

## Certification Test Report

CFR 47 FCC Part 2 and Part 27, Subpart C

Model: MR715F

FCC ID.: BCR-715F

Report Code: W7331-1

Revision: 0

**Prepared for:**

**Author:** Tom Tidwell, Manager of Wireless Services

**Issued:** 17 August, 2007

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## Report Summary

### NTS Plano

Accreditation Numbers: FCC: 101741  
IC: 46405-4319 File # IC-4319A

Applicant: Andrew Corporation

Customer Representative: Michael Williamson

#### EUT Description:

EUT Description	Manufacturer	Model	Revision	Serial Number
The EUT is a uni-directional signal enhancer for use in the Lower 700 MHz Block D. The repeater is optimized for MediaFLO mobile multi-media technology.	Andrew Corporation	MR715F	0	10

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## Test Summary

Appendix	Test/Requirement Description	Deviations from:			Pass / Fail	Applicable Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	RF Power Output	No	No	No	PASS	CFR 47, Part 2, Para. 2.1046 CFR 47, Part 27, Para. 27.50(c)
B	Modulation Characteristics	No	No	No	PASS	CFR 47, Part 2, Para. 2.1047
C	Occupied Bandwidth	No	No	No	PASS	CFR 47, Part 2, Para. 2.1049 CFR 47, Part 27, Para. 27.53(f)
D	Spurious Emissions at Antenna Terminals	No	No	No	PASS	CFR 47, Part 2, Para. 2.1051 CFR 47, Part 27, Para. 27.53(f)
E	Field Strength of Spurious Radiation	No	No	No	PASS	CFR 47, Part 2, Para. 2.1053 CFR 47, Part 27, Para. 27.53(f)
F	Frequency Stability	No	No	No	PASS	CFR 47, Part 2, Para. 2.1055 CFR 47, Part 24, Para. 27.54

Test Result: The product presented for testing complied with test requirements as shown above.

This is to certify that the preceding report is true and correct to the best of my knowledge.



Robert Stevens,  
Quality Assurance Manager



Tom Tidwell,  
Wireless Test Engineer

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**Register of revisions**

Revision	Reason for Revision	Release Date
0	Original	17 August, 2007

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## INTRODUCTION

### 1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Plano to demonstrate compliance of the MR715F to FCC Part 27 Subpart C in accordance with the certification requirements of CFR 47, Part 2.

## 2.0 EUT DESCRIPTION

### 2.1 CONFIGURATION

#### Description of EUT

	Name	Model	Revision	Serial Number
EUT	Band Selective miniRepeater	MR715F	0	10
RF Exposure Classification	Mobile. The user manual specifies a minimum separation distance of 20 cm. from nearby persons.			
Channels/Frequency Range	716 – 722 MHz			
Power	100 – 220 VAC			
Emission Designator:	W7D (OFDM)			
TX antenna details	The antenna is chosen by the installer. The user manual specifies a maximum antenna gain of 12 dBi.			
Functional Description	The device is a uni-directional repeater used to enhance the coverage of the BTS to mobile signal in a system operating in the lower 700 MHz band block D.			

#### 2.1.1 EUT POWER

Voltage	120 Vac, 60 Hz
Number of Feeds	Single phase (L1 and Neutral)

### 2.2 EUT CABLES

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
1	Power Cord	Switching PS	EUT	Unshielded	4 pin	1.25

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### 2.3 MODE OF OPERATION DURING TESTS

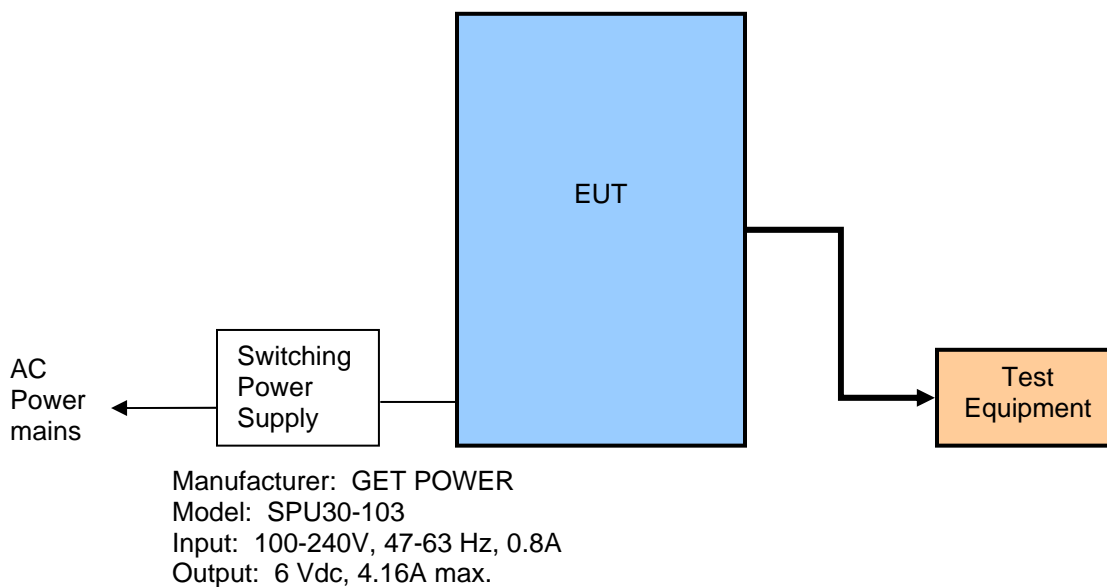
The EUT is configured for maximum gain at the factory. The rf input level was adjusted to -54 dBm.

## 3.0 SUPPORT EQUIPMENT

### 3.1 CONFIGURATION

The radio was activated using customer-supplied test software. The software allowed the test engineer to change modulation modes and data rates and transmit channel.

### 3.2 TEST BED/PERIPHERAL CABLES



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## APPENDICES

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## APPENDIX A: 2.1046 RF POWER OUTPUT

### A.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC PART 2.1046
<b>Test Basis</b>	TIA 603-C, 2004
<b>Test Method</b>	TIA 603-C, 2004

### A.2. Specifications

#### 27.50 Power and antenna height requirements

(c) The following power and antenna height requirements apply to stations transmitting in the 698–746 MHz band:

(1) Fixed and base stations are limited to a maximum effective radiated power (ERP) of 50 kW, with the limitation on antenna heights as follows:

(i) Fixed and base stations with an ERP of 1000 watts or less must not exceed an antenna height of 305 m height above average terrain (HAAT) except when the power is reduced in accordance with Table 1 of this section;

(ii) The antenna height for fixed and base stations with an ERP greater than 1000 watts but not exceeding 50 kW is limited only to the extent required to satisfy the requirements of §27.55(b).

