



Test Report Serial Number:	45461433 R2.0
Test Report Date:	5 April 2018
Project Number:	1402

## EMC Test Report - Class II Permissive Change

Applicant:



**4RF Limited**  
**PO Box 13-506**  
**Wellington, New Zealand 6440**  
**New Zealand**

FCC ID:

**UIPSQ757M160**

Product Model Number / HVIN

**Aprisa SR**

**Aprisa SR+**

IC Registration Number

-

Product Name / PMN

**SX757M160**

**SQ757M160**

In Accordance With:

**FCC 47 CFR Part 27 - Miscellaneous Wireless Communications Service**  
Licensed Non-Broadcast Station Transmitter (TNB)

Approved By:

**Ben Hewson, President**  
Celltech Labs Inc.  
21-364 Lougheed Rd.  
Kelowna, BC, V1X 7R8  
Canada



Test Lab Certificate: 2470.01



**Industry  
Canada**

IC Registration 3874A-1



FCC Registration: CA3874

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**1.0 DOCUMENT CONTROL**

Revision History					
<b>Samples Tested By:</b>		Art Voss, P.Eng.		<b>Date(s) of Evaluation:</b>	23 Mar - 29 Mar, 2018
<b>Report Prepared By:</b>		Art Voss, P.Eng.		<b>Report Reviewed By:</b>	Ben Hewson
Report Revision	Description of Revision	Revised Section	Revised By	Revision Date	
1.0	Draft Release	n/a	Art Voss	29 March 2018	
1.1	Draft Release - Changed Emissions Limits	9, 10, 11	Art Voss	3 April 2018	
2.0	Corrected Margins	8	Art Voss	5 April 2018	

## 2.0 CLIENT AND DUT INFORMATION

<b>Client Information</b>	
<b>Applicant Name</b>	<b>4RF Limited</b>
<b>Applicant Address</b>	PO Box 13-506 Wellington, New Zealand, 6440 New Zealand
<b>DUT Information</b>	
<b>Device Identifier(s):</b>	<b>FCC ID:</b> UIPSQ757M160
	<b>ISED ID:</b> -
<b>Equipment Class:</b>	TNB - Licensed Non-Broadcast Station Transmitter
<b>Device Type:</b>	Digital Radio
<b>Device Model(s) / HVIN: (See Note 1)</b>	SX757M160
	SQ757M160
<b>Device Marketing Name / PMN:</b>	Aprisa SR
	Aprisa SR+
<b>Firmware Version ID Number / FVIN:</b>	-
<b>Host Marketing Name / HMN:</b>	-
<b>Test Sample Serial No.:</b>	T/A Sample - Identical Prototype
<b>Transmit Frequency Range:</b>	757-758MHz, 787-788MHz
<b>Test Channels:</b>	Programmable
<b>Manuf. Max. Rated Output Power:</b>	QPSK: 37dBm
	16 QAM: 35dBm
	64 QAM: 34dBm
<b>Manuf. Max. Rated BW/Data Rate:</b>	12.5kHz, 25kHz, 50kHz, 100kHz
<b>Antenna Make and Model:</b>	n/a
<b>Antenna Model:</b>	ZDA Communications US LLC M/N ZDAFP750-10-60D
<b>Antenna Type and Gain:</b>	Dual Polarization Flat Panel, 10dBi
<b>Modulation:</b>	QPSK, 16QAM, 64QAM
<b>Mode:</b>	Half Duplex
<b>Emission Designator:</b>	See Section 8.0
<b>DUT Power Source:</b>	13.8 VDC External (Nominal)
<b>DUT Dimensions [HxWxD] (mm)</b>	90 x 432 x 280
<b>Deviation(s) from standard/procedure:</b>	None
<b>Modification of DUT:</b>	None

Note 1: This is a Class II Permissive Change. The SR and SR+ variants are same and identical units in all aspects of the RF Transmitter circuitry and form factor to that of the original filing. The SR is a feature reduced variant capable of QPSK only, no receive antenna and slight enclosure modifications. This Class II Permissive Change is to add 100kHz channel bandwidths. These changes are accomplished via software without any transmitter hardware changes in any manner.

### 3.0 SCOPE

This Certification Report was prepared on behalf of:



#### 4RF Limited

(the '*Applicant*'), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 rules parts and regulations (the '*Rules*'). The scope of this investigation was limited to only the equipment, devices and accessories (the '*Equipment*') supplied by the *Applicant*. The tests and measurements performed on this *Equipment* were only those set forth in the applicable *Rules* and/or the Test and Measurement Standards they reference. The *Rules* applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable *Rules* were applied to the measurement results obtained during this evaluation and ,unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the *Equipment* tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

As per FCC CFR 47 Part §2.1091 and §2.1093, an RF Exposure evaluation report is required for this *Equipment* and the results of the RF Exposure evaluation appear in a separate exhibit from this report.

**4.0 TEST SUMMARY**

<b>TEST SUMMARY</b>					
<b>Section</b>	<b>Description of Test</b>	<b>Procedure Reference</b>	<b>Applicable Rule Part(s) FCC</b>	<b>Test Date</b>	<b>Result</b>
<b>7.0</b>	Conducted Power (Fundamental)	ANSI/TIA/EIA-603-E-2016 ANSI C63.4:2014	§27.50(b)(1) §2.1046	26 March 2018	Pass
<b>8.0</b>	Occupied Bandwidth	ANSI/TIA/EIA-603-E-2016 ANSI C63.4:2014	§2.1049	26 March 2018	Pass
<b>9.0</b>	Band Edge	ANSI/TIA/EIA-603-E-2016 ANSI C63.4:2014	§27.53(c )	27 March 2018	Pass
<b>10.0</b>	Conducted TX Spurious Emissions	ANSI/TIA/EIA-603-E-2016 ANSI C63.4:2014	§27.53(c ) §2.1051	28 March 2018	Pass
<b>11.0</b>	Conducted TX Spurious Emissions 763-775MHz, 793-805MHz	ANSI/TIA/EIA-603-E-2016 ANSI C63.4:2014	§27.53(c )(3) §2.1051	28 March 2018	Pass
<b>12.0</b>	Emissions in 1550-1610MHz Band	ANSI/TIA/EIA-603-E-2016 ANSI C63.4:2014	§27.53(f)	28 March 2018	Pass

<p>I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.</p>	 <hr/> <p>Art Voss, P.Eng.          Technical Manager          Celltech Labs Inc.          29 March 2018  <hr/>         Date</p> 
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**5.0 NORMATIVE REFERENCES**

**Normative References**

ANSI / ISO 17025:2017 General Requirements for competence of testing and calibration laboratories

IEEE/ANSI C63.4:2014 Methods of Measurement of Radio-Noise Emissions from Low-Voltage  
Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

ANSI/TIA/EIA-603-E-2016 Land Mobile FM or PM Communications Equipment  
Measurement and Performance Standards

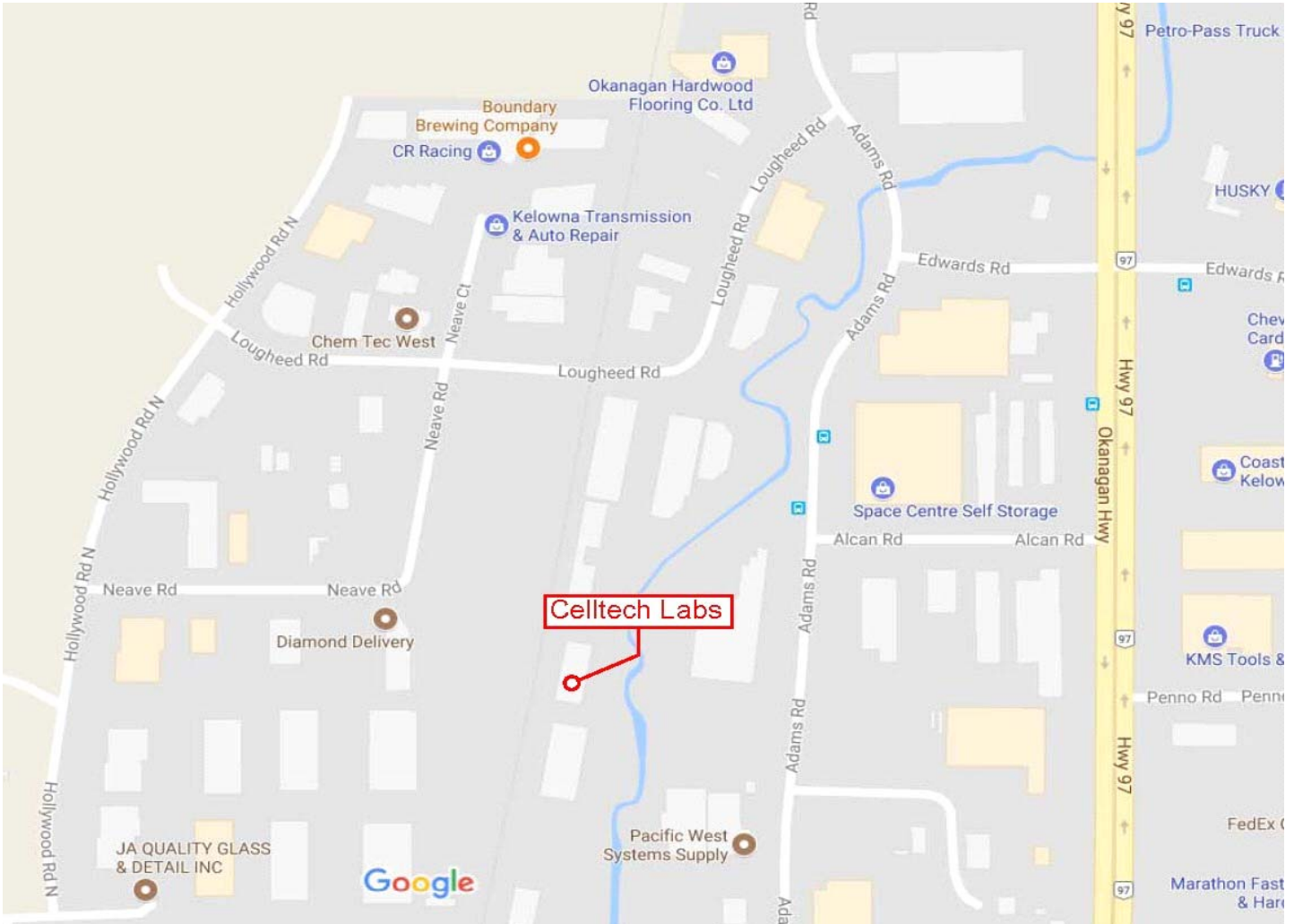
CFR Title 47 Code of Federal Regulations  
Title 47: Telecommunication  
Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations

