



Prüfbericht - Nr.: 02423347 001		Seite 1 von 45	
<i>Test Report No.:</i>		<i>Page 1 of 45</i>	
Auftraggeber: <i>Client:</i>	Vihaan Networks Ltd. 21-B, Sector 18, Udyog Vihar Gurgaon, Haryana India-122015		
Gegenstand der Prüfung: <i>Test item:</i>	VBTS 1900 MHz R2, R2.0		
Bezeichnung: <i>Identification:</i>	VBTS 1900 MHz R2, R2.0	Serien-Nr.: <i>Serial No.</i>	V2D20SE11223755
Wareneingangs-Nr.: <i>Receipt No.:</i>	1403015582	Eingangsdatum: <i>Date of receipt:</i>	24.07.2011
Prüfört: <i>Testing location:</i>	Refer Page 4 of 45 for test facilities		
Prüfgrundlage: <i>Test specification:</i>	FCC Part 2 FCC Part 24		
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The tests item passed the test specification(s).</i>		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. Alpha Tower, Sigma Soft Tech Park, # 7, Whitefield Main Road, Varthur Kodi, Bangalore – 560066, India		
geprüft / tested by:		kontrolliert / reviewed by:	
16.08.2011	Vinay.N Test Engineer	17.08.2011	Varma Kalyan Manager
			
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
Sonstiges / Other Aspects:		FCC ID : ZO7-VBTS1900R2 Contains FCC ID: SWX-XR5	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. M. Test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

Test Result Summary

Clause	Test Item	Result
2.1046 / 24.232	Maximum Channel Power	Pass
2.1047	Modulation Characteristics	Pass
2.1049	Occupied Bandwidth	Pass
2.1051 / 24.238	Band Edges Compliance	Pass
2.1051 / 24.238	Spurious Emission at Antenna Terminal	Pass
2.1053 / 24.238	Radiated Spurious Emission	Pass
2.1055 / 24.235	Frequency Stability	Pass

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List of Test and Measurement Instruments

Wipro Technologies, Bangalore

List of Test and Measurements

Equipment	Manufacturer	Type	S/N	Calibration Due Date
EMI Test Receiver	Rohde & Schwarz	ESIB40	100306	24.03.2012
Hybrid Log Periodic Antenna	TDK	HLP3003C	130334	21.03.2012
Broadband Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA9170	9170-344	21.03.2012
Double Ridged Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA9120D	9120D-687	21.03.2012
Pre-Amplifier	TDK-RFSolution	PA-02	100008	15.02.2012
Digital Radio Communication Tester	Rohde & Schwarz	CMU 300	100342	07.07.2012
Spectrum Analyzer	Agilent Technologies	E4407B	US41192772	27.01.2012

Testing Facilities

- 1) Wipro Technologies
Survey No. 70, 77, 78 / 8A, Dodda Kannelli,
Sarjapur Road, Bangalore – 560 035
India

General Product Information

Product Function and Intended Use

A BTS provides coverage for a cell, which is usually located at the center of a cell. A BTS provides the connectivity between the network and the mobile station via the Air-interface using the RF frequencies. The VNL VBTS-1900 with TU in built in DMB card, RU and power system corresponds to BTS/Cell-Site in 1900MHz GSM band. The VBTS shall have smaller coverage, and it shall be with VPA/DLNA.

Ratings and System Details

Operating Frequency	1930 – 1990 MHz
No. of channel	299
Channel Spacing	200 kHz
Transmitted Power	+33.13 dBm
Modulation	GMSK
Antenna Type	Omni Directional
Antenna Gain	~10 dBi
Supply Voltage	24V DC
Dimensions	674mm x 422.3mm x 223.3mm
Environmental	Storage: -65 to +125degrees C Operational: -40 to +60 degrees C.

Test Conditions:

24V DC Battery Supply

Environmental conditions:

Temperature: +23 ° C

RH: 62%

Operation Descriptions

In case of VBTS-1900, RU along with DMB is inside the VBTS unit. In this case Abis link will be on the air, so external RU and TU are needed to extract Ethernet packets and then to generate standard E1 traffic respectively, which is then to be fed into the BSC Simulator.

The base band system is divided in three parts: Main block, and two slave blocks. The main block consists of an ARM9 based processor (Freescale i.MX27L) responsible for all common tasks in the system. The two slave blocks are used to control of the TRX's (one block for each TRX). The slave blocks consists of two (Analog Devices) Blackfin BF547 processors each (total of four Blackfins). For each TRX there are two slave CPU's. The SPI interfaces used for control of the radio parts are only connected to one of these slave CPU's. The interfaces used for data transmission are connected to both slave CPU's. The received data from each TRX are connected to all four slave CPU's. There are a total of two Tx DACs in the system, one on each RTM. The DAC uses a parallel interface for data transfer. This interface is connected to each of the Blackfin CPU's controlling one TRX. There are a total of two Rx ADCs in the system, one on each RTM

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Test Set-up and Operation Mode

Principle of Configuration Selection

The test was performed under continuous transmission to obtain the maximum emissions.

Test Operation and Test Software

Console computer used to enable the continuous transmission and changing channels (low/mid/high) on the EUT for the tests in this report.

Special Accessories and Auxiliary Equipment

The EUT was tested together with the following additional accessory:

- Console Computer used to set the test configuration (channel and power level)

Countermeasures to achieve EMC Compliance

- None

Table of carrier frequencies

Frequency Band	Channel No.	Frequency (MHz)
1930 – 1990 MHz	512	1930.2
	513	1930.4
	.	.
	.	.
	.	.
	.	.
	.	.
	.	.
	809	1989.6
	810	1989.8

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Test Results

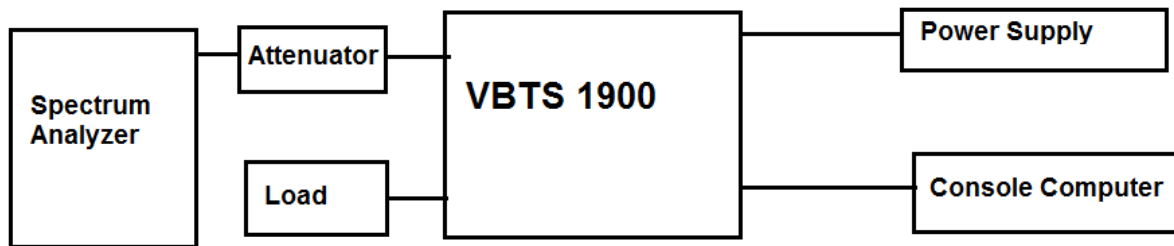
Maximum Channel Power Result

Section 2.1046 / 24.232
Pass

Test Specification	CFR 47 (FCC) part 2.1046 and part 24.232
Measured at	Antenna Connector
Test Method	TIA-603-C:2004.
Test Configuration	Transmitter 1 – Channel Low, Mid and High Transmitter 2 – Channel Low, Mid and High

Test Method:

The EUT was connected to the Spectrum Analyzer via the one RF connector. Other RF connectors were connected to match load. BTS was controlled to transmit Maximum power by console computer. Measure and record the Maximum Channel Power of the Base Station by the Spectrum Analyzer.



Limits:

Compliance with FCC part 24.232, in no any case may the peak power of a base station transmitter exceeds 100 Watts. $P \text{ (dBm)} = 10 \cdot \log(P \text{ mWatts})$.

Maximum Output Power (Watts)	< 100 Watts
Maximum Output Power (dBm)	< 50 dBm

Test Conditions:

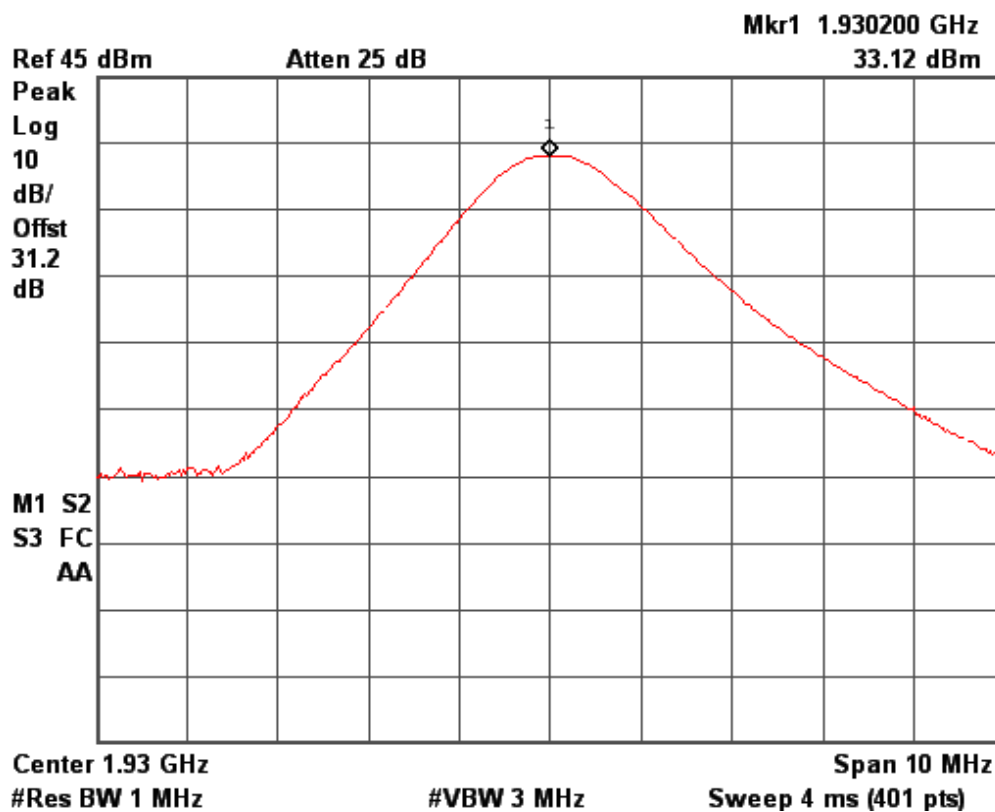
Supply Voltage: 24V DC
Temperature: 25° C

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Test Results:

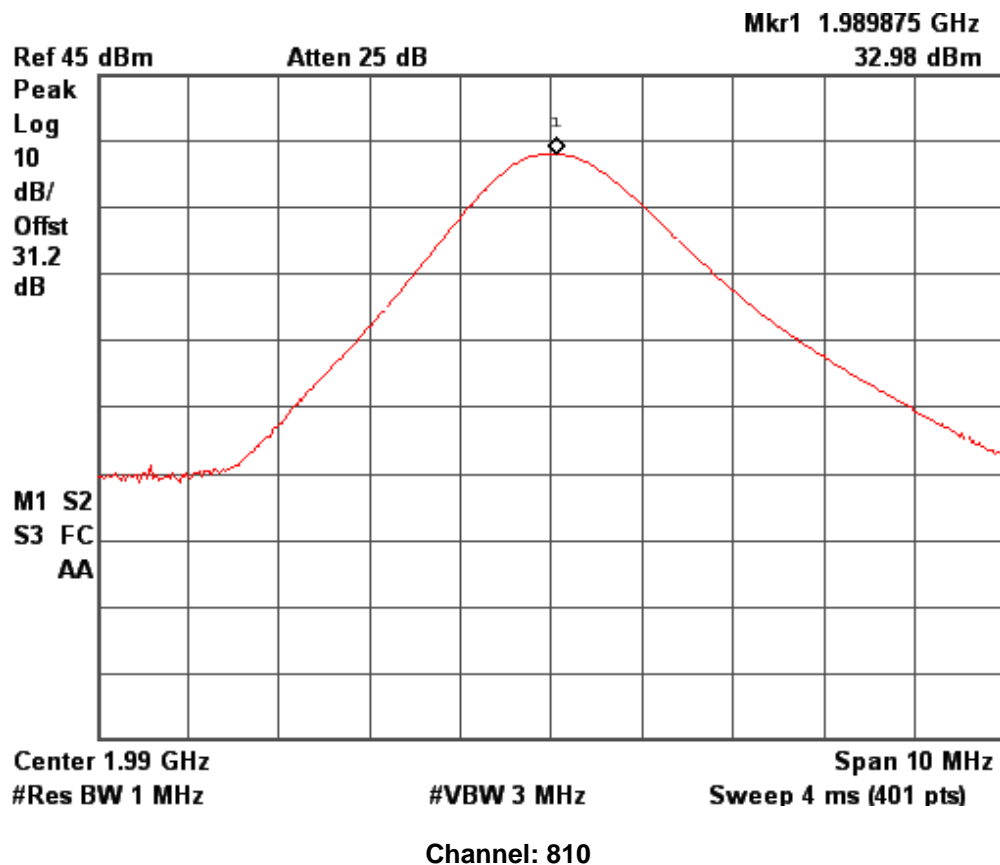
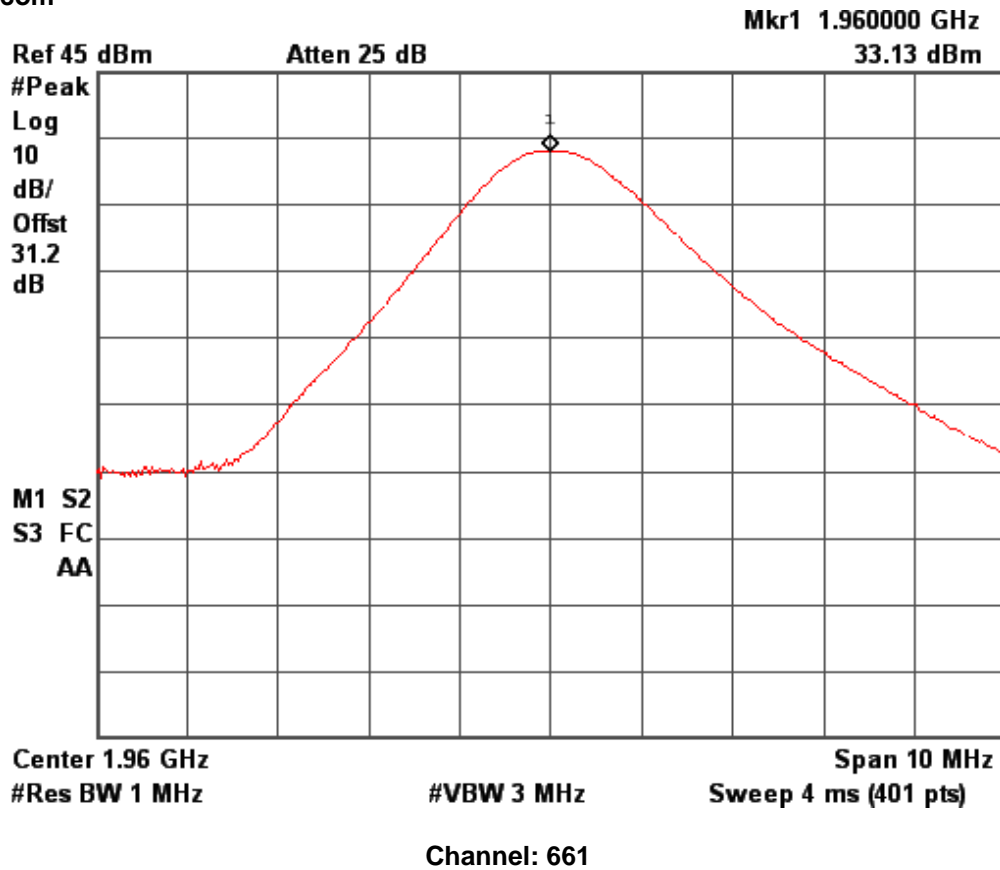
Transmitter 1

Channel Number	Channel Frequency (MHz)	Measured RF Output power (dBm)	Limit (dBm)	Margin (dB)
512	1930.2	33.12	50	-16.88
661	1960.0	33.13	50	-16.87
810	1989.8	32.98	50	-17.02