(2) Control and mobile stations are limited to 30 watts ERP.

(3) Portable stations (hand-held devices) are limited to 3 watts ERP.

(4) Maximum composite transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of RMS-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain a true maximum composite measurement for the emission in question over the full bandwidth of the channel.

(5) Licensees intending to operate a base or fixed station at a power level greater than 1 kW ERP must provide advanced notice of such operation to the Commission and to licensees authorized in their area of operation. Licensees that must be notified are all licensees authorized under this part to operate a base or fixed station on an adjacent spectrum block at a location within 75 km of the base or fixed station operating at a power level greater than 1 kW ERP. Notices must provide the location and operating parameters of the base or fixed station operating at a power level greater than 1 kW ERP, including the station's ERP, antenna coordinates, antenna height above ground, and vertical antenna pattern, and such notices must be provided at least 90 days prior to the commencement of station operation.

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**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**

TIA 603-C, 2004 and 27.50(c)(4)

**A.5. Test Results**

The EUT is in compliance with the limits as specified above. The maximum rf output power at the antenna terminals is +15.07 dBm.

**A.6. Operating Mode During Test**

The transmitter was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel in both the downlink (base to mobile) and uplink (mobile to base) directions. In the course of this testing, it was found that operating the device with a fixed rf gain and adjusting rf input signal to obtain maximum rf output power produced the worst-case results.

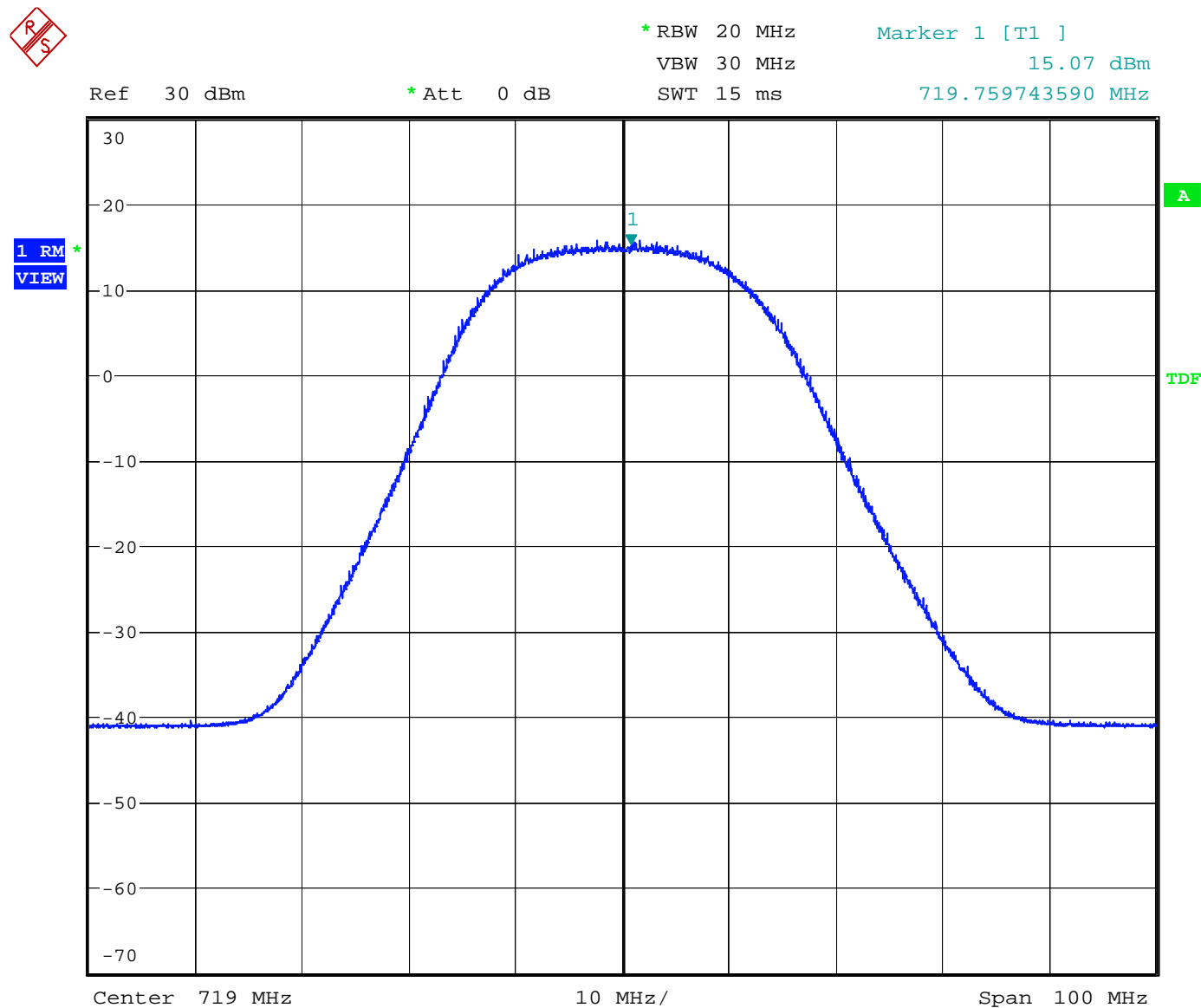
**A.7. Sample Calculation**

$$\text{Rf power(watts)} = 10^{(\text{rf power(dBm)}/10)} \times 1000$$

**A.8. Test Data**

Note: RF power output was measured using a spectrum analyzer with RBW set to 20 MHz and VBW set to 30 MHz