CFR Title 47 Code of Federal Regulations  
Title 47: Telecommunication  
Part 27: Miscellaneous Wireless Communications Services

**6.0 FACILITIES AND ACCREDITATIONS**

**Facility and Accreditation:**

The facilities used to evaluate this device outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site (OATS) conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number CA3874 and Industry Canada under Test Site File Number IC 3874A-1. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



## 7.0 CONDUCTED POWER

### Test Procedure

<b>Normative Reference</b>	FCC 47 CFR §2.1046, §27.50(b )(1)
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### Limits

47 CFR §27.50	<p><b>§ 27.50 Power Limits and Duty Cycle</b></p> <p>(b) The following power and antenna height limits apply to transmitters operating in the 746-758 MHz, 775-788 MHz and 805-806 MHz bands:</p> <p>(1) Fixed and base stations transmitting a signal in the 757-758 and 775-776 MHz bands must not exceed an effective radiated power (ERP) of 1000 watts...</p>
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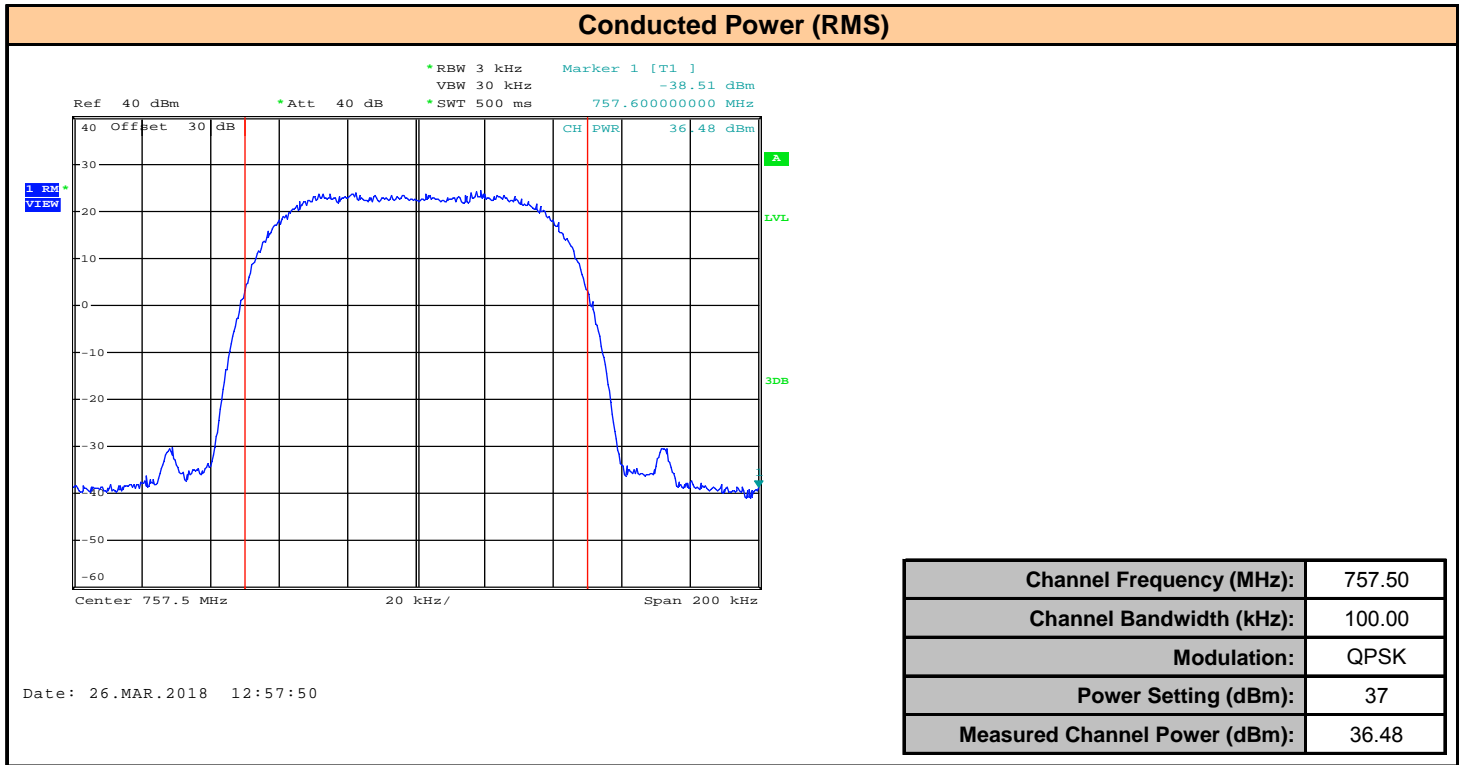
### Test Setup

<b>Appendix A</b>	<b>Figure A.1</b>
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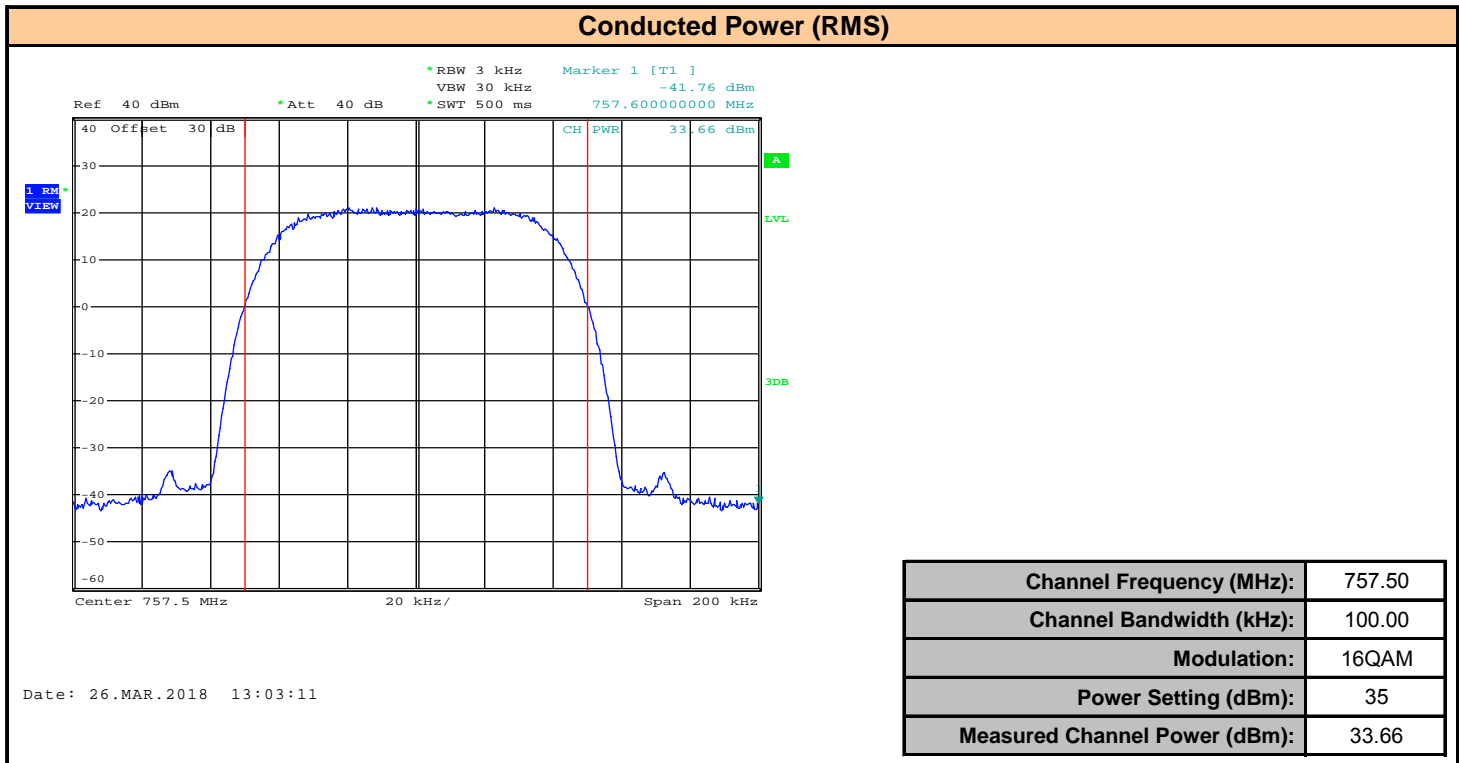
### Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA Detector was set to RMS and set to measure the channel power with the channel bandwidth set to 100kHz. The output power of the DUT was set to the manufacturer's highest rated setting for each modulation type and to the center frequency of each transmission band. All modulations (QPSK, 16 QAM, and 64 QAM) were investigated.

