occupied Bandwidth Preset 4, 5 Watts RF power



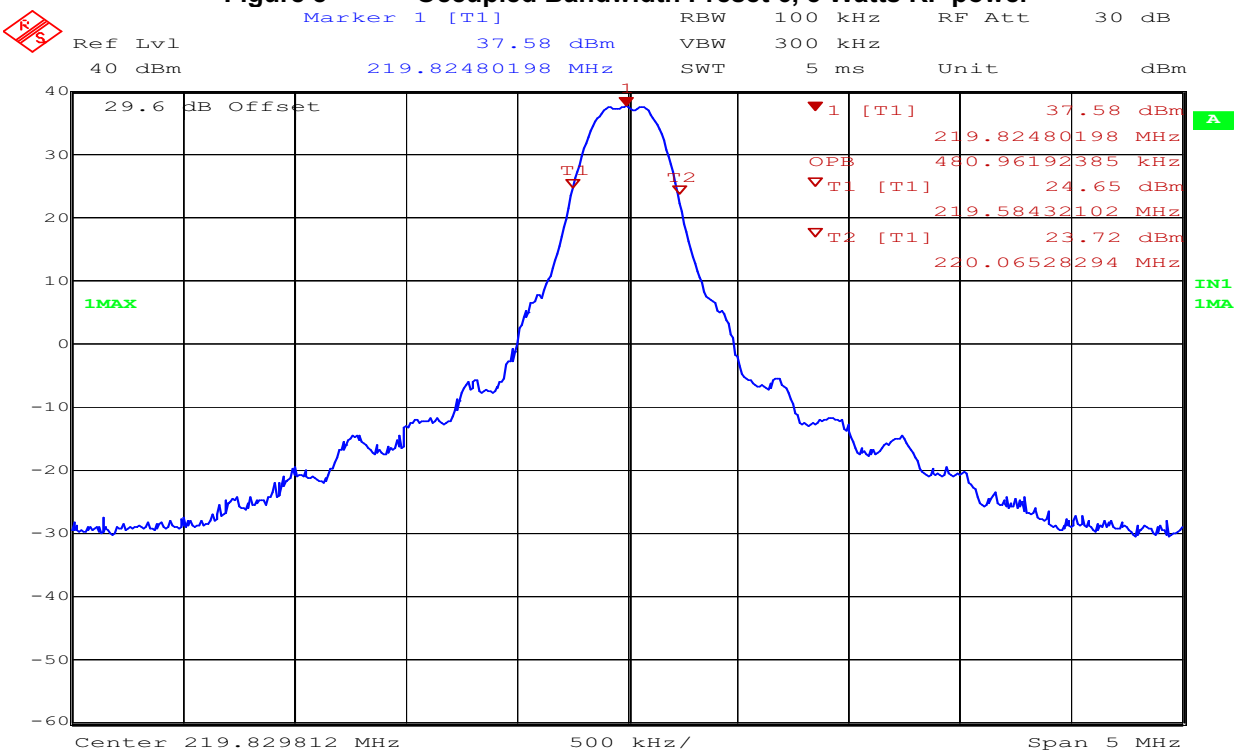
Comment A: Preset 4, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:17:44

Figure 7 Occupied Bandwidth Preset 6, 2 Watts Transmit Power



Comment A: Preset 6, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:23:26

Figure 8 Occupied Bandwidth Preset 6, 5 Watts RF power



Comment A: Preset 6, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:21:32

APPENDIX C: TRANSMITTER EMISSION MASK

C.1. Base Standard & Test Basis

Base Standard	FCC Title 47, PART 90 Subpart I, 90.210 RSS 119 Issue 9 5.8.1
Test Basis	FCC Title 47, PART 90 Subpart I, 90.210 RSS 119 Issue 9 5.8.1
Test Method	FCC Title 47, PART 90 Subpart I, 90.210 RSS 119 Issue 9 5.8.10.2

C.2. Specifications

FCC Title 47, PART 90 Subpart I, 90.210;

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

(n) *Other frequency bands.* Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B. Equipment operating under this part on frequencies allocated to but shared with the Federal Government, must meet the applicable Federal Government technical standards.
b) *Emission Mask B.* For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated 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.

RSS 119 Issue 9, 5.8.1;

5.8.1 Emission Mask B for Transmitters Equipped with an Audio Low-pass Filter;
The power of any emission must be attenuated below the transmitter output power (P, in watts) as specified in Table 4.

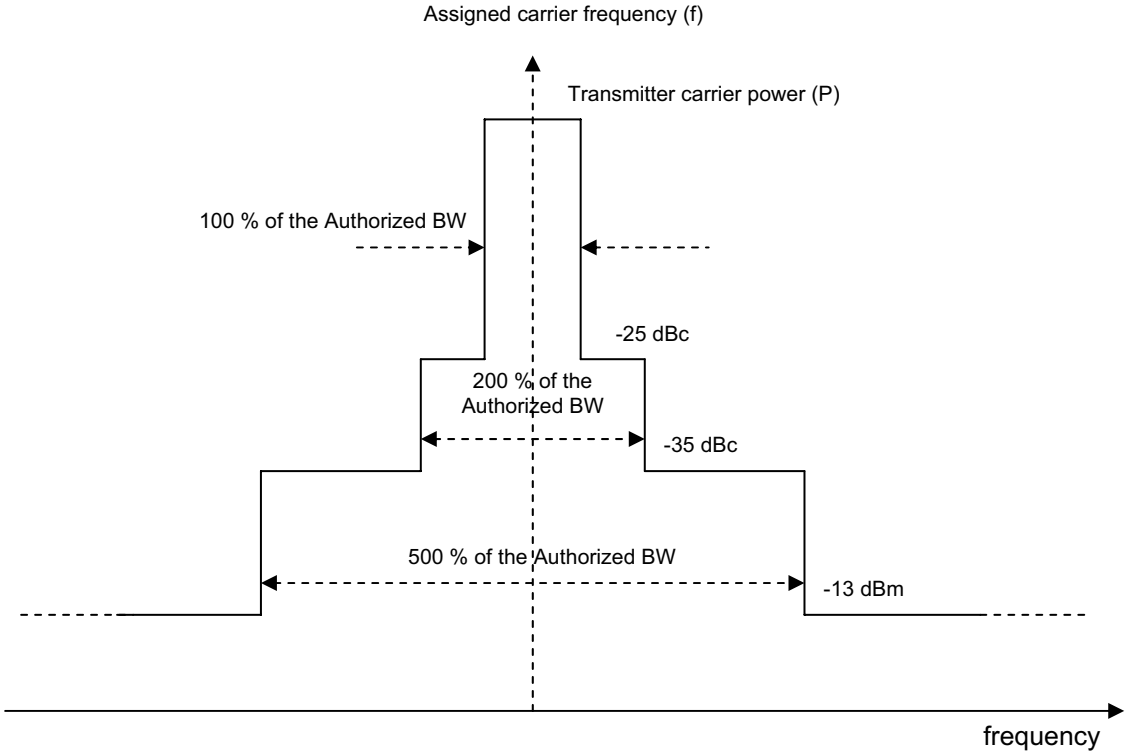
Table 4 - Emission Mask B

Displacement Frequency, fd (% of the Authorized Bandwidth)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
50 ≤ fd ≤ 100	25	300
100 < fd ≤ 250	35	300
fd > 250	43 + 10 log10 (P)	As per specified in Section 4.2.1

Fd = 325 kHz

5.8.9 Emission Mask L;
For an aggregate channel of bandwidth wider than 25 kHz (i.e. wider than a 25 kHz spaced channel) equipped with or without an audio filter, users may request bandwidths in multiples of 12.5 kHz. A mask similar to mask B may be used to evaluate the request on a case-by-case basis.

Figure 9 Emission Mask



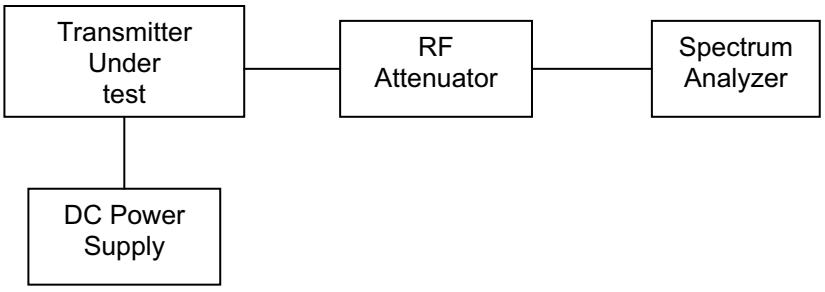
C.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

C.4. Test Procedure

Conducted RF measurement, using 30 dB attenuator, RF cables and spectrum analyzer.

C.5. Test Setup



C.6. Test Results

Preset 1	ABW (kHz)	325	Required Attenuation	Measured with 2W RF output (MHz)	Limit (MHz)	Measured with 5W RF output (MHz)	Limit (MHz)
	f (MHz)	217.171592					
	f - (ABW/2)	217.009092	-25 dBc	N/A*	Pass	N/A*	Pass
	f + (ABW/2)	217.334092	-25 dBc	N/A*	Pass	N/A*	Pass
	f - (ABW)	216.846592	-35 dBc	217.028305	0.181713	217.026301	0.179709
	f + (ABW)	217.496592	-35 dBc	217.316883	0.179709	217.316883	0.179709
	f - (ABW * 2.5)	216.359092	-13 dBm	216.635520	0.276428	216.395039	0.035947
	f + (ABW * 2.5)	217.984092	-13 dBm	217.687624	0.296468	217.928105	0.055987

Preset 3	ABW (kHz)	325	Required Attenuation	Measured with 2W RF output (MHz)	Limit (MHz)	Measured with 5W RF output (MHz)	Limit (MHz)
	f (MHz)	217.873763					
	f - (ABW/2)	217.711263	-25 dBc	N/A*	Pass	N/A*	Pass
	f + (ABW/2)	218.036263	-25 dBc	N/A*	Pass	N/A*	Pass
	f - (ABW)	217.548763	-35 dBc	217.728472	0.179709	217.728472	0.179709
	f + (ABW)	218.198763	-35 dBc	218.019053	0.179710	218.019053	0.179710
	f - (ABW * 2.5)	217.061263	-13 dBm	217.337690	0.276427	217.087189	0.025926
	f + (ABW * 2.5)	218.686263	-13 dBm	218.389795	0.296468	218.640296	0.045967

Preset 4	ABW (kHz)	325	Required Attenuation	Measured with 2W RF output (MHz)	Limit (MHz)	Measured with 5W RF output (MHz)	Limit (MHz)
	f (MHz)	219.127641					
	f - (ABW/2)	218.965141	-25 dBc	N/A*	Pass	N/A*	Pass
	f + (ABW/2)	219.290141	-25 dBc	N/A*	Pass	N/A*	Pass
	f - (ABW)	218.802641	-35 dBc	218.984354	0.181713	218.982350	0.179709
	f + (ABW)	219.452641	-35 dBc	219.272931	0.179710	219.272931	0.179710
	f - (ABW * 2.5)	218.315141	-13 dBm	218.591568	0.276427	218.341067	0.025926
	f + (ABW * 2.5)	219.940141	-13 dBm	219.633653	0.306488	219.894174	0.045967

Preset 6	ABW (kHz)	325	Required Attenuation	Measured with 2W RF output (MHz)	Limit (MHz)	Measured with 5W RF output (MHz)	Limit (MHz)
	f (MHz)	219.829812					
	f - (ABW/2)	219.667312	-25 dBc	N/A*	Pass	N/A*	Pass
	f + (ABW/2)	219.992312	-25 dBc	N/A*	Pass	N/A*	Pass
	f - (ABW)	219.504812	-35 dBc	219.686525	0.181713	219.684521	0.179709
	f + (ABW)	220.154812	-35 dBc	219.975102	0.179710	219.975102	0.179710
	f - (ABW * 2.5)	219.017312	-13 dBm	219.293739	0.276427	219.043239	0.025927
	f + (ABW * 2.5)	220.642312	-13 dBm	220.345822	0.296490	220.596345	0.045967

* Carrier levels were lower than -25 dBc with 300 Hz RBW hence the measurements were not possible.

ABW = Authorized Bandwidth
f = Assigned Carrier Frequency

C.7. Operating Mode During Test

EUT is in 2 Watts and 5 Watts Transmit power with QPSK Modulation
Transmit frequencies;
Preset 1: 217.171592 MHz
Preset 3: 217.873763 MHz
Preset 4: 219.127641 MHz
Preset 6: 219.829812 MHz

C.8. Tested By

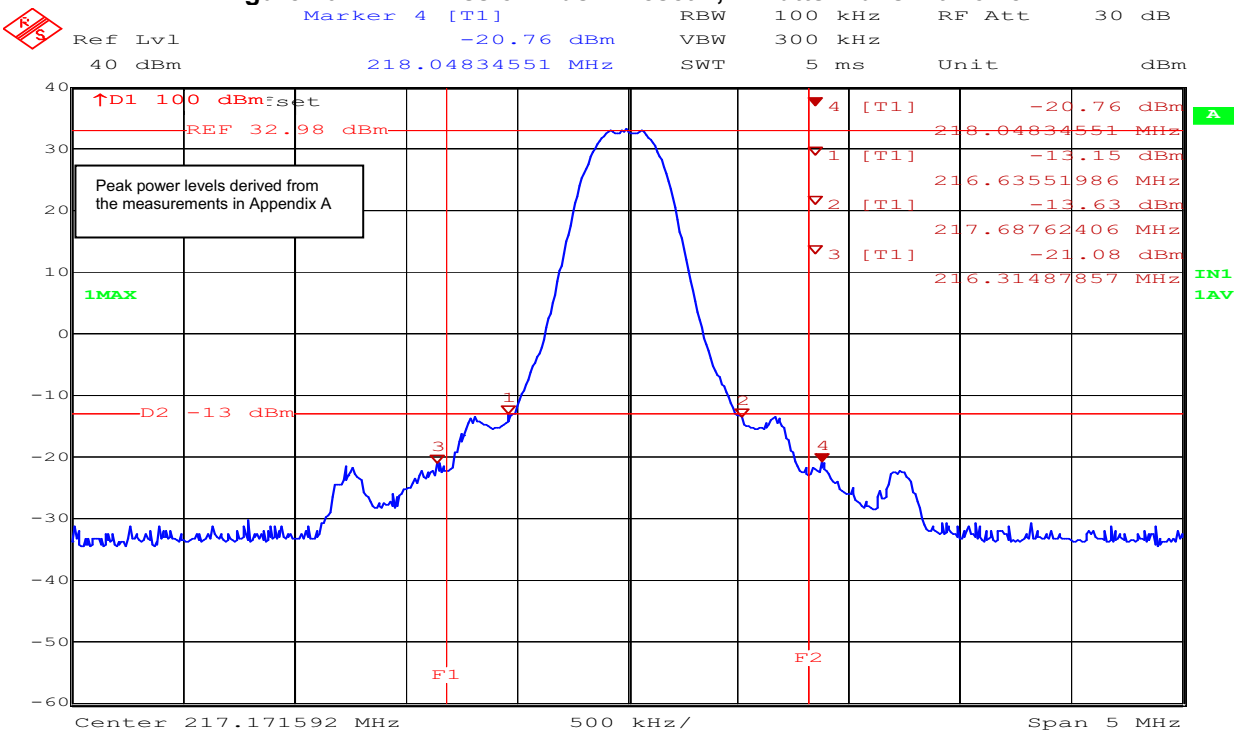
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name:	Glen Moore	Deniz Demirci
Function:	Wireless / EMC Manager	Senior Wireless / EMC Technologist

C.9. Test date

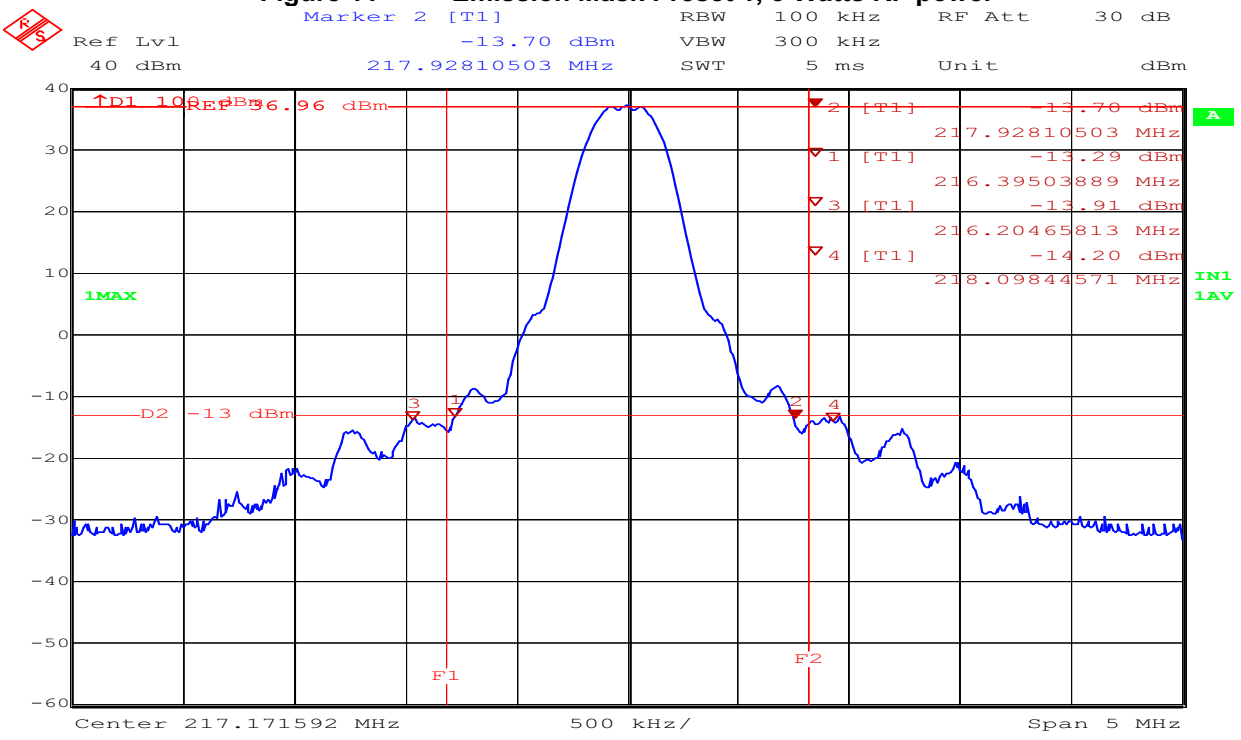
Test started: October 20, 2008 Ended: October 22, 2008