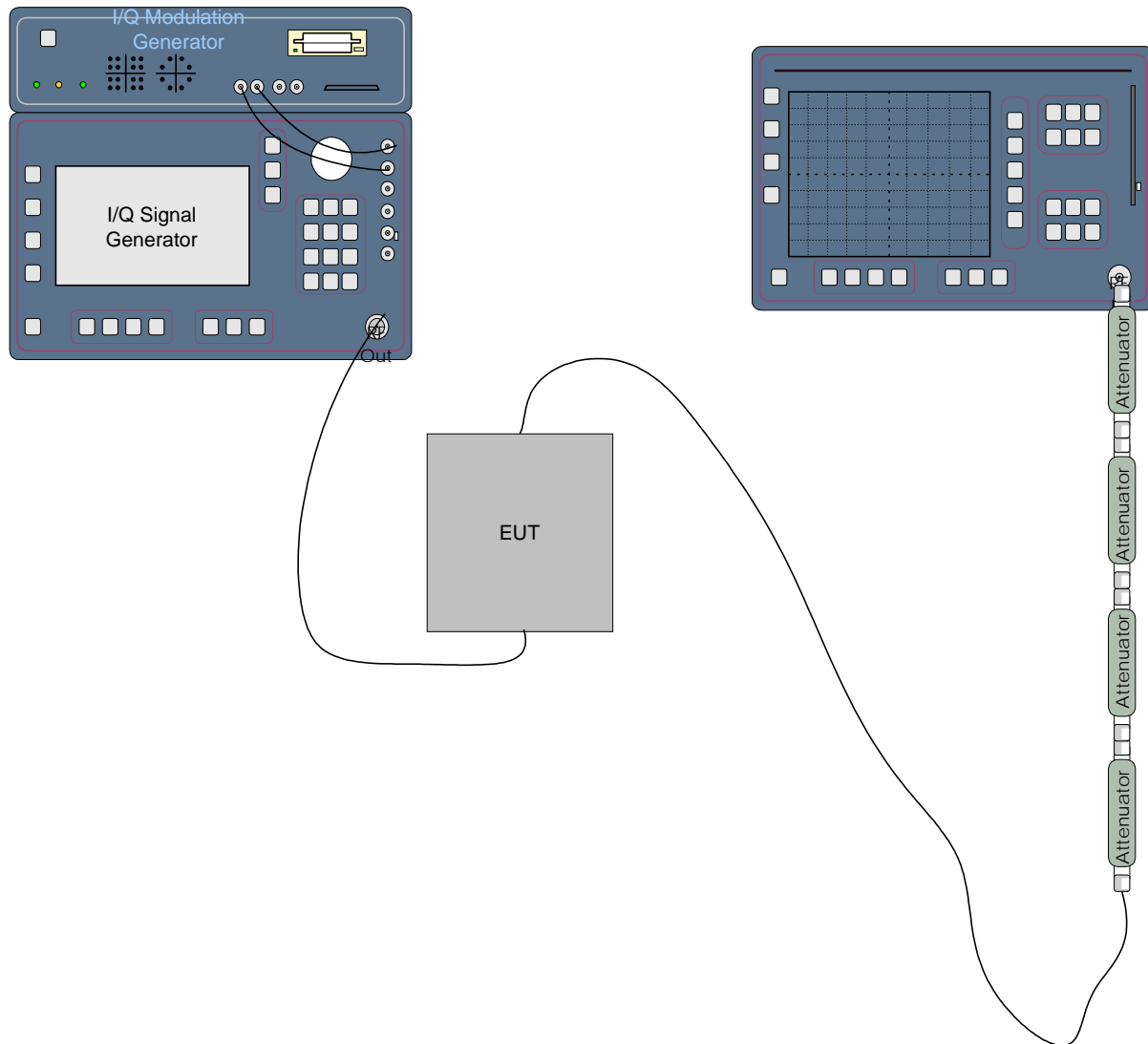
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**Figure 1** RF power output – MediaFLO OFDM signal

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**A.9. Test Diagram****A.10. Tested By**

Name: Tom Tidwell,  
Function: Manager of Wireless Services

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## APPENDIX B: 2.1047 MODULATION CHARACTERISTICS

### B.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 2.1047
<b>Test Basis</b>	FCC 2.1047 Modulation Characteristics
<b>Test Method</b>	TIA 603-C, 2004

### B.2. Specifications

#### 2.1047 – Modulation Characteristics

(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) *Equipment which employs modulation limiting.* A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) *Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.* A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.

(d) *Other types of equipment.* A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

### 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 Method

This device does not generate a modulated waveform.

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## B.5. Test Results

Not applicable – The device does not produce a modulated waveform.

## Test Data Summary

### Emission Designators

W7D

## B.6. Test Diagram

N/A

## B.7. Tested By

Name: Tom Tidwell  
Function: Manager of Wireless Services

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## APPENDIX C: 2.10.49 OCCUPIED BANDWIDTH

### C.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 2.1049
<b>Test Basis</b>	FCC 2.1049 Occupied Bandwidth
<b>Test Method</b>	TIA 603-C, 2004

### C.2. Specifications

27.53(f)

For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

### 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 Method

TIA 603-C, 2004 and 27.53(l)(6)

### C.5. Test Results

Compliant.

### C.6. Deviations from Normal Operating Mode During Test

None.