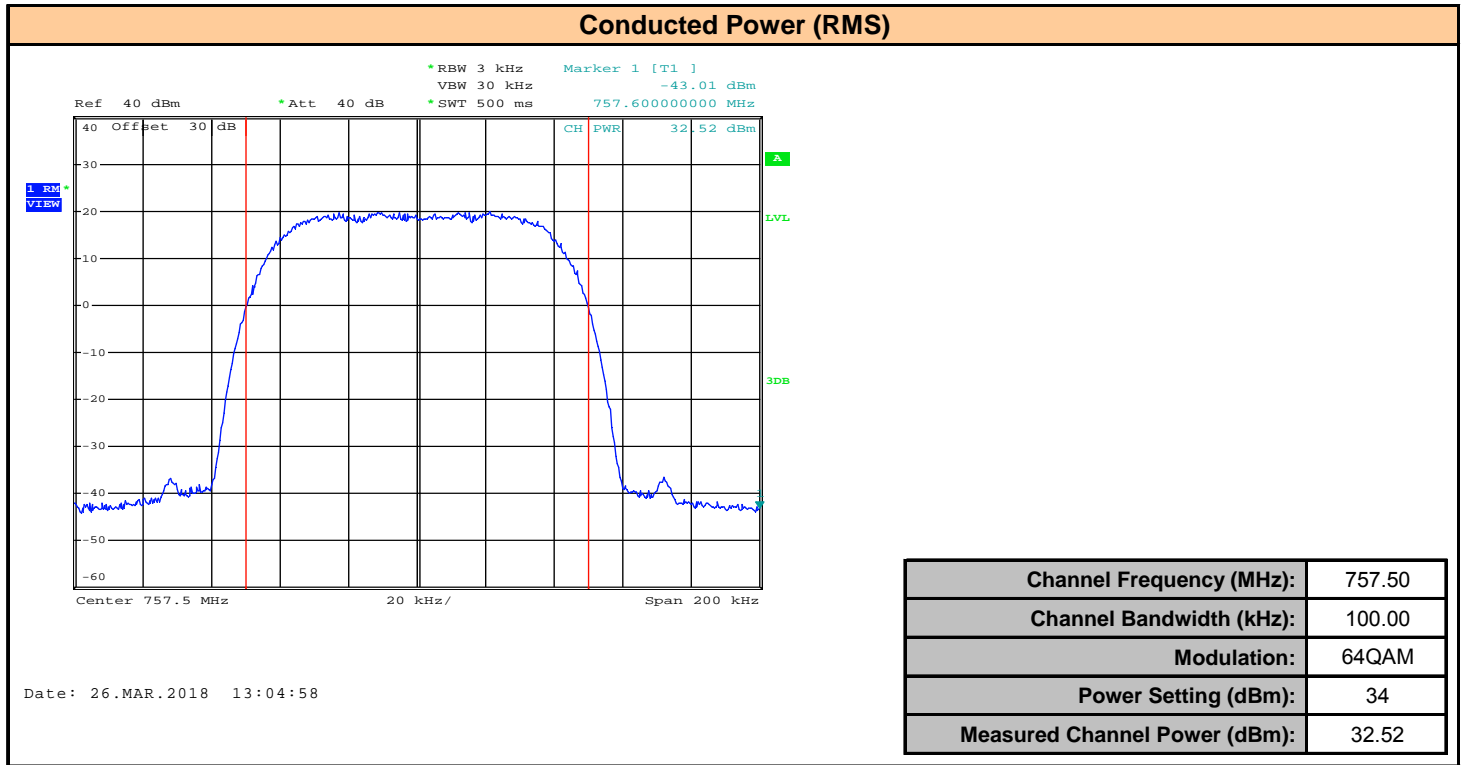
**Plot 7.1 – Conducted Power 757.5MHz, 100kHz BW, QPSK**



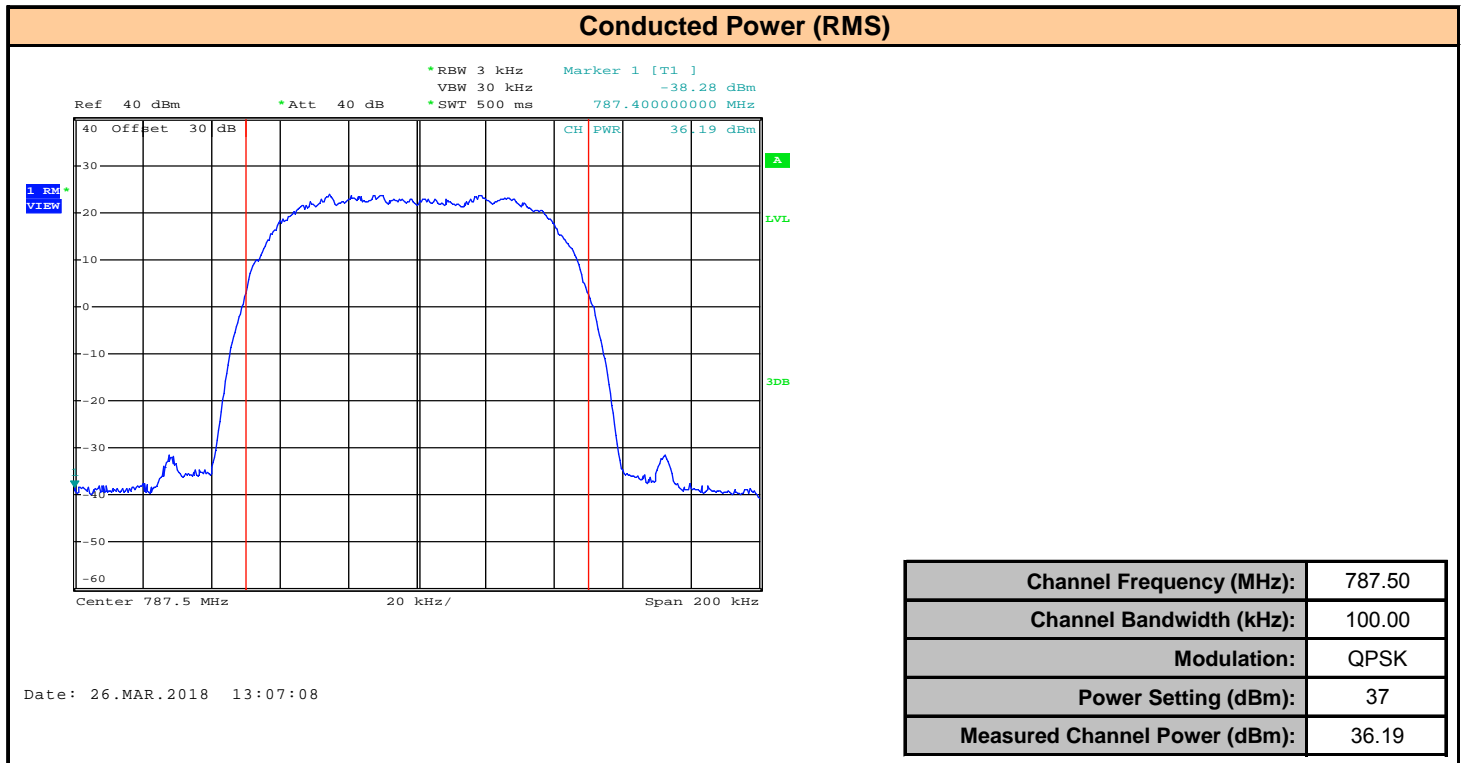
**Plot 7.2 – Conducted Power 757.5MHz, 100kHz BW, 16QAM**