Figure 10 Emission Mask Preset 1, 2 Watts Transmit Power



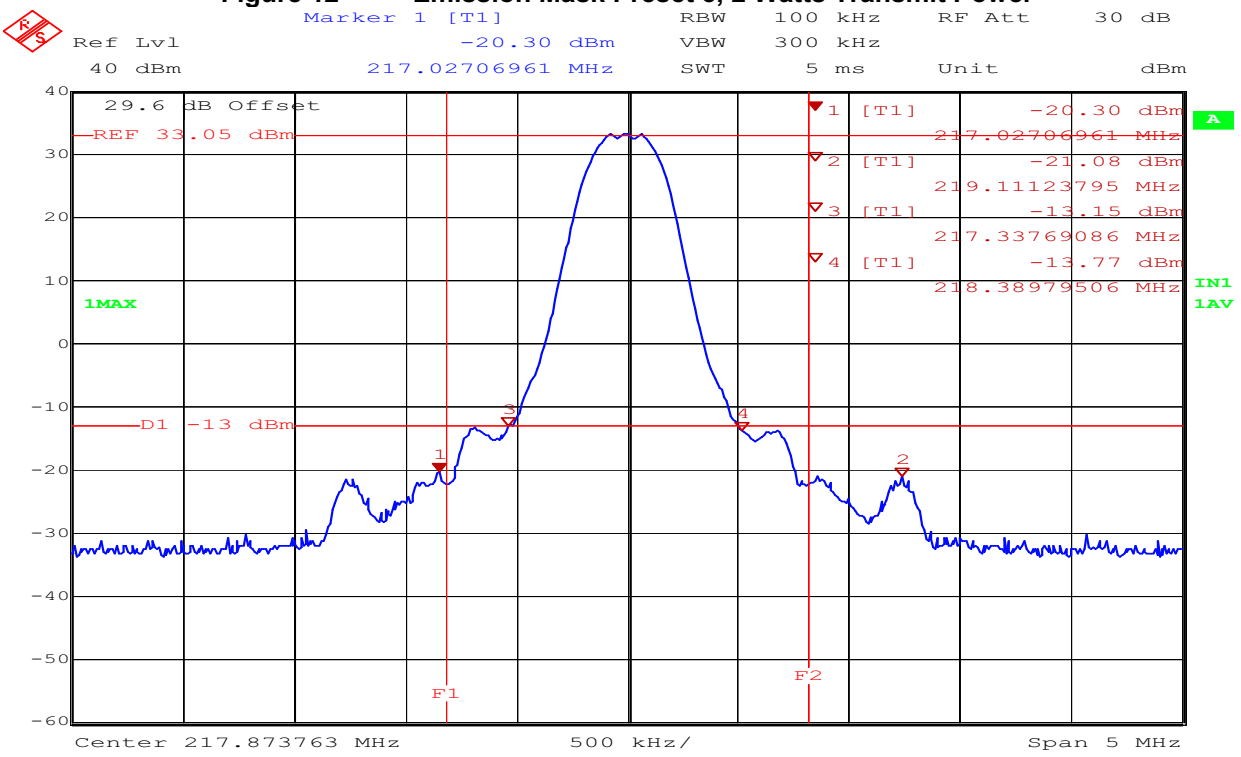
Comment A: Channel 217.171592 Mhz, QPSK 33 dbm LDR 03, LDRPWR-1
F1 and F2 Lines fc +/-812.5 KHz
Date: 20.OCT.2008 13:08:08

Figure 11 Emission Mask Preset 1, 5 Watts RF power



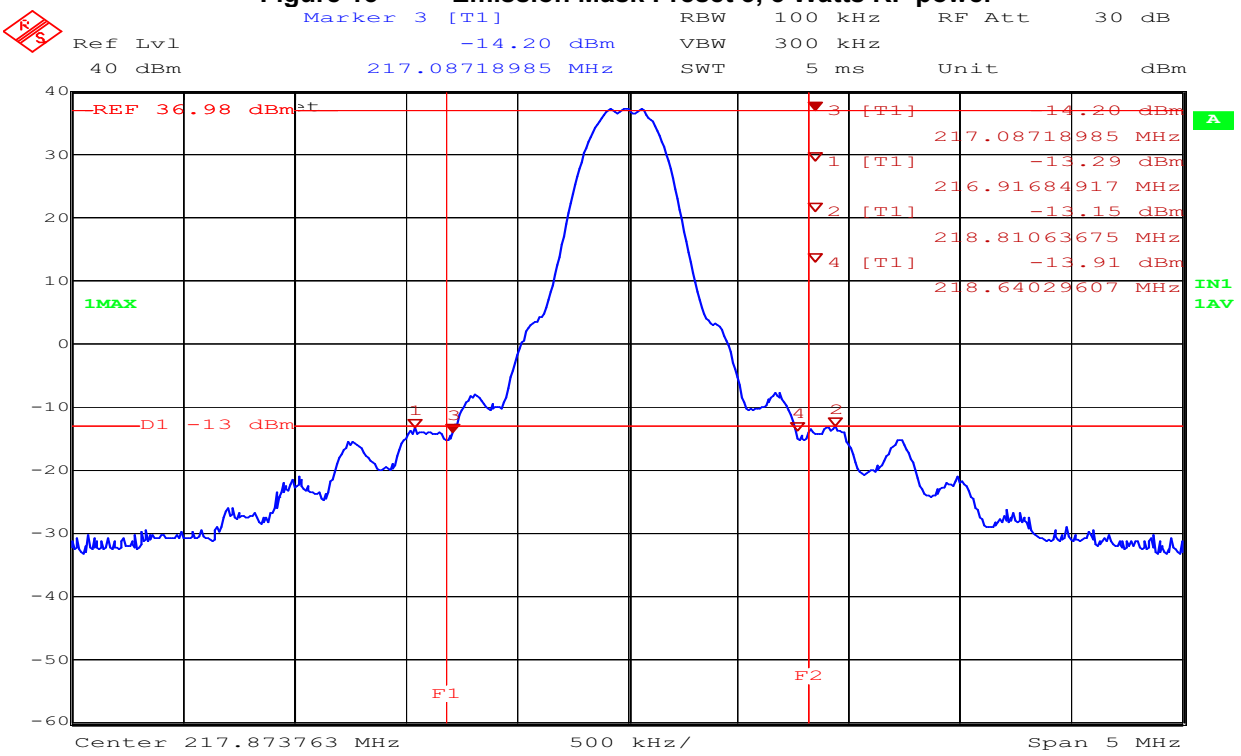
Comment A: Channel 217.171592 Mhz, QPSK 37 dbm LDR 03, LDRPWR-1
F1 and F2 Lines fc +/-812.5 KHz
Date: 20.OCT.2008 13:05:19

Figure 12 Emission Mask Preset 3, 2 Watts Transmit Power



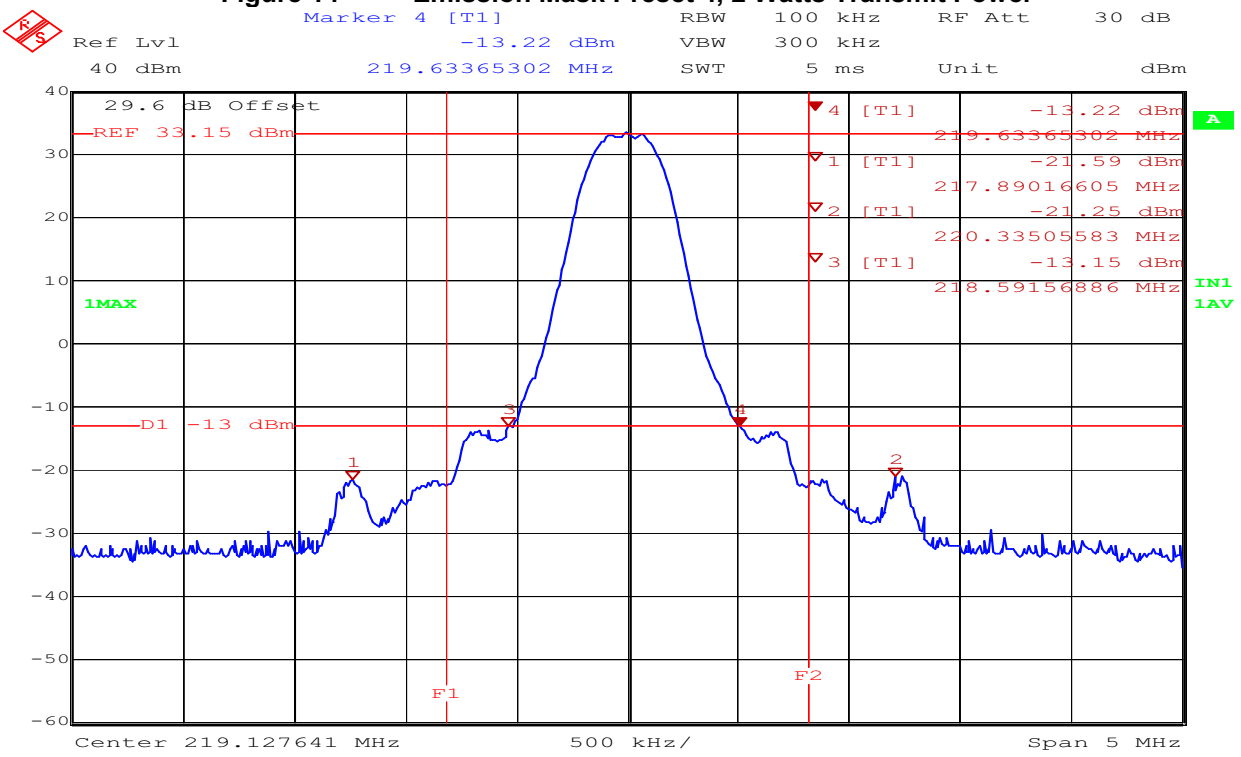
Comment A: Preset 3, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 15:16:12

Figure 13 Emission Mask Preset 3, 5 Watts RF power



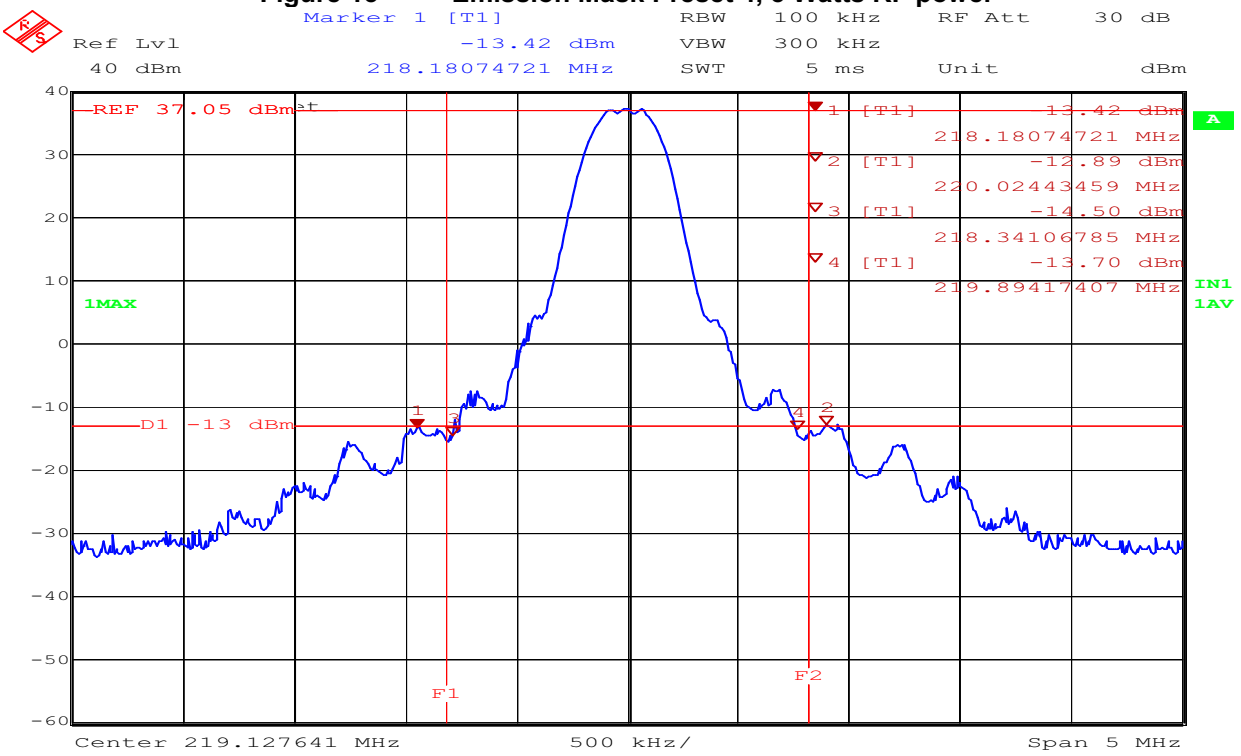
Comment A: Preset 3, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 15:11:10

Figure 14 Emission Mask Preset 4, 2 Watts Transmit Power



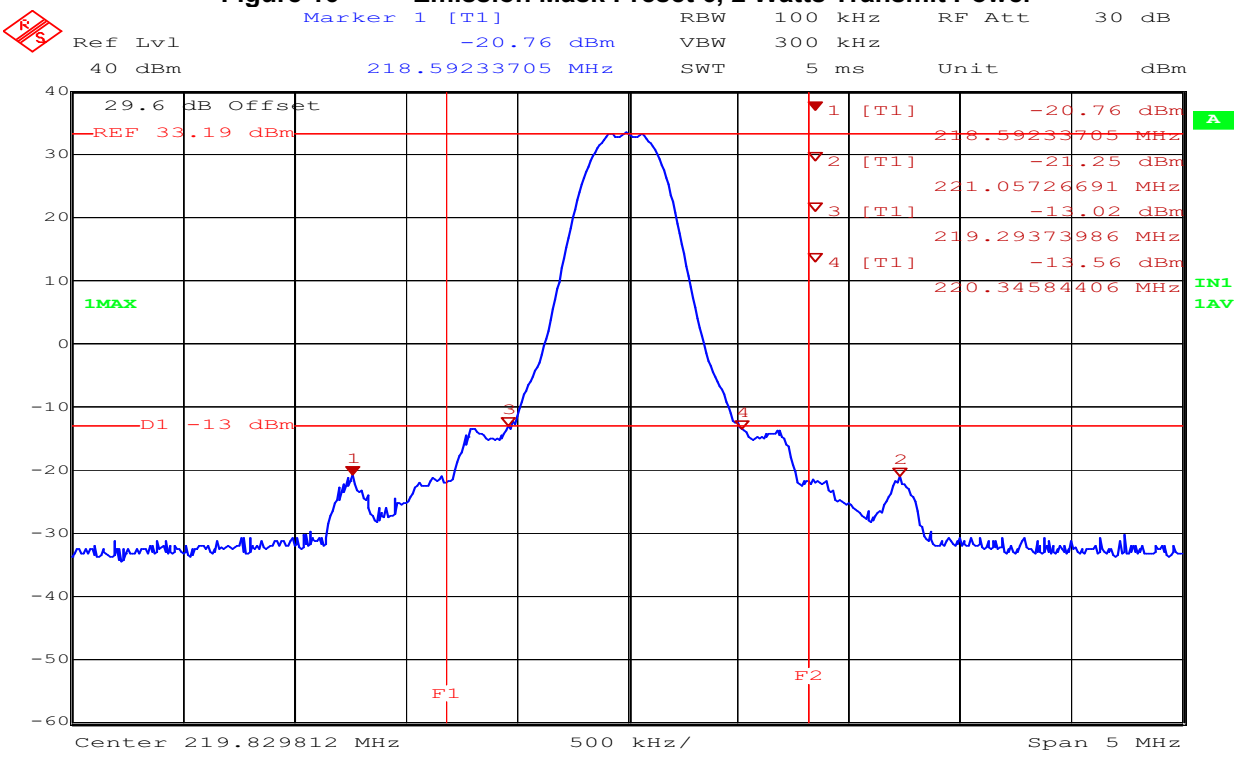
Comment A: Preset 4, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 15:35:08

Figure 15 Emission Mask Preset 4, 5 Watts RF power



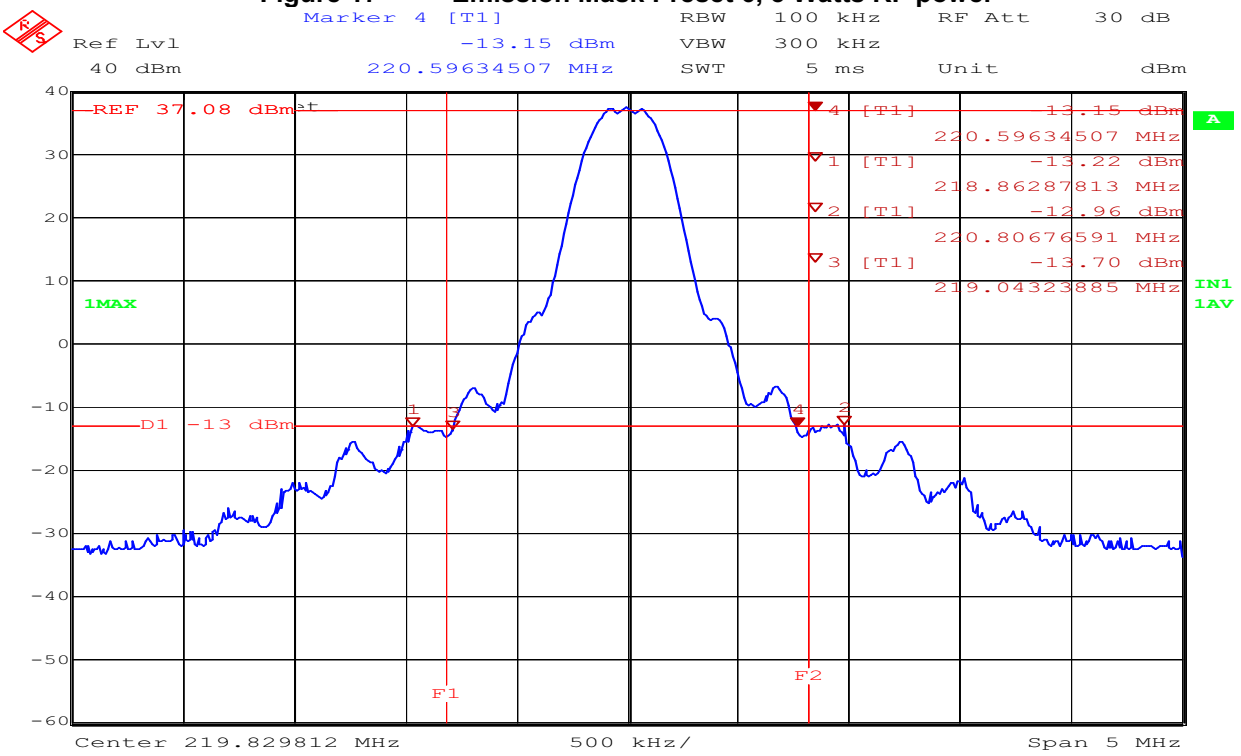
Comment A: Preset 4, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 15:32:13