### C.7. Sample Calculation

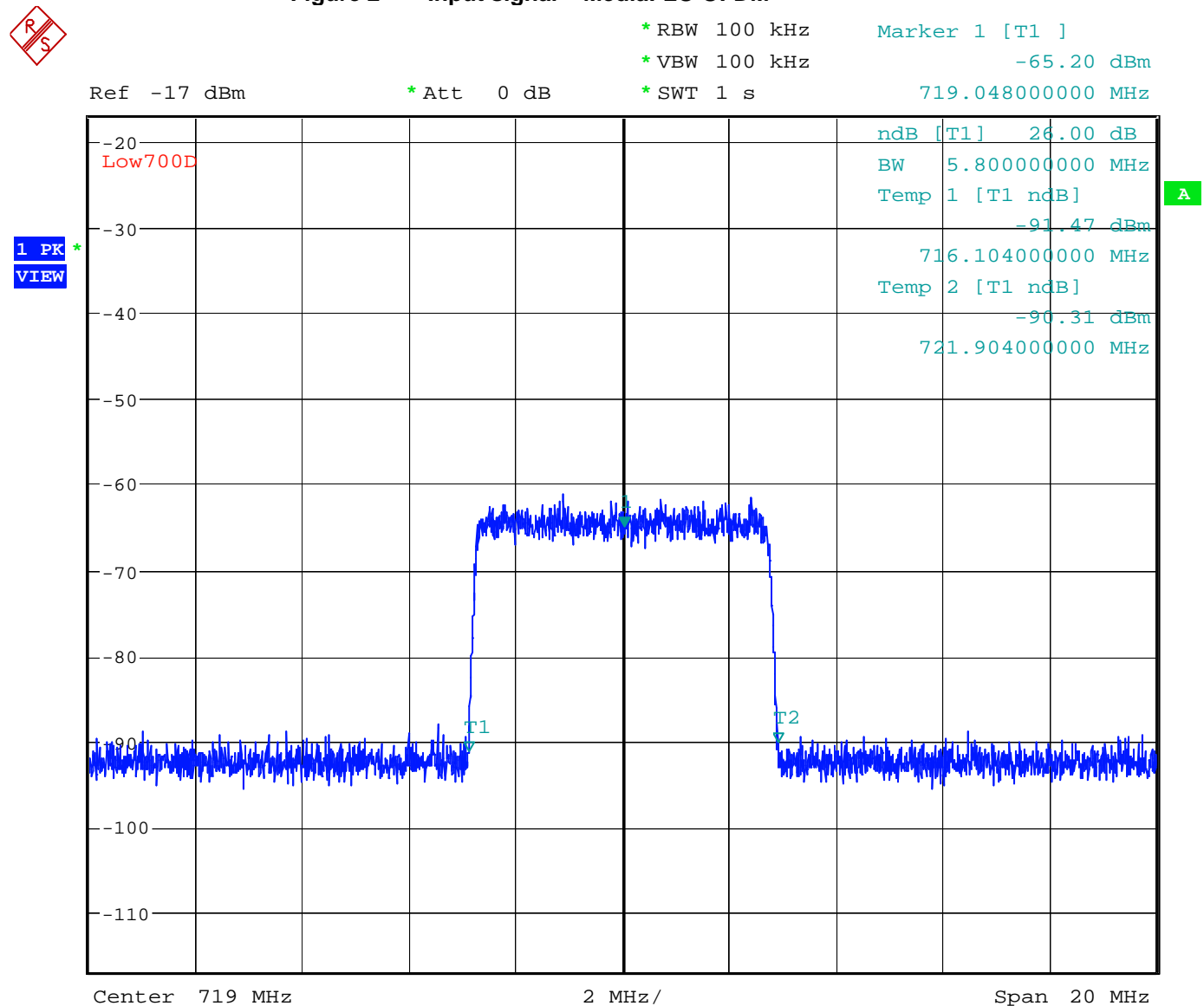
$43 + 10 \log(P)$

### C.8. Test Data

See plots following.

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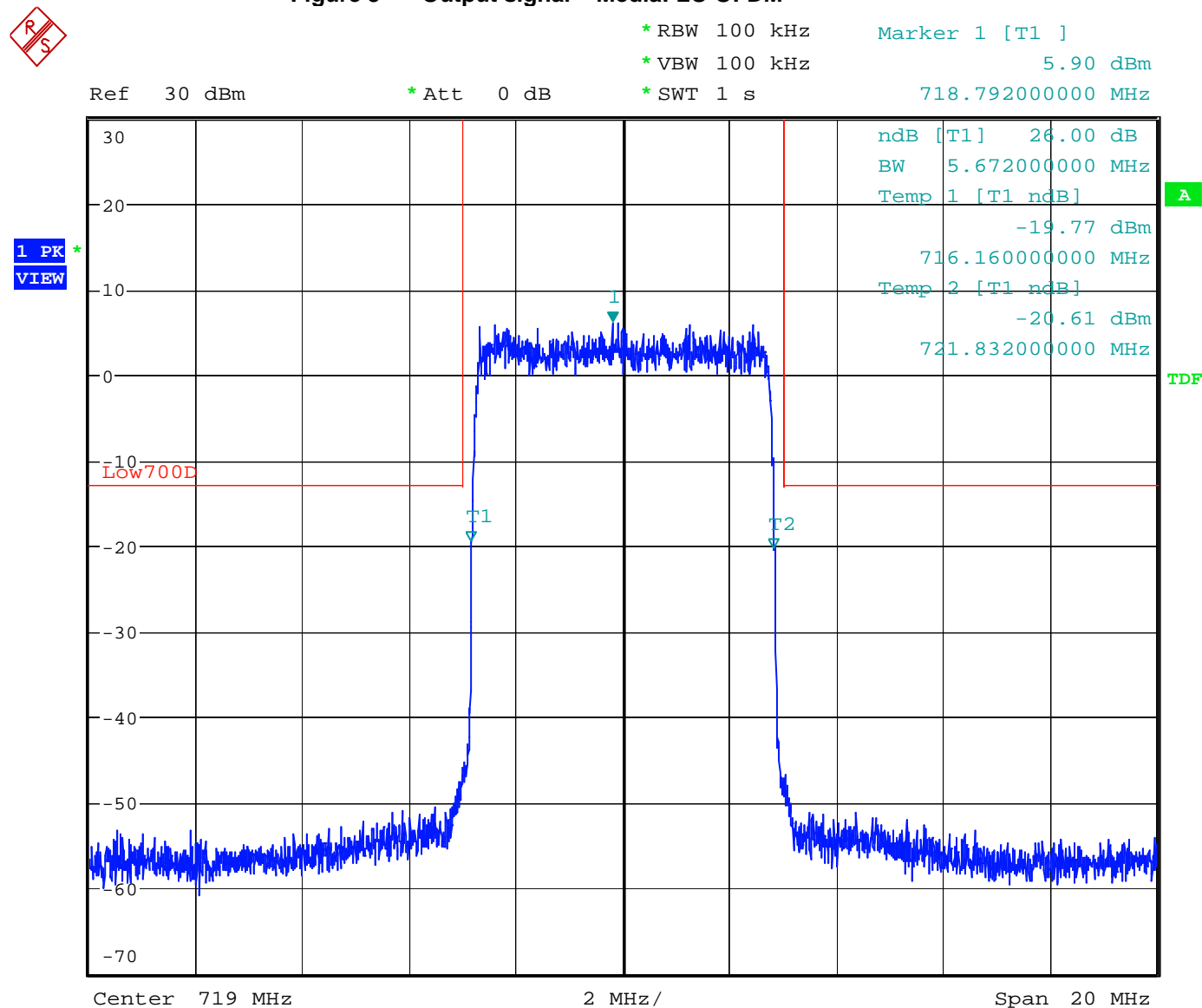
**Figure 2**      **Input signal – MediaFLO OFDM**