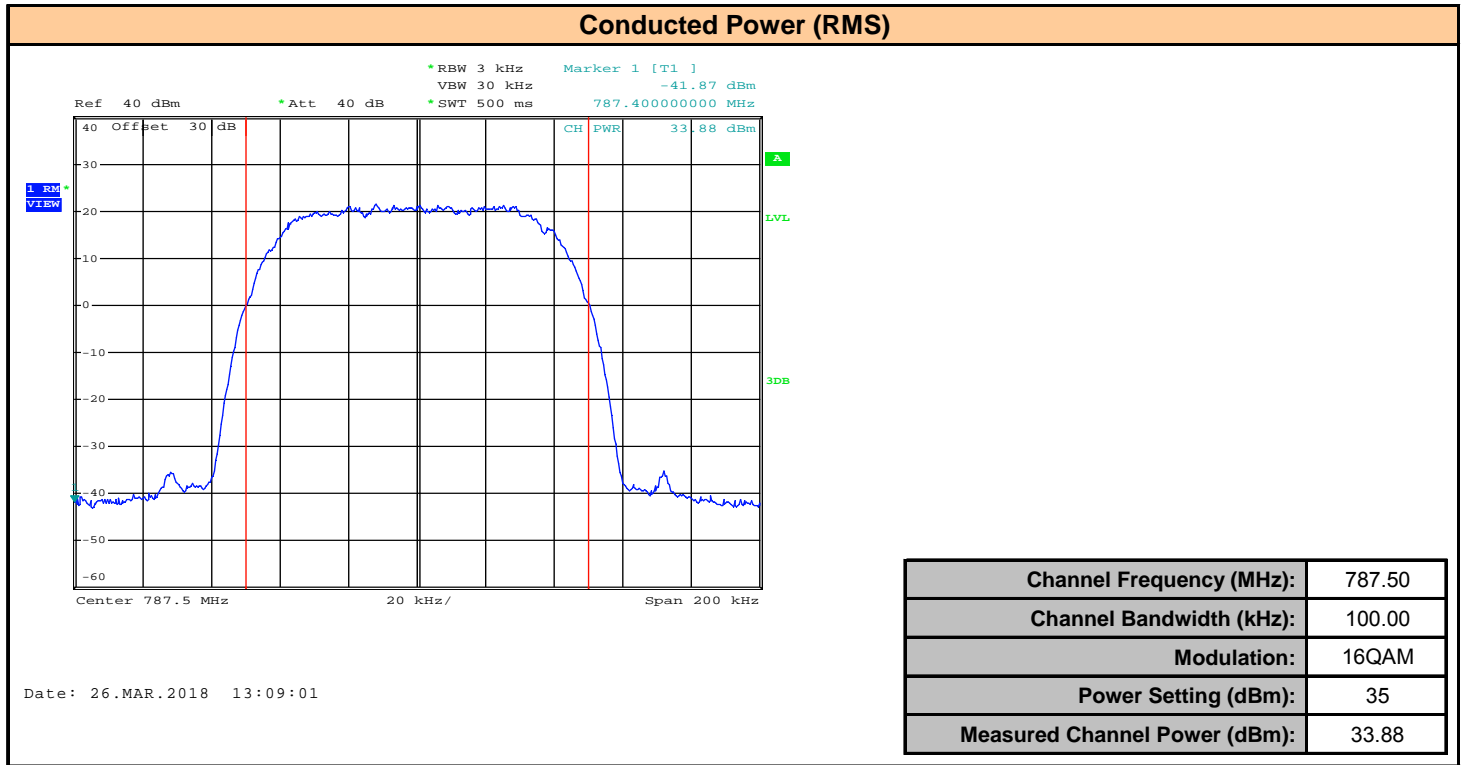
**Plot 7.3 – Conducted Power 757.5MHz, 100kHz BW, 64QAM**



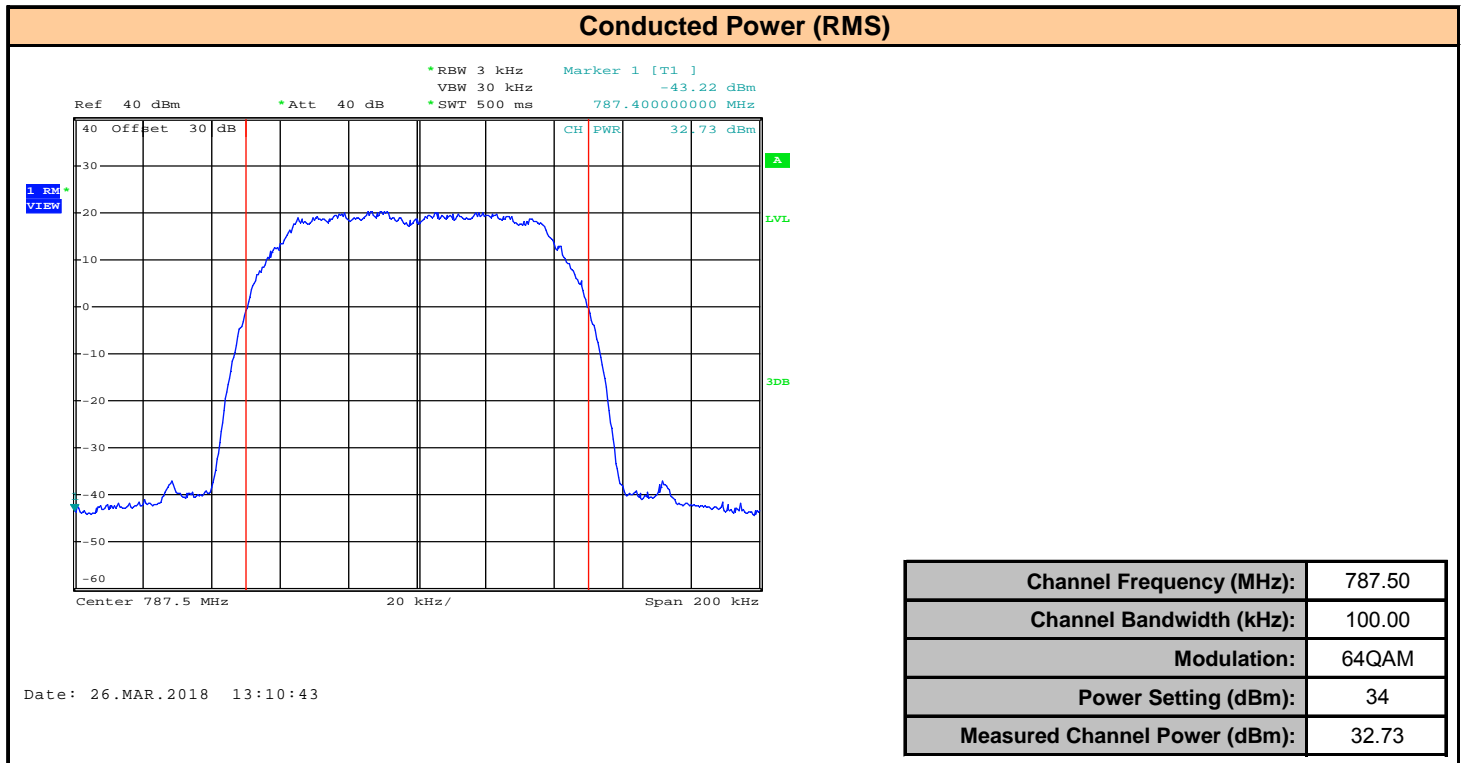
**Plot 7.4 – Conducted Power 787.5MHz, 100kHz BW, QPSK**



**Plot 7.5 – Conducted Power 787.5MHz, 100kHz BW, 16QAM**



**Plot 7.6 – Conducted Power 787.5MHz, 100kHz BW, 64QAM**



**Table 7.1 – Summary of Conducted Power Measurements**

<b>§27.50 Channel Output Power (RMS)</b>											
Freq (MHz)	BW (kHz)	Modulation	Power Setting <sup>(1)</sup> (dBm)	Measured Power [E <sub>Meas</sub> ] (dBm)	Antenna Gain <sup>(2)</sup> [G <sub>T</sub> ]* (dBi)	Gain Correction [G <sub>C</sub> ]** (dB)	Cable Loss [L <sub>C</sub> ] (dB)	ERP (dBm)	ERP (W)	Limit (W)	Margin (dB)
757.5	100	QPSK	37	36.48	10	-2.15	0.5	44.83	30.41	1000.0	15.2
		16 QAM	35	33.66				42.01	15.89		18.0
		64 QAM	34	32.52				40.87	12.22		19.1
787.5	100.0	QPSK	37	36.19				44.54	28.44		15.5
		16 QAM	35	33.88				42.23	16.71		17.8
		64 QAM	34	32.73				41.08	12.82		18.9
<b>Results:</b>										<b>Complies</b>	

$$\text{ERP (dBm)} = E_{\text{Meas}} + G_T + G_C + L_C$$

$$\text{Margin} = \text{Limit} - \text{ERP in dB}$$

\* The Gain of the ZDAP750-10-60D used for compliance to §27.53(f) is assumed for this calculation

\*\* Correction to dBd

(1) The Aprisa SR and SR+ automatically sets the output power to the level indicated base on the modulation.

#### Applicant Attestation Regarding Antenna Gain:

The maximum antenna gain in the manual does not consider regulatory requirements as it is there for exposure calculation only.

As the Aprisa SR+ is installed by professionals the TX power should be reduced at installation if using a higher gain antenna (typically at the remote site) to ensure that the license conditions are adhered to.

This is covered explicitly in the user manual under “Compliance General” which states:

The Aprisa SR+ radio predominantly operates within frequency bands that require a site license be issued by the radio regulatory authority with jurisdiction over the territory in which the equipment is being operated. It is the responsibility of the user, before operating the equipment, to ensure that where required the appropriate license has been granted and all conditions attendant to that license have been met.

Adjustment of the TX power is included in our product for exactly this reason.

Typically the Base station will have an omni directional antenna and the Remotes will have small directional antenna. The ability to adjust the TX power at the remotes to ensures EIRP requirements are meet also improves frequency reuse that may not be possible if directional (i.e. higher gain) antennas were not used.

Consideration in setting the TX power must also be given to the modulation used and feeder loss.