Channel: 512

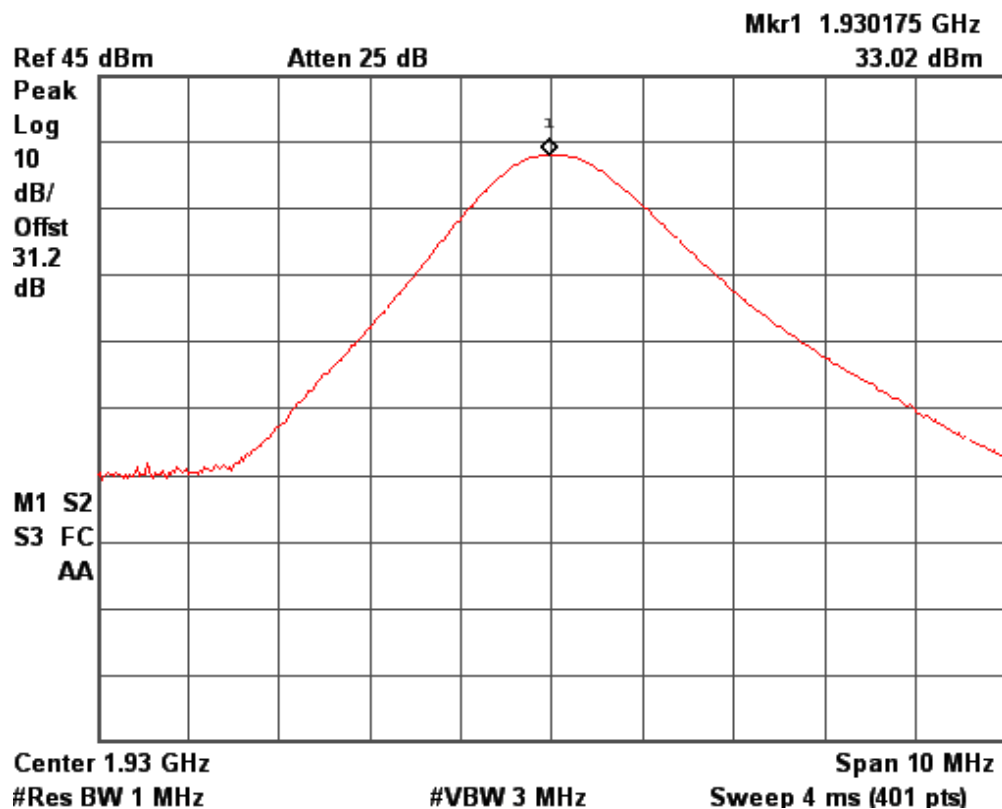
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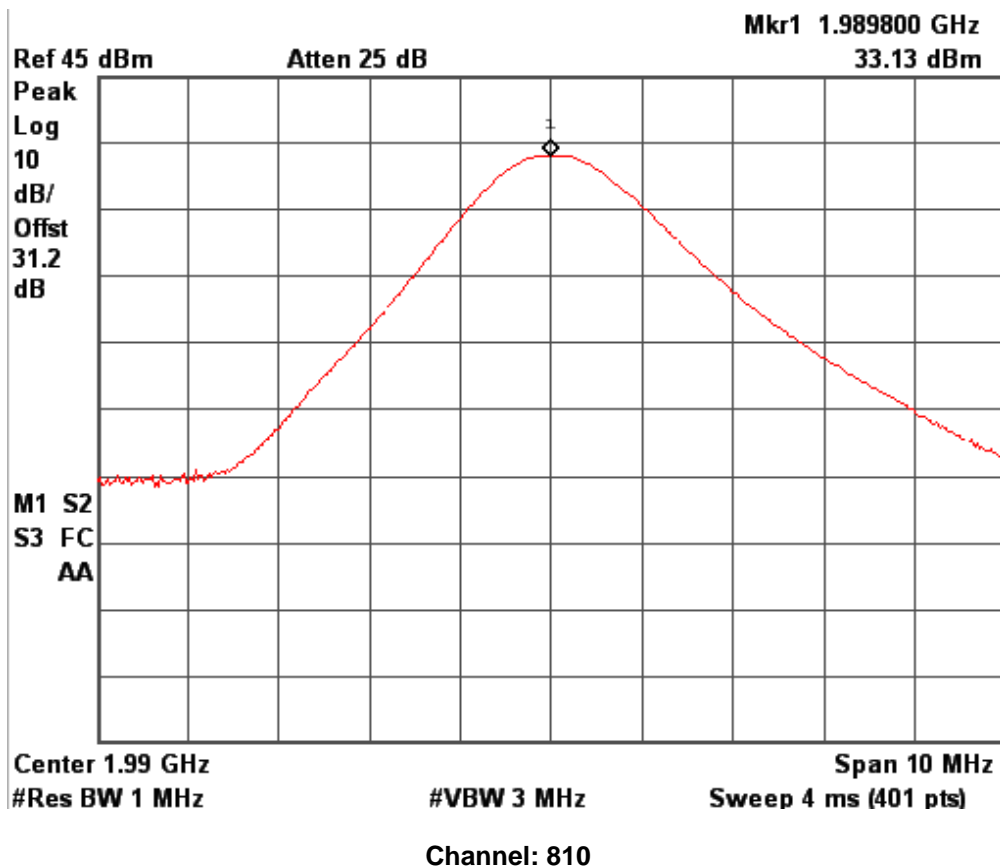
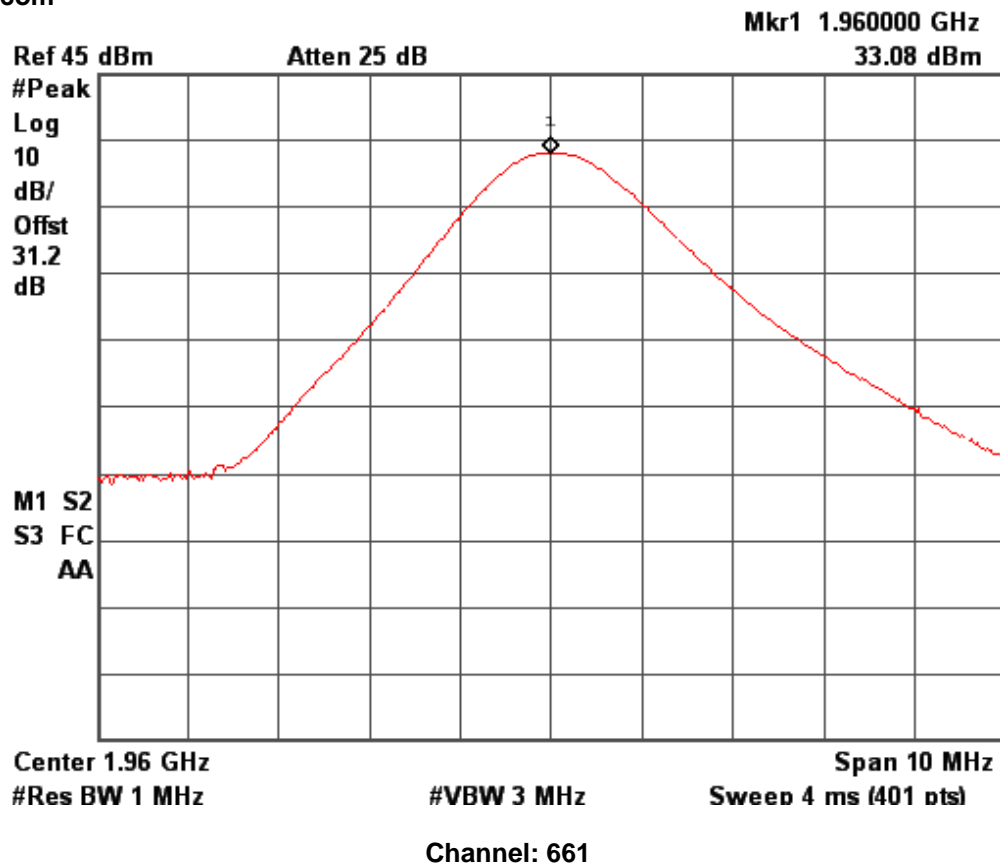
Transmitter 2

Channel Number	Channel Frequency (MHz)	Measured RF Output power (dBm)	Limit (dBm)	Margin (dB)
512	1930.2	33.02	50	-16.98
661	1960.0	33.08	50	-16.92
810	1989.8	33.13	50	-16.87



Channel: 512

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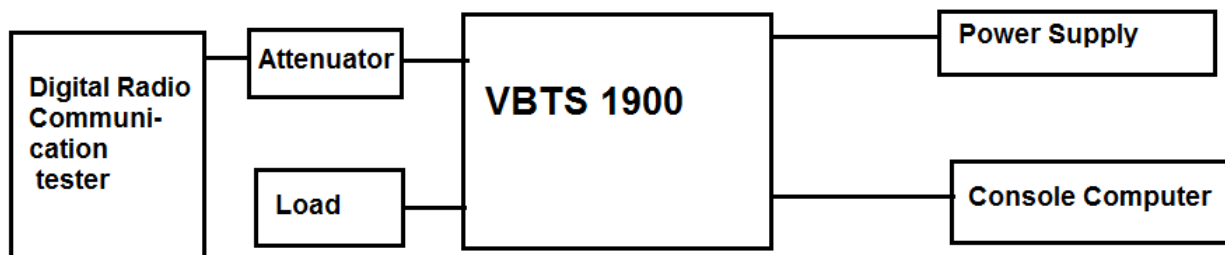


Modulation Characteristics
Result
Section 2.1047
Pass

Test Specification	CFR 47 (FCC) part 2.1047 and part 24
Measured at	Antenna Connector
Test Method	TIA-603-C: 2004.
Test Configuration	Transmitter 1 – Channel Mid Transmitter 2 – Channel Mid

Test Method:

The EUT was connected to the Digital Radio Communication tester via the one RF connector. Other RF connectors were connected to match load. BTS was controlled to transmit Maximum power by console computer. Measure and record the Modulation Characteristics of the Base Station by the Digital Radio Communication tester.


Limits:

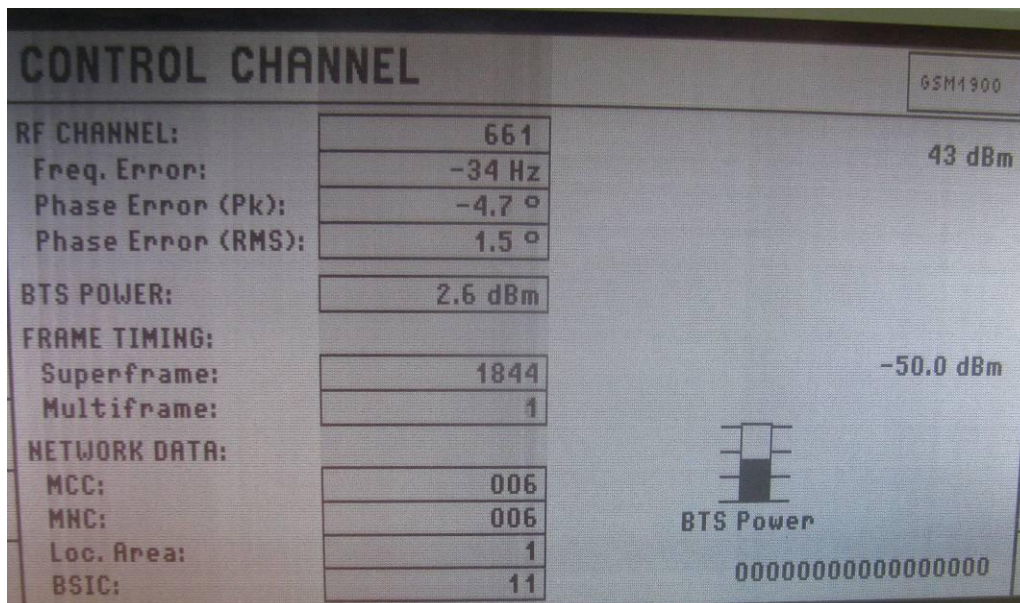
No specific modulation characteristics requirement limits in part 2.1047 and part 24 subpart E.

Limits According to 3GPP TS 11.21

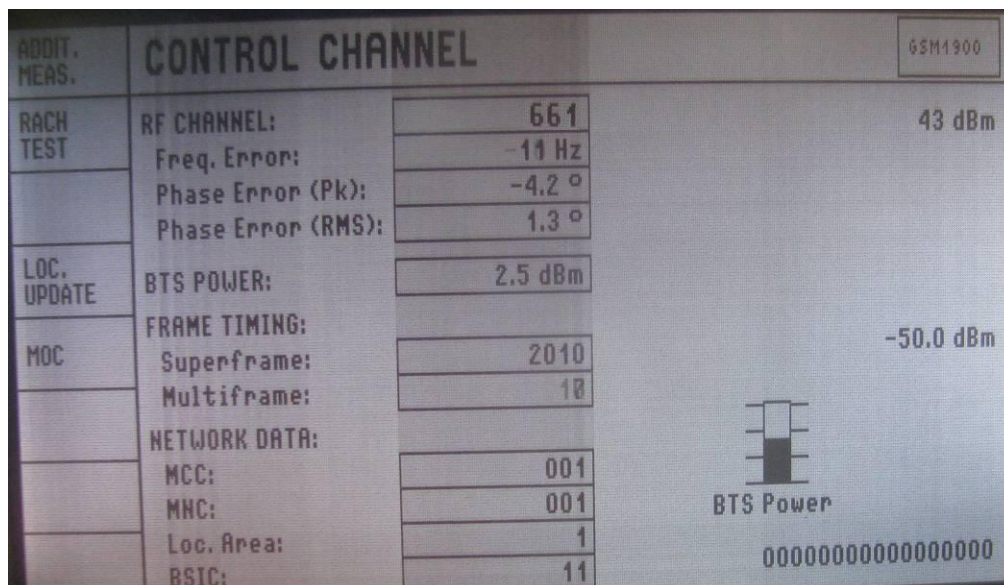
Modulation: GMSK	rms phase error (°)	<5
	peak phase error (°)	<20

Test Result:

Test Conditions	Modulation GMSK			
	Measured		Limit	
	Phase Error (°)		Phase Error (°)	
	° rms	peak °	rms °	° peak
Transmitter 1 Channel 661 (1960 MHz)	1.5	-4.7	<5	<20
Transmitter 2 Channel 661 (1960 MHz)	1.3	-4.2	<5	<20



Transmitter 1: Channel 661



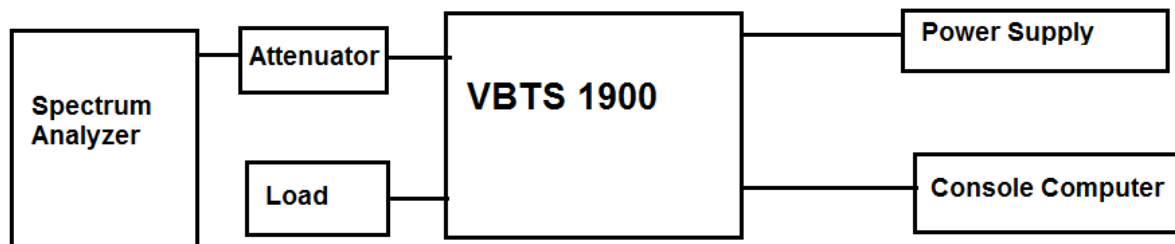
Transmitter 2: Channel 661

**Occupied Bandwidth
Result**
**Section 2.1049
Pass**

Test Specification	CFR 47 (FCC) part 2.1049
Measured at	Antenna Connector
Test Method	TIA-603-C:2004.
Test Configuration	Transmitter 1 – Channel Low, Mid and High Transmitter 2 – Channel Low, Mid and High

Test Method:

The EUT was connected to the Spectrum Analyzer via the one RF connector. Other RF connectors were connected to match load. BTS was controlled to transmit Maximum power by console computer. Measure and record the Occupied Bandwidth of the Base Station by the Spectrum Analyzer.

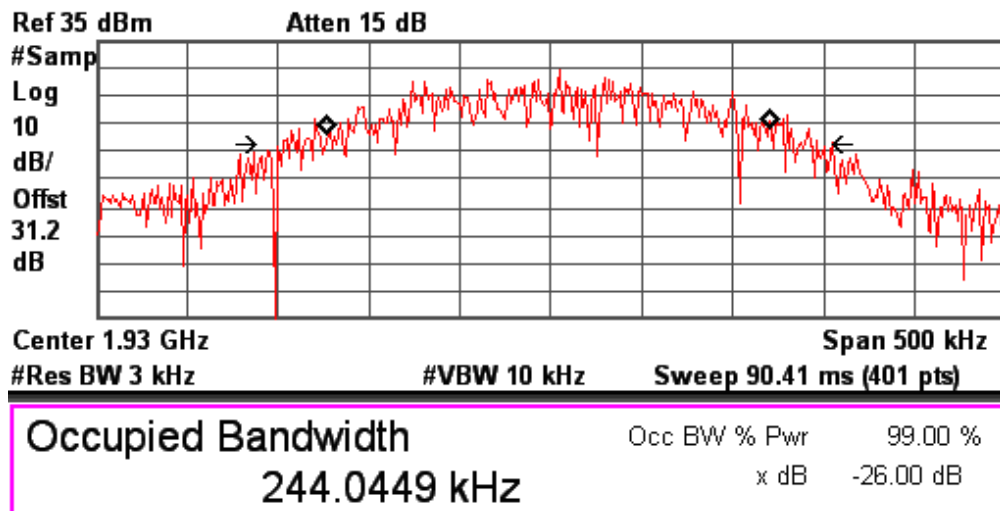

Limits:

No specific occupied bandwidth requirement in FCC part 24 subpart E, but the occupied bandwidth was defined in part 2.1049: the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

Test Results:
Transmitter 1

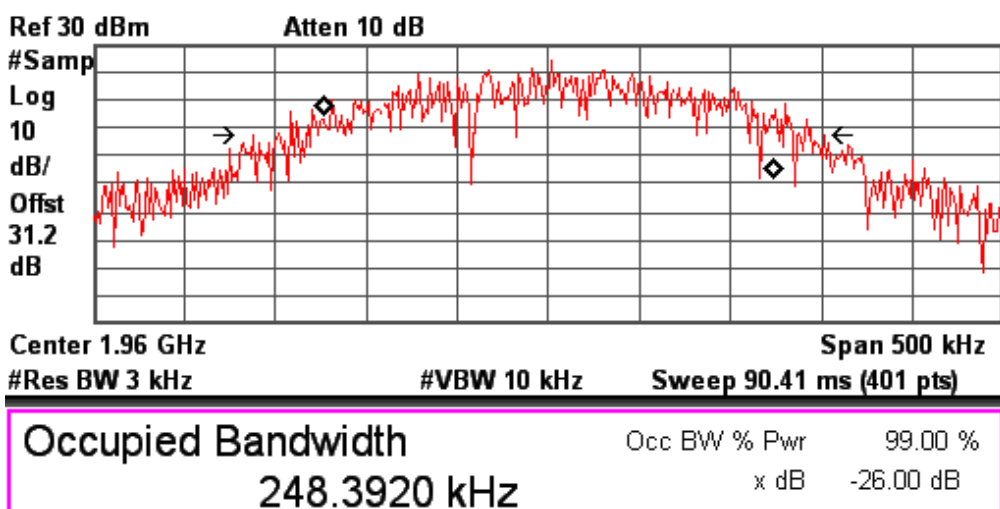
Channel	Channel Frequency (MHz)	Occupied Bandwidth (kHz)
512	1930.2	244.04
661	1960.0	248.39
810	1989.8	248.71