Date: 16.AUG.2007 11:52:23

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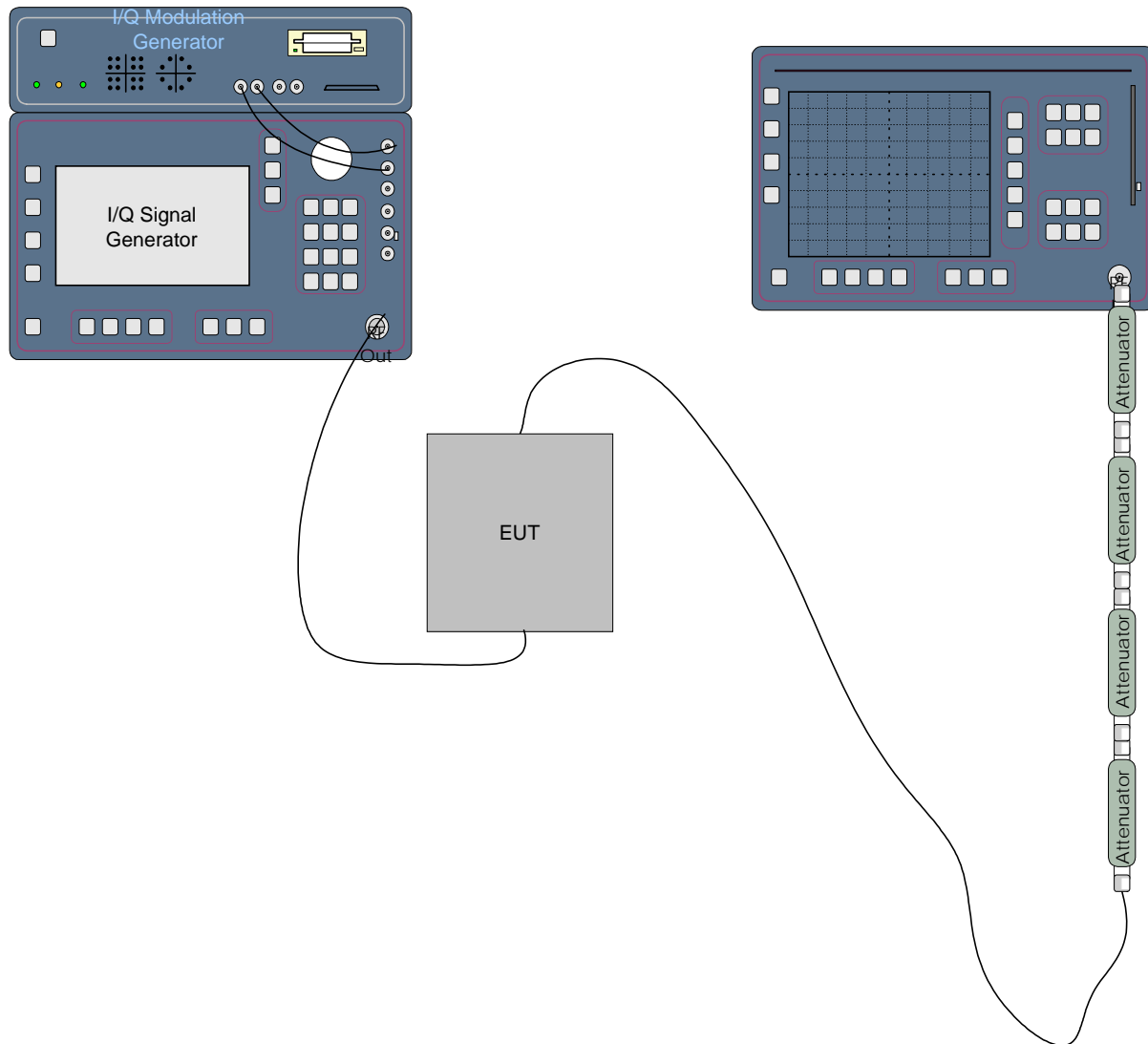
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**Figure 3 Output signal – MediaFLO OFDM**

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**C.9. Test Diagram****C.10. Tested By**

Name: Tom Tidwell,  
Function: Manager of Wireless Services

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## APPENDIX D: 2.1051 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### D.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 2.1051
<b>Test Basis</b>	FCC 2.1051 Spurious Emissions at Antenna Terminals
<b>Test Method</b>	TIA 603-C, 2004

### D.2. Specifications

27.53(f)

(f) For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log(P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

### D.3. Measurement Uncertainty

**Expanded Uncertainty (K=2)**

+1.11/-1.22

### D.4. Deviations

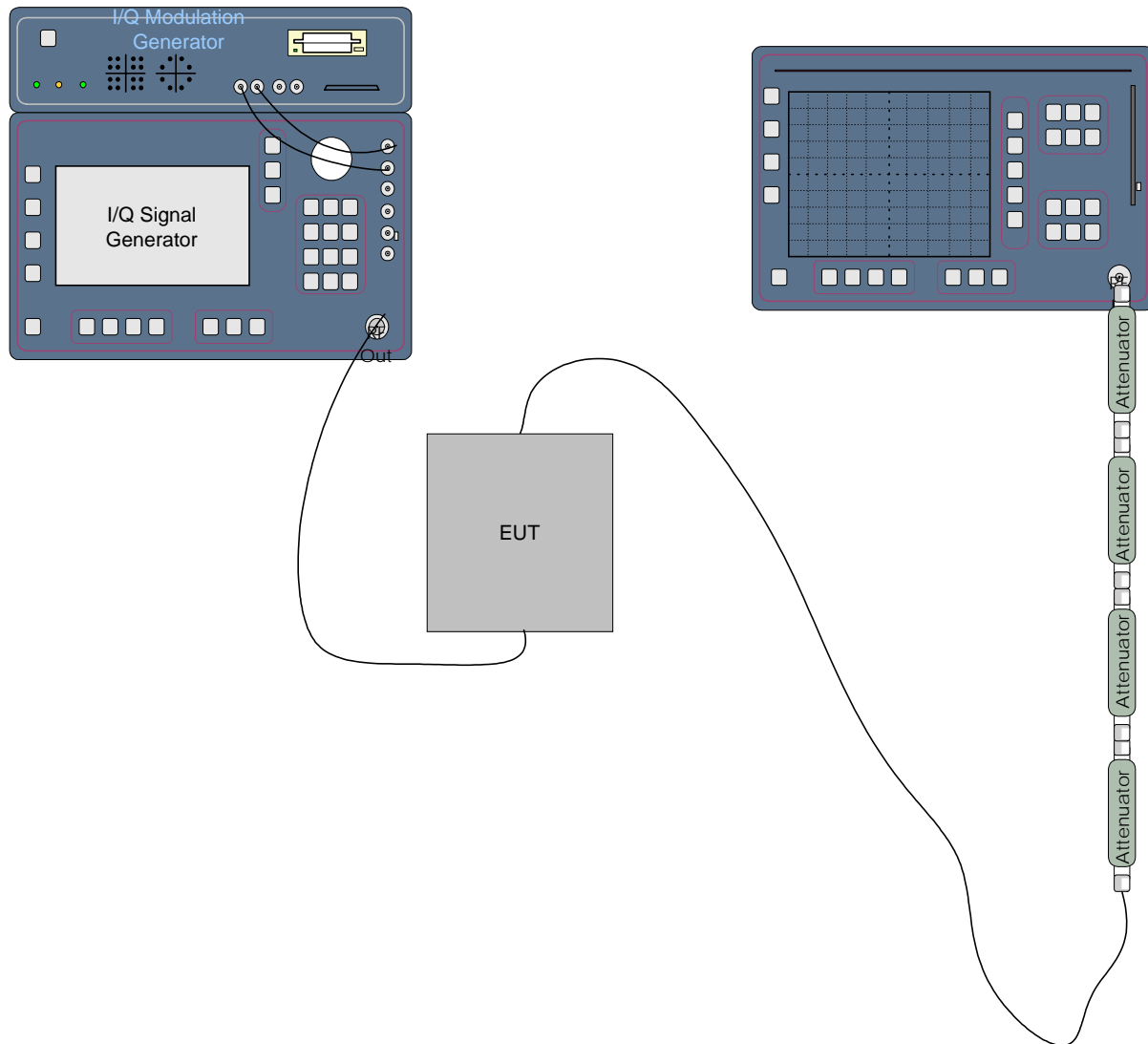
Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