Figure 16 Emission Mask Preset 6, 2 Watts Transmit Power



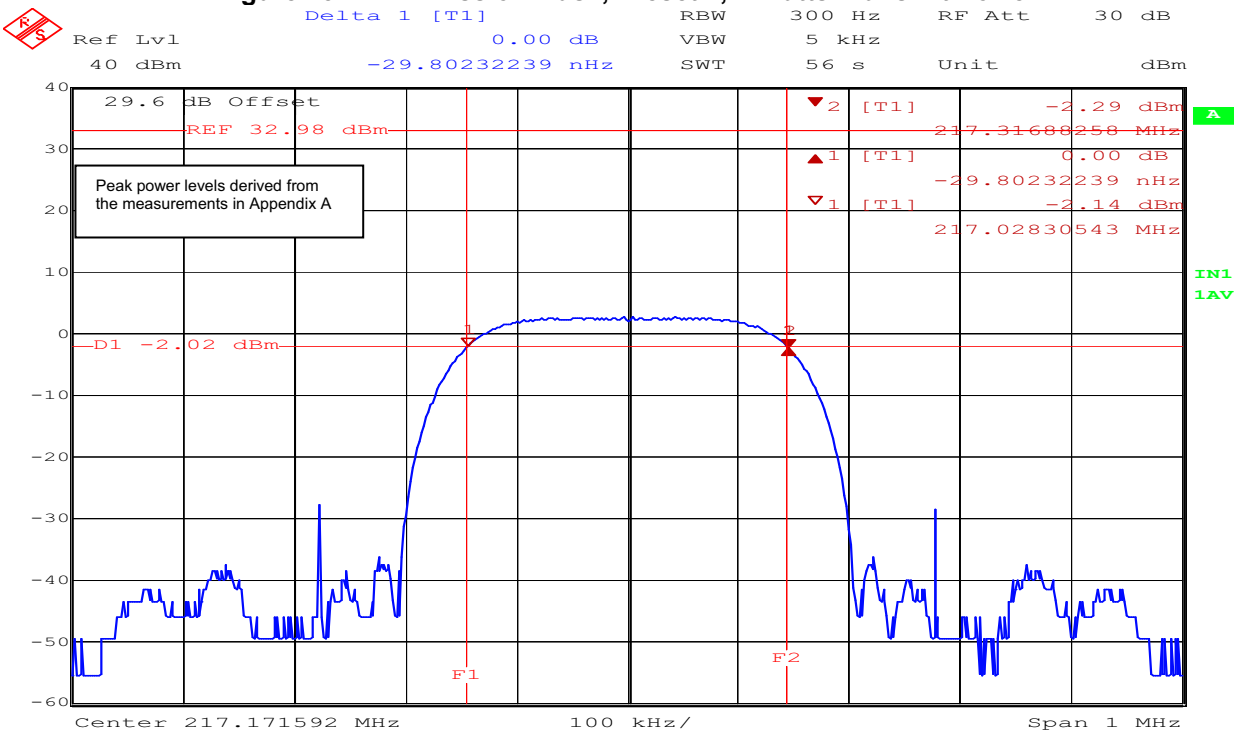
Comment A: Preset 6, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 15:44:41

Figure 17 Emission Mask Preset 6, 5 Watts RF power



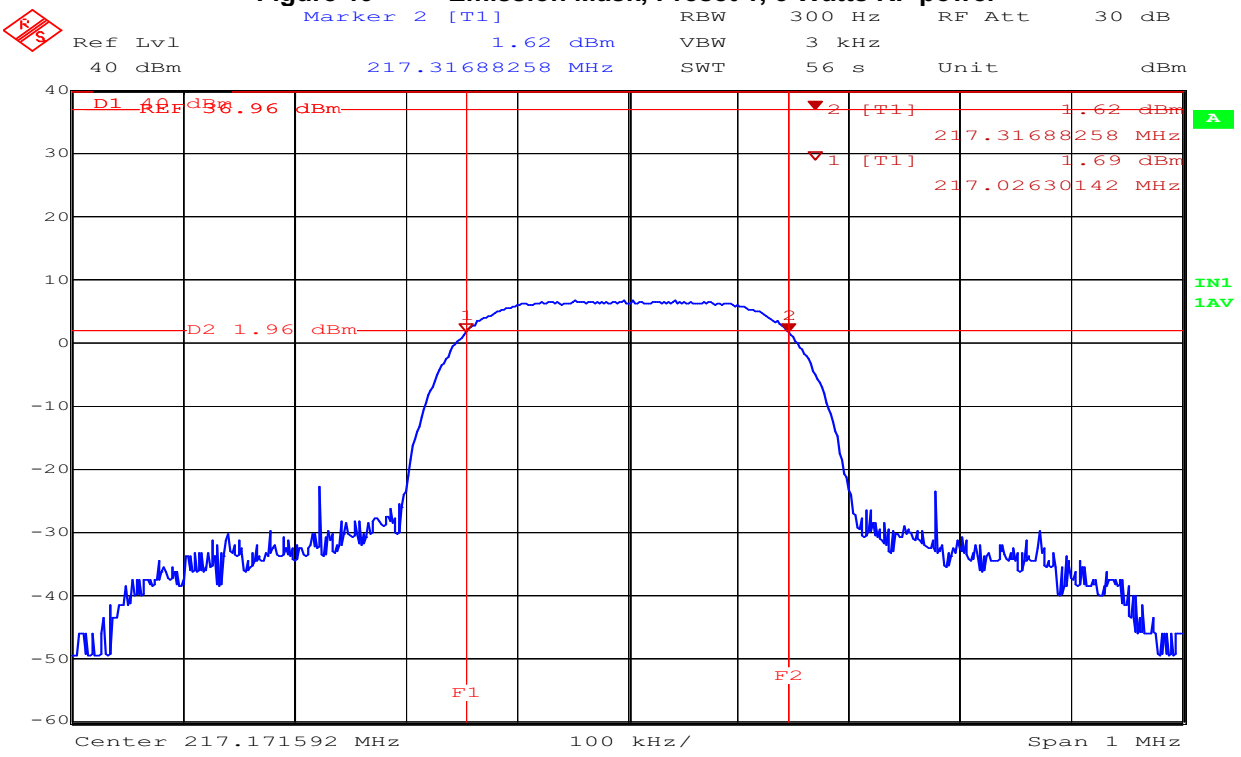
Comment A: Preset 6, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 15:40:46

Figure 18 Emission Mask, Preset 1, 2 Watts Transmit Power



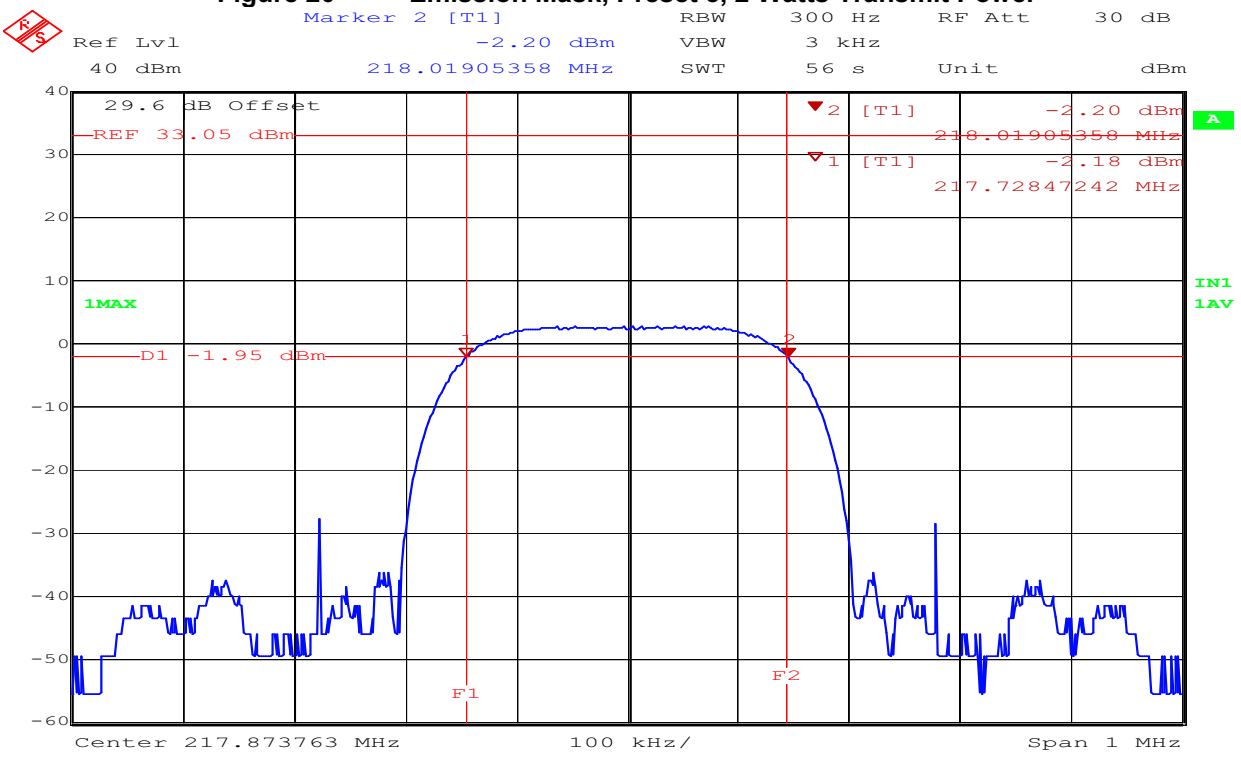
Comment A: Channel 217.171592 Mhz, QPSK 33 dbm LDR 03, LDRPWR-1
F1 and F2 Lines fc +/-812.5 KHz
Date: 20.OCT.2008 13:19:15

Figure 19 Emission Mask, Preset 1, 5 Watts RF power



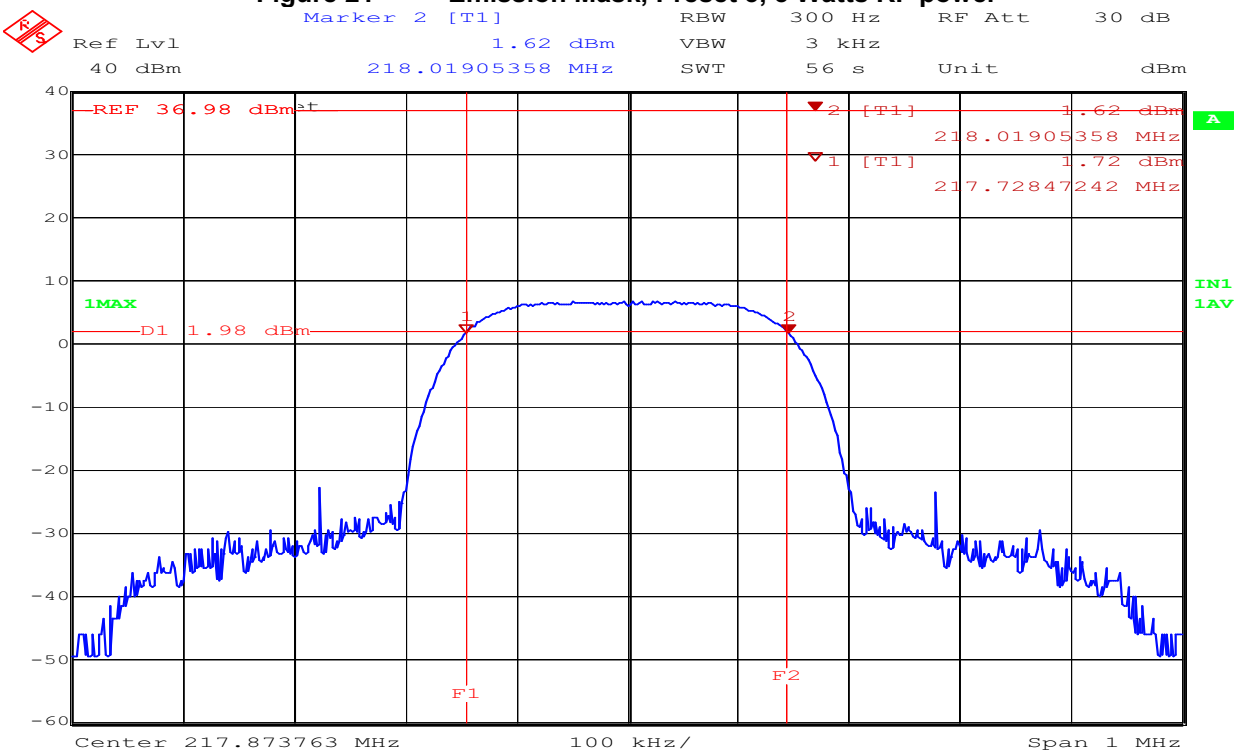
Comment A: Channel Preset 1, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 11:37:45

Figure 20 Emission Mask, Preset 3, 2 Watts Transmit Power



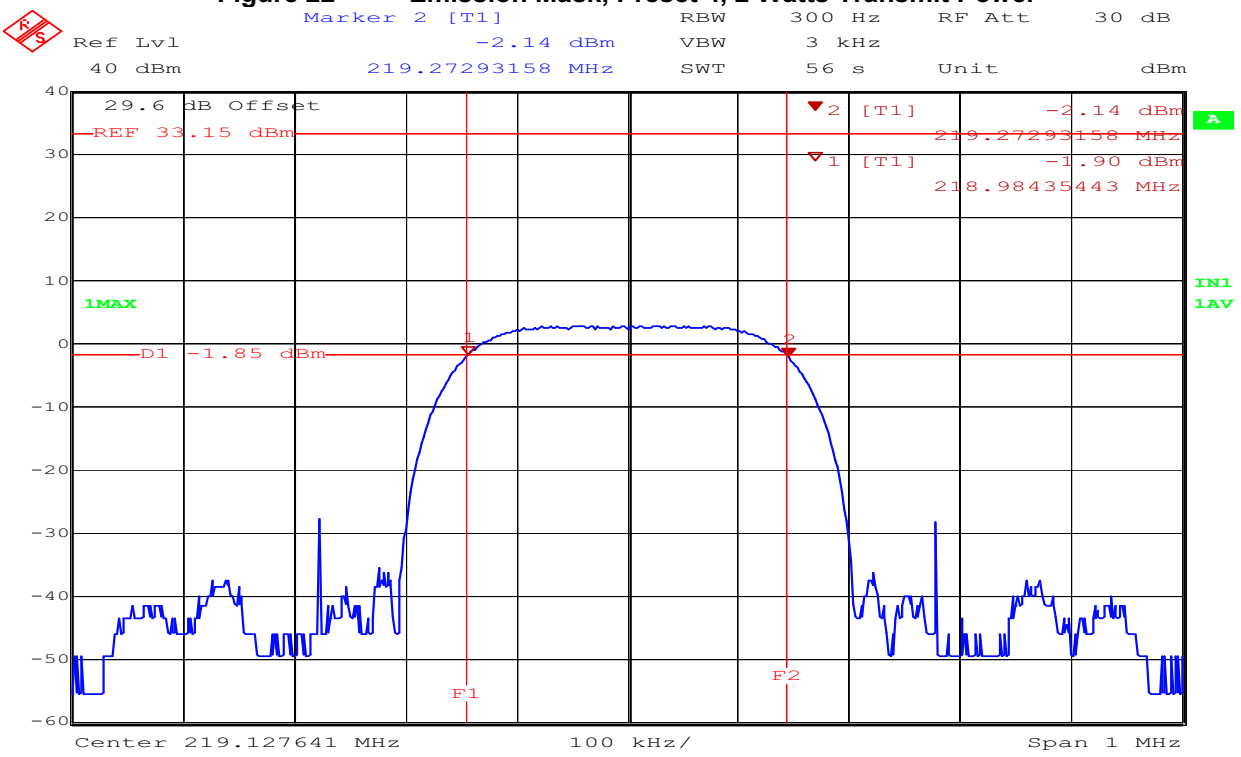
Comment A: Preset 3, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 14:39:08

Figure 21 Emission Mask, Preset 3, 5 Watts RF power



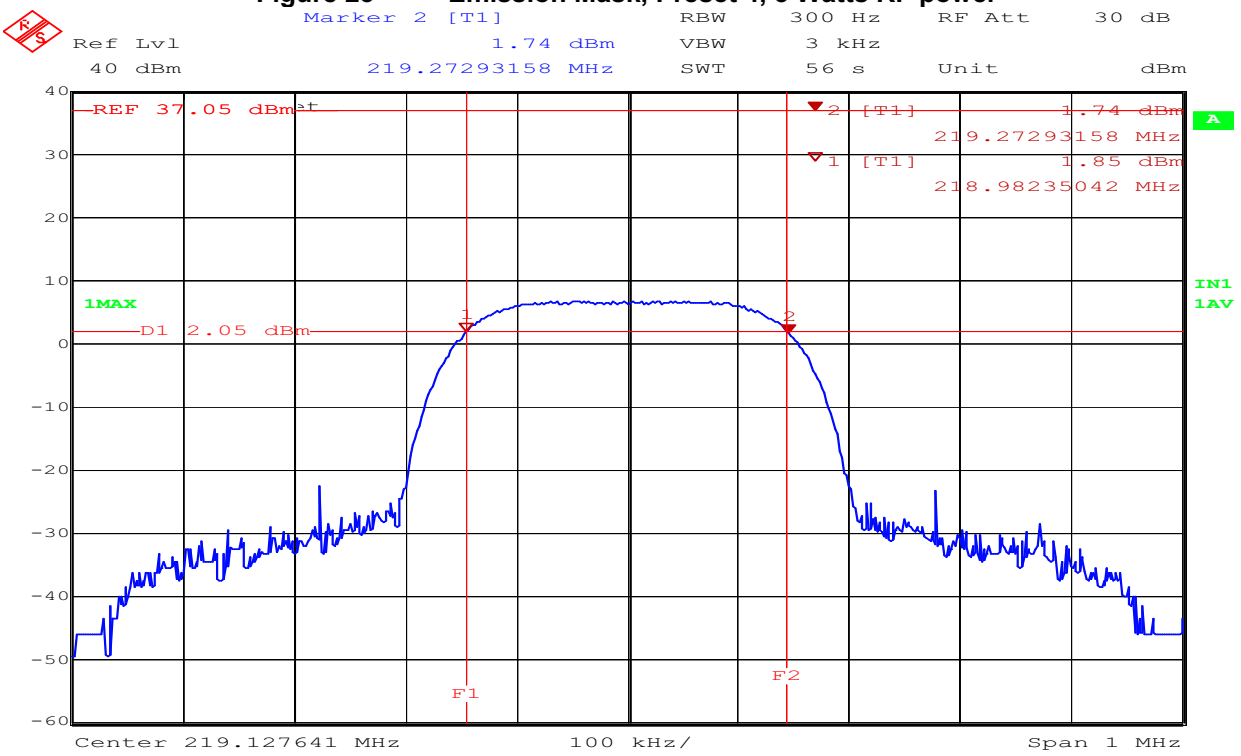
Comment A: Preset 3, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 14:27:51