Ch Freq 1.9302 GHz Trig Free
 Occupied Bandwidth



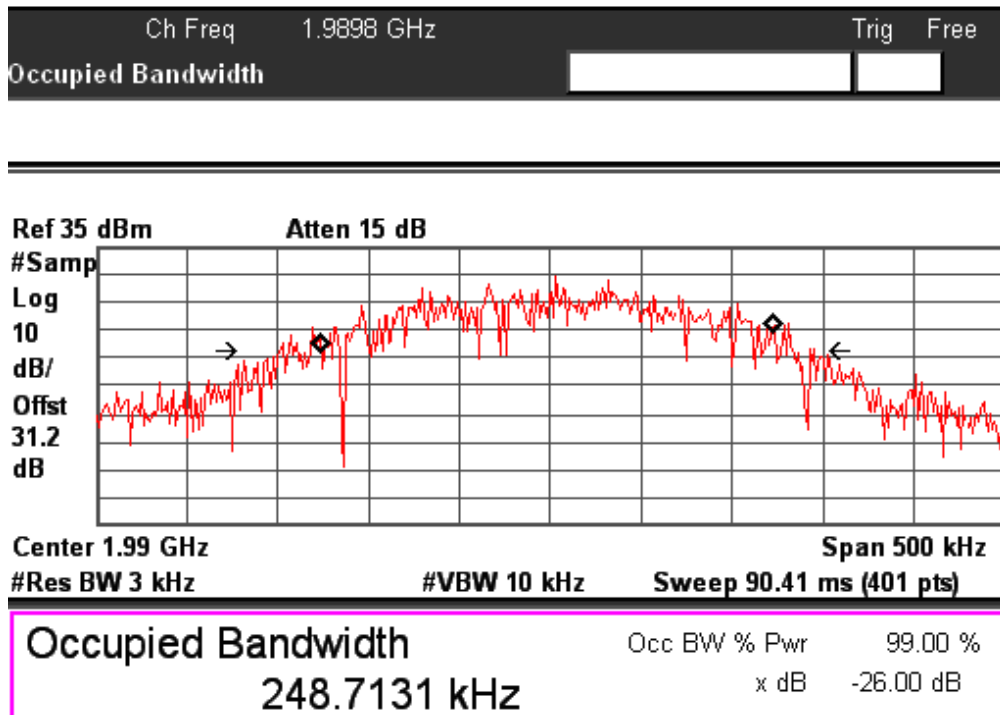
Channel: 512

Ch Freq 1.96 GHz Trig Free
 Occupied Bandwidth



Channel: 661

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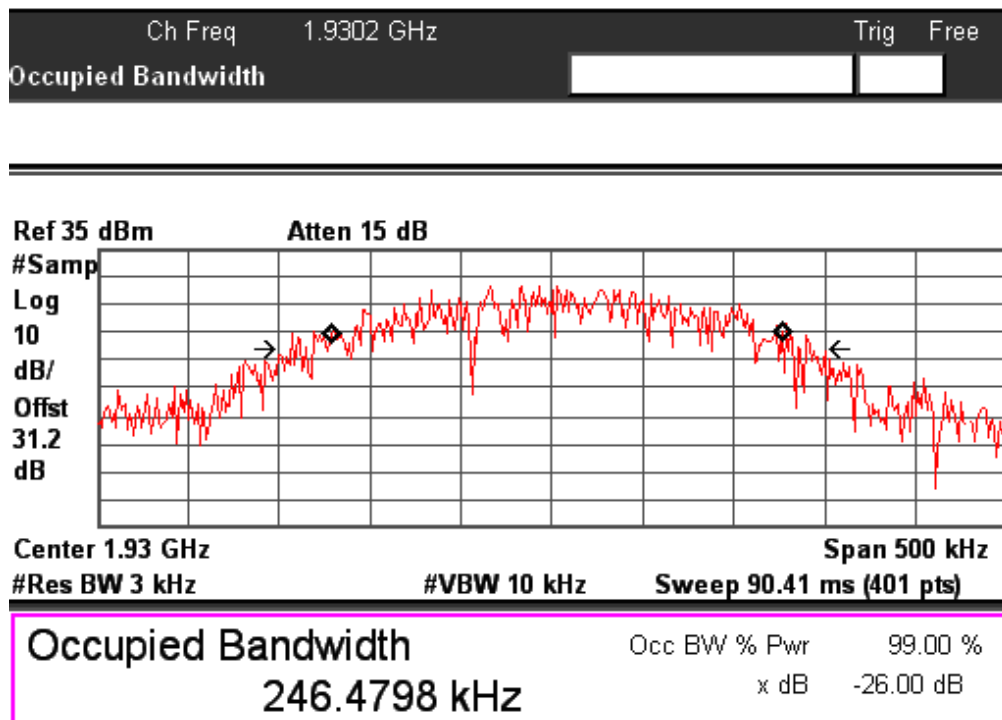


Channel: 810

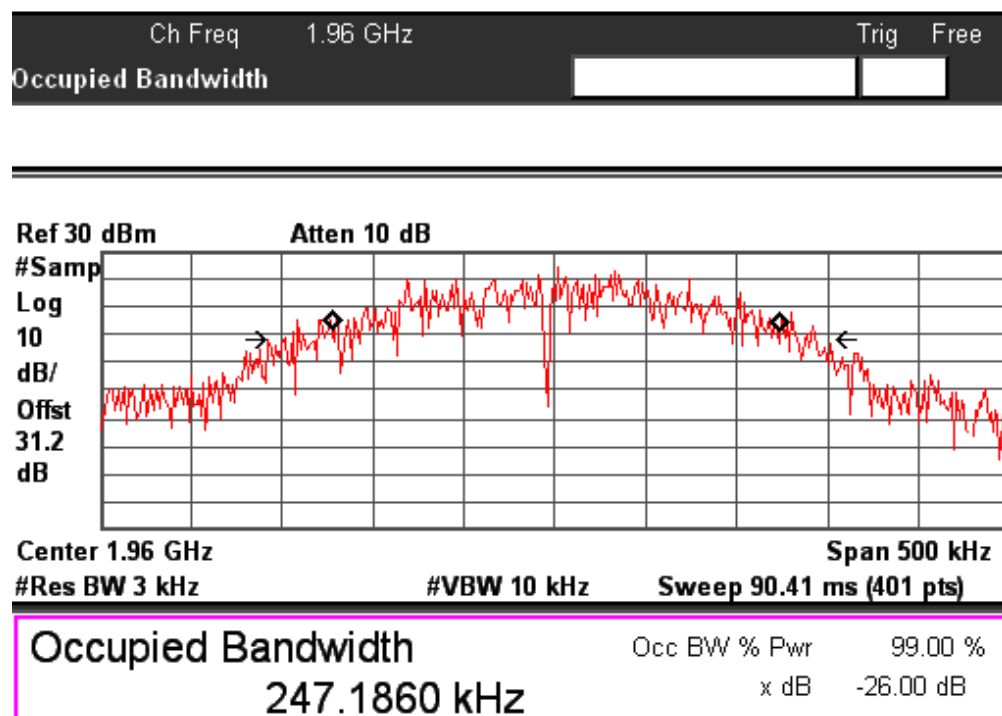
Transmitter 2

Channel	Channel Frequency (MHz)	Occupied Bandwidth (kHz)
512	1930.2	246.47
661	1960.0	247.18
810	1989.8	249.99

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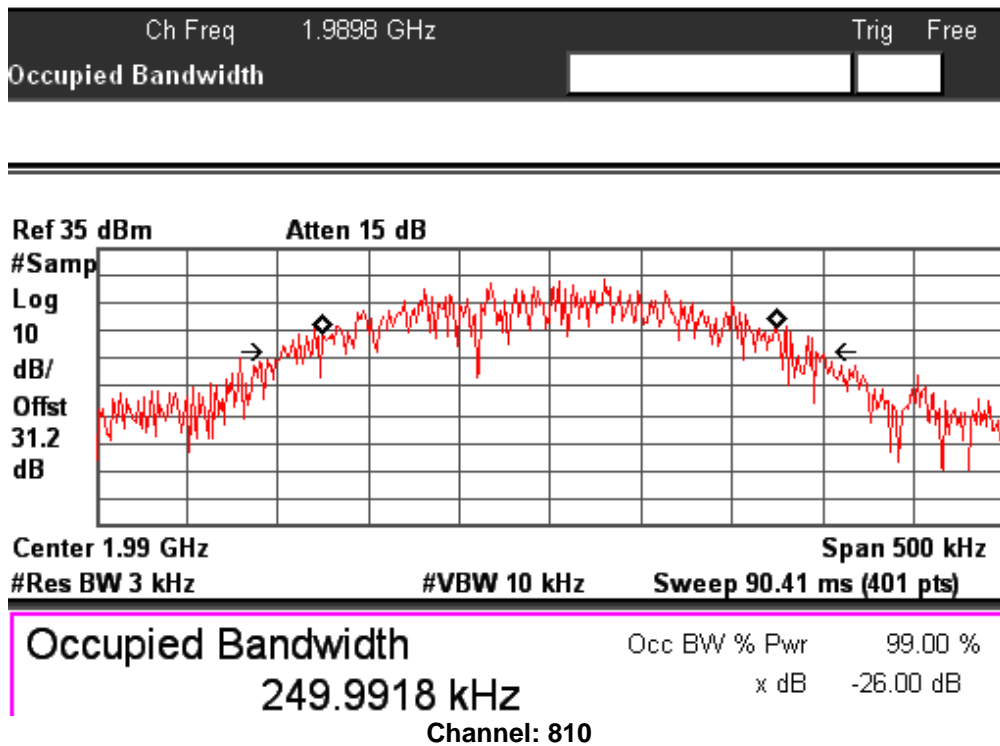


Channel: 512



Channel: 661

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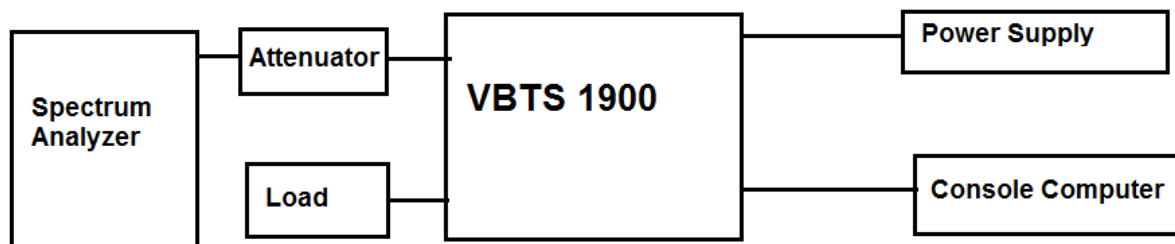
Band-edge Compliance
Result

Section 2.1051 and 24.238
Pass

Test Specification	CFR 47 (FCC) part 2.1051 and Part 24.238
Test Method	TIA-603-C: 2004.
Measured at	Antenna Connector
Test Configuration	Transmitter 1 – Channel Low and High Transmitter 2 – Channel Low High

Test Method:

The EUT was connected to the Spectrum Analyzer via the one RF connector. Other RF connectors were connected to match load. BTS was controlled to transmit Maximum power by console computer. Measure and record the power at band edge of the Base Station by the Spectrum Analyzer.



Limits:

Compliance with FCC part 24.238, all spurious emission must be attenuated below the transmitter power by at least $43 + 10 \log_{10} P$. (Whereas P is the rated power of the EUT).

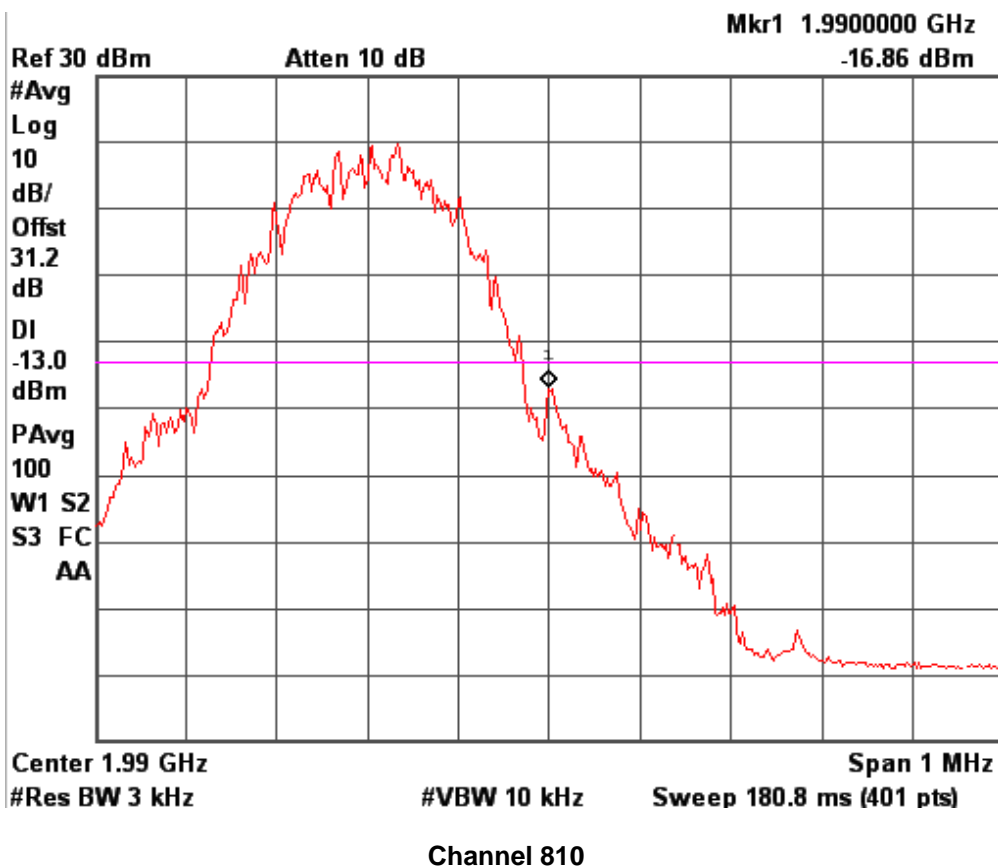
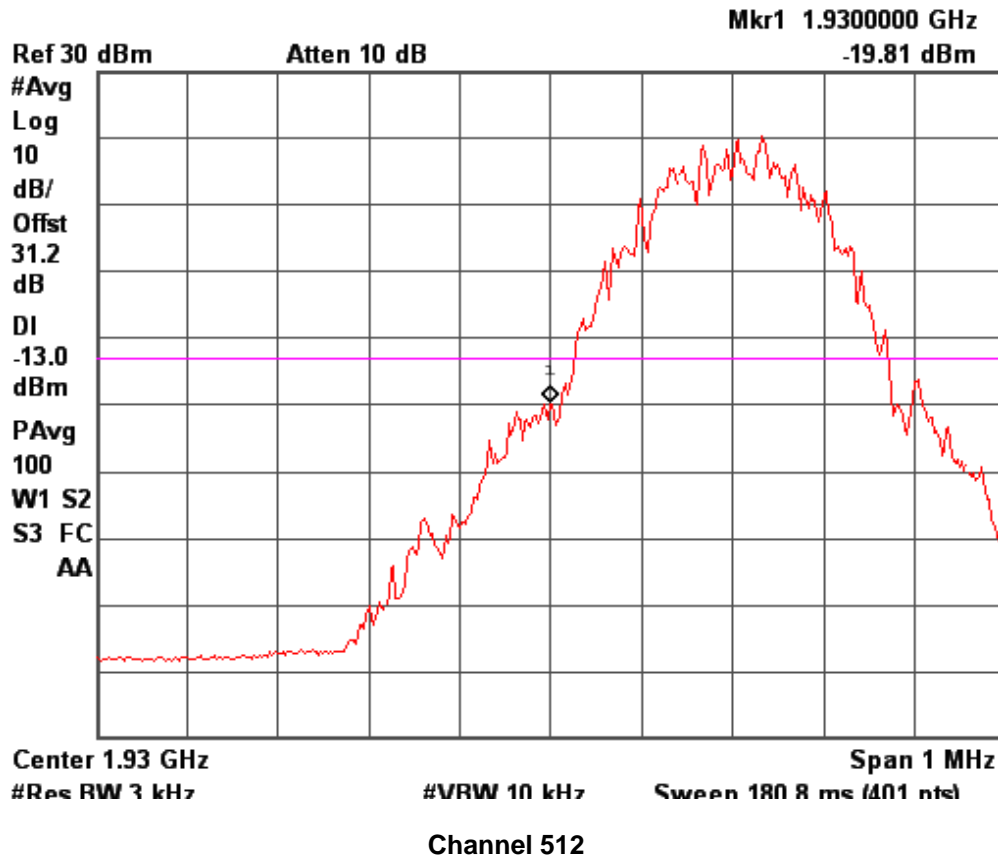
Limit	$P - (43 + 10 \log_{10} P) = 10 \log_{10}(1000P) - 43 - 10 \log_{10} P = 30 - 43 = -13 \text{ dBm}$
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Test Result:

Transmitter 1

Channel	Fundamental Frequency (MHz)	Measured Emission (dBm)	Limit (dBm)
512	1930.2	-19.81	-13
810	1989.8	-16.86	-13