**8.0 OCCUPIED BANDWIDTH**

**Test Conditions**

**Normative Reference** FCC 47 CFR §2.1049, KDB 971168 D01v02r02

**Limits**

47 CFR §2.1049

**§ 2.1049 Measurements required: Occupied Bandwidth.**

The occupied bandwidth, that is 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 Setup**

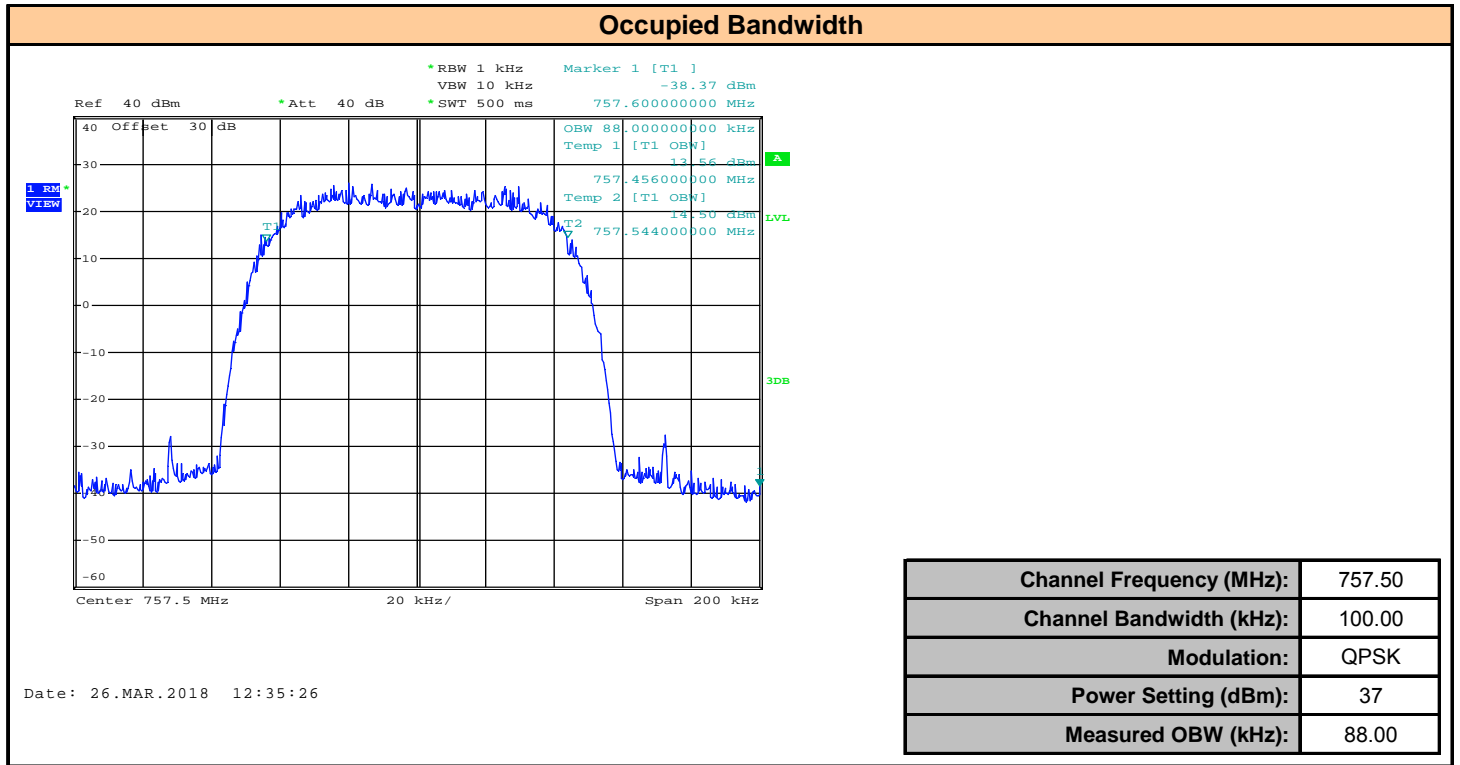
**Appendix A                      Figure A.1**

**Measurement Procedure**

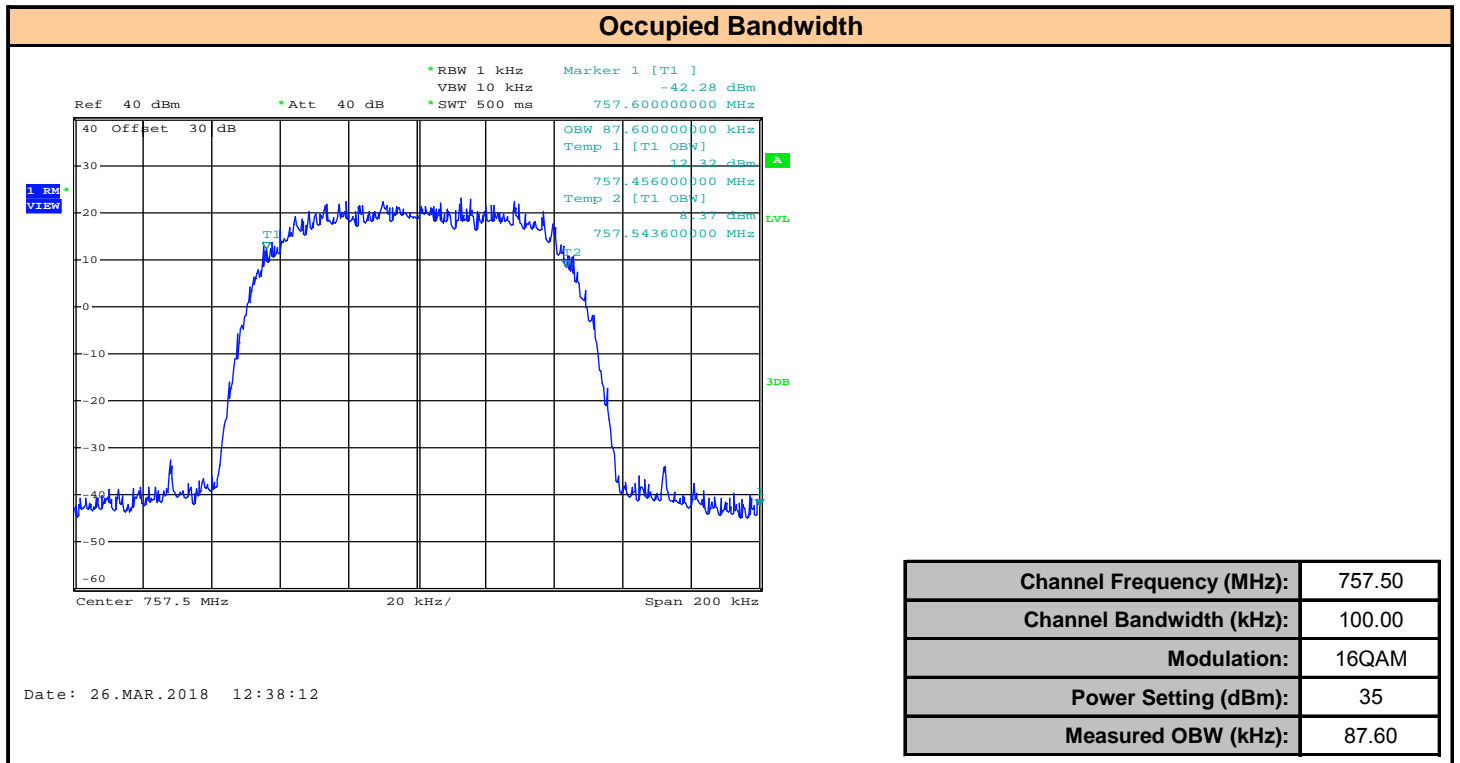
The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA Detector was set to RMS with the RBW set to < the OBW of the DUT. The output power of the DUT was set to the manufacturer's highest rated setting for each modulation type and set to the center frequency of each transmission band. All modulations (QPSK, 16 QAM, and 64 QAM) were investigated. The SA trace was set to Max Hold and the SA set to measure the 99% Occupied Bandwidth.



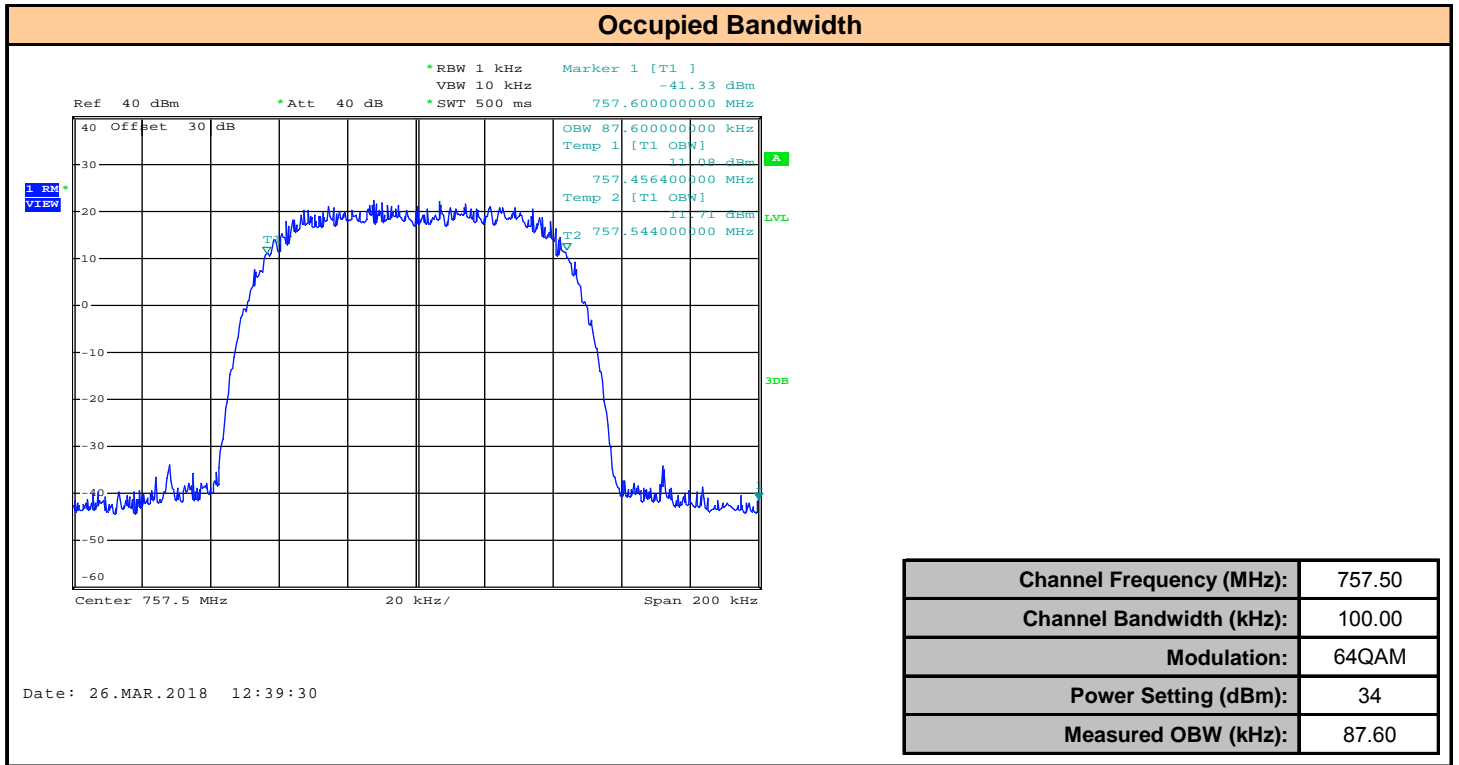
**Plot 8.1 – Occupied Bandwidth 757.5MHz, 100kHz BW, QPSK**