Figure 22 Emission Mask, Preset 4, 2 Watts Transmit Power



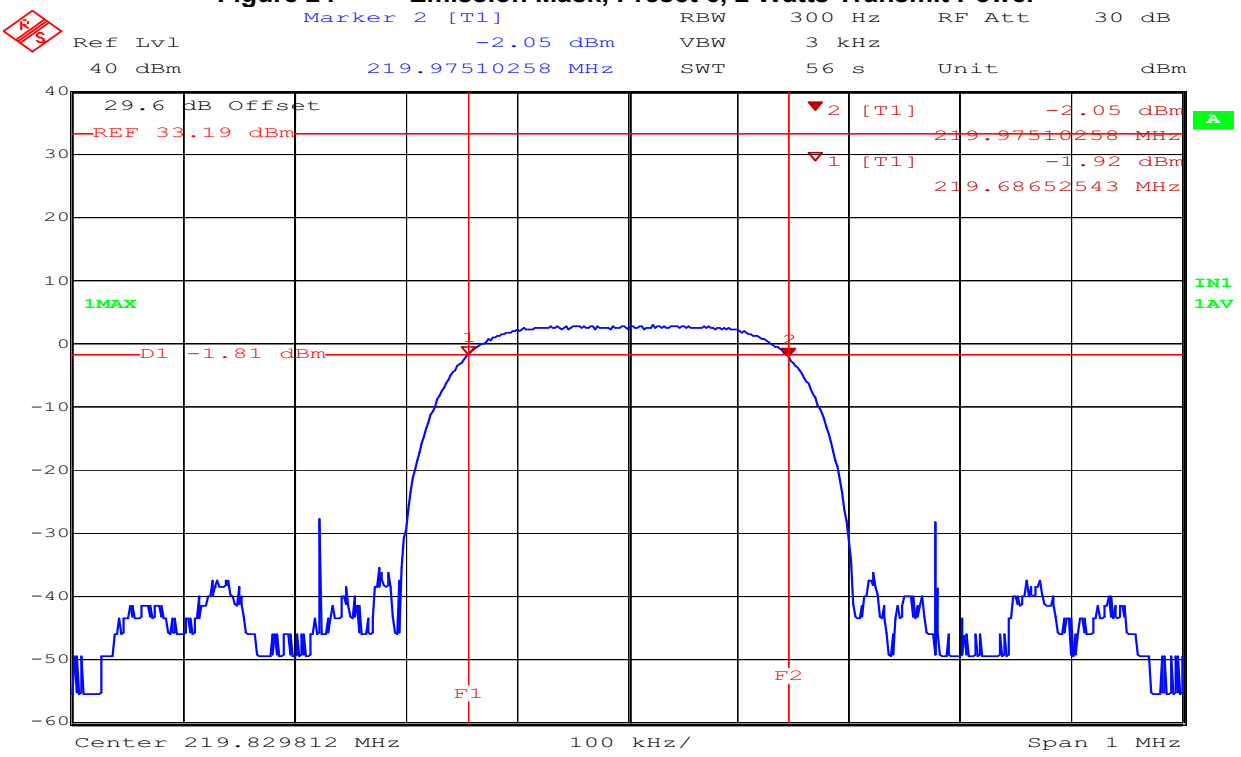
Comment A: Preset 4, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 14:48:54

Figure 23 Emission Mask, Preset 4, 5 Watts RF power



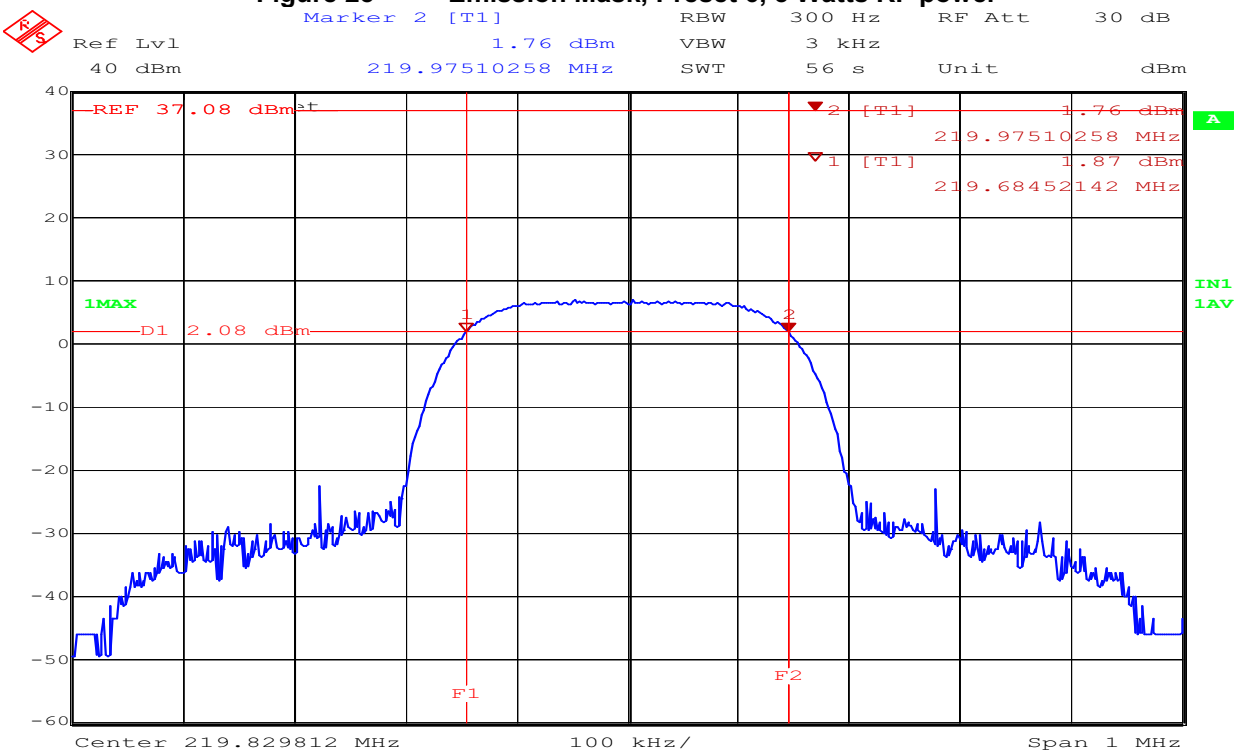
Comment A: Preset 4, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 14:45:21

Figure 24 Emission Mask, Preset 6, 2 Watts Transmit Power



Comment A: Preset 6, QPSK 33 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 14:57:45

Figure 25 Emission Mask, Preset 6, 5 Watts RF power



Comment A: Preset 6, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 14:54:49

APPENDIX D: TRANSMITTER CONDUCTED SPURIOUS EMISSIONS

D.1. Base Standard & Test Basis

Base Standard	FCC Title 47, PART 90, Subpart I, 90.210 RSS-119 Issue 9 5.8
Test Basis	FCC Title 47, PART 90, Subpart I, 90.210 RSS-119 Issue 9 5.8
Test Method	ANSI TIA -603-C-2004, 2.2.13 RSS-119 Issue 9 5.8.10.2

D.2. Specifications

FCC Title 47, PART 90, Subpart I, 90.210;

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

(n) *Other frequency bands.* Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B. Equipment operating under this part on frequencies allocated to but shared with the Federal Government, must meet the applicable Federal Government technical standards.
b) *Emission Mask B.* For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(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.

RSS 119 Issue 9, 5.8.1;

5.8.1 Emission Mask B for Transmitters Equipped with an Audio Low-pass Filter;
The power of any emission must be attenuated below the transmitter output power (P, in watts) as specified in the Table

Displacement Frequency, fd (% of the Authorized Bandwidth)	Minimum Attenuation (dB)
fd > 250	43 + 10 log10 (P)

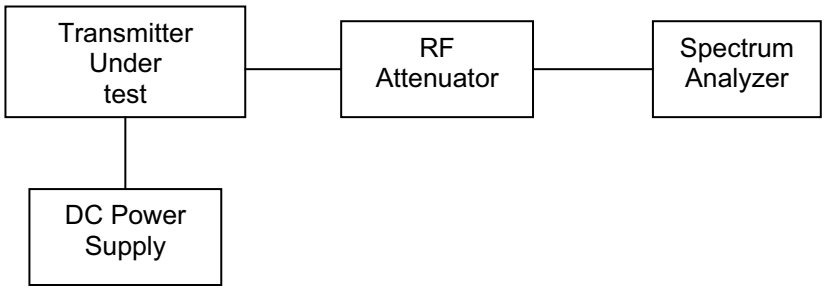
D.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

D.4. Test Procedure

Conducted RF measurement, using 30 dB attenuator, RF cables and a Spectrum Analyzer
30 MHz – 1 GHz pre-scans were performed using 300 kHz RBW and 1 MHz VBW.
30 MHz – 1 GHz Final measurements were performed using 120 kHz RBW and 300 kHz VBW
1 GHz – 2.2 GHz pre-scans were performed using 1 MHz RBW and 1 MHz VBW

D.5. Test Setup



D.6. Test Results

Pass,
The highest peak spurious emission was -21.46 dBm at 871.473 MHz. It has 8.46 dB margin to the limit. (871.473 MHz is the 4th harmonic of the carrier frequency 217.873763 MHz).

EUT Setting	Frequency (MHz)	Detector	RBW (kHz)	Measured Level (dBm)	Correction Factor (dB)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
Preset 1	868.682	Peak	120	-52.10	30.41	-21.69	-13.00	8.69
Preset 3	871.473	Peak	120	-51.88	30.42	-21.46	-13.00	8.46
Preset 4	876.511	Peak	120	-52.25	30.42	-21.83	-13.00	8.83
Preset 6	879.319	Peak	120	-52.65	30.41	-22.24	-13.00	9.24

D.7. Operating Mode During Test

EUT is in 5 Watts Transmit power with QPSK Modulation
Transmit frequencies;
Preset 1: 217.171592 MHz
Preset 3: 217.873763 MHz
Preset 4: 219.127641 MHz
Preset 6: 219.829812 MHz

D.8. Sample Calculation

Emission Level (dBm) = Measured Level (dBm) + Correction Factor (dB)

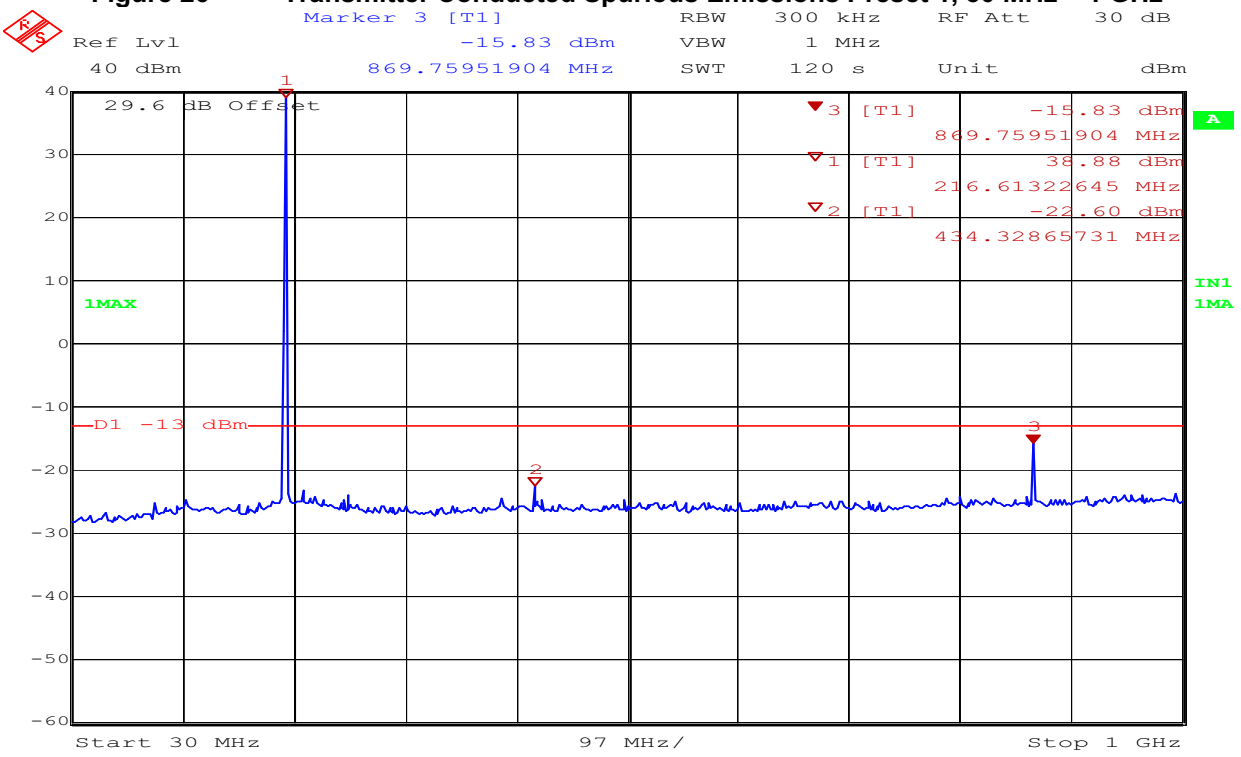
D.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

D.10. Test date

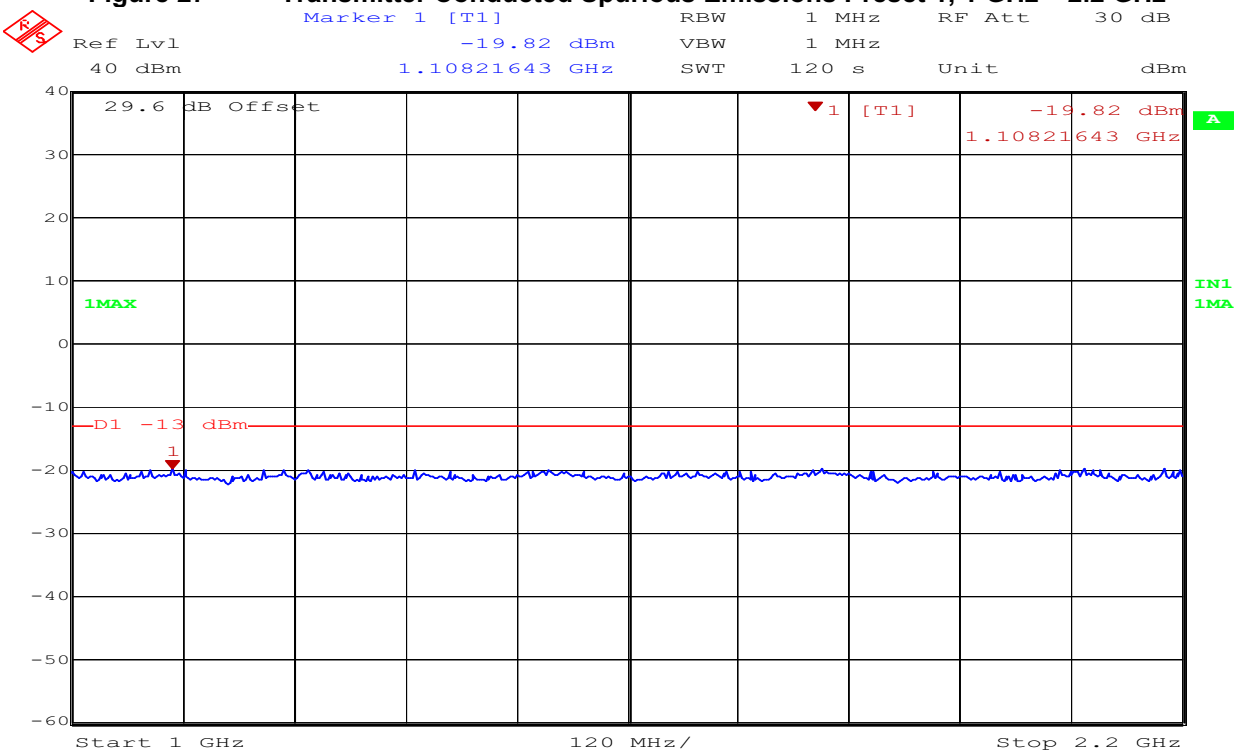
Test started: October 20, 2008 Ended: October 22, 2008

Figure 26 Transmitter Conducted Spurious Emissions Preset 1, 30 MHz – 1 GHz



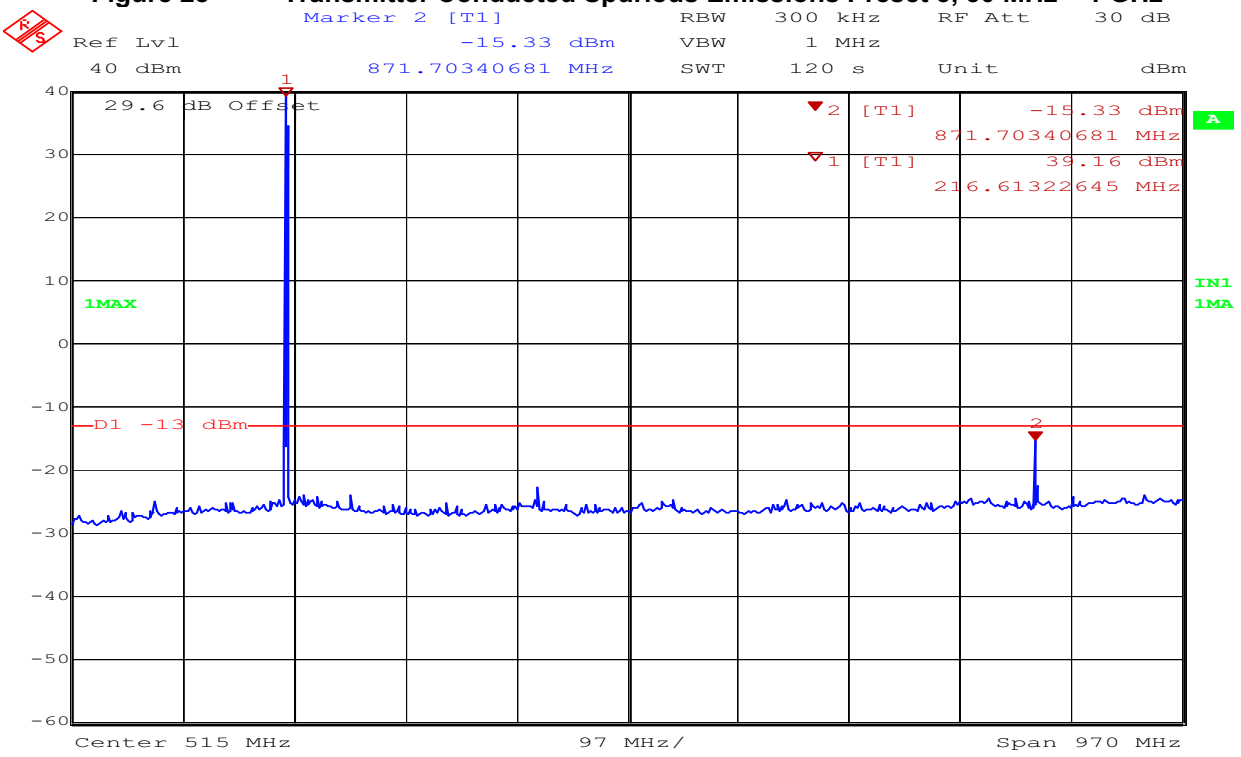
Comment A: Preset 1, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 20.OCT.2008 16:49:36