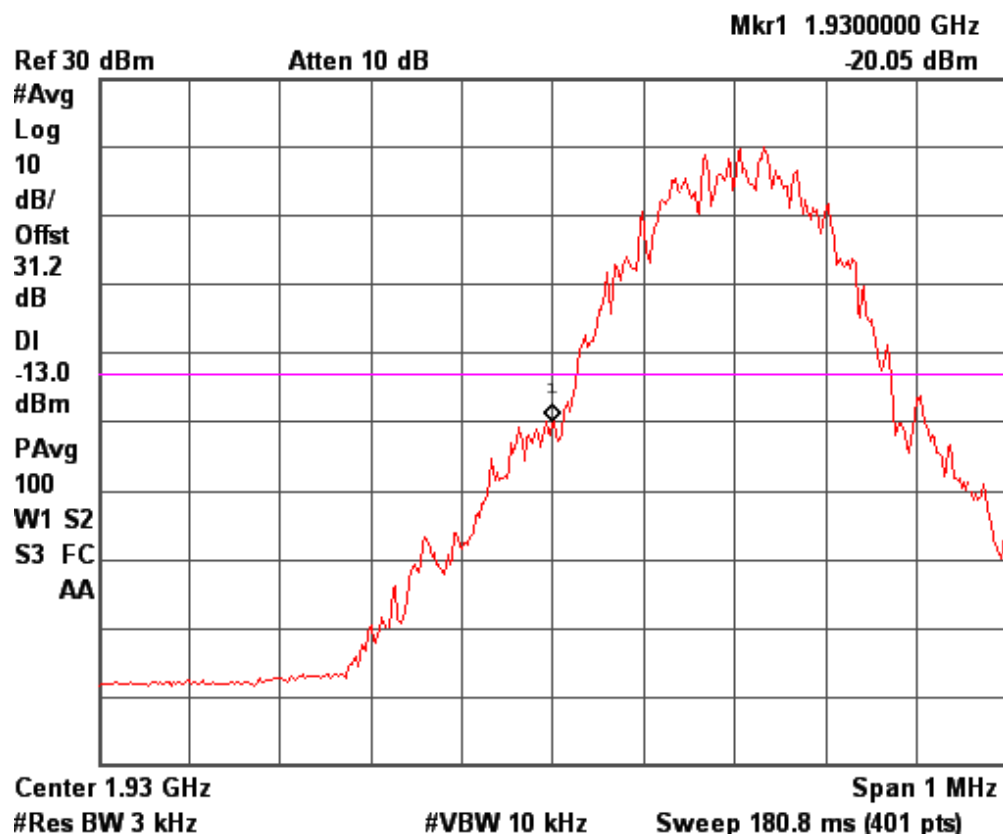
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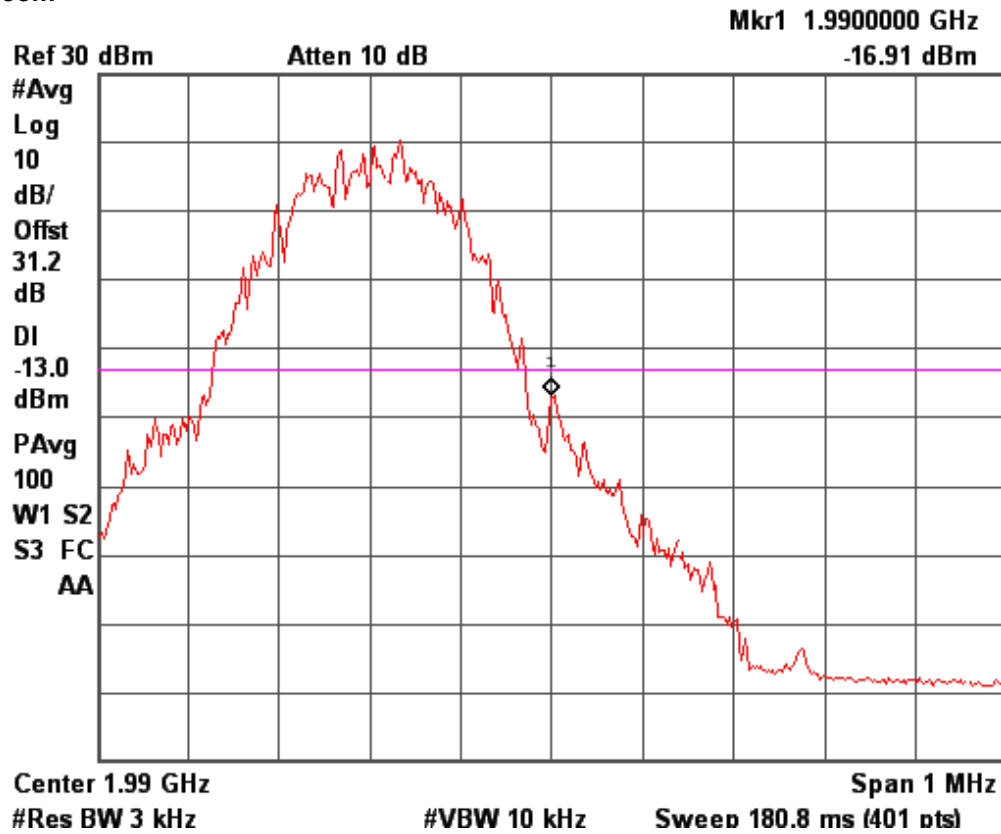
Transmitter 2

Channel	Fundamental Frequency (MHz)	Measured Emission (dBm)	Limit (dBm)
512	1930.2	-20.05	-13
810	1989.8	-16.91	-13



Channel 512

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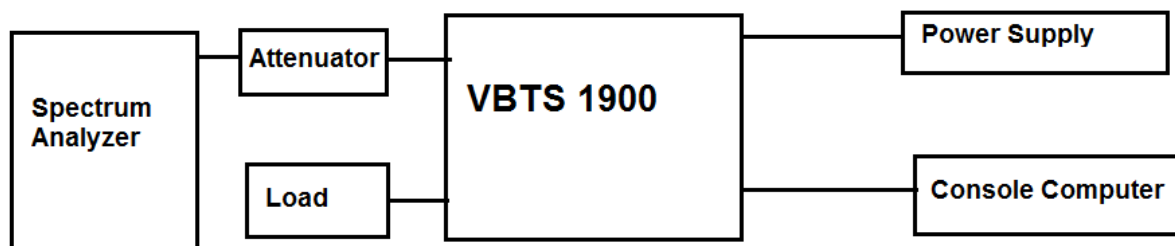
Channel 810

Spurious Emissions at antenna terminals
Section 2.1051 and 24.238
Result
Pass

Test Specification	CFR 47 (FCC) part 2.1051 and Part 24.238
Measured at	Antenna Connector
Test Method	TIA-603-C: 2004.
Test Configuration	Transmitter 1 – Channel Low, Mid and High Transmitter 2 – Channel Low, Mid and High

Test Method

The EUT was connected to the Spectrum Analyzer via the one RF connector. Other RF connectors were connected to match load. BTS was controlled to transmit Maximum power by console computer. Measure and record the power at spurious emissions of the Base Station by the Spectrum Analyzer.



According to 47CFR part 24.238, this defined the measurement bandwidth of as following:

Measurement bandwidth (RBW) for 9 kHz up to 10th harmonic included: 1MHz;

Limit:

Compliance with FCC part 24.238, all spurious emission must be attenuated below the transmitter power by at least $43 + 10 \log_{10} P$. (Whereas P is the rated power of the EUT).

Limit	$P - (43 + 10 \log_{10} P) = 10 \log_{10}(1000P) - 43 - 10 \log_{10} P = 30 - 43 = -13 \text{ dBm}$
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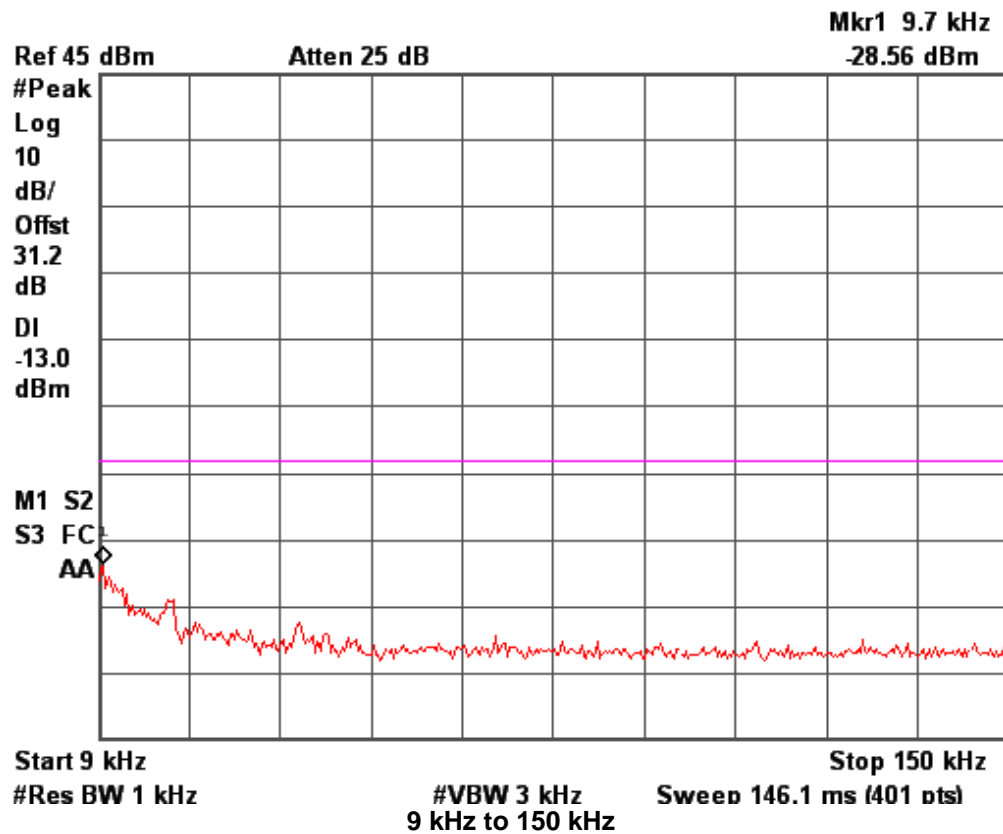
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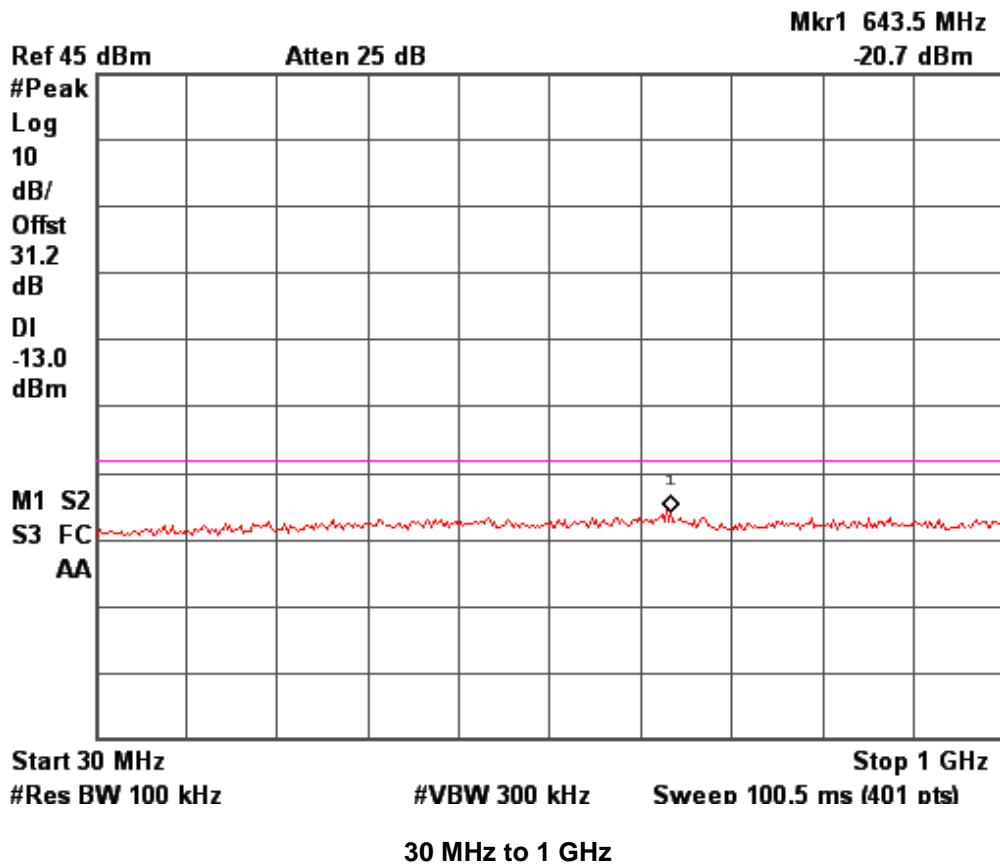
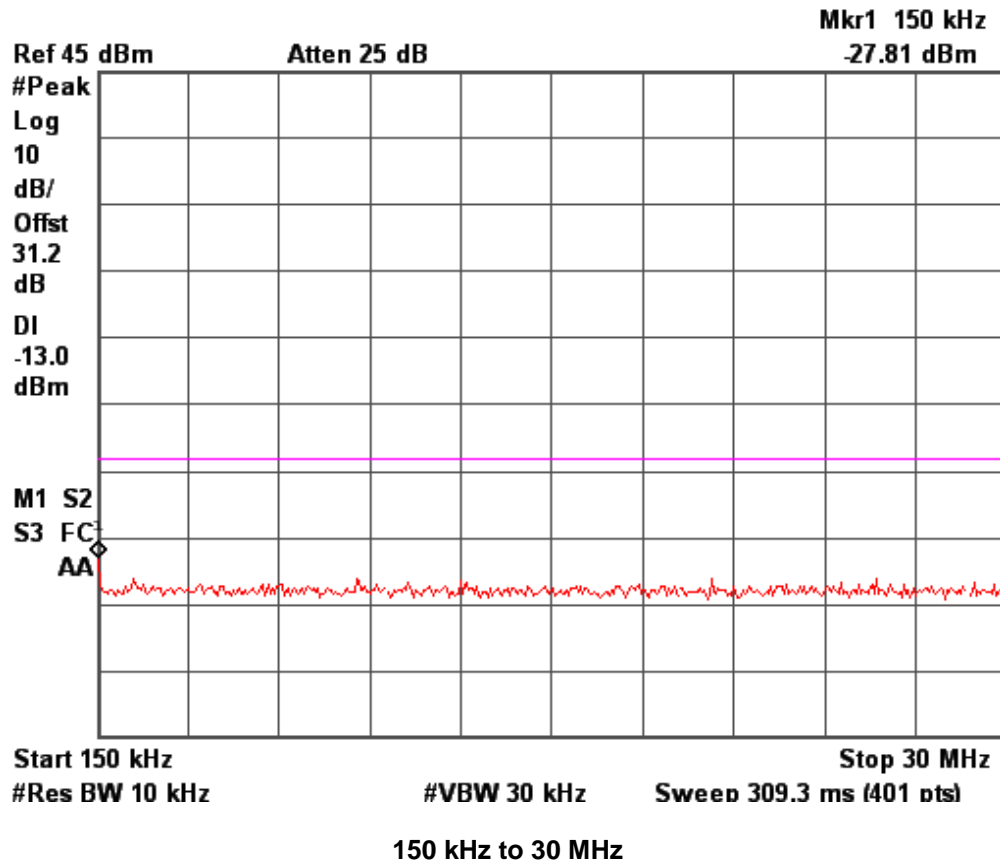
Test Results

Transmitter 1

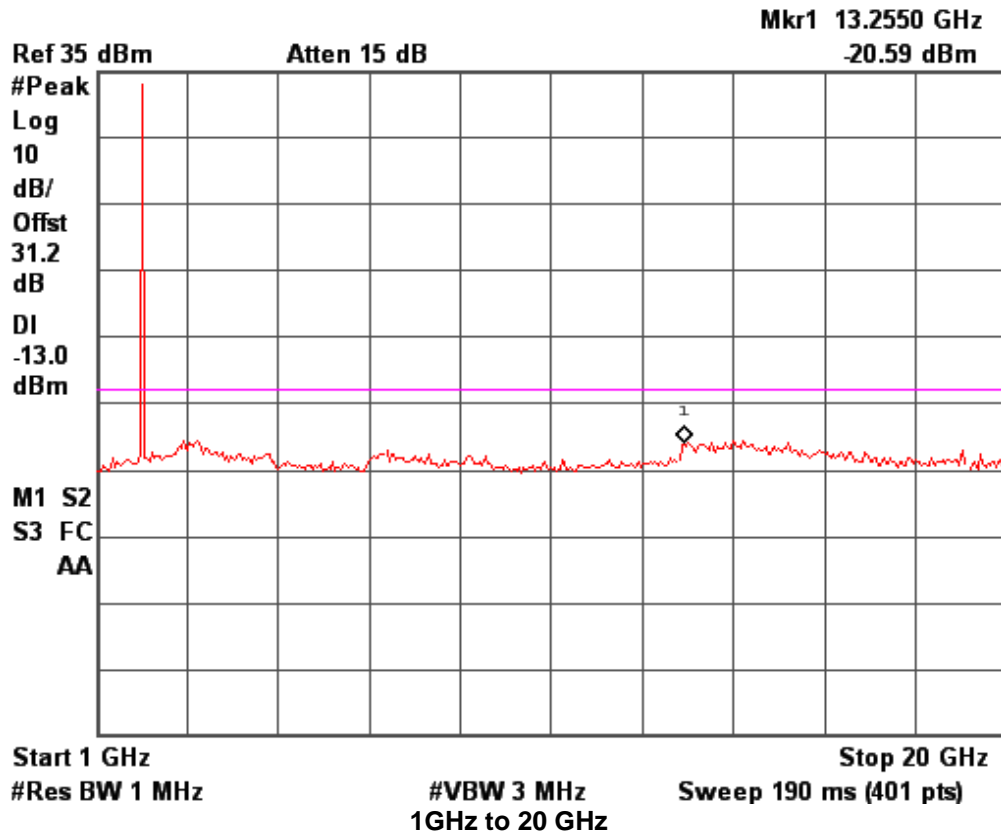
Channel	Channel Frequency (MHz)	Test Frequency	Measured Maximum Emission (dBm)	Limit (dBm)
512	1930.2	9 kHz – 20 GHz	-20.59	-13
661	1960.0	9 kHz – 20 GHz	-19.53	-13
810	1989.8	9 kHz – 20 GHz	-19.13	-13