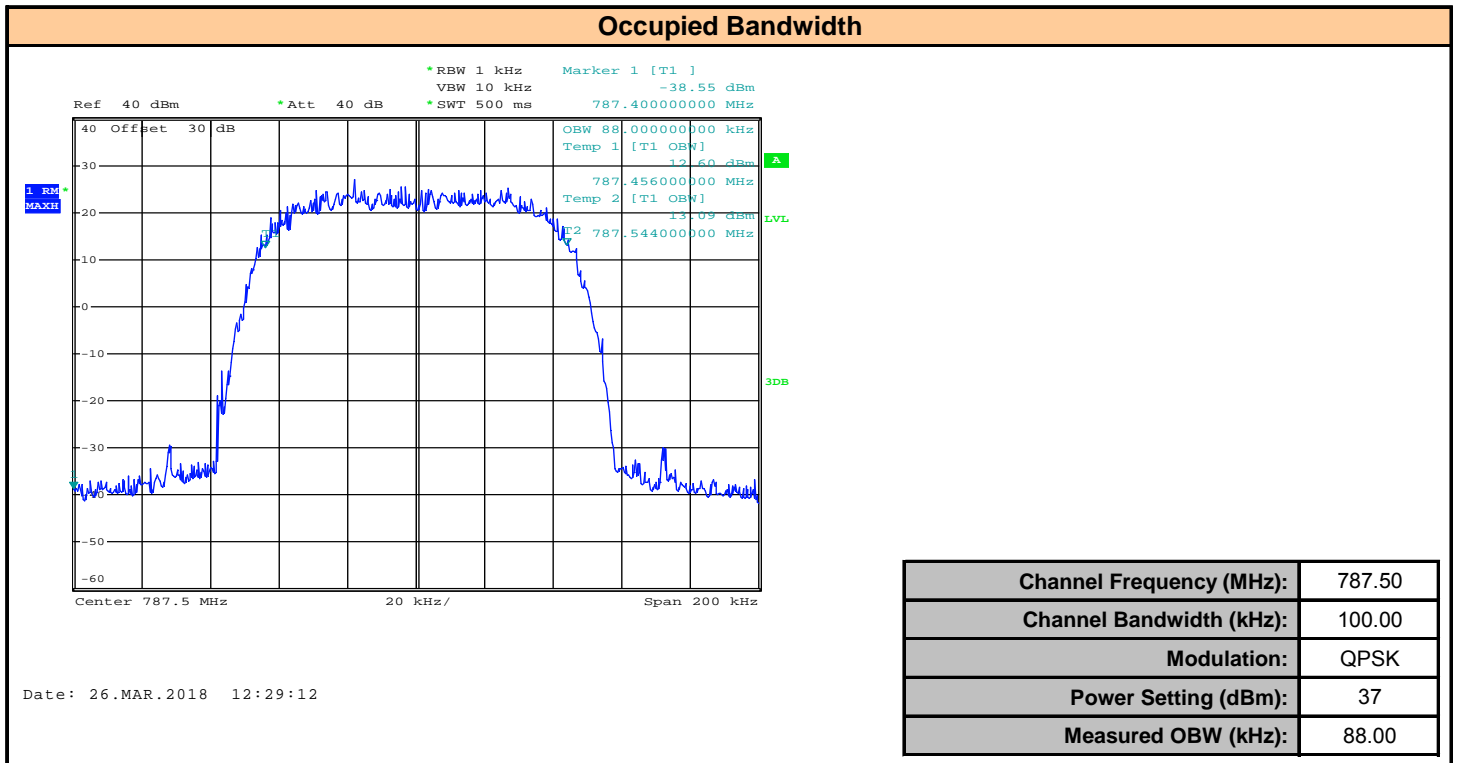
**Plot 8.2 – Occupied Bandwidth 757.5MHz, 100kHz BW, 16QAM**



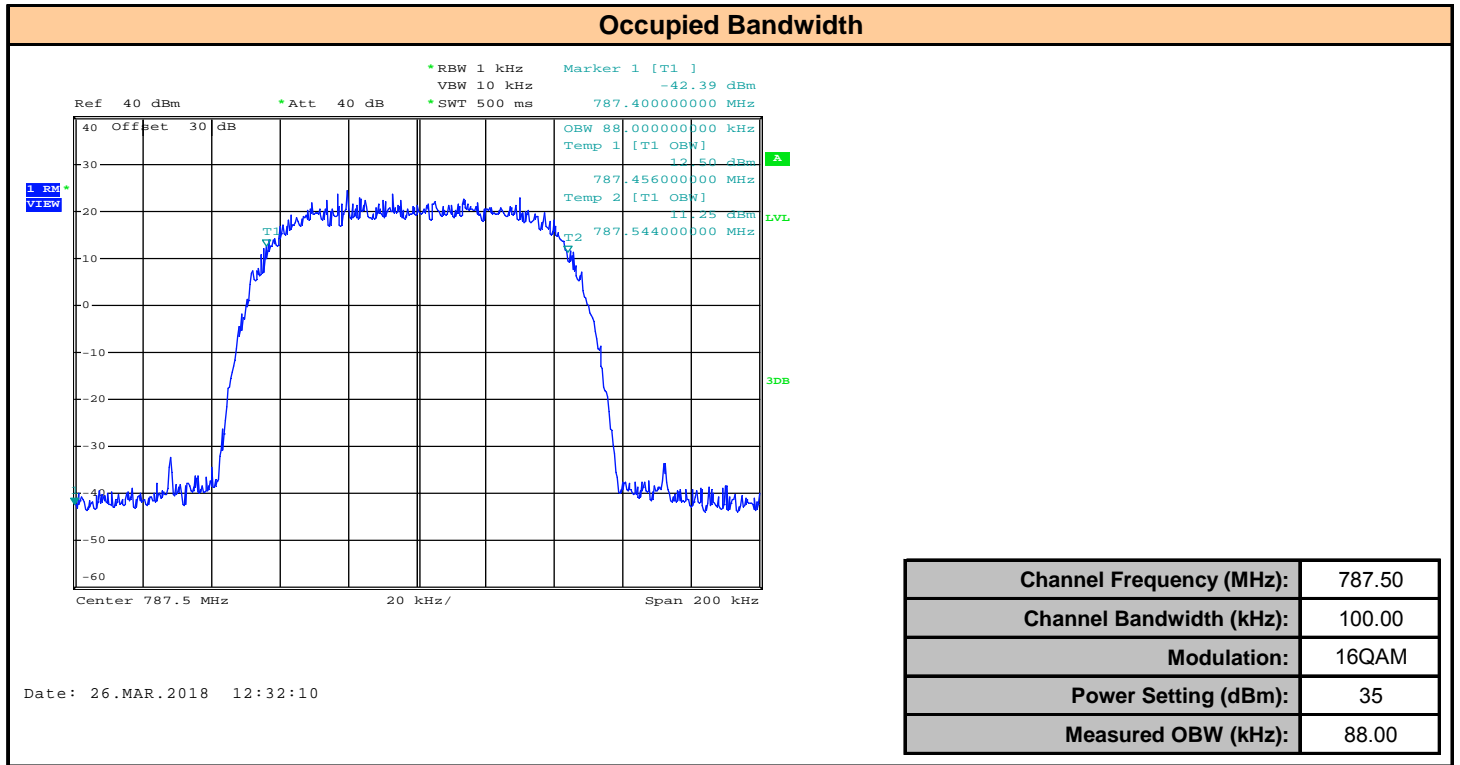
**Plot 8.3 – Occupied Bandwidth 757.5MHz, 100kHz BW, 64QAM**