Figure 27 Transmitter Conducted Spurious Emissions Preset 1, 1 GHz – 2.2 GHz



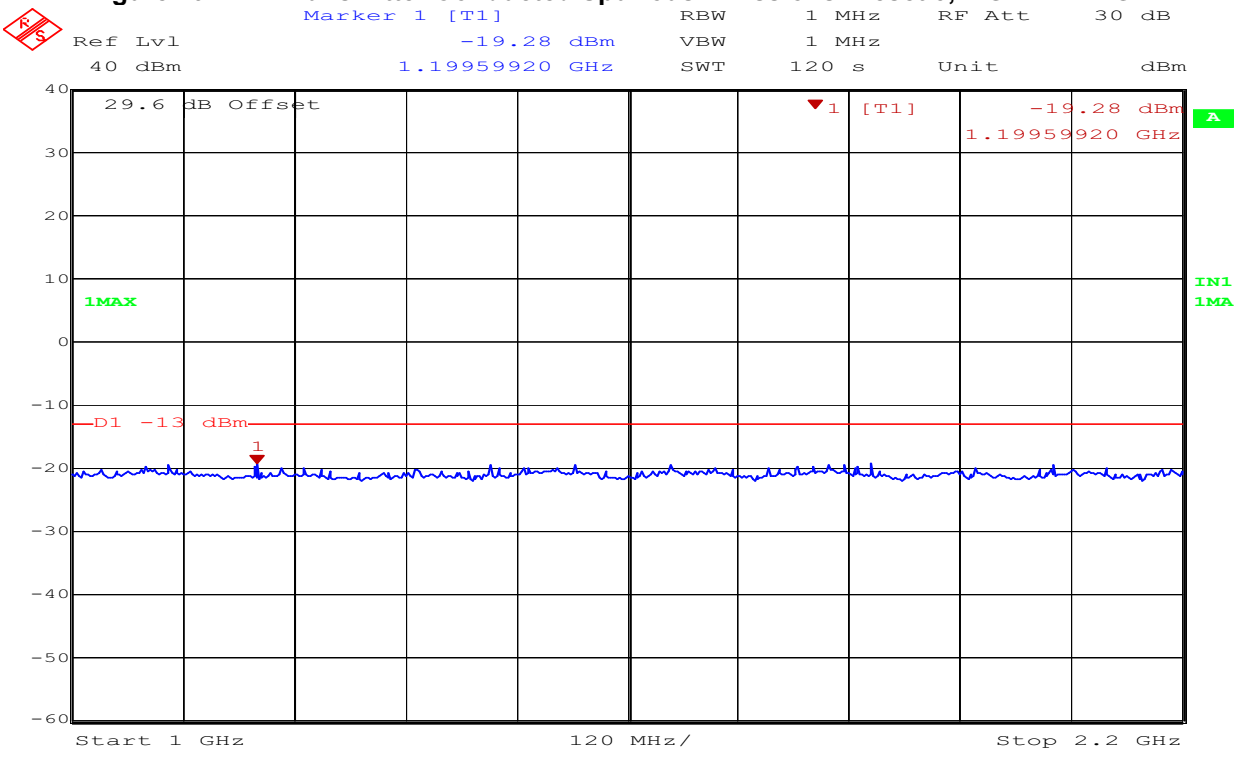
Comment A: Preset 1, QPSK 37 dBm, LDR 03, LDRPWR-1
Date: 22.OCT.2008 18:35:38

Figure 28 **Transmitter Conducted Spurious Emissions Preset 3, 30 MHz – 1 GHz**



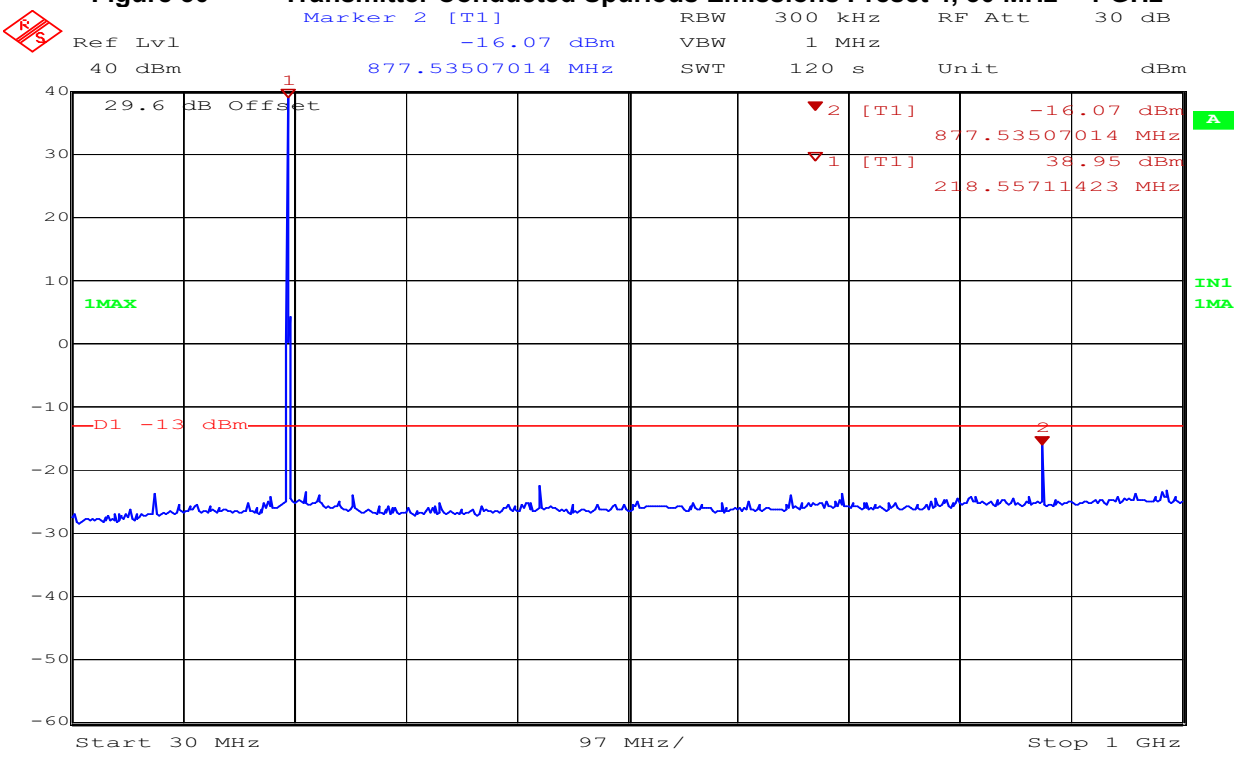
Comment A: Preset 3, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 21.OCT.2008 08:20:39

Figure 29 **Transmitter Conducted Spurious Emissions Preset 3, 1 GHz – 2.2 GHz**



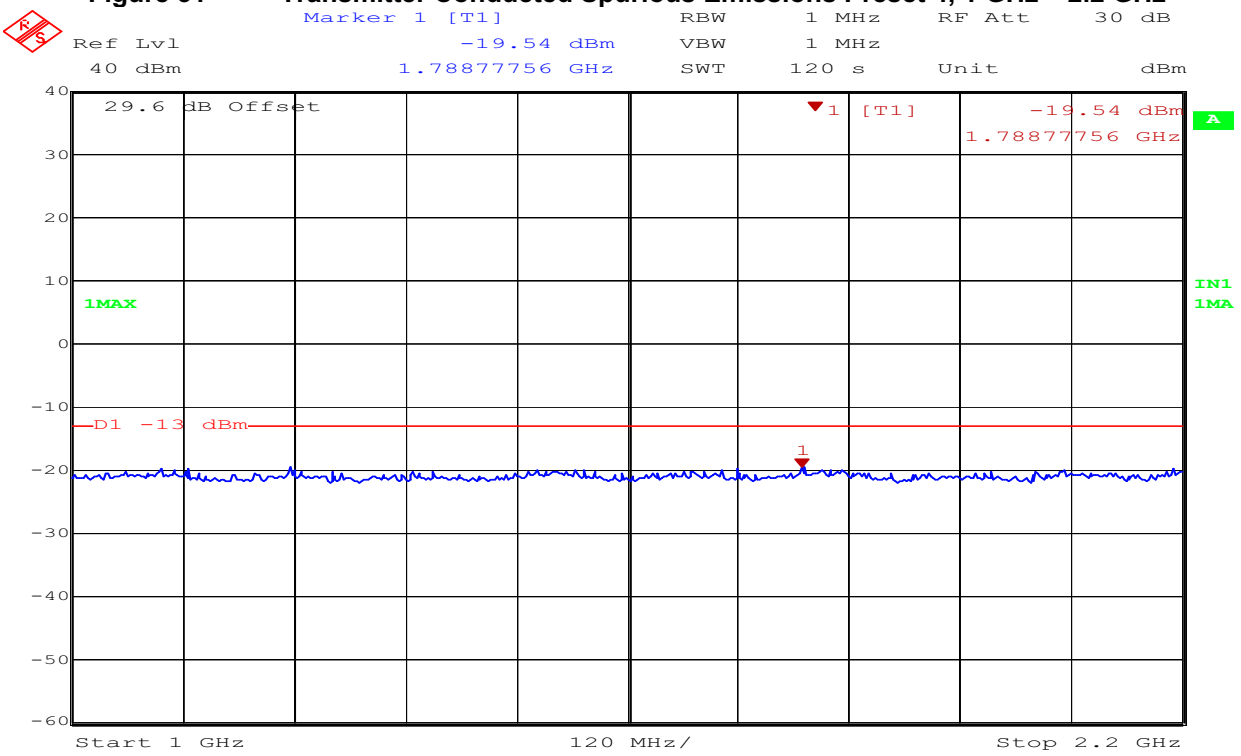
Comment A: Preset 3, QPSK 37 dBm, LDR 03, LDRPWR-1
Date: 22.OCT.2008 18:40:02

Figure 30 Transmitter Conducted Spurious Emissions Preset 4, 30 MHz – 1 GHz



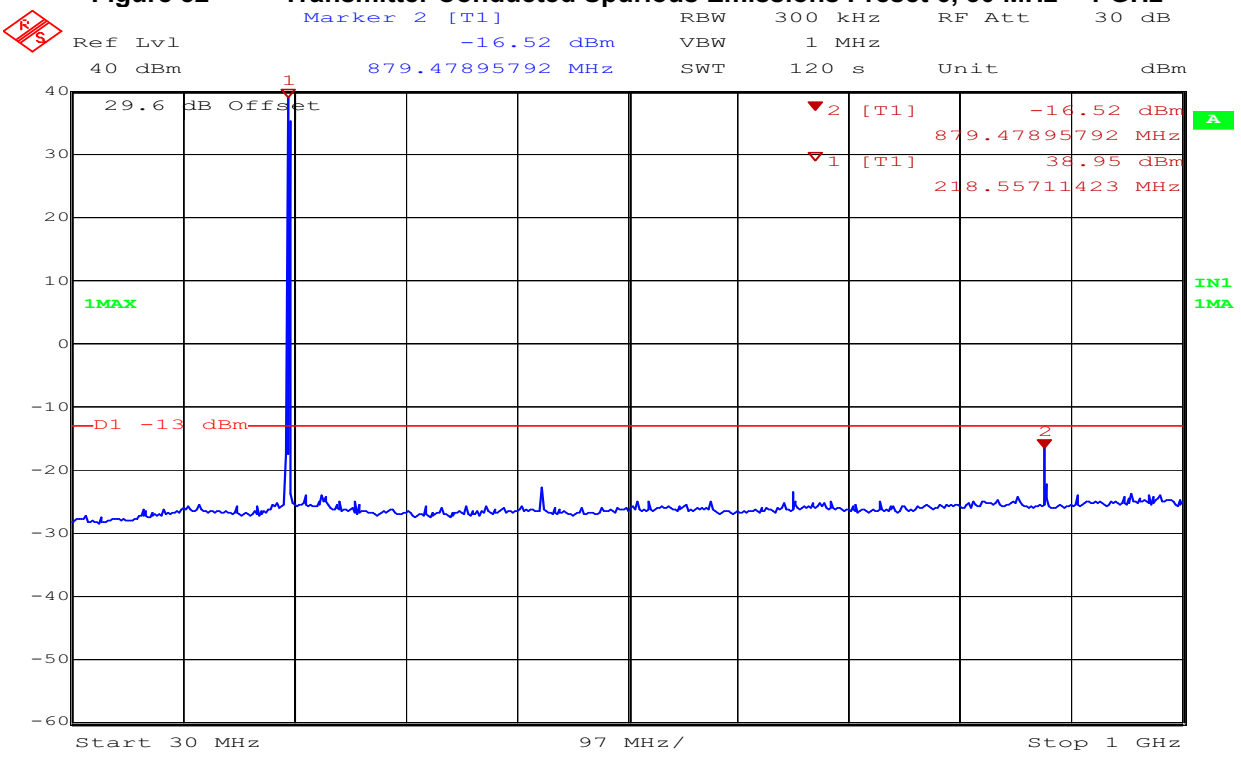
Comment A: Preset 4, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 21.OCT.2008 08:41:01

Figure 31 Transmitter Conducted Spurious Emissions Preset 4, 1 GHz – 2.2 GHz



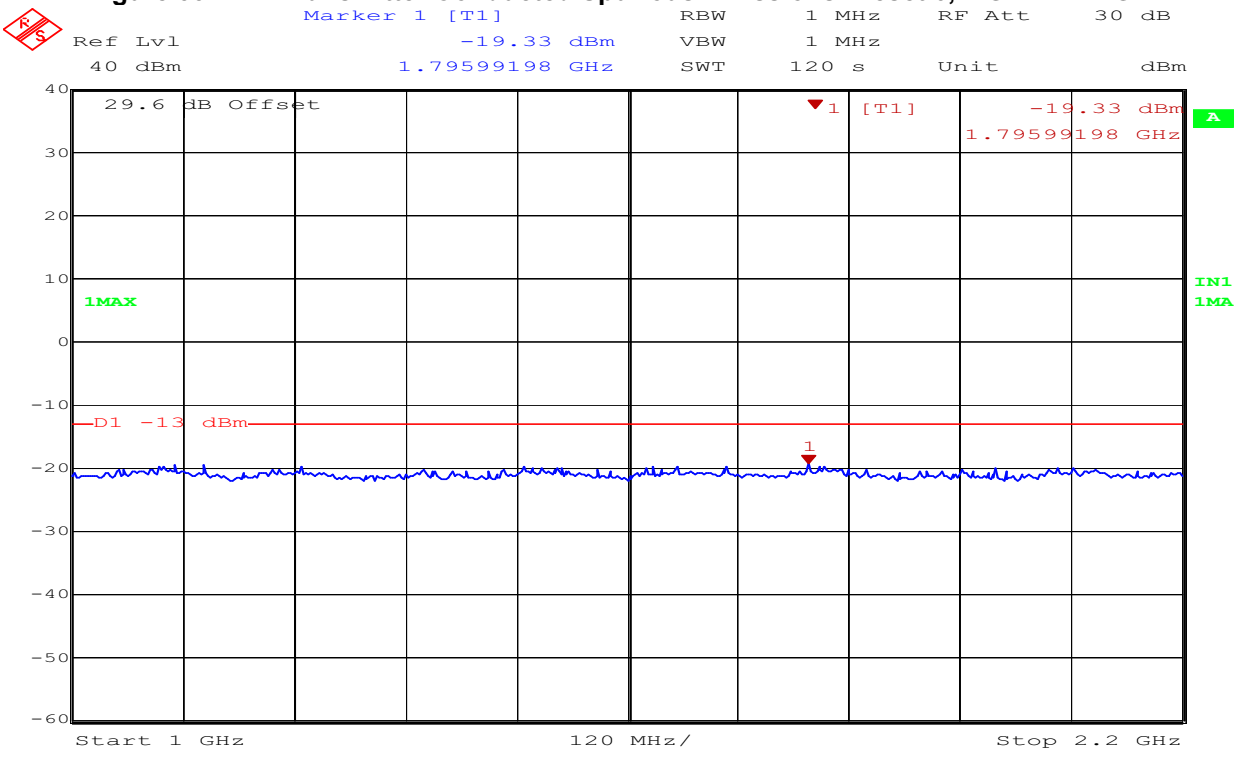
Comment A: Preset 4, QPSK 37 dBm, LDR 03, LDRPWR-1
Date: 22.OCT.2008 18:44:18

Figure 32 Transmitter Conducted Spurious Emissions Preset 6, 30 MHz – 1 GHz



Comment A: Preset 6, QPSK 37 dbm LDR 03, LDRPWR-1
Date: 21.OCT.2008 09:00:39

Figure 33 Transmitter Conducted Spurious Emissions Preset 6, 1 GHz – 2.2 GHz



Comment A: Preset 6, QPSK 37 dBm, LDR 03, LDRPWR-1
Date: 22.OCT.2008 18:50:00

APPENDIX E: RECEIVER CONDUCTED SPURIOUS EMISSIONS

E.1. Base Standard & Test Basis

Base Standard	FCC Title 47, PART 15 Subpart B, 15.111 RSS-119 Issue 9, 5.11
Test Basis	FCC Title 47, PART 15 Subpart B, 15.111 RSS-Gen Issue 2, 4.10 (7.2.3)
Test Method	ANSI TIA -603-C-2004, 2.1.2 RSS-Gen Issue 2, 4.10

E.2. Specifications

RSS 119 Issue 9, 5.11;
Receiver Spurious Emissions shall comply with the limits specified in RSS-Gen.