Channel low

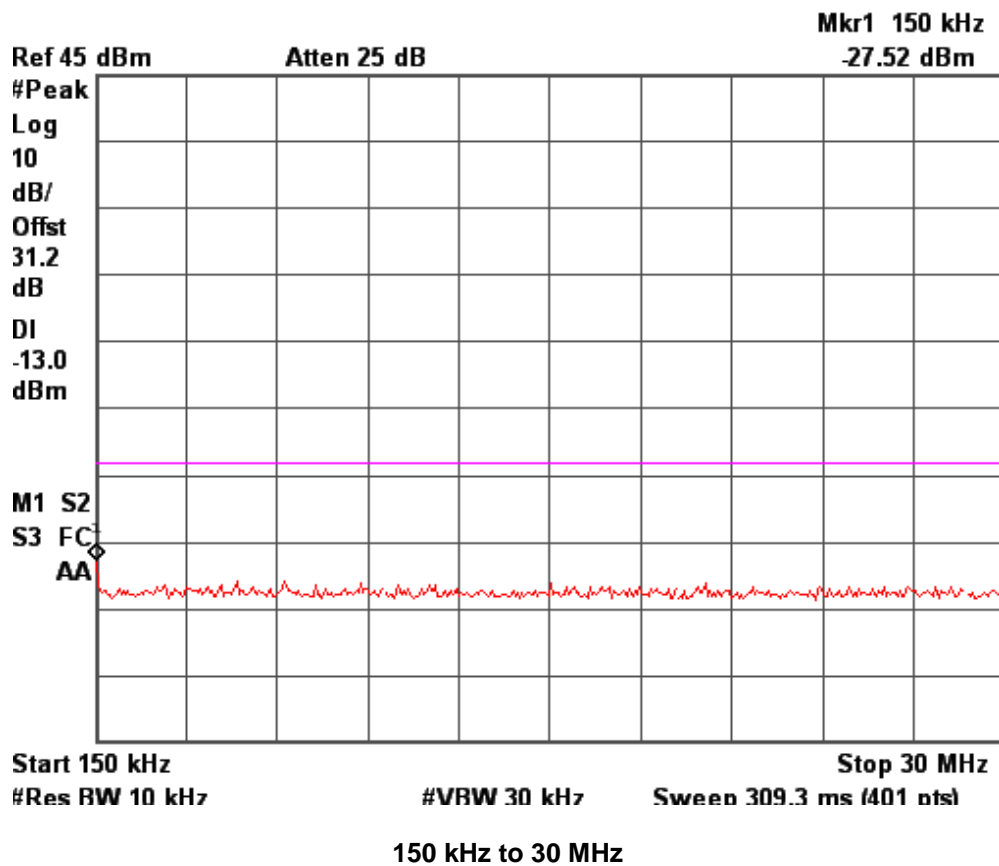
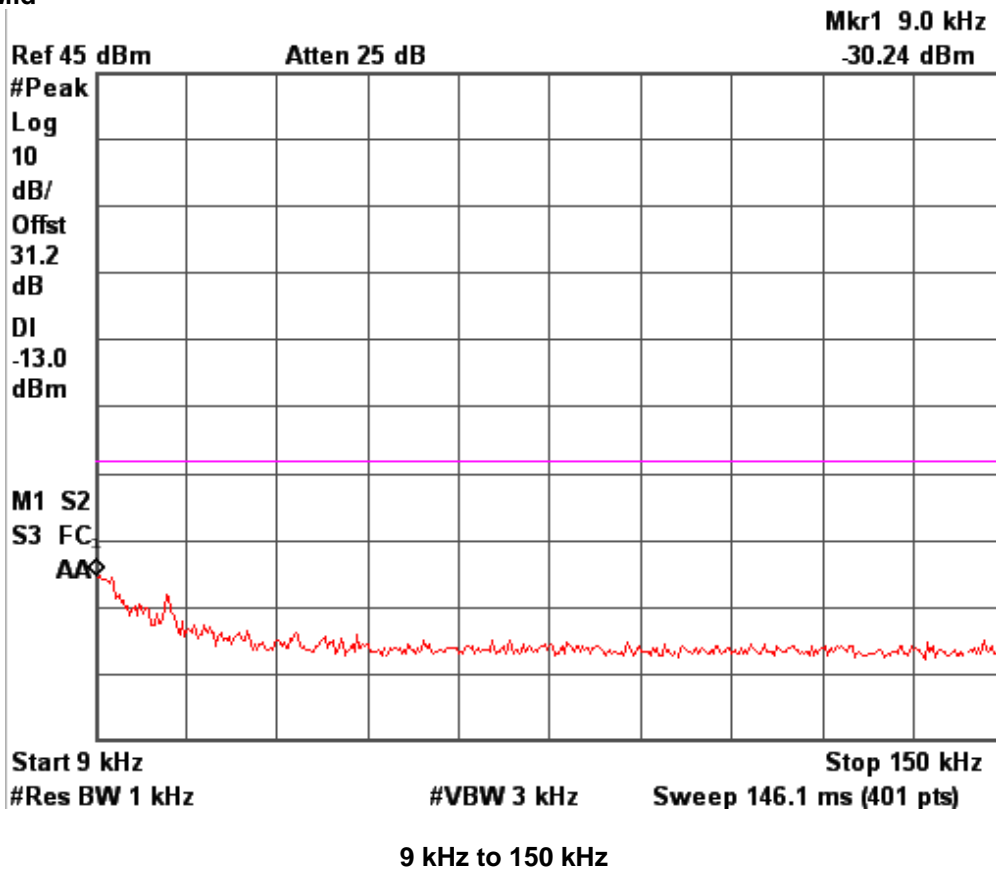




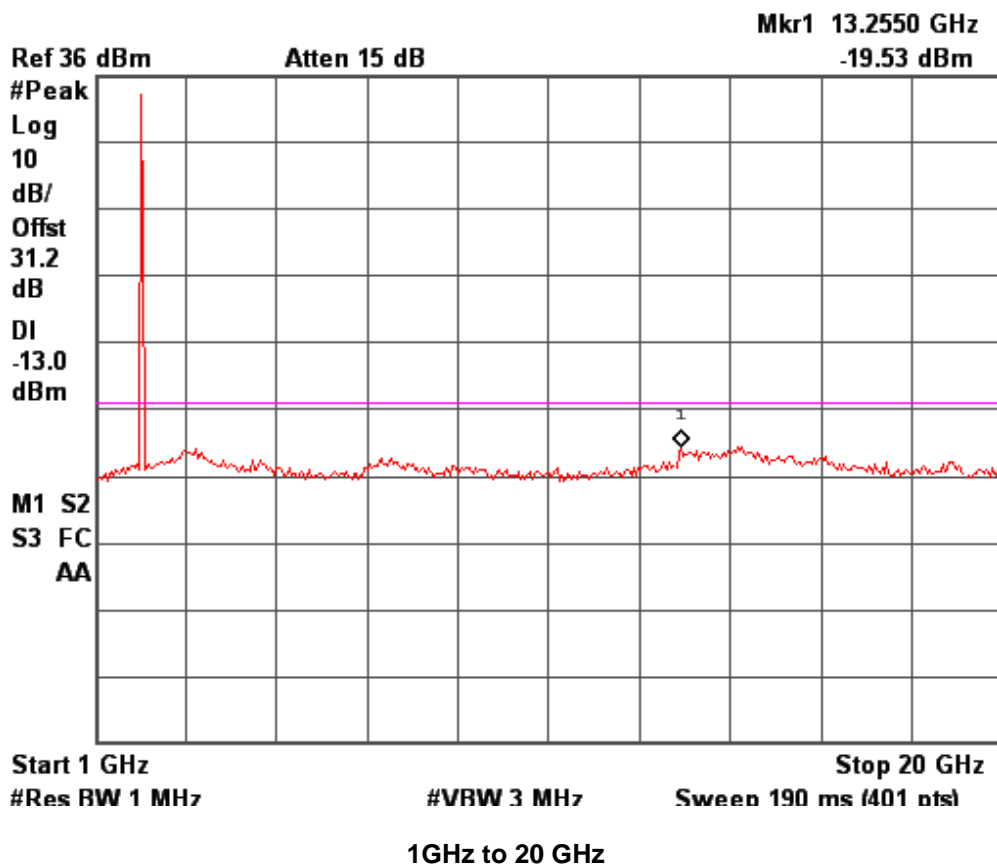
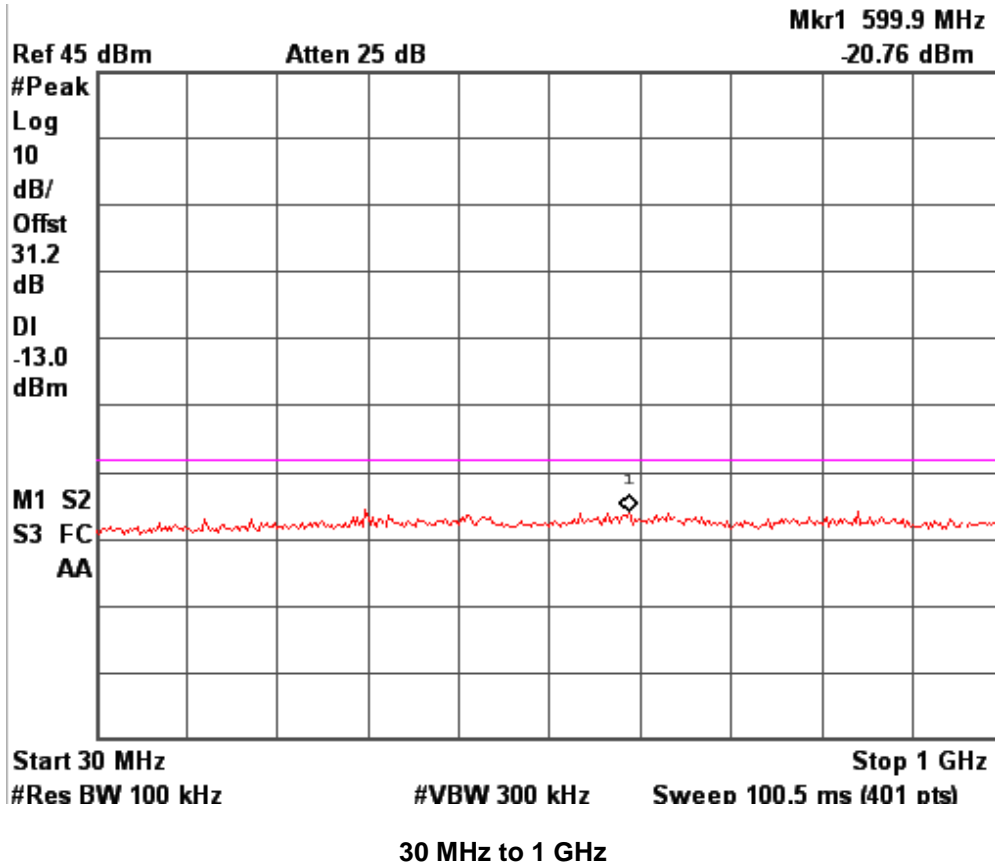
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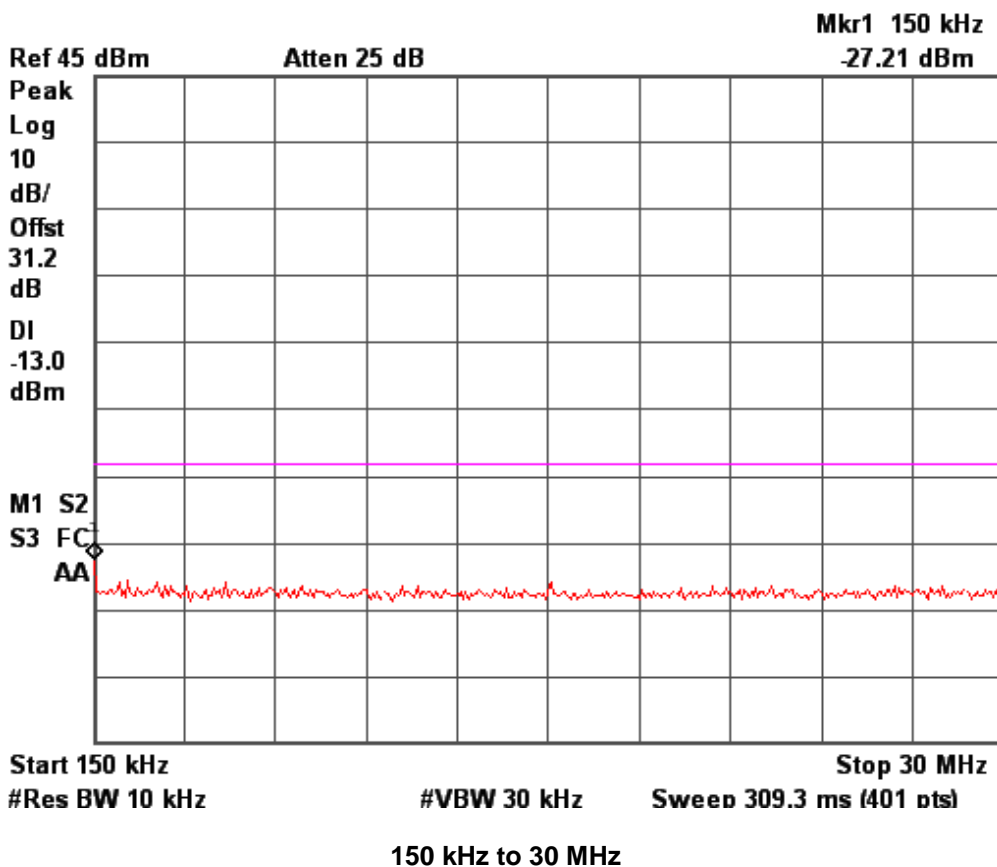
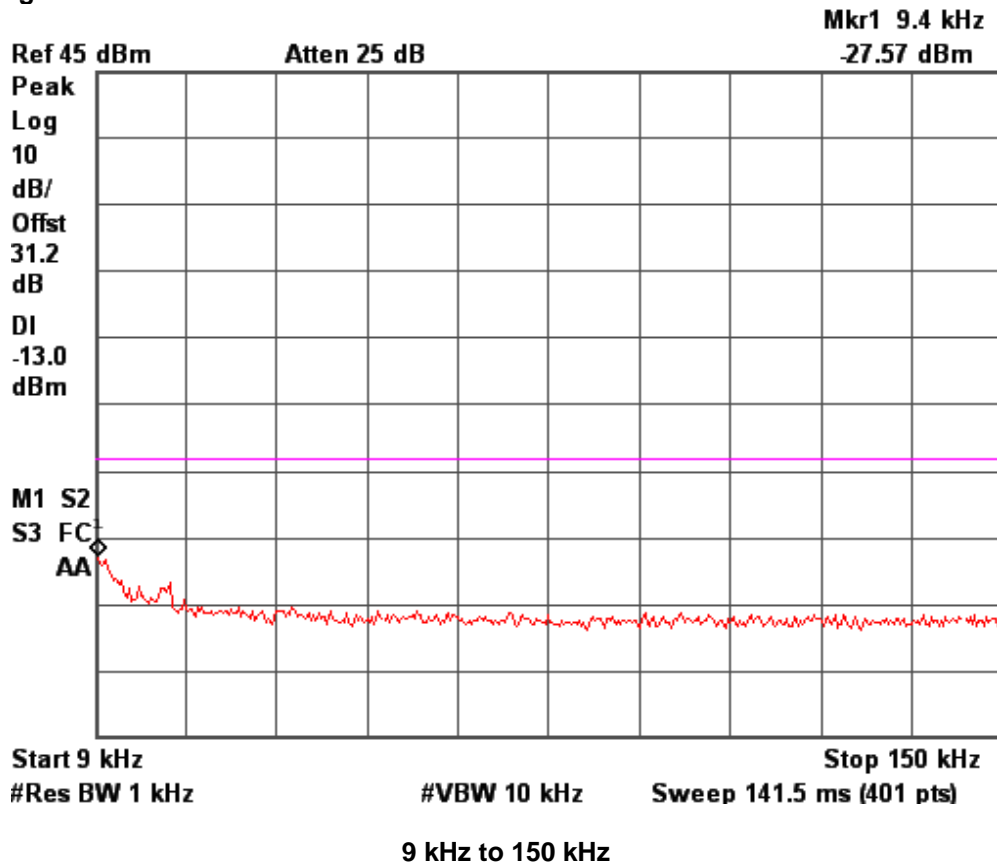
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Channel Mid