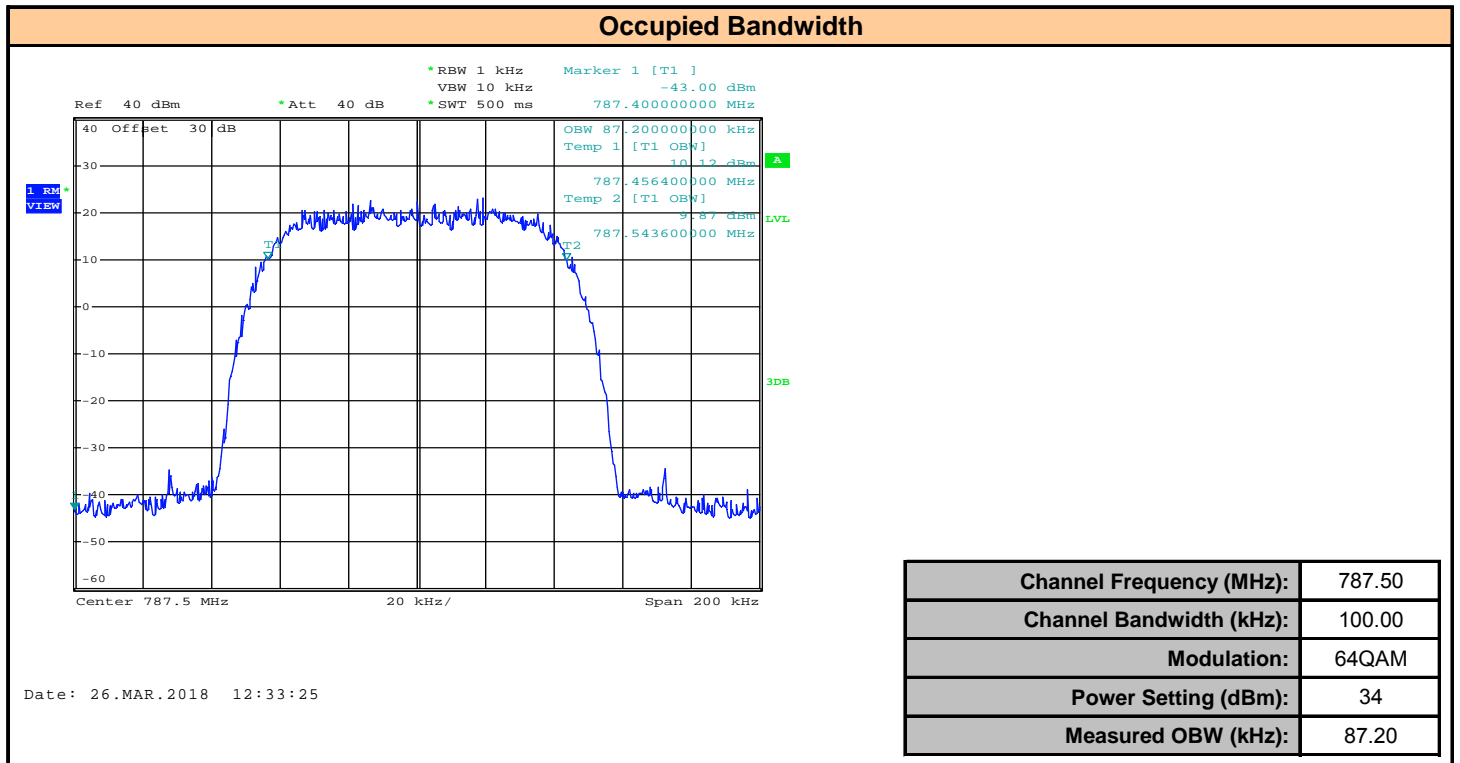
**Plot 8.4 – Occupied Bandwidth 787.5MHz, 100kHz BW, QPSK**



**Plot 8.5 – Occupied Bandwidth 787.5MHz, 100kHz BW, 16QAM**



**Plot 8.6 – Occupied Bandwidth 787.5MHz, 100kHz BW, 64QAM**



**Table 8.1 – Summary of Occupied Bandwidth Measurements**

<b>§2.1049 Occupied Bandwidth</b>						
<b>Frequency (MHz)</b>	<b>Bandwidth Setting (kHz)</b>	<b>Modulation</b>	<b>Measured OBW [OBW] (kHz)</b>	<b>Authorized BW [ABW] (kHz)</b>	<b>Margin (kHz)</b>	<b>Emission Designator</b>
757.5	100	QPSK	88.00	100	<b>12.00</b>	88K0G1D
		16 QAM	87.60		<b>12.40</b>	87K6D1D
		64 QAM	87.60		<b>12.40</b>	87K6D1D
787.5		QPSK	88.00		<b>12.00</b>	88K0G1D
		16 QAM	88.00		<b>12.00</b>	88K0D1D
		64 QAM	87.20		<b>12.80</b>	87K2D1D
Margin = ABW - OBW						
					<b>Result:</b>	<b>Complies</b>

**9.0 BAND EDGE COMPLIANCE**

**Test Procedure**

**Normative Reference** FCC 47 CFR §2.1046, §27.53(c), KDB 971168 D02

**Limits**

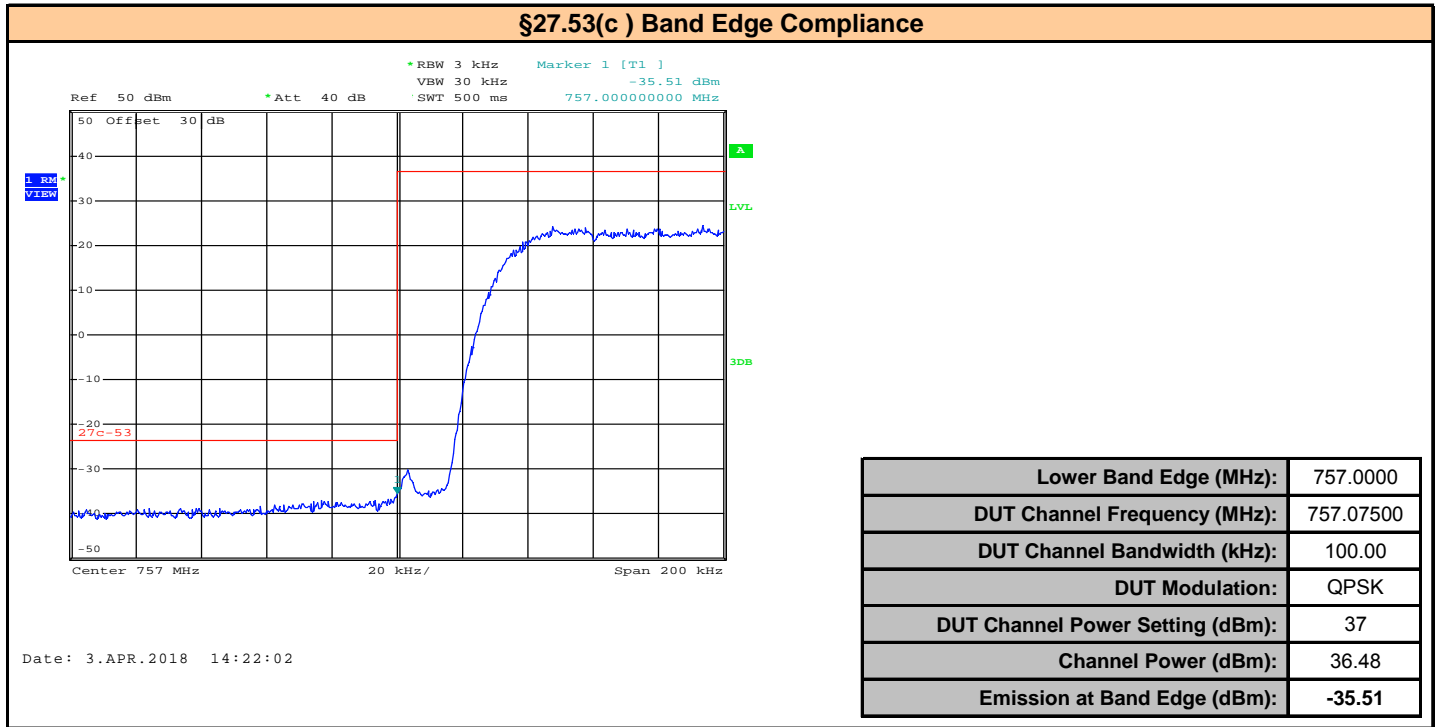
47 CFR §27.53	<p><b>§ 27.53(c) Emission Limits</b></p> <p>(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:</p> <p>(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;</p> <p>(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;</p> <p>(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;</p> <p>(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;</p> <p>(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.</p>
KDB 971168 D02	In general, scaling of RBW is appropriate only when the signal is noise-like and is relatively flat across the spectrum under measurement.