RSS-Gen Issue 2, 4.10;
The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz. For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

RSS-Gen Issue 2, 7.2.3
Receiver Spurious Emission Limits
7.2.3.1 Antenna Conducted Measurement;
If the device has a detachable antenna of known antenna impedance, then the antenna conducted method is permitted in lieu of a radiated measurement.
Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

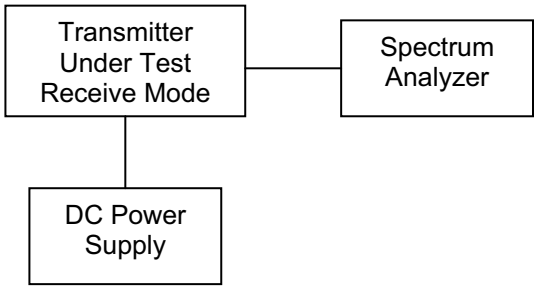
E.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

E.4. Test Procedure

Conducted RF measurement, using an RF cable and an EMI receiver.
30 MHz – 1 GHz pre-scans were performed using 100 kHz RBW and 300 kHz VBW.
1 GHz – 2 GHz pre-scans were performed using 1 MHz RBW and 1 MHz VBW

E.5. Test Setup



E.6. Test Results

Pass,
The highest spurious emission was -73.23 dBm at 348.797 MHz which has 16.24 dB margin to the limit

E.7. Operating Mode During Test

EUT is in Receive Mode
Receive frequencies;
Preset 1: 217.171592 MHz
Preset 3: 217.873763 MHz
Preset 4: 219.127641 MHz
Preset 6: 219.829812 MHz

E.8. Sample Calculation

30 MHz – 1 GHz Limit = 2 nW = 10*Log (0.000002) = -56.99 dBm
Above 1 GHz Limit = 5 nW = 10*Log (0.000005) = -53.01 dBm

E.9. Tested By

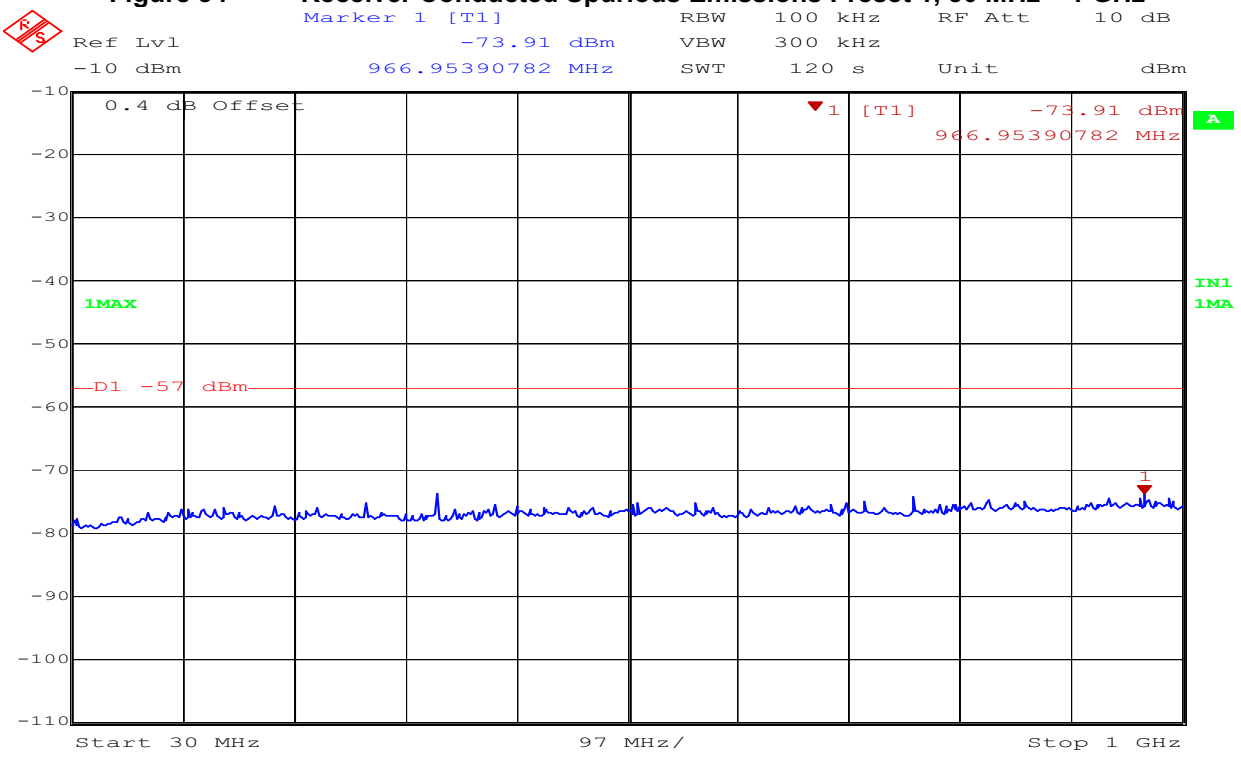
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

E.10. Test date

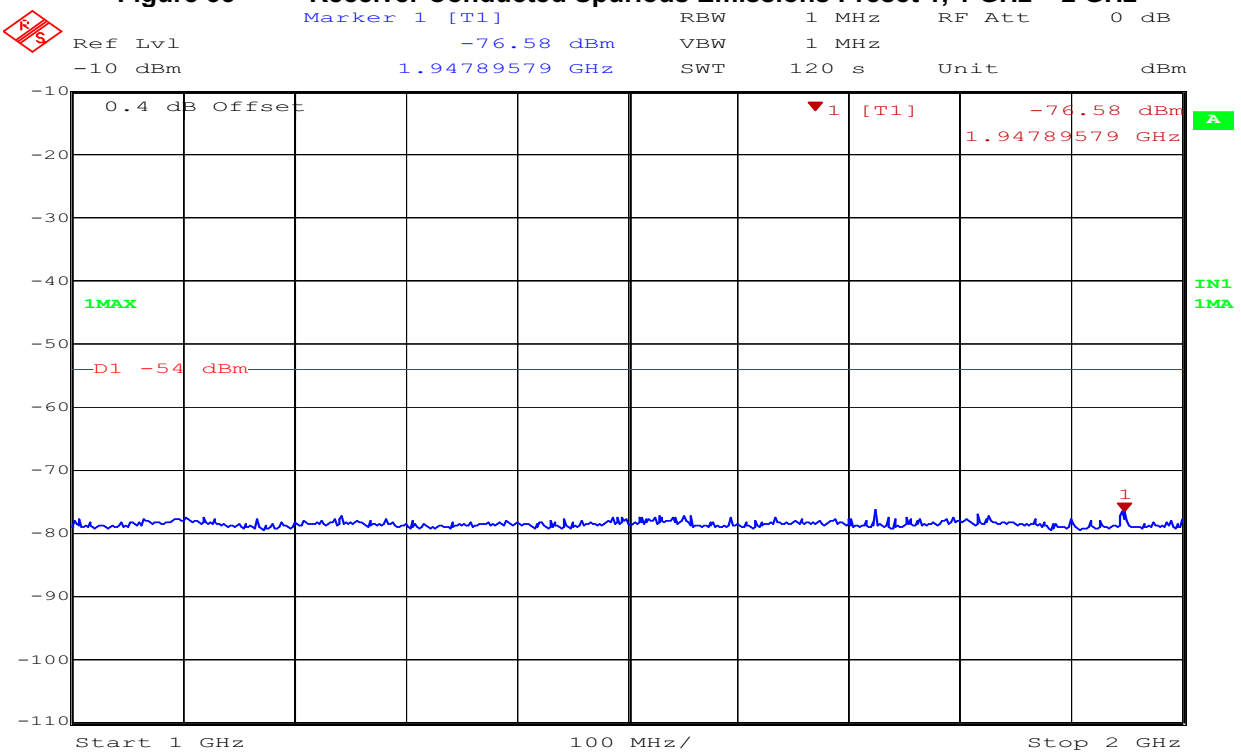
Test started: October 20, 2008 Ended: October 22, 2008

Figure 34 Receiver Conducted Spurious Emissions Preset 1, 30 MHz – 1 GHz



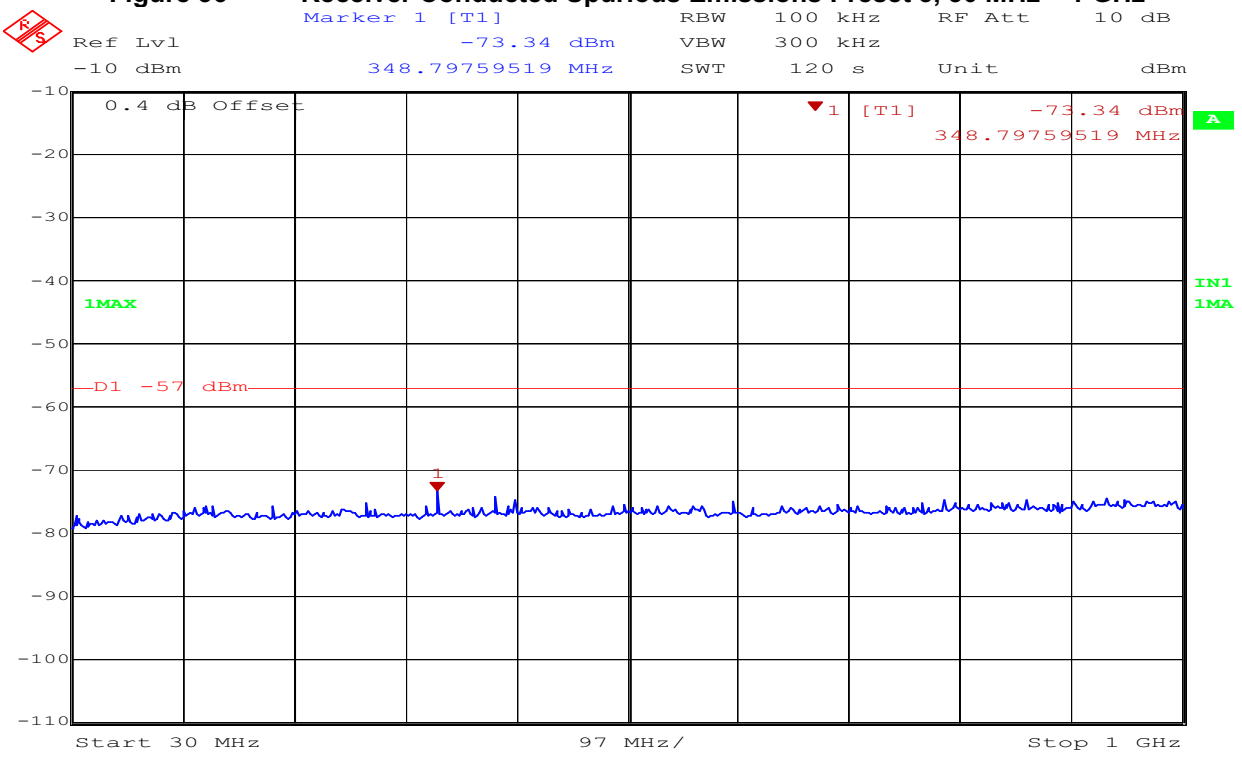
Comment A: Preset 1, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 09:35:43

Figure 35 Receiver Conducted Spurious Emissions Preset 1, 1 GHz – 2 GHz



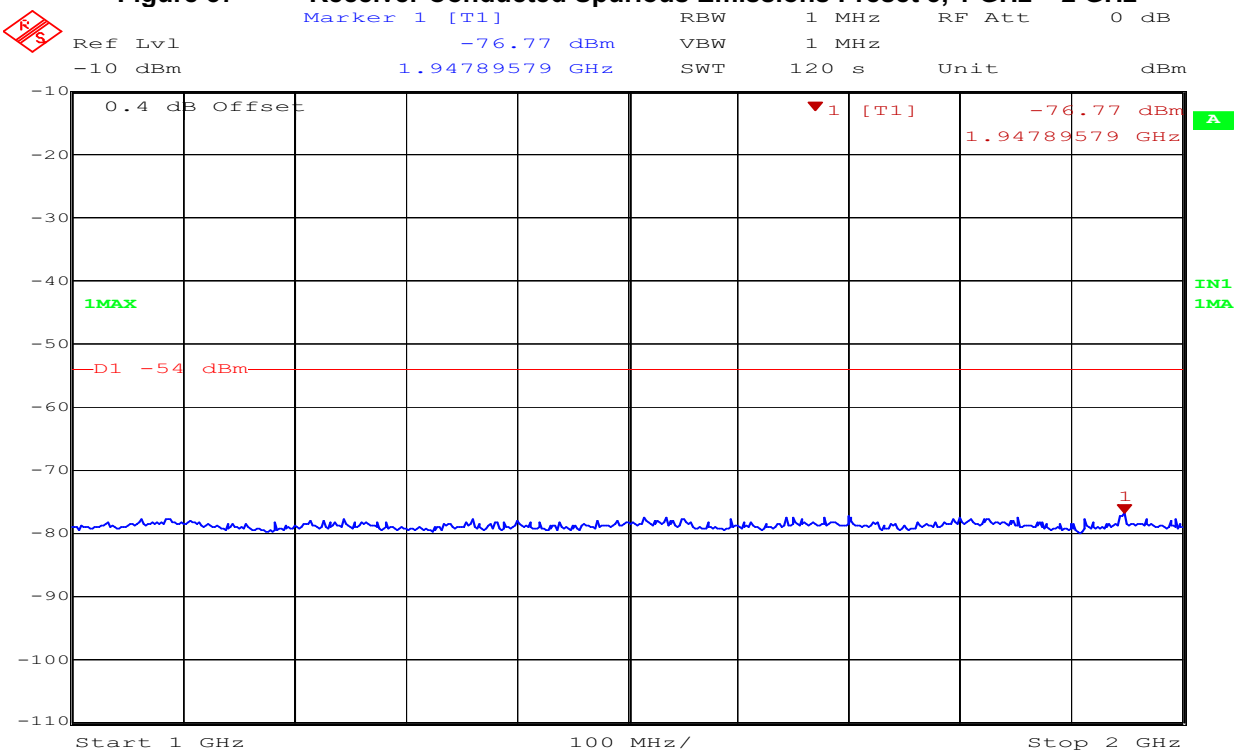
Comment A: Preset 1, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 09:42:02

Figure 36 Receiver Conducted Spurious Emissions Preset 3, 30 MHz – 1 GHz



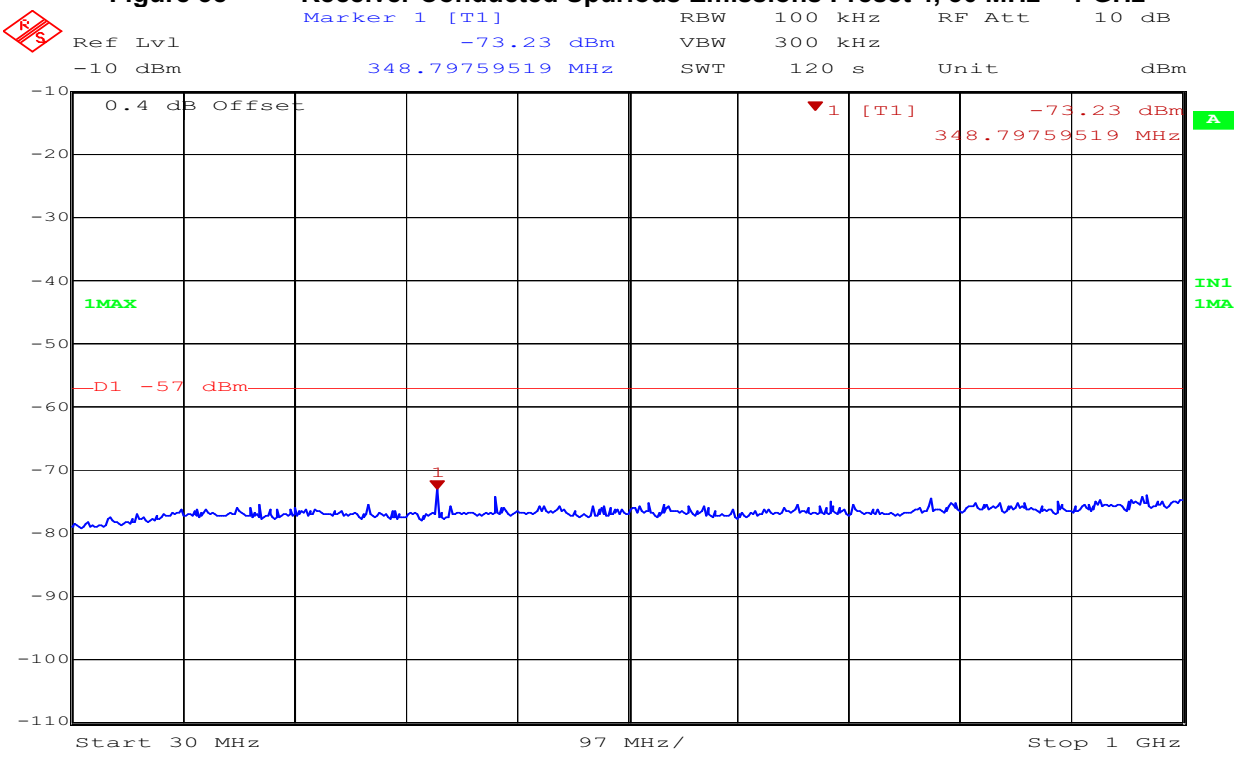
Comment A: Preset 3, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 10:11:21

Figure 37 Receiver Conducted Spurious Emissions Preset 3, 1 GHz – 2 GHz



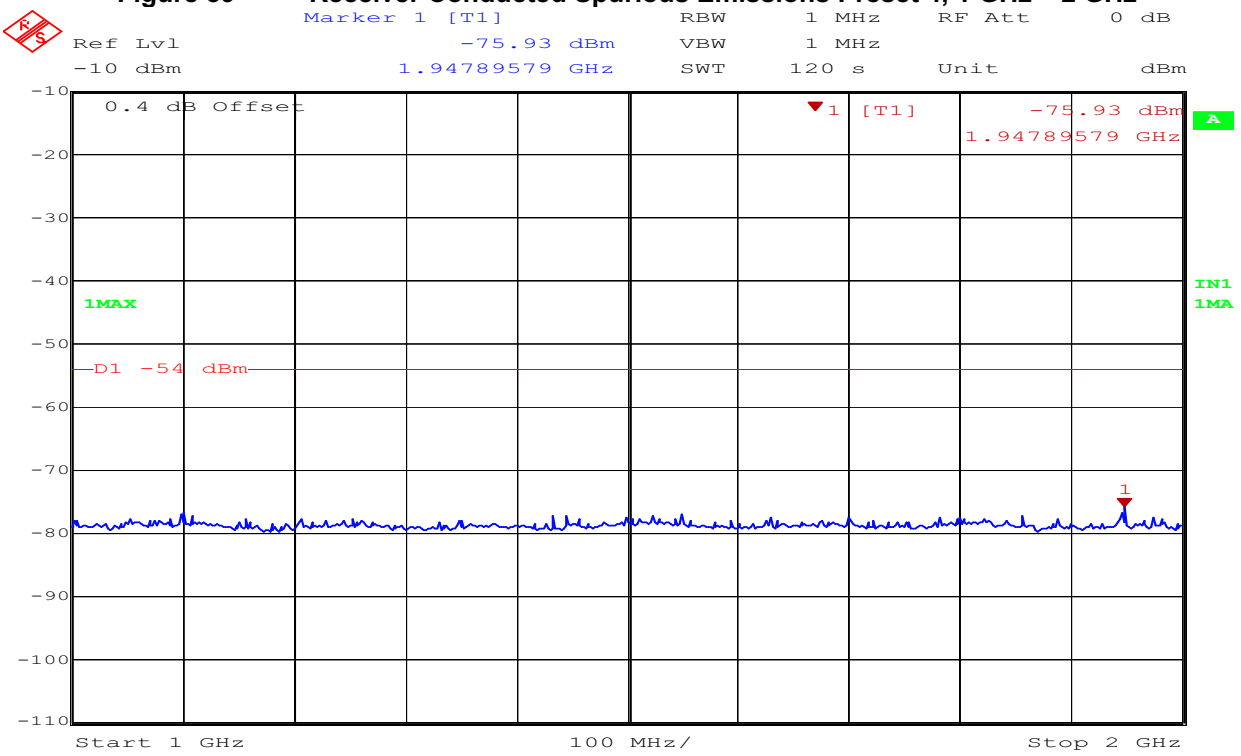
Comment A: Preset 3, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 09:47:13