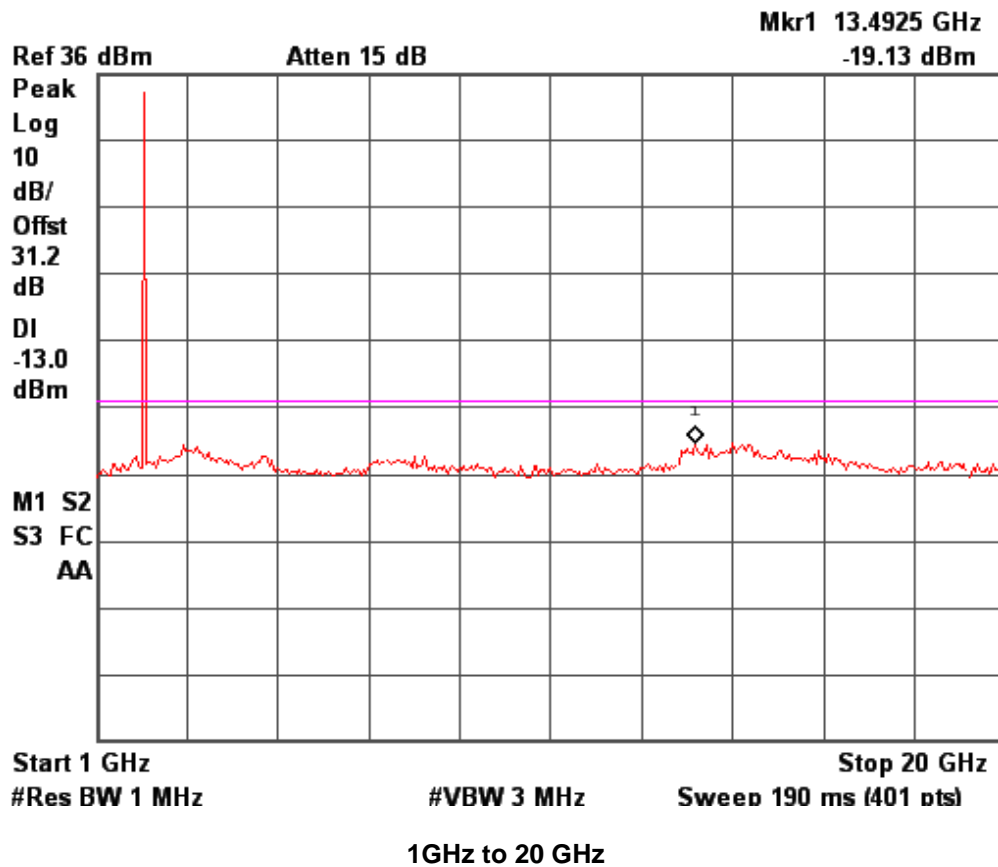
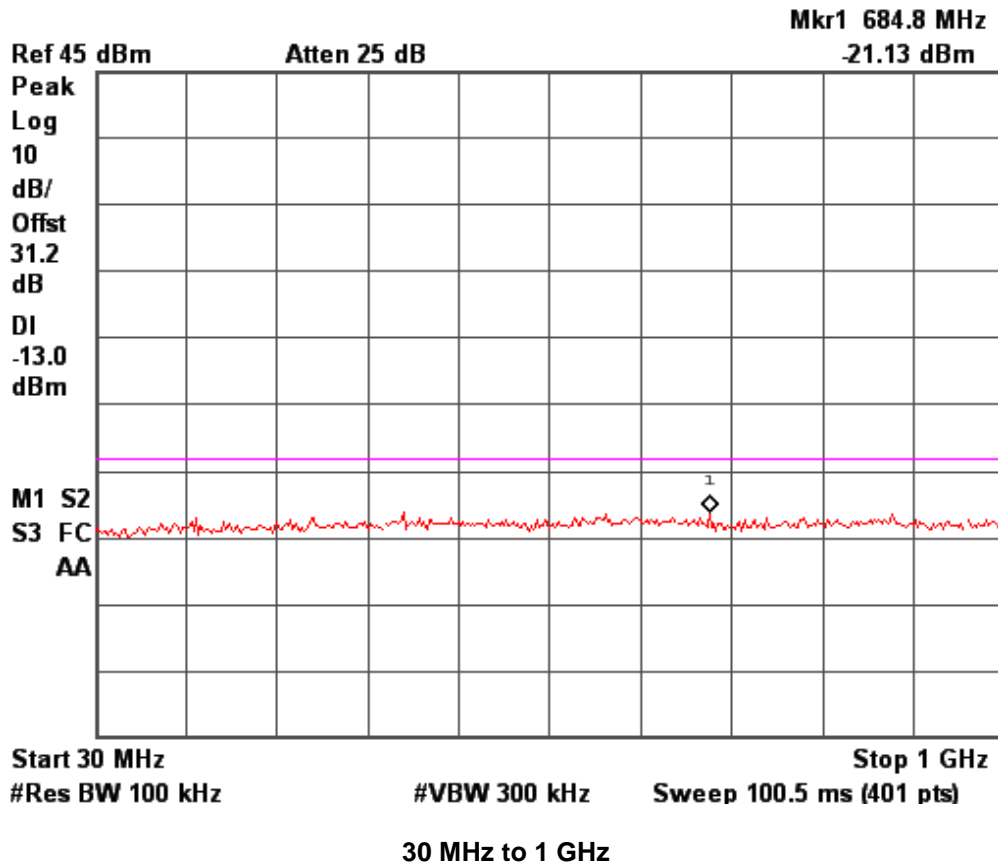


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Channel High



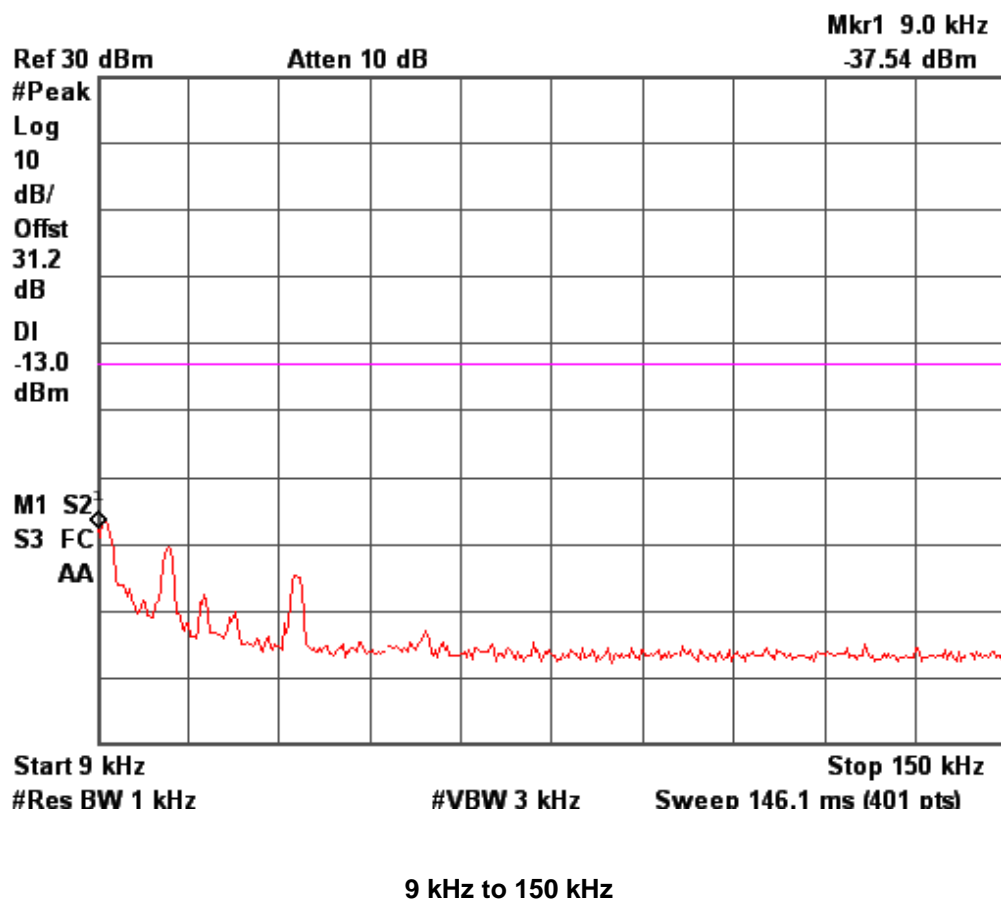


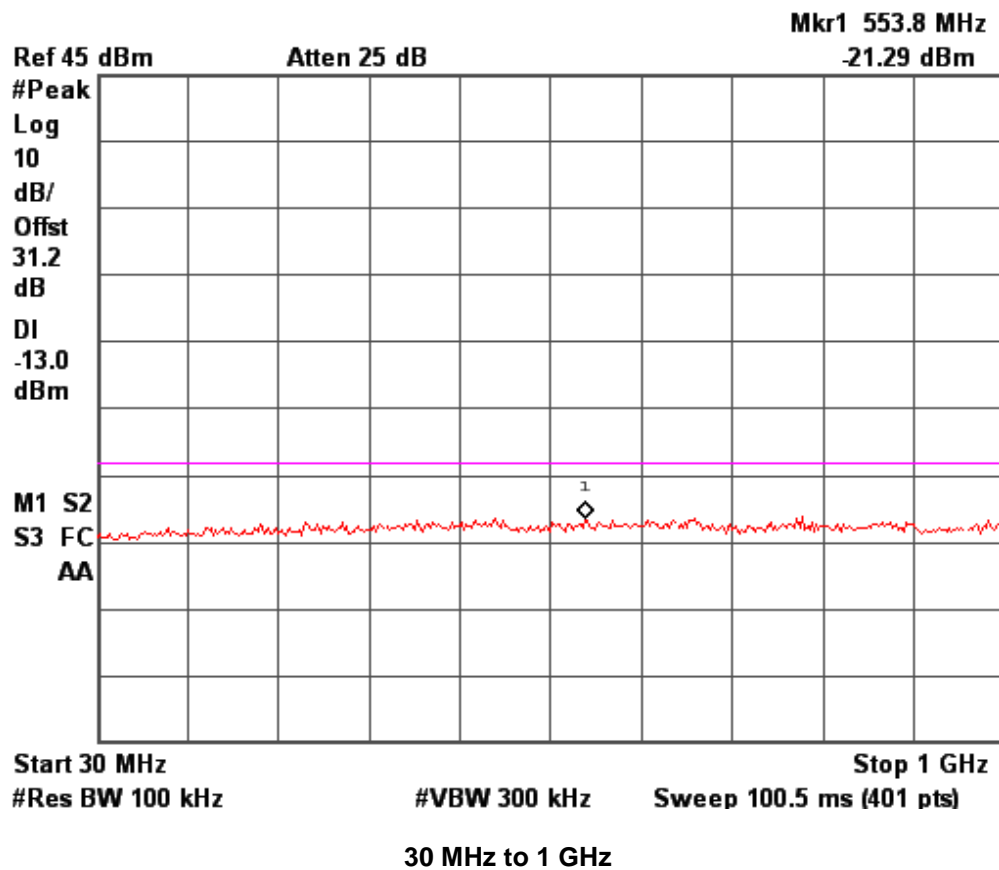
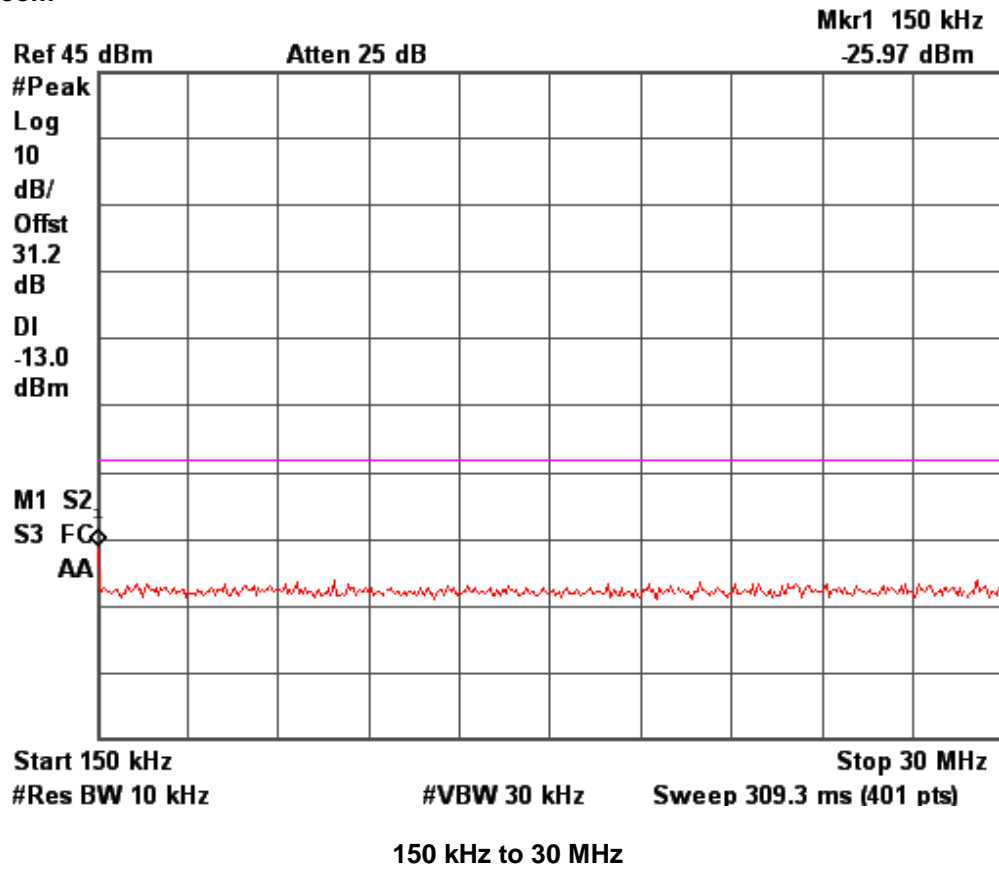
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Transmitter 2:

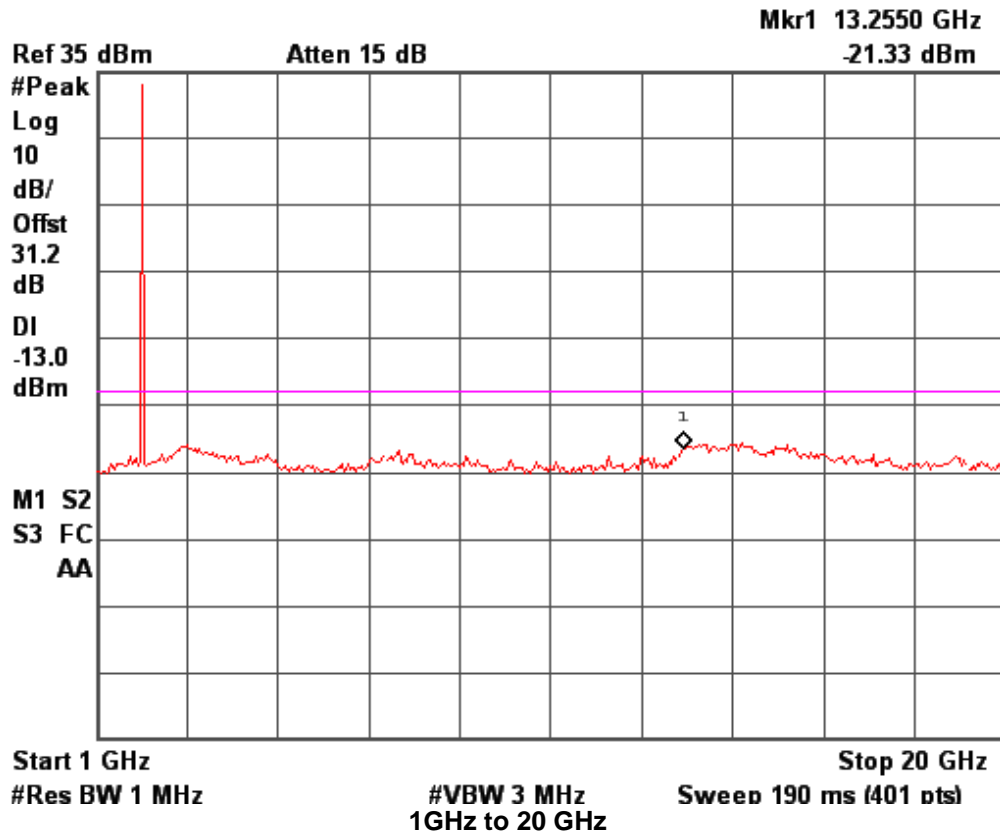
Channel	Channel Frequency (MHz)	Test Frequency	Measured Maximum Emission (dBm)	Limit (dBm)
512	1930.2	9 kHz – 20 GHz	-21.29	-13
661	1960.0	9 kHz – 20 GHz	-19.51	-13
810	1989.8	9 kHz – 20 GHz	-20.55	-13