### D.5. Test Results

Complies. All emissions meet the out of band limits.

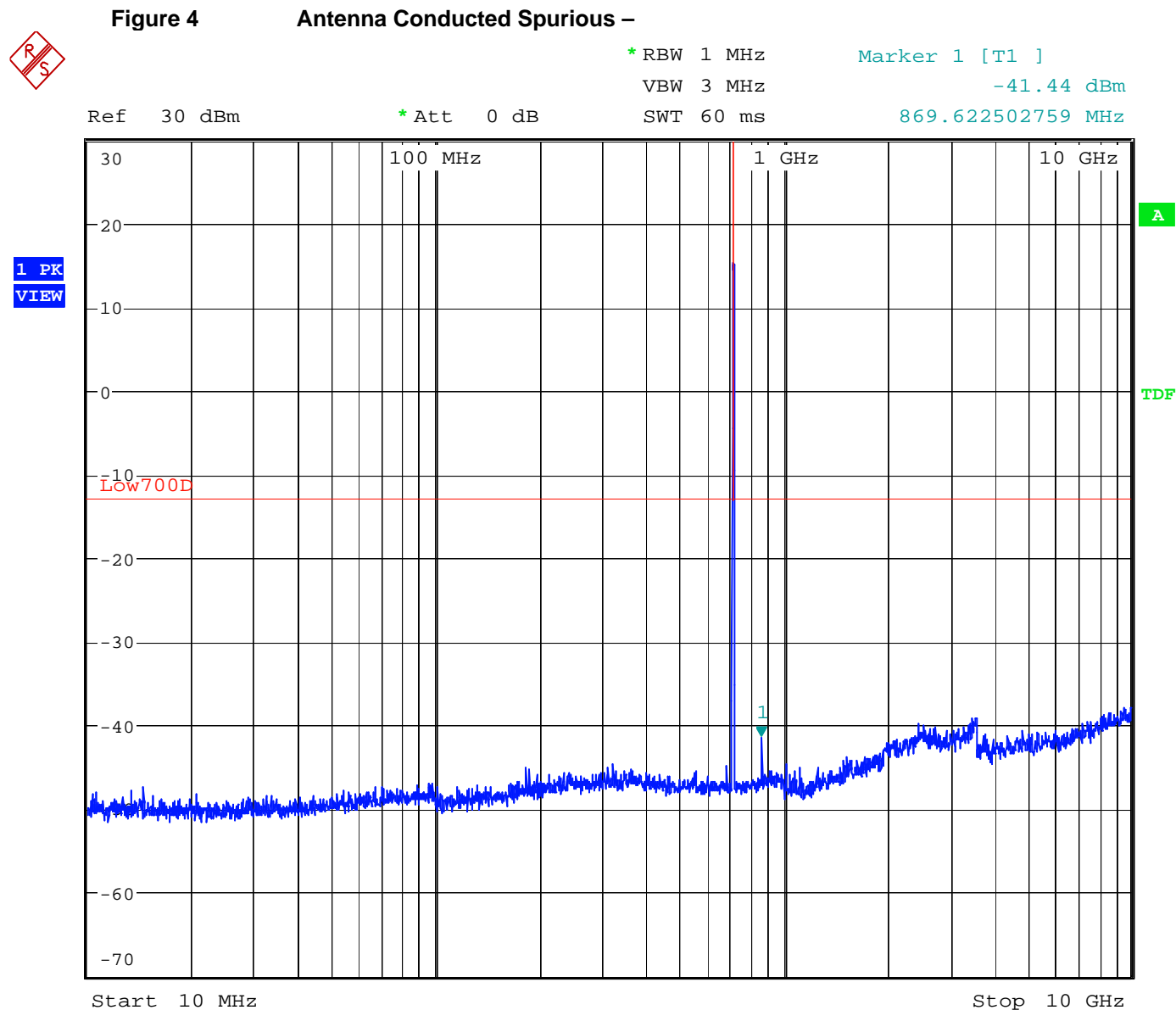
Out-of-Band Emissions limit is  $43 + 10 \log(P)$  which relates to -13 dBm absolute power.

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**D.6. Test Diagram****D.7. Test Data**

See following pages.

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**D.8. Tested By**

Name: Tom Tidwell,  
Function: Manager of Wireless Services

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## APPENDIX E: 2.1053 FIELD STRENGTH OF SPURIOUS RADIATION

### E.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 2.1053
<b>Test Basis</b>	FCC 2.1053 Field Strength of Spurious Radiation
<b>Test Method</b>	TIA 603-C, 2004 Substitution Antenna Method

### E.2. Limits

27.53(l)

(f) For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log(P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

### E.3. Test Results

Compliant. There were no emissions detected. See data for the ambient noise threshold. The spectrum was searched up to 10 GHz.