Figure 38 Receiver Conducted Spurious Emissions Preset 4, 30 MHz – 1 GHz



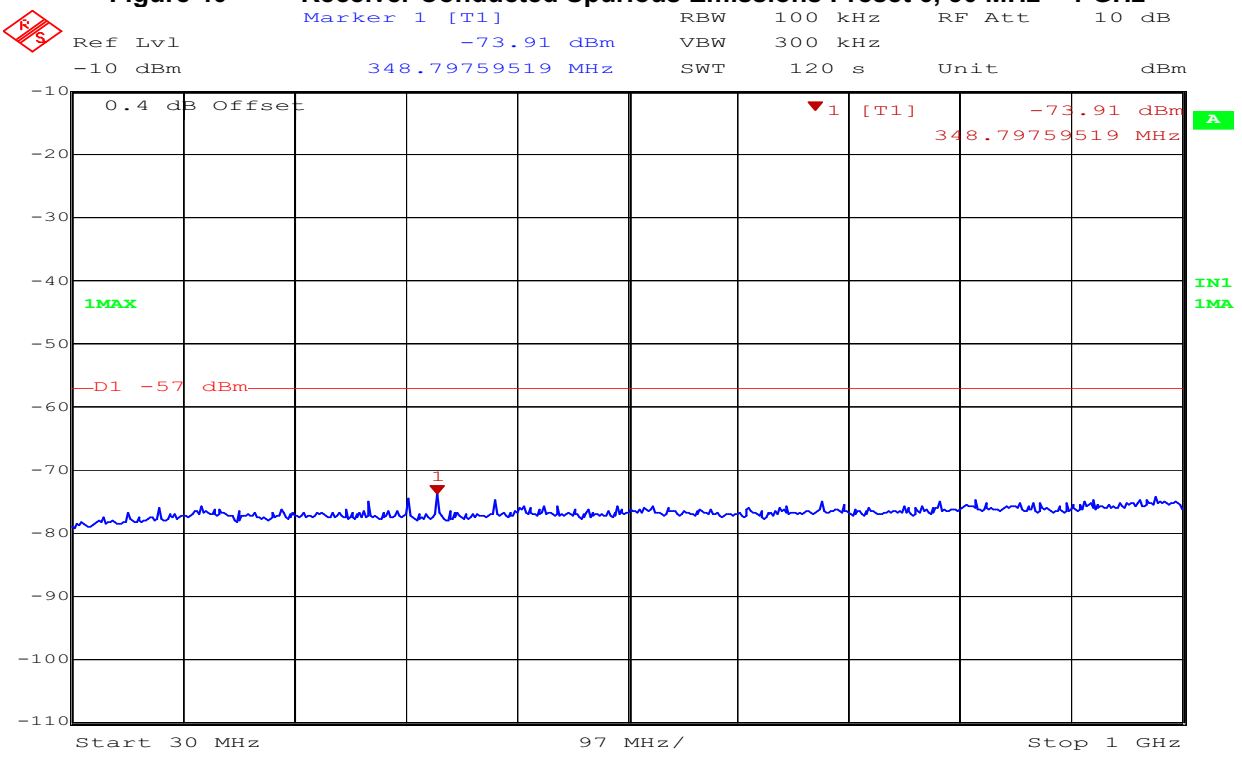
Comment A: Preset 4, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 10:06:28

Figure 39 Receiver Conducted Spurious Emissions Preset 4, 1 GHz – 2 GHz



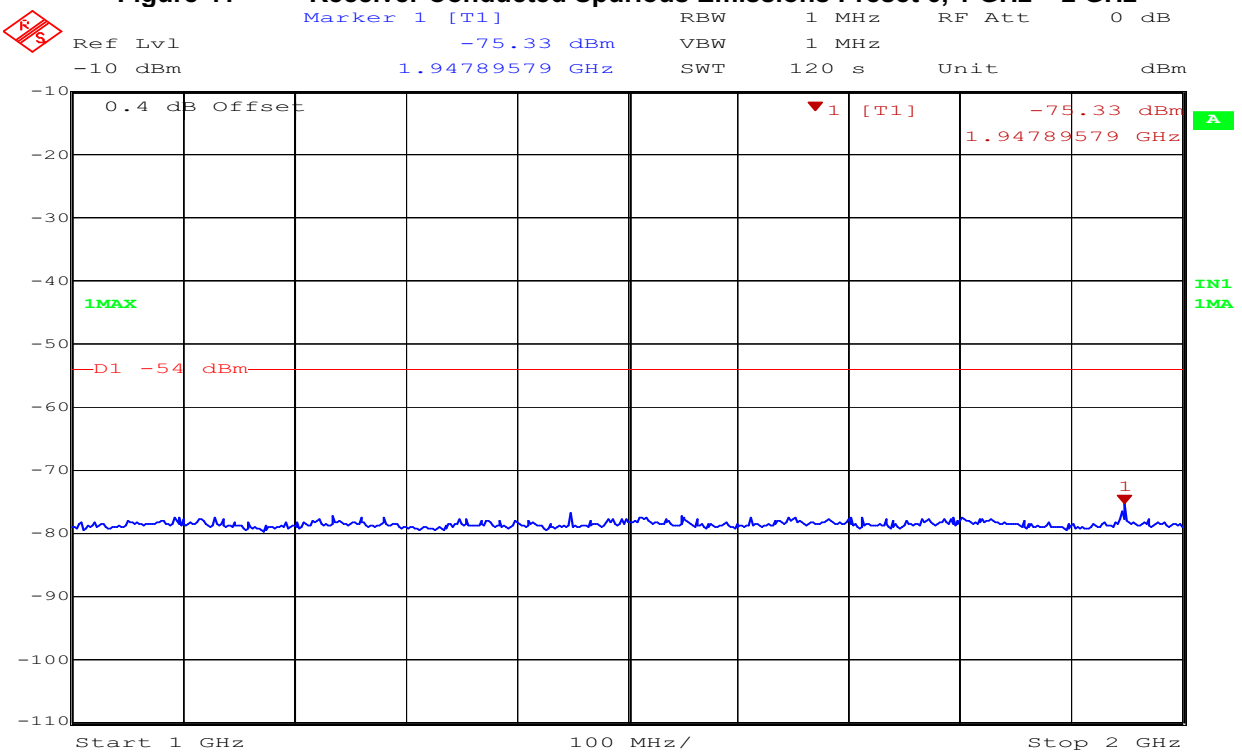
Comment A: Preset 4, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 10:01:08

Figure 40 Receiver Conducted Spurious Emissions Preset 6, 30 MHz – 1 GHz



Comment A: Preset 6, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 10:21:48

Figure 41 Receiver Conducted Spurious Emissions Preset 6, 1 GHz – 2 GHz



Comment A: Preset 6, RX Mode LDR 03, LDRPWR-1
Date: 21.OCT.2008 10:26:50

APPENDIX F: TRANSMITTER RADIATED SPURIOUS EMISSIONS

F.1. Base Standard & Test Basis

Base Standard	FCC Title 47, PART 90 Subpart I, 90.210 RSS-119 Issue 9, 5.8
Test Basis	FCC Title 47, PART 90 Subpart I, 90.210 RSS-119 Issue 9, 5.8
Test Method	ANSI TIA -603-C-2004, 2.2.12 RSS-Gen Issue 2, 4.9

F.2. Specifications

FCC Title 47, PART 90, Subpart I, 90.210;

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

(n) *Other frequency bands.* Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B. Equipment operating under this part on frequencies allocated to but shared with the Federal Government, must meet the applicable Federal Government technical standards.
b) *Emission Mask B.* For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(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.

RSS 119 Issue 9, 5.8.10.2 Out-of-band Emission Limit;
On any frequency outside of the ranges specified in the ACP tables 12 to 15, the power of any emission shall be attenuated below the mean output power (P) by at least 43+10log10(P) measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

F.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

F.4. Test Procedure

10m Radiated emission measurement and signal substitution. EUT was battery powered
EUT RF output was terminated with a 40 dB RF attenuator and a 50 ohm termination

F.5. Operating Mode During Test

EUT is in 5 Watts Transmit power with QPSK Modulation.

Transmit frequencies;
Preset 1: 217.171592 MHz,
Preset 3: 217.873763 MHz,
Preset 6: 219.829812 MHz

EUT RF output was terminated with a 40 dB RF attenuator and 50 Ohm termination during the tests

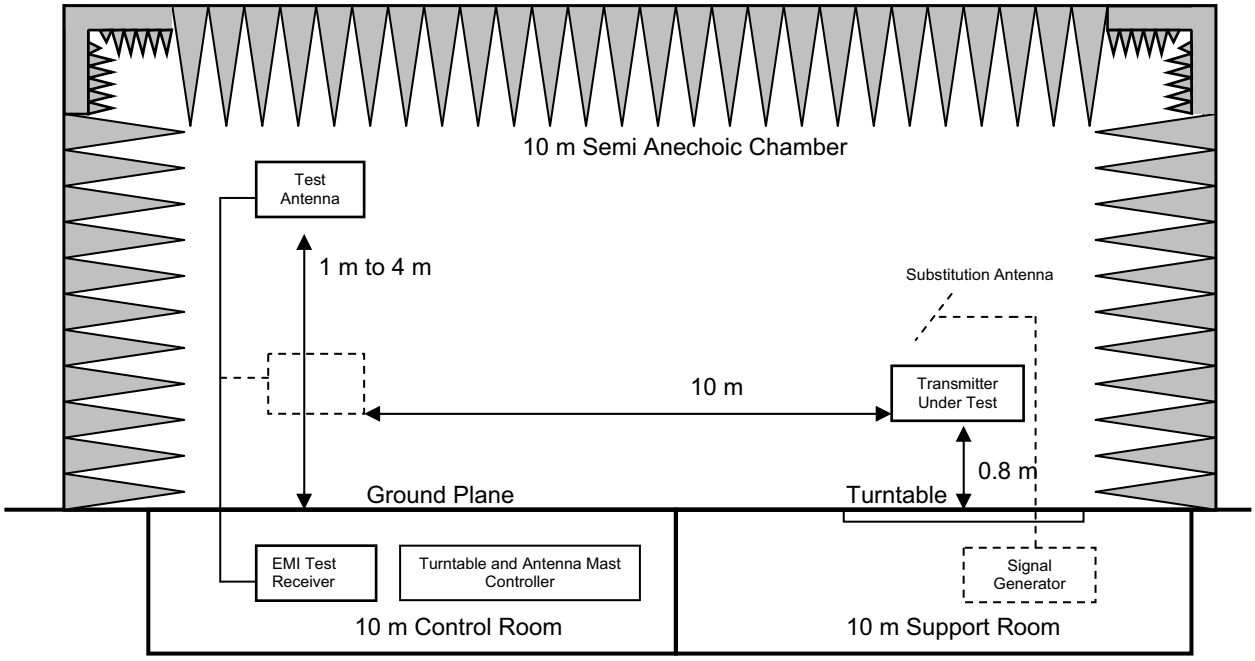
F.6. Test Results

Pass.

The highest emission was 53.79 dBµV/m at 1737.21 MHz with vertical and horizontal polarization at 10m distance. It has 17.92 dB margin to the limit.

EUT Setting	Receiver Antenna polarization	Spurious Frequency (MHz)	Detector	RBW (MHz)	Radiated Emission Level (dBµV/m)	Signal generator level (dBm)	Tx Cable loss (dB)	Tx Antenna gain (dB)	ERP /EIRP Level (dBm)	Limit (dBm)	Margin (dB)
Preset 1: 217.171592 MHz	Horizontal	434.33	Peak	0.12	43.10	-48.90	0.73	N/A	-49.63	-13.00	36.63
	Vertical	434.34	Peak	0.12	39.02	-51.10	0.73	N/A	-51.83	-13.00	38.83
	Horizontal	868.83	Peak	0.12	46.50	-45.10	0.91	N/A	-46.01	-13.00	33.01
	Vertical	868.53	Peak	0.12	44.10	-47.40	0.91	N/A	-48.31	-13.00	35.31
	Horizontal	1086.09	Peak	1	47.67	-42.30	1.00	6.23	-37.07	-13.00	24.07
	Vertical	1085.78	Peak	1	47.94	-42.00	1.00	6.23	-36.77	-13.00	23.77
	Horizontal	1520.26	Peak	1	48.70	-42.60	1.17	7.77	-36.00	-13.00	23.00
	Vertical	1520.91	Peak	1	48.45	-42.90	1.17	7.77	-36.30	-13.00	23.30
	Horizontal	1737.21	Peak	1	53.79	-37.90	1.26	8.24	-30.92	-13.00	17.92
	Vertical	1737.21	Peak	1	53.79	-37.90	1.26	8.24	-30.92	-13.00	17.92
Preset 3: 217.873763 MHz	Horizontal	437.04	Peak	0.12	42.97	-49.00	0.73	N/A	-49.73	-13.00	36.73
	Vertical	437.06	Peak	0.12	39.41	-50.80	0.73	N/A	-51.53	-13.00	38.53
	Horizontal	873.94	Peak	0.12	48.97	-42.70	0.91	N/A	-43.61	-13.00	30.61
	Vertical	874.01	Peak	0.12	40.32	-51.00	0.91	N/A	-51.91	-13.00	38.91
	Horizontal	1092.55	Peak	1	47.29	-42.70	1.00	6.26	-37.44	-13.00	24.44
	Vertical	1092.47	Peak	1	45.79	-44.30	1.00	6.26	-39.04	-13.00	26.04
	Horizontal	1529.71	Peak	1	49.88	-41.50	1.17	7.78	-34.89	-13.00	21.89
	Vertical	1529.64	Peak	1	51.37	-40.00	1.17	7.78	-33.39	-13.00	20.39
	Horizontal	1748.21	Peak	1	52.50	-39.30	1.27	8.26	-32.31	-13.00	19.31
	Vertical	1748.29	Peak	1	52.31	-39.40	1.27	8.26	-32.41	-13.00	19.41
Preset 6: 219.829812 MHz	Horizontal	439.67	Peak	0.12	43.09	-48.90	0.73	N/A	-49.63	-13.00	36.63
	Vertical	439.66	Peak	0.12	39.69	-50.50	0.73	N/A	-51.23	-13.00	38.23
	Horizontal	879.45	Peak	0.12	45.38	-46.30	0.91	N/A	-47.21	-13.00	34.21
	Vertical	879.43	Peak	0.12	44.41	-47.00	0.91	N/A	-47.91	-13.00	34.91
	Horizontal	1098.92	Peak	1	46.56	-43.50	1.00	6.29	-38.21	-13.00	25.21
	Vertical	1099.06	Peak	1	46.07	-44.00	1.00	6.29	-38.71	-13.00	25.71
	Horizontal	1538.70	Peak	1	50.95	-40.50	1.18	7.82	-33.86	-13.00	20.86
	Vertical	1538.77	Peak	1	49.95	-41.50	1.18	7.82	-34.86	-13.00	21.86
	Horizontal	1758.76	Peak	1	53.72	-38.00	1.27	8.28	-30.99	-13.00	17.99
	Vertical	1758.17	Peak	1	52.16	-39.60	1.27	8.28	-32.59	-13.00	19.59

F.7. Test Setup



F.8. Sample Calculation

EIRP (dBm) = Signal generator level (dBm) – Tx cable loss (dB) + Tx antenna gain (dB)

ERP (dBm) = Signal generator level (dBm) – Tx cable loss (dB)

Margin (dB) = Limit (dBm) – ERP / EIRP level (dBm)

F.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

F.10. Test date

Test started: October 23, 2008 Ended: October 23, 2008

Note 1: Plots were not provided in order to reduce file size.
Note 2: Final measurements (worst case) were performed with 120 kHz RBW instead of 10 kHz RBW which is defined in ANSI TIA-603-C-2004, 2.2.12.2 b) or 100 kHz RBW defined in RSS 119 Issue 9, 5.8.10.2 for below 1 GHz measurements.

APPENDIX G: RECEIVER RADIATED SPURIOUS EMISSIONS

G.1. Base Standard & Test Basis

Base Standard	FCC Title 47, PART 15 Subpart B, 15.111 RSS-119 Issue 9, 5.11
Test Basis	FCC Title 47, PART 15 Subpart B, 15.109 RSS-Gen Issue 2, 4.10 (7.2.3)
Test Method	ANSI TIA-603-C-2004 2.1.1 RSS-Gen Issue 2, 4.10 (7.2.3)

G.2. Specifications

15.111 Antenna power conduction limits for receivers;
(a) In addition to the radiated emission limits, receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers that provide terminals for the connection of an external receiving antenna may be tested to demonstrate compliance with the provisions of §15.109 with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna.

RSS 119 Issue 9, 5.11;
Receiver Spurious Emissions shall comply with the limits specified in RSS-Gen.

RSS-Gen Issue 2, 4.10;
The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz. For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

RSS-Gen Issue 2, 7.2.3
Receiver Spurious Emission Limits 7.2.3.1;
Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

G.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

G.4. Test Procedure

10m Radiated emission measurement and signal substitution.

G.5. Operating Mode During Test

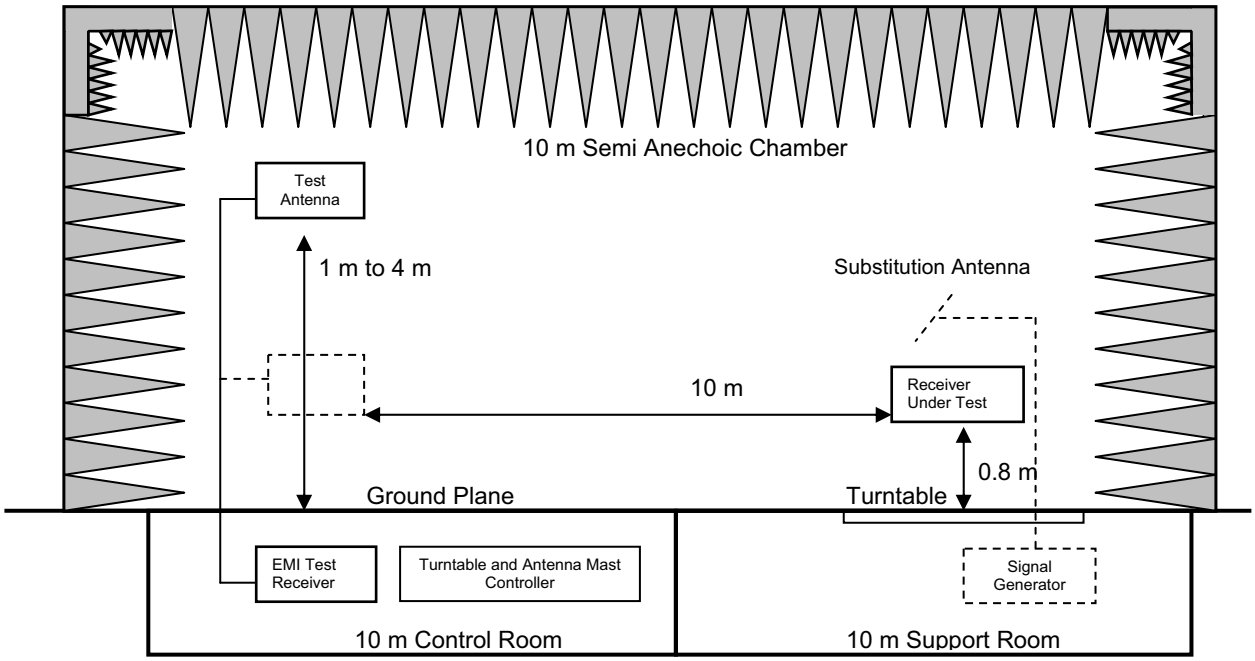
EUT is in Receive Mode. Preset 2: 217.522678 MHz. RF output was terminated with 50 ohm.