Channel low

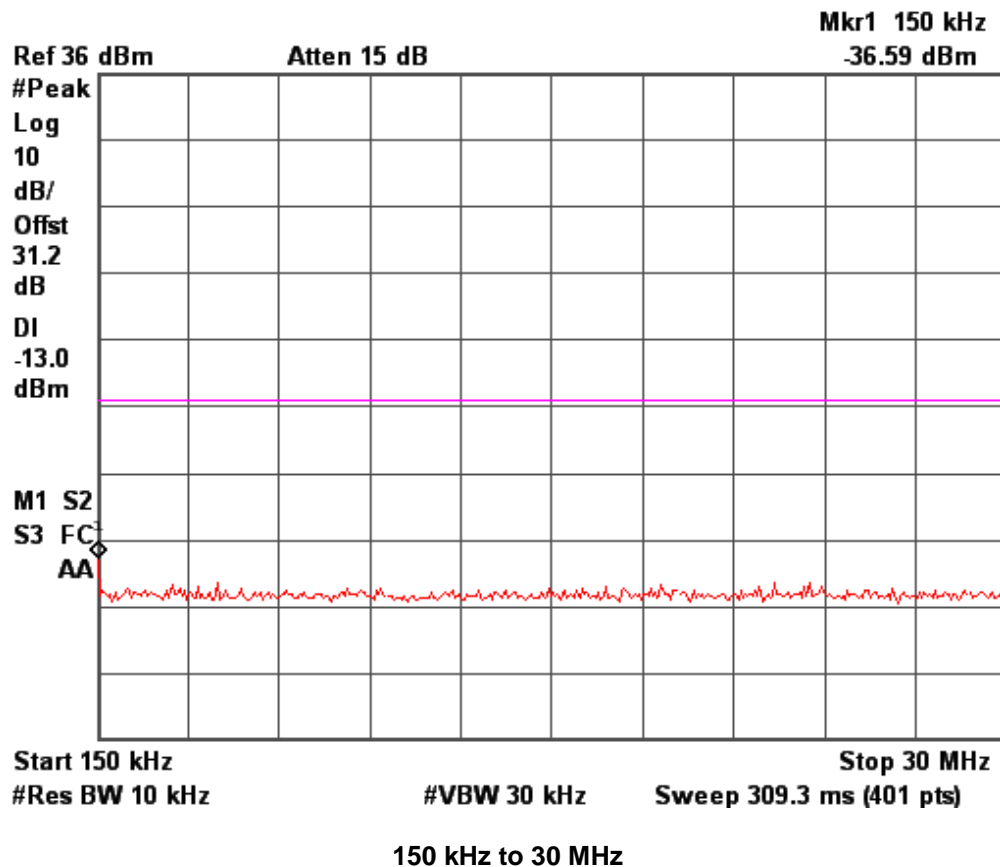
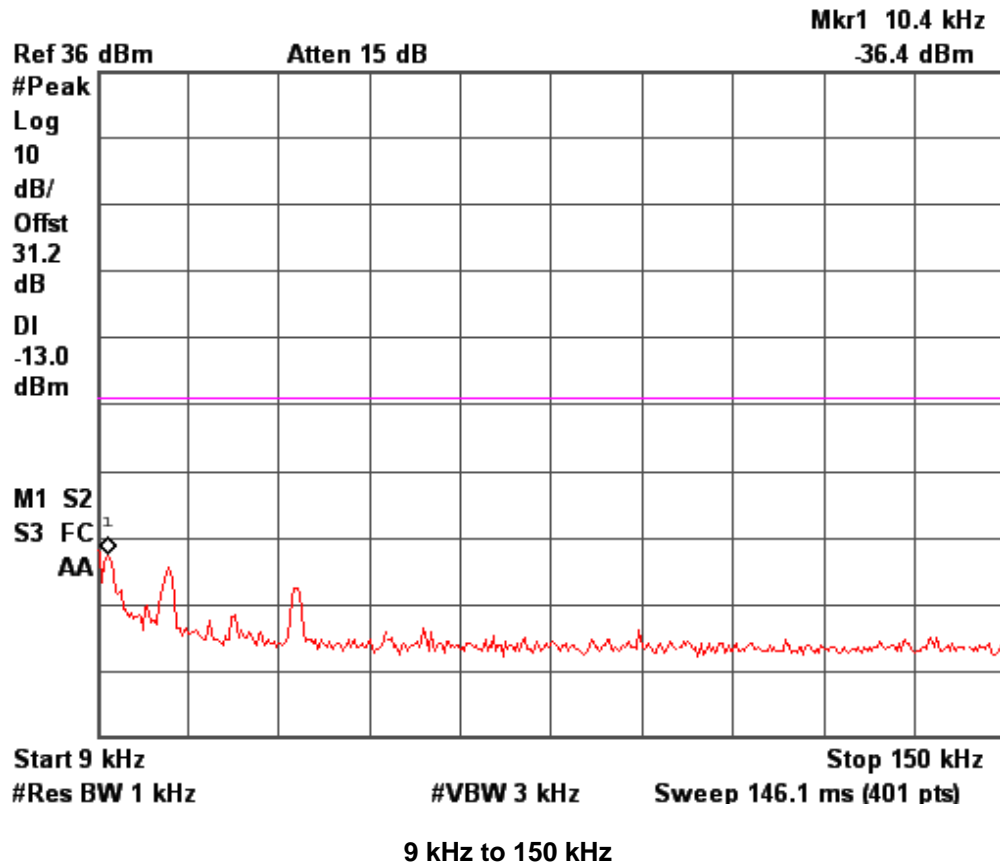


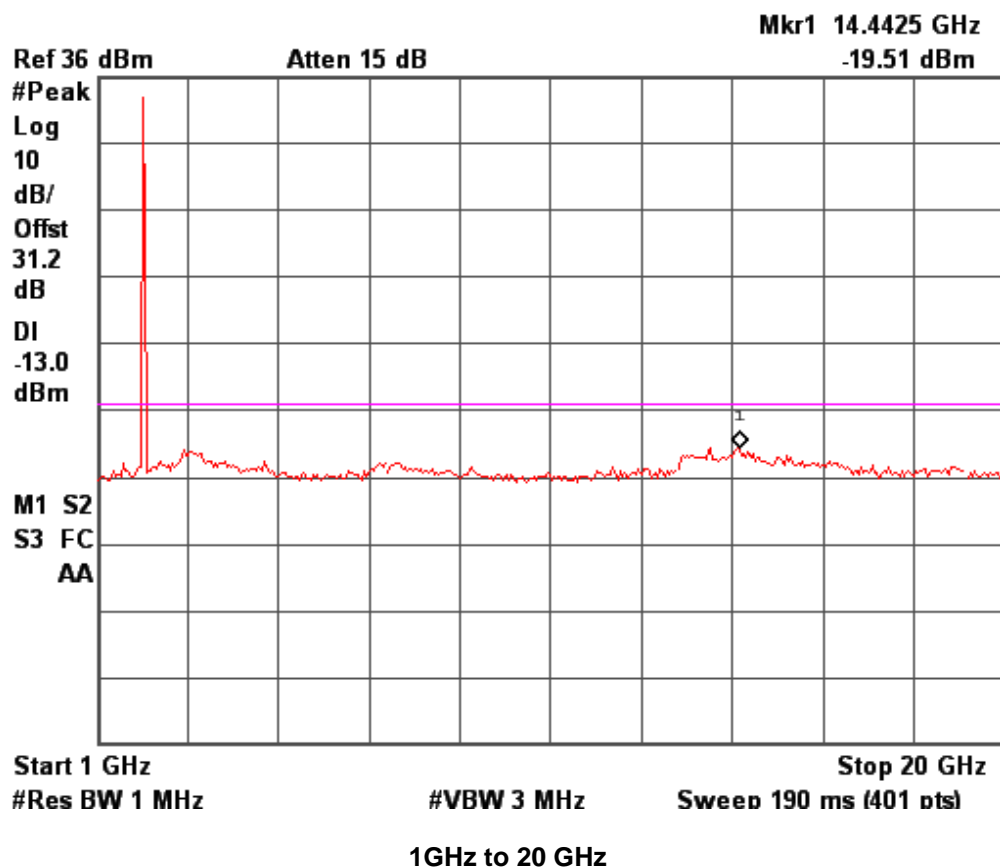
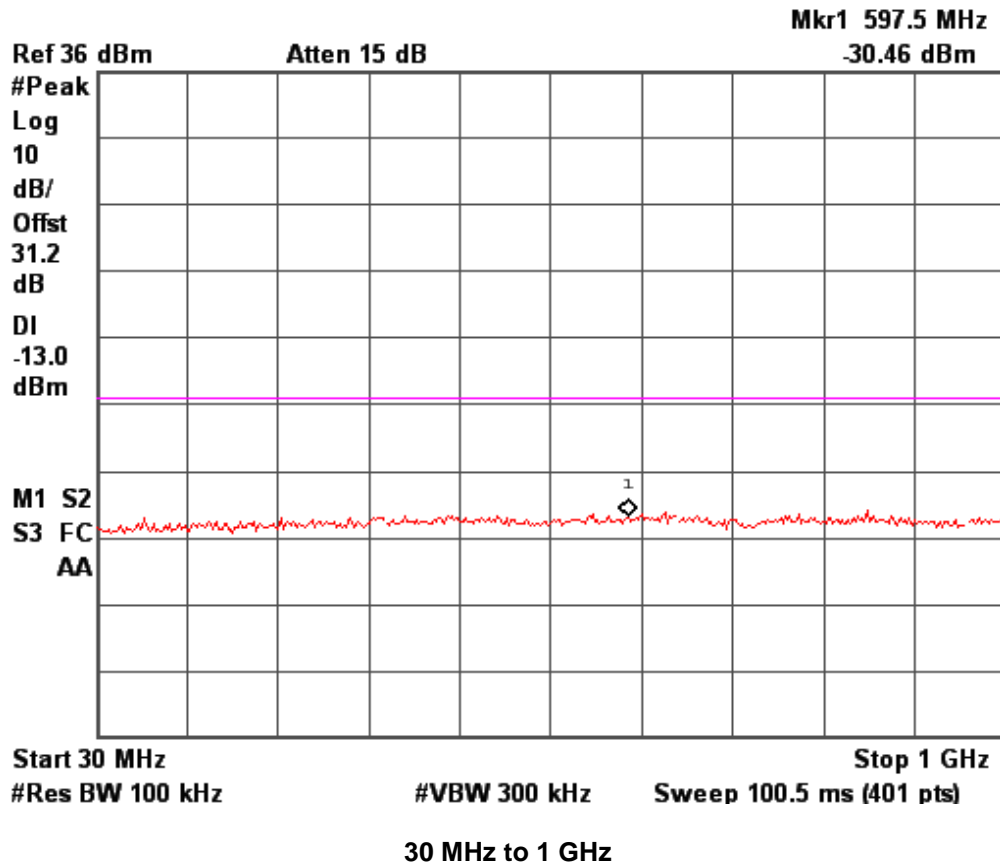


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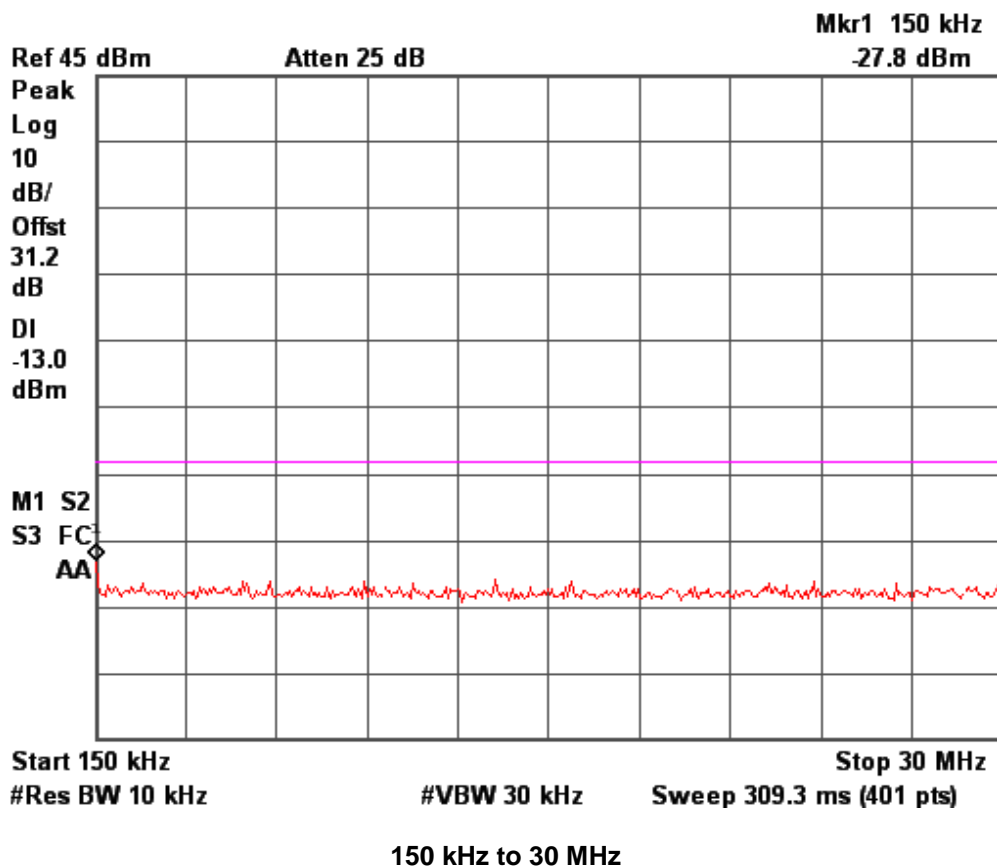
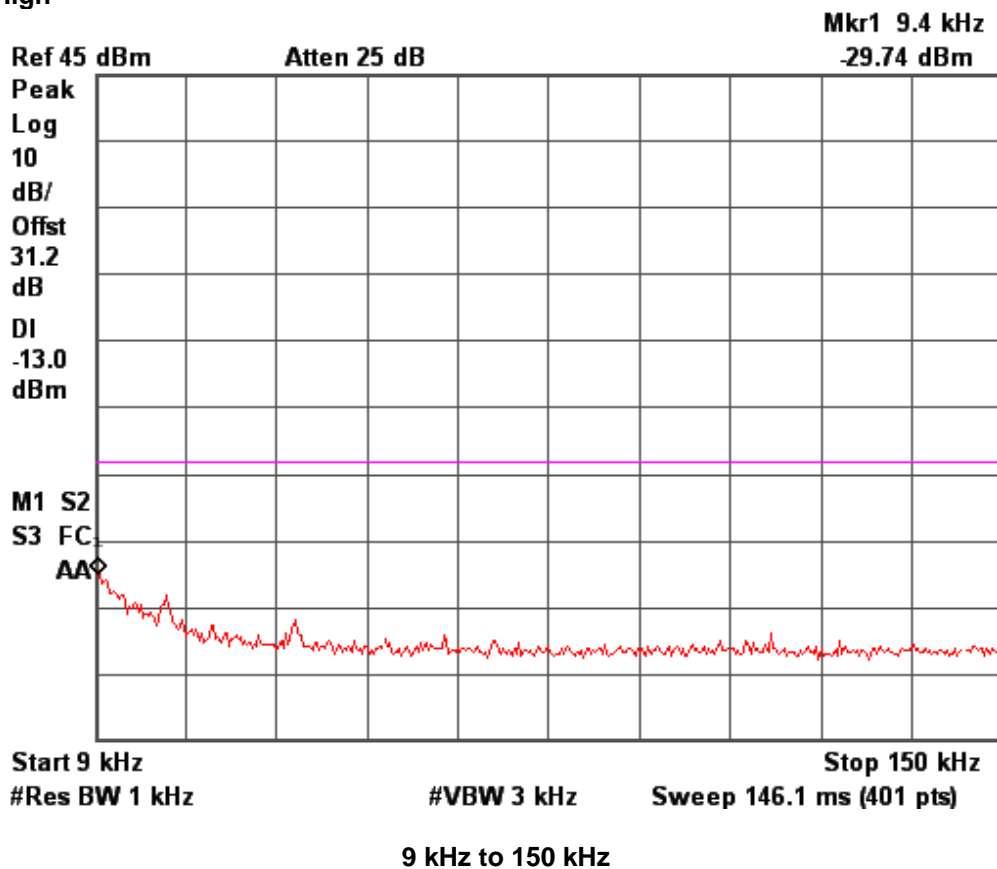