### E.4. Deviations from Normal Operating Mode During Test

None.

### E.5. Sample Calculation

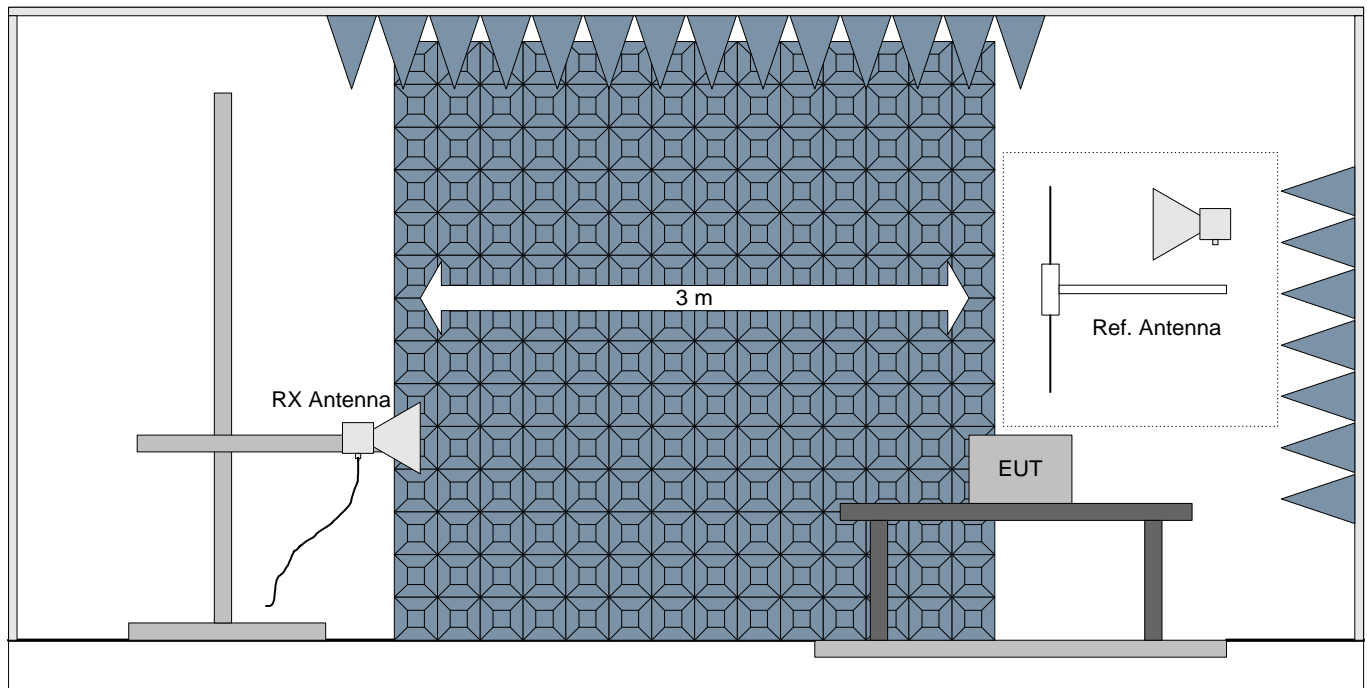
**Final measured value (dBm) = Substitution level (dBm) + Antenna Gain (dBd)**

**Minimum attenuation limit (dB) =  $43 + 10 \log(P)$  where P = Peak power of the carrier in watts.**

Min. Atten. Limit dB) =  $43 + 10 * \log(0.0316 \text{ watts})$   
 $= 43 + 10 * -1.5$   
 $= 43 + (-15)$   
 $= 28 \text{ dB}$

$15 \text{ dBm} - 28 \text{ dB} = -13 \text{ dBm}$

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**E.6. Test Diagram**

Note: The EUT is set to repeat a signal at maximum rf output power into a coaxial load for this testing.

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## E.7. Test Data



Project No: Andrew Corporation W7331  
 Model: MR715F  
 Comments: Transmit at full rf output power (+15 dBm)  
 The EUT was tested with a CW input signal at 719 MHz

Distance: 3 m

Standard: CFR 47, Part 2.1043

RBW: < 1 GHz = 120 kHz  
1 GHz = 1 MHz

VBW: 1 MHz

Antenna	Polarization	Frequency (MHz)	Measured (dBm)	Substitution Level (dBm)	Substitution Antenna Gain (dBd)	Final Measured Value		Peak Carrier Power		Minimum Attenuation Limit (dBc)	Margin (dB)
	(V/H)					(dBm)	(watts)	(dBm)	(watts)		
Ambient	V	1438.0	-84.3	-83	6.2	-76.8	2.09E-11	15	0.032	28	63.8
Ambient	H	1438.0	-87.7	-98	6.2	-91.8	6.61E-13	15	0.032	28	78.8
Ambient	V	2157.0	-75.0	-98.0	9.3	-88.7	1.35E-12	15	0.032	28	75.7
Ambient	H	2157.0	-75.0	-98.0	9.3	-88.7	1.35E-12	15	0.032	28	75.7
Ambient	V	2876.0	-68.0	-97.0	9.3	-87.7	1.70E-12	15	0.032	28	74.7
Ambient	H	2876.0	-68.0	-97.0	9.3	-87.7	1.70E-12	15	0.032	28	74.7
Ambient	V	3595.0	-70.0	-94.0	10.7	-83.3	4.68E-12	15	0.032	28	70.3
Ambient	H	3595.0	-70.0	-94.0	10.7	-83.3	4.68E-12	15	0.032	28	70.3
Ambient	V	5752.0	-65.0	-90.0	11.0	-79.0	1.26E-11	15	0.032	28	66.0
Ambient	H	5752.0	-65.0	-90.0	11.0	-79.0	1.26E-11	15	0.032	28	66.0
Ambient	V	7190.0	-60.0	-88.0	10.9	-77.1	1.95E-11	15	0.032	28	64.1
Ambient	H	7190.0	-60.0	-88.0	10.9	-77.1	1.95E-11	15	0.032	28	64.1

## Notes:

- (1) A positive margin indicates a passing result  
 (2) If duty cycle correction is indicated, plots are included in the test report to validate the factor used.  
 (3) The minimum threshold of sensitivity was sufficient to detect signals within 20 dB of the -13 dBm limit over the frequency range 30 MHz - 10 GHz.