G.6. Test Results

Rx Antenna polarization	Spurious Frequency (MHz)	Detector	RBW (MHz)	Radiated Emission Level (dBµV/m)	Signal generator level (dBm)	Tx Cable loss (dB)	ERP /EIRP Level (dBm)	Limit (dBm)	Margin (dB)
Vertical	88.48	Peak	0.12	21.31	-70.50	0.59	-71.09	-57.00	14.09
Vertical	103.22	Peak	0.12	24.15	-66.70	0.59	-67.29	-57.00	10.29
Vertical	132.70	Peak	0.12	28.09	-63.50	0.60	-64.10	-57.00	7.10
Vertical	162.19	Peak	0.12	25.00	-66.50	0.62	-67.12	-57.00	10.12
Horizontal	324.41	Peak	0.12	30.39	-59.70	0.68	-60.38	-57.00	3.38
Vertical	339.13	Peak	0.12	26.07	-64.00	0.69	-64.69	-57.00	7.69

The highest spurious emission was 30.39 dBµV/m at 324.41 MHz which has 3.38 dB margin to the RSS-Gen Issue 2 limit and 5.61 dB margin to the FCC Title 47, PART 15 Subpart B, 15.109 Class B limit. There was no measurable emission observed between 1 GHz and 2.2 GHz

G.7. Test Setup



G.8. Sample Calculation

30 MHz – 1 GHz Limit = 2 nW = 10*Log (0.000002) = -56.99 dBm
Above 1 GHz Limit = 5 nW = 10*Log (0.000005) = -53.01 dBm

G.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

G.10. Test date

Test started: October 23, 2008 Ended: October 23, 2008

Note : Plots were not provided in order to reduce file size.

APPENDIX H: TRANSMITTER FREQUENCY STABILITY

H.1. Base Standard & Test Basis

Base Standards	FCC Title 47, PART 90 Subpart I, 90.213 RSS-119 Issue 9, 5.3
Test Basis	FCC Title 47, PART 90 Subpart I, 90.213 RSS-Gen Issue 2, 4.7
Test Method	FCC Title 47, PART 2 Subpart J, 2.1055 Frequency Stability RSS-Gen Issue 2, 4.7

H.2. Specifications

FCC Title 47, PART 90 Subpart I, 90.213 frequency stability;

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Parts per million (ppm)

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	100	100	200
25–50	20	20	50
72–76	5	N/A	50
150–174	5	5	50
216–220	1	N/A	1
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928	2.5	2.5	2.5
929–930	1.5	N/A	N/A
935–940	0.1	1.5	1.5
1427–1435	300	300	300

RSS-119 Issue 9, 5.3.Transmitter Frequency Stability;
The carrier frequency shall not depart from the reference frequency in excess of the values given below:

Frequency Band (MHz)	Authorized Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			>2 watts	≤ 2 watts
217-218 and 219-220	11.25	1	5	5

H.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

H.4. Test Procedure

FCC Title 47, PART 2 Subpart J, 2.1055;

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

H.5. Operating Mode During Test

EUT was in CW carrier transmit Mode (unmodulated)
Preset 2: 217.522678 MHz

EUT was in a thermal chamber. A DC power supply, 30 dB RF attenuator, RF cables and a spectrum analyzer used during the test.

H.6. Sample Calculation

None

H.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

H.8. Test date

Test started: October 21, 2008 Ended: October 22, 2008

H.9. Test Results

Pass. The highest frequency deviation was 0.72 ppm at -30 °C with nominal DC voltage

Temperature (°C)	DC Voltage	Measurement Minutes	Measured Frequency (MHz)	Channel Frequency (MHz)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)
20	Nom.24.02	1	217.17159200	217.17159200	0.00	0.00	2
20	18.08	1	217.17159701	217.17159200	5.01	0.02	2
20	28.11	1	217.17159501	217.17159200	3.01	0.01	2
-30	24	1	217.17174931	217.17159200	157.31	0.72	2
		2	217.17174330	217.17159200	151.30	0.70	2
		3	217.17174130	217.17159200	149.30	0.69	2
		4	217.17174130	217.17159200	149.30	0.69	2
		5	217.17173729	217.17159200	145.29	0.67	2
		6	217.17173529	217.17159200	143.29	0.66	2
		7	217.17173529	217.17159200	143.29	0.66	2
		8	217.17173328	217.17159200	141.28	0.65	2
		9	217.17173128	217.17159200	139.28	0.64	2
		10	217.17173128	217.17159200	139.28	0.64	2
-20	24	1	217.17156695	217.17159200	-25.05	0.12	2
		2	217.17155693	217.17159200	-35.07	0.16	2
		3	217.17155493	217.17159200	-37.07	0.17	2
		4	217.17155493	217.17159200	-37.07	0.17	2
		5	217.17155493	217.17159200	-37.07	0.17	2
		6	217.17155292	217.17159200	-39.08	0.18	2
		7	217.17155493	217.17159200	-37.07	0.17	2
		8	217.17155292	217.17159200	-39.08	0.18	2
		9	217.17155493	217.17159200	-37.07	0.17	2
		10	217.17155493	217.17159200	-37.07	0.17	2
-10	24	1	217.17154290	217.17159200	-49.10	0.23	2
		2	217.17154290	217.17159200	-49.10	0.23	2
		3	217.17153889	217.17159200	-53.11	0.24	2
		4	217.17153689	217.17159200	-55.11	0.25	2
		5	217.17153228	217.17159200	-59.72	0.27	2
		6	217.17152687	217.17159200	-65.13	0.30	2
		7	217.17152487	217.17159200	-67.13	0.31	2
		8	217.17152487	217.17159200	-67.13	0.31	2
		9	217.17152286	217.17159200	-69.14	0.32	2
		10	217.17152487	217.17159200	-67.13	0.31	2
0	24	1	217.17155893	217.17159200	-33.07	0.15	2
		2	217.17155292	217.17159200	-39.08	0.18	2
		3	217.17154691	217.17159200	-45.09	0.21	2
		4	217.17154691	217.17159200	-45.09	0.21	2
		5	217.17154691	217.17159200	-45.09	0.21	2
		6	217.17154691	217.17159200	-45.09	0.21	2
		7	217.17154691	217.17159200	-45.09	0.21	2
		8	217.17154491	217.17159200	-47.09	0.22	2
		9	217.17154691	217.17159200	-45.09	0.21	2
		10	217.17154691	217.17159200	-45.09	0.21	2

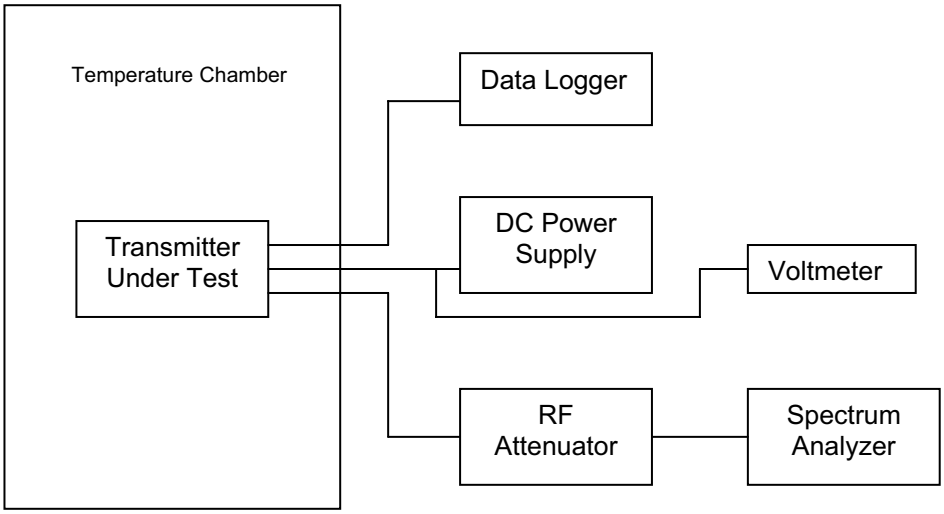
H.10. Test Results continued

Temperature (°C)	DC Voltage	Measurement Minutes	Measured Frequency (MHz)	Channel Frequency (MHz)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)
10	24	1	217.17158499	217.17159200	-7.01	0.03	2
		2	217.17157897	217.17159200	-13.03	0.06	2
		3	217.17157697	217.17159200	-15.03	0.07	2
		4	217.17157697	217.17159200	-15.03	0.07	2
		5	217.17157497	217.17159200	-17.03	0.08	2
		6	217.17157497	217.17159200	-17.03	0.08	2
		7	217.17157497	217.17159200	-17.03	0.08	2
		8	217.17157497	217.17159200	-17.03	0.08	2
		9	217.17157497	217.17159200	-17.03	0.08	2
		10	217.17157497	217.17159200	-17.03	0.08	2
20	24	1	217.17160102	217.17159200	9.02	0.04	2
		2	217.17160102	217.17159200	9.02	0.04	2
		3	217.17160102	217.17159200	9.02	0.04	2
		4	217.17160102	217.17159200	9.02	0.04	2
		5	217.17159901	217.17159200	7.01	0.03	2
		6	217.17159901	217.17159200	7.01	0.03	2
		7	217.17160102	217.17159200	9.02	0.04	2
		8	217.17160102	217.17159200	9.02	0.04	2
		9	217.17160102	217.17159200	9.02	0.04	2
		10	217.17160102	217.17159200	9.02	0.04	2
30	24	1	217.17159901	217.17159200	7.01	0.03	2
		2	217.17159701	217.17159200	5.01	0.02	2
		3	217.17159901	217.17159200	7.01	0.03	2
		4	217.17159901	217.17159200	7.01	0.03	2
		5	217.17159901	217.17159200	7.01	0.03	2
		6	217.17159701	217.17159200	5.01	0.02	2
		7	217.17159701	217.17159200	5.01	0.02	2
		8	217.17159701	217.17159200	5.01	0.02	2
		9	217.17159901	217.17159200	7.01	0.03	2
		10	217.17159901	217.17159200	7.01	0.03	2
40	24	1	217.17156695	217.17159200	-25.05	0.12	2
		2	217.17156695	217.17159200	-25.05	0.12	2
		3	217.17156695	217.17159200	-25.05	0.12	2
		4	217.17156895	217.17159200	-23.05	0.11	2
		5	217.17156695	217.17159200	-25.05	0.12	2
		6	217.17156895	217.17159200	-23.05	0.11	2
		7	217.17156695	217.17159200	-25.05	0.12	2
		8	217.17156695	217.17159200	-25.05	0.12	2
		9	217.17156895	217.17159200	-23.05	0.11	2
		10	217.17156695	217.17159200	-25.05	0.12	2

H.11. Test results continued

Temperature (°C)	DC Voltage	Measurement Minutes	Measured Frequency (MHz)	Channel Frequency (MHz)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)
50	24	1	217.17152286	217.17159200	-69.14	0.32	2
		2	217.17152286	217.17159200	-69.14	0.32	2
		3	217.17152286	217.17159200	-69.14	0.32	2
		4	217.17152086	217.17159200	-71.14	0.33	2
		5	217.17152086	217.17159200	-71.14	0.33	2
		6	217.17152286	217.17159200	-69.14	0.32	2
		7	217.17152286	217.17159200	-69.14	0.32	2
		8	217.17152086	217.17159200	-71.14	0.33	2
		9	217.17152086	217.17159200	-71.14	0.33	2
		10	217.17152286	217.17159200	-69.14	0.32	2

H.12. Test Setup



APPENDIX I: RADIATED EMISSIONS (DIGITAL DEVICES)

I.1. Base Standard & Test Basis

Base Standards	FCC Title 47, PART 15 Subpart B, 15.109 ICES-003 Issue 4
Test Basis	FCC Title 47, PART 15 Subpart B, 15.109 ICES-003 Issue 4
Test Method	ANSI C63.4-2003 CISPR 22-2002

I.2. Specifications

15.109 Radiated Emission Limits:
The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission (MHz)	Field strength (microvolts/meter)
30–88	90
88–216	150
216–960	210
Above 960	300

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, “Information Technology Equipment—Radio Disturbance Characteristics—Limits and Methods of Measurement”

ICES-003 Issue 4, 7.1;
This Standard refers to the following publication and where such reference is made, it shall be to the edition listed below.
Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment."

Limits for radiated disturbance of class A ITE
at a measuring distance of 10 m

Frequency range MHz	Quasi-peak limits dB(µV/m)
30 to 230	40
30 to 1 000	47
NOTE 1: The lower limit shall apply at the transition frequency. NOTE 2: Additional provisions may be required for cases where interference occurs.	

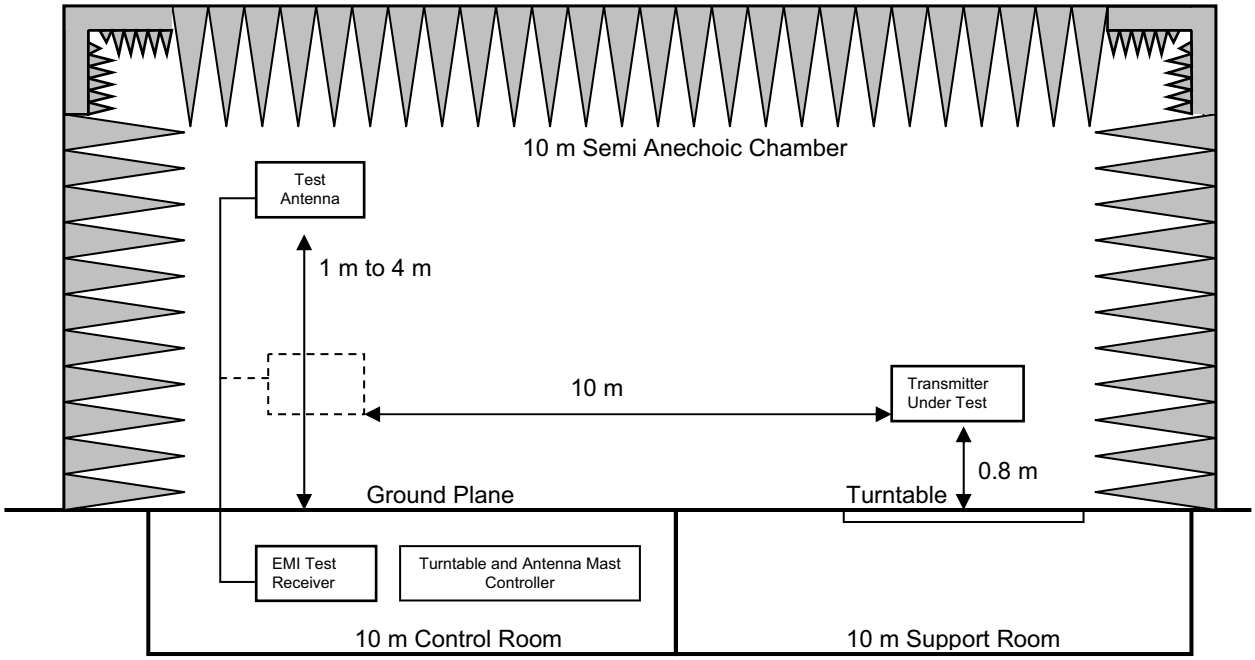
I.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

I.4. Test Procedure

10m Radiated emission measurement

I.5. Test Setup



I.6. Operating Mode During Test

EUT was in Preset 2: 217.522678 MHz, 5 Watts Transmit power with QPSK Modulation.

EUT RF output was terminated with a 40 dB attenuator and 50 Ohm termination during the tests.

I.7. Test Results

EUT is in compliance with FCC Title 47, PART 15 Subpart B, 15.109 and ICES-003 Issue 4

Worst case peak emission was 28.90 dBµV/m at 132.70 MHz when antenna height was 149 cm and turntable angle was 51degree. It has 11.10 dB margin to CISPR 22 Class A limits

There was no digital circuitry related emission observed between 1 GHz and 2 GHz

Antenna polarization	Antenna Height (cm)	Turntable angle (degree)	Spurious Frequency (MHz)	Detector	RBW (MHz)	Radiated Emission Level (dBµV/m)	Class A Limit (dBm)	Margin (dB)
Vertical	154	74	88.48	Peak	0.12	21.31	40.00	18.69
Vertical	104	152	103.22	Peak	0.12	24.15	40.00	15.85
Vertical	149	51	132.70	Peak	0.12	28.90	40.00	11.10
Vertical	107	18	162.19	Peak	0.12	25.00	40.00	15.00
Horizontal	238	142	324.41	Peak	0.12	30.39	47.00	16.61
Vertical	390	355	339.13	Peak	0.12	26.07	47.00	20.93

I.8. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

I.9. Test date

Test started: October 23, 2008 Ended: October 23, 2008

Note: Plots were not provided in order to reduce file size.

APPENDIX J: MEASUREMENT EQUIPMENT

10 m SEMI-ANECHOIC CHAMBER 30 MHz – 2.2 GHz Radiated Emission					
Descriptions	**Manufacturer**	**Type/Model**	**Serial #**	**Cal Due**	**Cal Date**
Test Receiver	Rohde & Schwarz	ESMI	CG0433 CG0434	02APR09	02APR08
Bilog Antenna	Teseq	CBL 6112D	CG1177	10OCT09	10OCT07
HPIB Extender	HP	37204	CG0181	N/A	N/A
Mast Controller	EMCO	2090	CG0179	N/A	N/A
Turntable Controller	EMCO	2090	CG0178	N/A	N/A
Digital Barometer / Thermometer	Cole-Parmer	1870	CG0728	30JUN09	30JUN08
Attenuator 40 dB 25 Watts	Pasternack	PE7017-40	CG0497	N/A	N/A
RF Termination, 50 Ohm	Huber + Suhner	65 I-50-0-17	N/A	N/A	N/A
Radio Measurements					
EMI Receiver 9 kHz – 40 GHz	Rohde & Schwarz	ESI	CG0109	12NOV08	12NOV07
Power Meter	Agilent	E4418B	CG0119	29JUL09	29JUL08
Power Meter Sensor	HP	8481A	CG0264	29JUL09	29JUL08
Temperature Chamber	Thermotron	SM-8C	CG0836	NA	NA
Data Logger	Fluke	2620A	CG0215	29JAN09	9OCT07
DC Power Supply	HP	6296A	CG0218	N/A	N/A
Multimeter	Fluke	Fluke 87	CG0383	11FEB09	11FEB08
Attenuator	Weinschel	30 dB	CG0751	N/A	N/A

END OF DOCUMENT