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Channel Mid

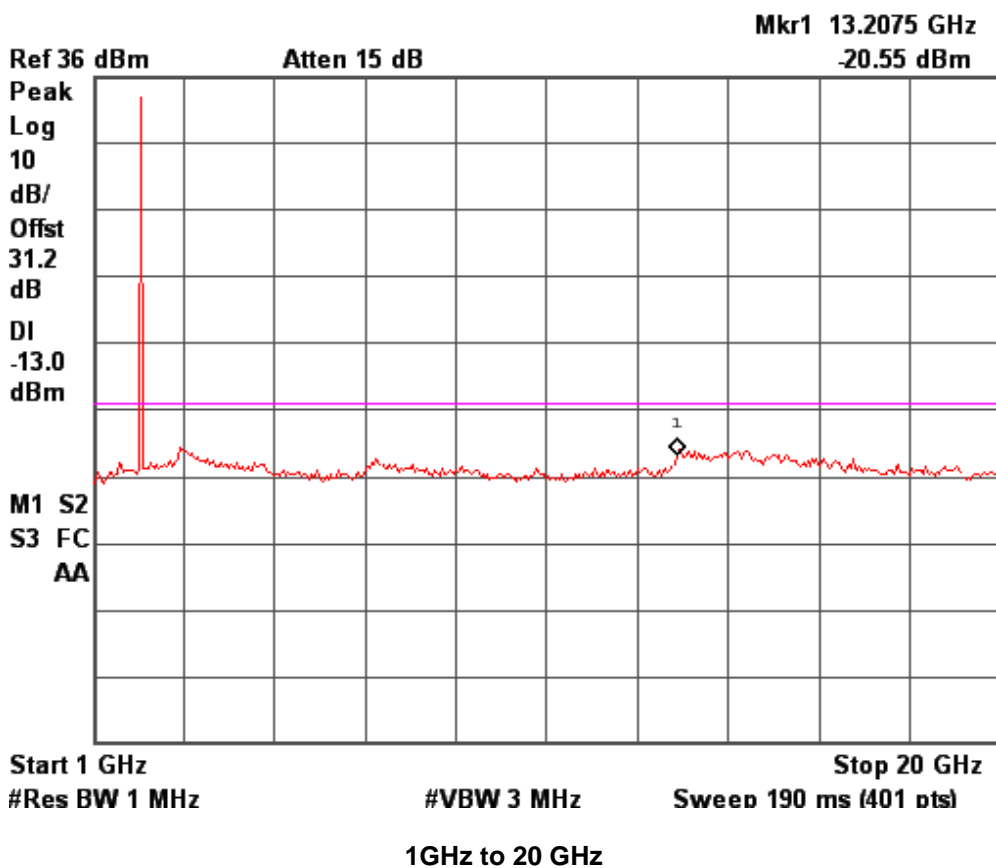
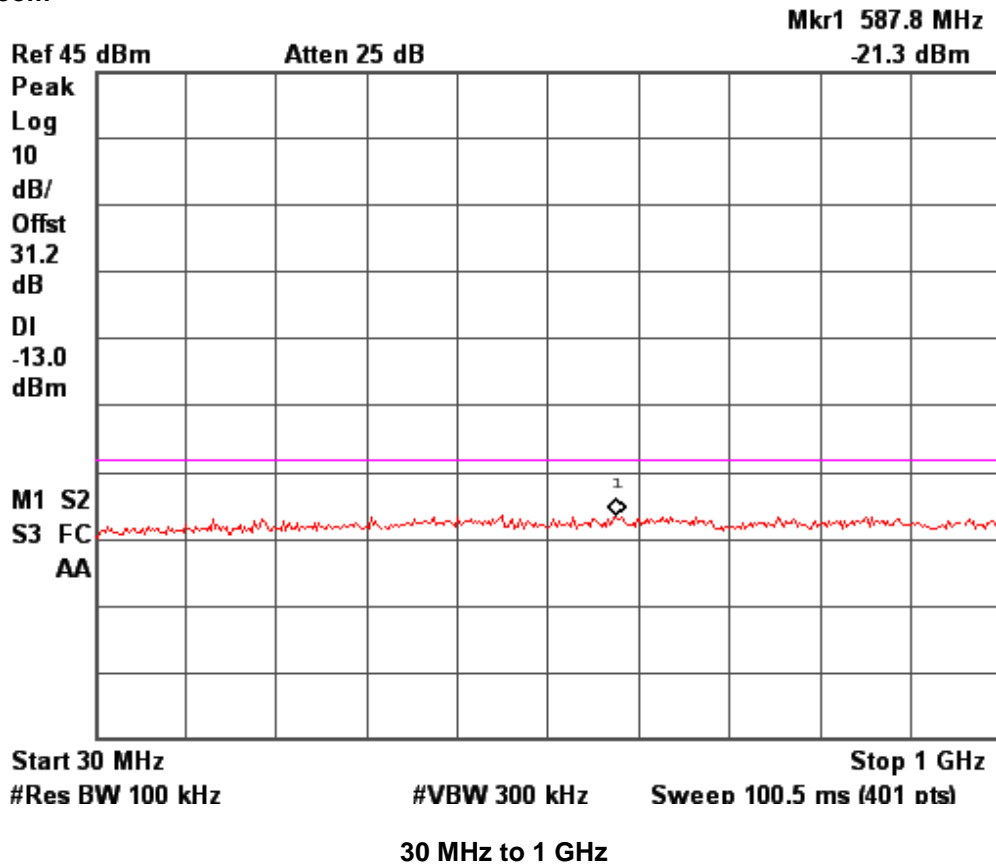




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Channel High



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Radiated Spurious Emissions
Result

Section 2.2051 and 24.238
Pass

Test Specification	CFR 47 (FCC) part 2.1051 and Part 24.238
Measured at	Enclosure
Test Method	TIA-603-C:2004.
Test Configuration	Channel Low, Mid and High

Test Method:

BTS is connected to match loads. The console computer controls the EUT to transmitter the maximum power which defined in specification of product. The EUT operates on a typical channel.

The test procedure:

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, E.R.P. shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in FCC 2.1033(c)(8). The EUT was connected to ancillary in order to simulate normal operating conditions with reference to the guidance given in the standard for this type of equipment.

(b) Test the radiated maximum output power by the R&S test receiver ESMI received from test antenna.

(c) Use substitution method to verify the Maximum output power. The EUT is substituted by a dipole antenna. The dipole is connected to a signal generator. And then adjust the output level of the signal generator to get the same received power recorded in step (b) on ESMI, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.

According to 47CFR part 22.917, this defined the measurement bandwidth of as following:

Measurement bandwidth (RBW) for 9 kHz up to 10th harmonic included: 100kHz;

According to IC RSS-133 clause 6.5, this defined the measurement bandwidth of as following:

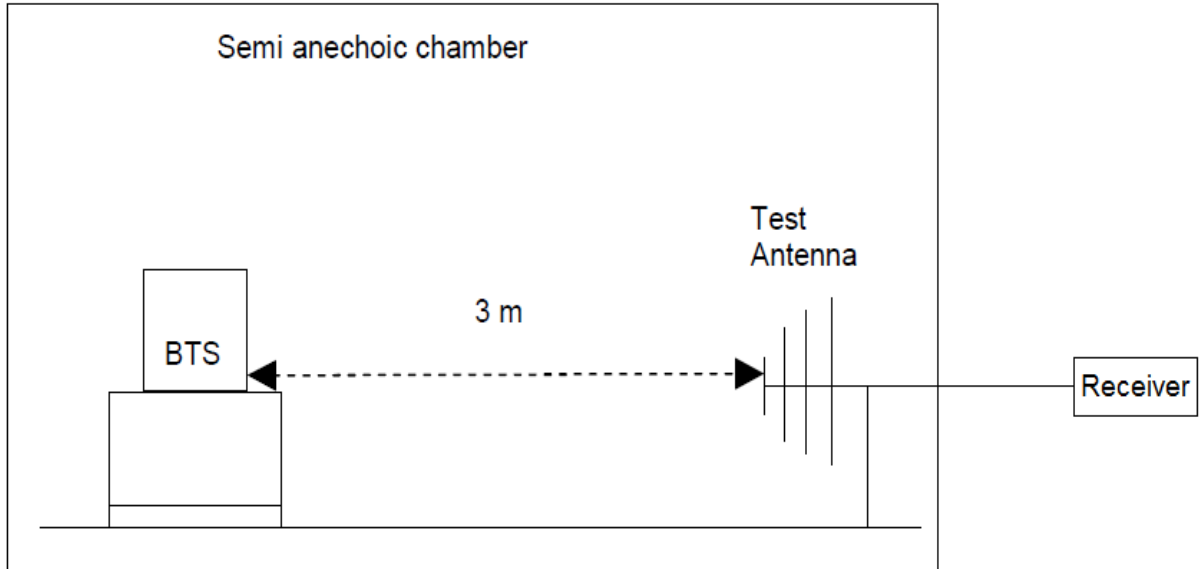
Measurement bandwidth (RBW): 1MHz;

The product was pre-tested with vertical placement also, but worst test results were found with EUT Horizontal placement. Hence the final test was done EUT Horizontal placement.

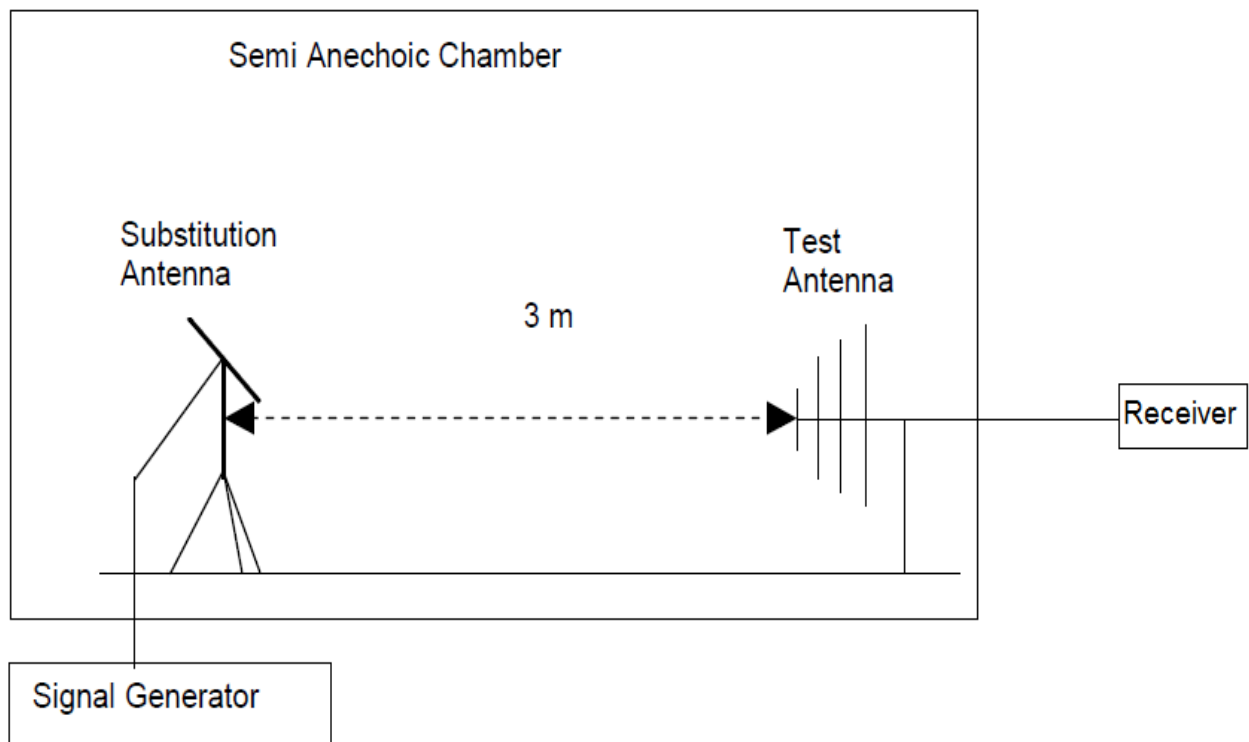
Also, The final test was made with EUT on table of 80cm high.

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Pre test:



Substitution test:



Test Results

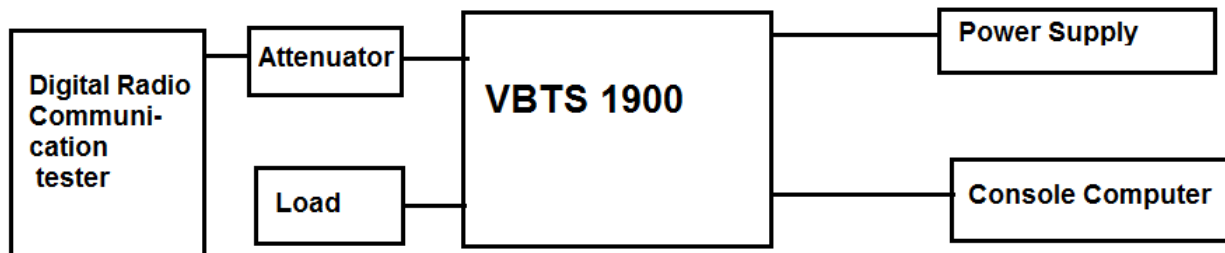
Channel	Polarization	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)
512 1930.20 MHz	V	30.00	-71.11	-13.00	-58.11
		55.00	-74.58	-13.00	-61.58
		99.97	-79.08	-13.00	-66.08
		3860.29	-59.30	-13.00	-46.30
	H	37.77	-76.98	-13.00	-63.98
		64.98	-81.27	-13.00	-68.27
		3860.53	-63.30	-13.00	-50.30
661 1960.00 MHz	V	39.71	-75.84	-13.00	-62.84
		57.21	-79.37	-13.00	-66.37
		94.14	-80.08	-13.00	-67.08
		144.68	-80.20	-13.00	-67.20
		249.65	-75.37	-13.00	-62.37
		3920.00	-64.26	-13.00	-51.26
	H	33.88	-77.57	-13.00	-64.57
		64.98	-81.27	-13.00	-68.27
		94.14	-78.08	-13.00	-65.08
		3920.00	-64.26	-13.00	-51.26
810 1989.80 MHz	V	43.60	-73.52	-13.00	-60.52
		57.21	-79.37	-13.00	-66.37
		94.14	-81.08	-13.00	-68.08
		125.25	-79.45	-13.00	-66.45
		249.46	-75.37	-13.00	-62.37
		3979.60	-64.20	-13.00	-51.20
	H	31.94	-72.25	-13.00	-59.25
		64.98	-81.27	-13.00	-68.27
		125.25	-75.45	-13.00	-62.45
		3979.60	-63.20	-13.00	-50.20

**Frequency Stability
Result**
**Section 2.1055 and 24.235
Pass**

Test Specification	CFR 47 (FCC) part 2.1055 and part 24.235
Measured at	Antenna Connector
Test Method	TIA-603-C: 2004.
Test Configuration	Transmitter 1 – Channel Low, Mid and High Transmitter 2 – Channel Low, Mid and High

Test Method

The EUT was connected to the Radio Communication Tester via the one RF connector. Other RF connectors were connected to match load. BTS was controlled to transmit Maximum power by console computer. Measure and record the Frequency drift of the Base Station by the Radio Communication Tester.



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 subparagraphs (2) and (3) of FCC paragraph 2.1055
- (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.
- (d) The frequency stability shall be measured with variation of primary supply voltage as follows:
 - (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
 - (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point, which shall be specified by the manufacturer.
 - (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on

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frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

Limit:

No specific frequency stability requirement in FCC part 2.1055 and part 24.235.

According to IC RSS-133 clause 6.3, the carrier frequency shall not depart from the reference frequency in excess of ± 1.0 ppm for base stations.

Test Results
Transmitter 1

Channel	Temperature (°C)	Measured Frequency Error (Hz)	Error (ppm)	Limit
512 (1930.2 MHz)	-30	-37	-0.019	± 1
	-20	58	0.030	± 1
	-10	58	0.030	± 1
	0	47	0.024	± 1
	10	64	0.033	± 1
	20	-58	-0.030	± 1
	30	-34	-0.018	± 1
	40	78	0.040	± 1
	50	73	0.038	± 1
661 (1960.0 MHz)	-30	44	0.022	± 1
	-20	79	0.040	± 1
	-10	44	0.022	± 1
	0	42	0.021	± 1
	10	47	0.024	± 1
	20	39	0.020	± 1
	30	-76	-0.039	± 1
	40	76	0.039	± 1
	50	-73	-0.037	± 1
810 (1989.8 MHz)	-30	-36	-0.018	± 1
	-20	70	0.035	± 1
	-10	58	0.029	± 1
	0	38	0.019	± 1
	10	-38	-0.019	± 1
	20	66	0.033	± 1
	30	-61	-0.031	± 1
	40	-74	-0.037	± 1
	50	82	0.041	± 1

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Transmitter 2

Channel	Temperature (°C)	Measured Frequency Error (Hz)	Error (ppm)	Limit
512 (1930.2 MHz)	-30	52	0.027	±1
	-20	59	0.031	±1
	-10	77	0.040	±1
	0	49	0.025	±1
	10	-45	-0.023	±1
	20	68	0.035	±1
	30	-62	-0.032	±1
	40	75	0.039	±1
	50	55	0.028	±1
661 (1960.0 MHz)	-30	44	0.022	±1
	-20	55	0.028	±1
	-10	86	0.044	±1
	0	44	0.022	±1
	10	42	0.021	±1
	20	76	0.039	±1
	30	-53	-0.027	±1
	40	-51	-0.026	±1
	50	-75	-0.038	±1
810 (1989.8 MHz)	-30	35	0.018	±1
	-20	62	0.031	±1
	-10	51	0.026	±1
	0	57	0.029	±1
	10	45	0.023	±1
	20	57	0.029	±1
	30	-66	-0.033	±1
	40	72	0.036	±1
	50	64	0.032	±1

Frequency Error vs. Voltage

Transmitter	Voltage	Channel	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
Transmitter 1	85% Vnorm (20.4V DC)	512 (1930.2 MHz)	-34	-0.039	±1
		661 (1960.0 MHz)	-31	-0.035	±1
		810 (1989.8 MHz)	38	0.043	±1
	115% Vnorm (27.6 V DC)	512 (1930.2 MHz)	-36	-0.041	±1
		661 (1960.0 MHz)	-31	-0.035	±1
		810 (1989.8 MHz)	38	0.043	±1
Transmitter 2	85% Vnorm (20.4V DC)	512 (1930.2 MHz)	-38	-0.044	±1
		661 (1960.0 MHz)	-34	-0.039	±1
		810 (1989.8 MHz)	-40	-0.045	±1
	115% Vnorm (27.6 V DC)	512 (1930.2 MHz)	-35	-0.040	±1
		661 (1960.0 MHz)	-33	-0.037	±1
		810 (1989.8 MHz)	-35	-0.039	±1