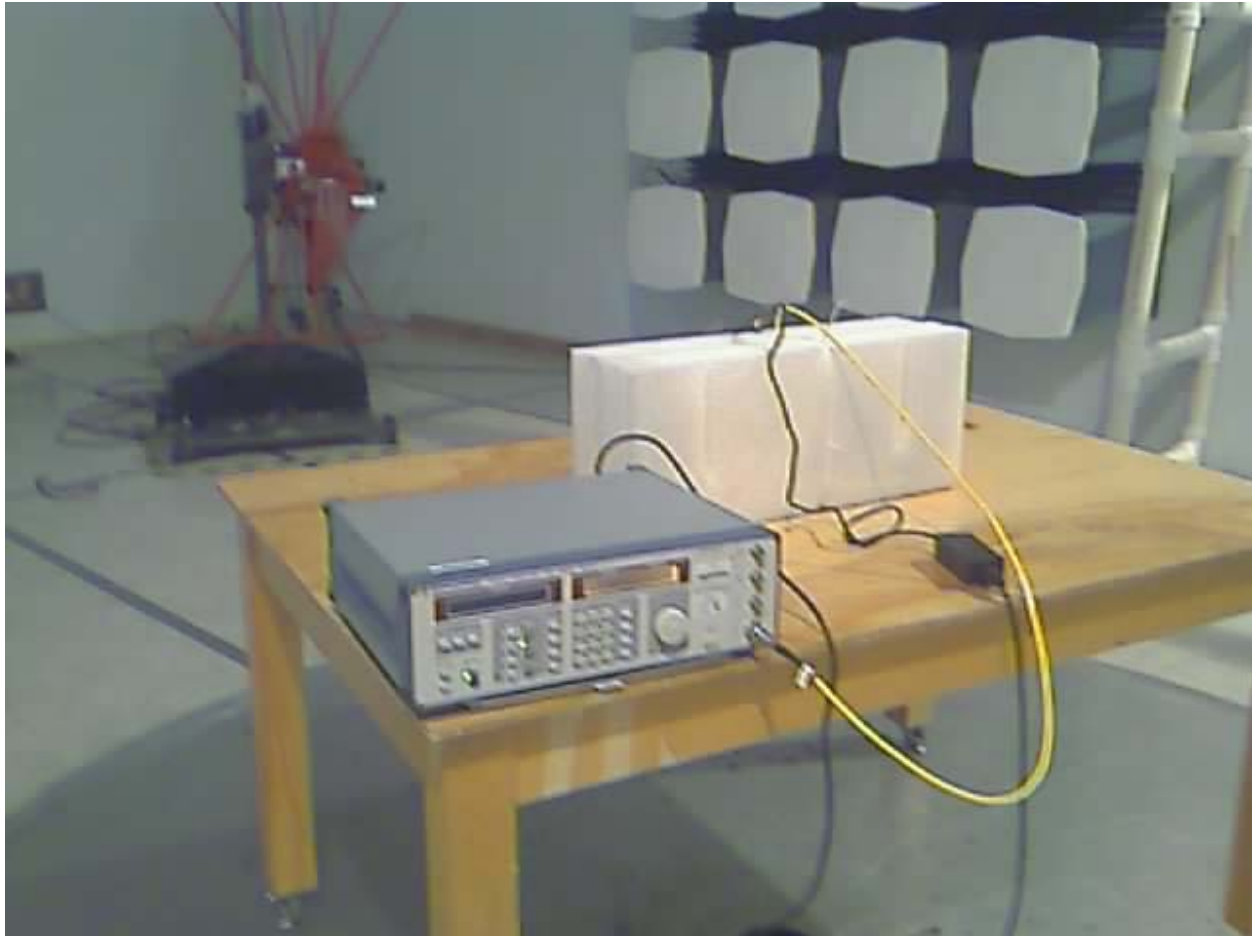
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**E.8. Test Photo**



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NTS Plano, 1701 E. Plano Pkwy., Plano, TX 75074 Tel: (972) 509-2566, Fax: (972) 509-0073



**E.9. Tested By**

Name: Tom Tidwell,  
Function: Manager of Wireless Services  
Date: 16 August, 2007

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## APPENDIX F: 2.1055 FREQUENCY STABILITY

### F.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 2.1055
<b>Test Method</b>	TIA 603-C, 2004

### Specifications

#### 27.54 Frequency Stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

### F.2. Deviations

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

### F.3. Test Results

Not Applicable. This device is an F1 to F1 repeater that does not use frequency translation.

### F.4. Observations

None

### F.5. Deviations from Normal Operating Mode During Test

None.

### F.6. Sample Calculation

Frequency drift (ppm) = Frequency Drift (Hz)/Authorized frequency (MHz)

### F.7. Test Data

None

### F.8. Test Diagram

None

### F.9. Tested By

Name: Tom Tidwell,  
Function: Manager of Wireless Services

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## APPENDIX G: TEST EQUIPMENT LIST

### G.1. Field Strength of Spurious Emissions 30 MHz – 26.5 GHz Measurement Equipment

Description	Manufacturer	Type/Model	Calibration Frequency	Cal Due	NTS Control No.
<b>3m ANECHOIC CHAMBER</b>					
RX Bilog Antenna	ETS	3142C	12 Months	8/17/07	E1288P
Ref. Horn Antenna	ETS	3115	12 Months	11/1/07	E1019P
RX Horn Antenna	ETS	3115	12 Months	-	E1022P
High Frequency - Cable 1	MegaPhase	TM26-3135-144	12 Months	8/23/07	W1010P
Reference Antenna	ETS	3121 Dipole Set	12 months	8/8/08	S/N. 274
<b>CONTROL ROOM</b>					
Test Receiver	Rohde & Schwarz	FSQ 26	12 Months	9/21/07	W1020P
High Frequency - Cable 2	MegaPhase	NA	12 Months	8/23/07	W1011P

### G.2. Antenna Conducted Emissions Measurement Equipment

Instrument	Manufacturer	Model	Calibration Frequency	Calibration Due
<b>ANTENNA CONDUCTED EMISSIONS</b>				
Spectrum Analyzer	Rohde & Schwarz	FSQ 26	12 Months	9/21/07
High Frequency - Cable 1	MegaPhase	TM26-3135-144	12 Months	8/23/07
Directional Coupler	Narda	3020A	12 Months	8/28/07
Directional Coupler	Narda	4242-10	12 Months	8/28/07
50 ohm loads	Amphenol	50R	12 Months	8/28/07

\*This device was not used for calibrated measurements.

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**END OF DOCUMENT**

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