**Test Setup** Appendix A Figure A.1

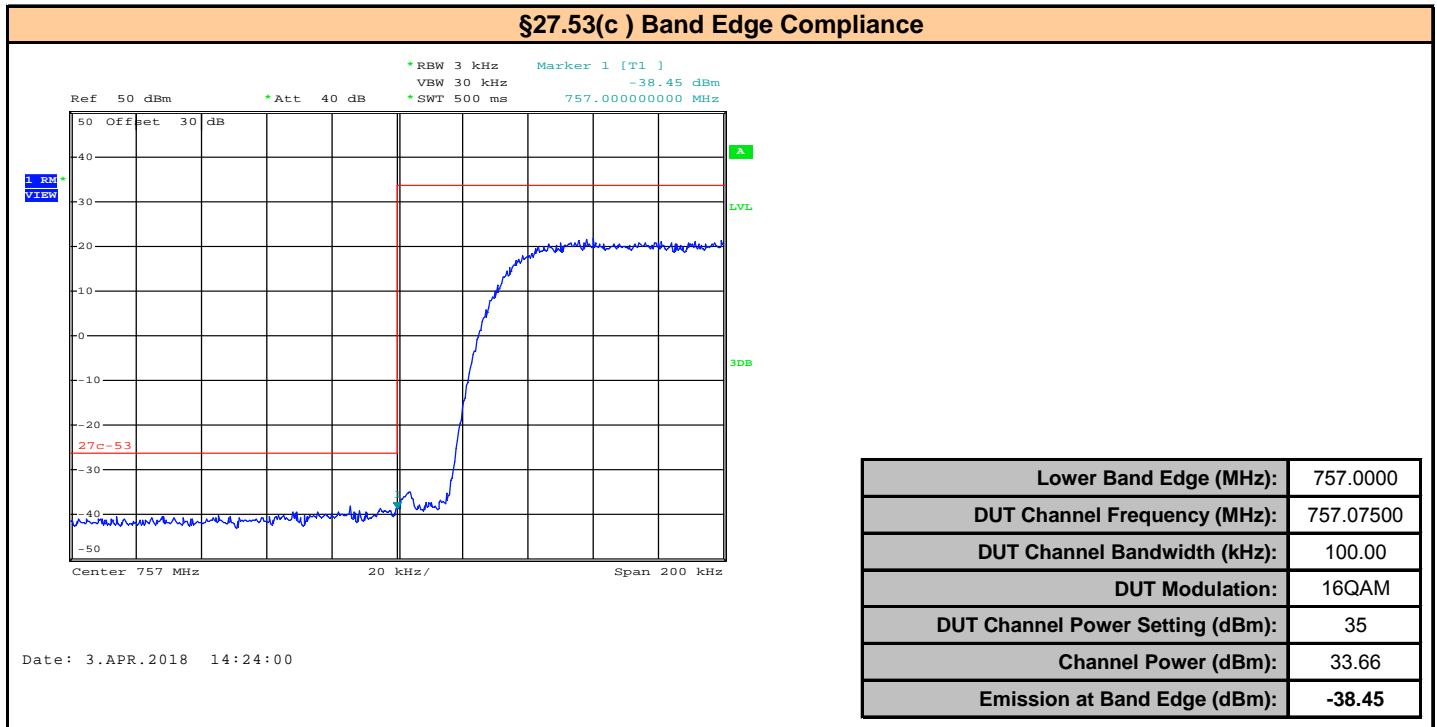
**Measurement Procedure**

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA Detector was set to RMS with the RBW set to 3kHz. RBW Scaling was used per KDB 971168 D02. The output power of the DUT was set to the manufacturer's highest rated setting for each modulation type. The DUT frequency was set to the lowest and highest channel setting in each channel Group. All modulations (QPSK, 16 QAM, and 64 QAM) were investigated. An emission mask of the above limits was used to determine compliance.

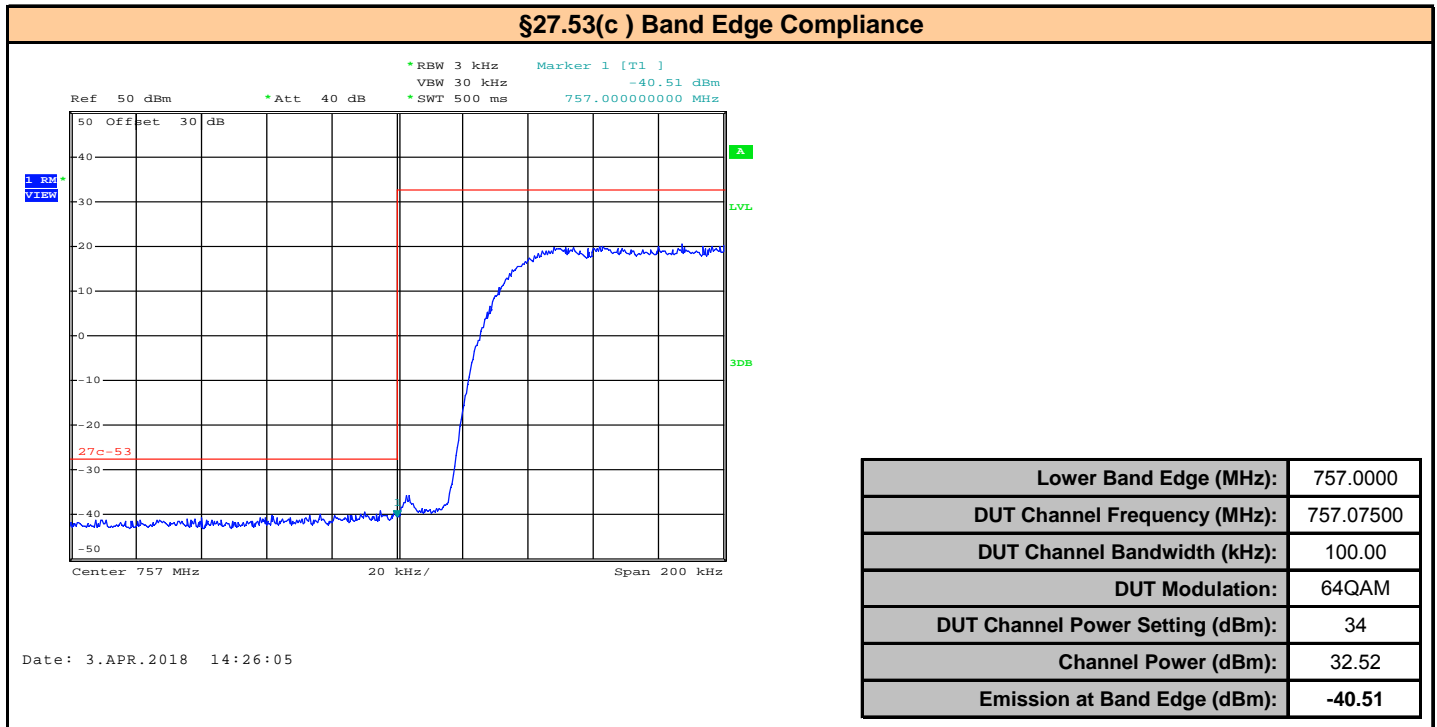
**Plot 9.1 – Lower Band Edge, 757MHz, 100kHz BW, QPSK**



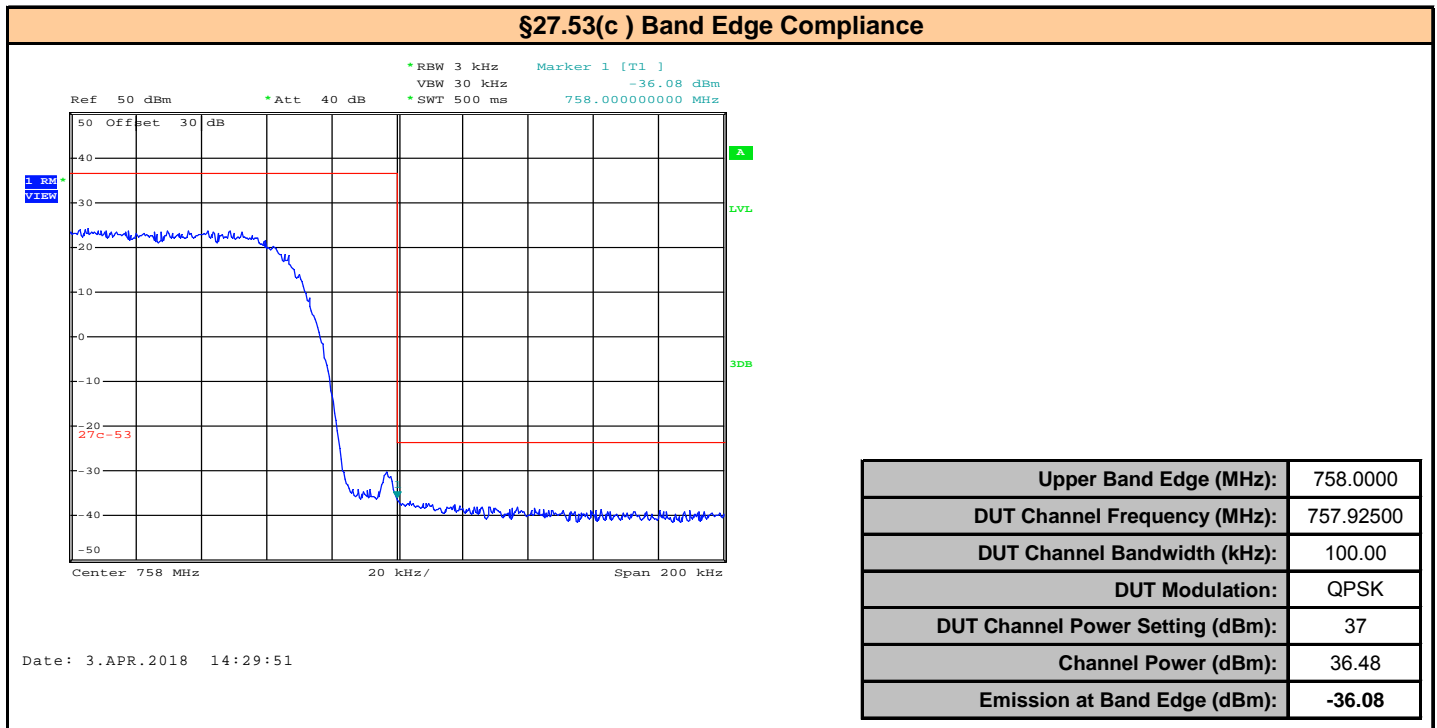
**Plot 9.2 – Lower Band Edge, 757MHz, 100kHz BW, 16Q**



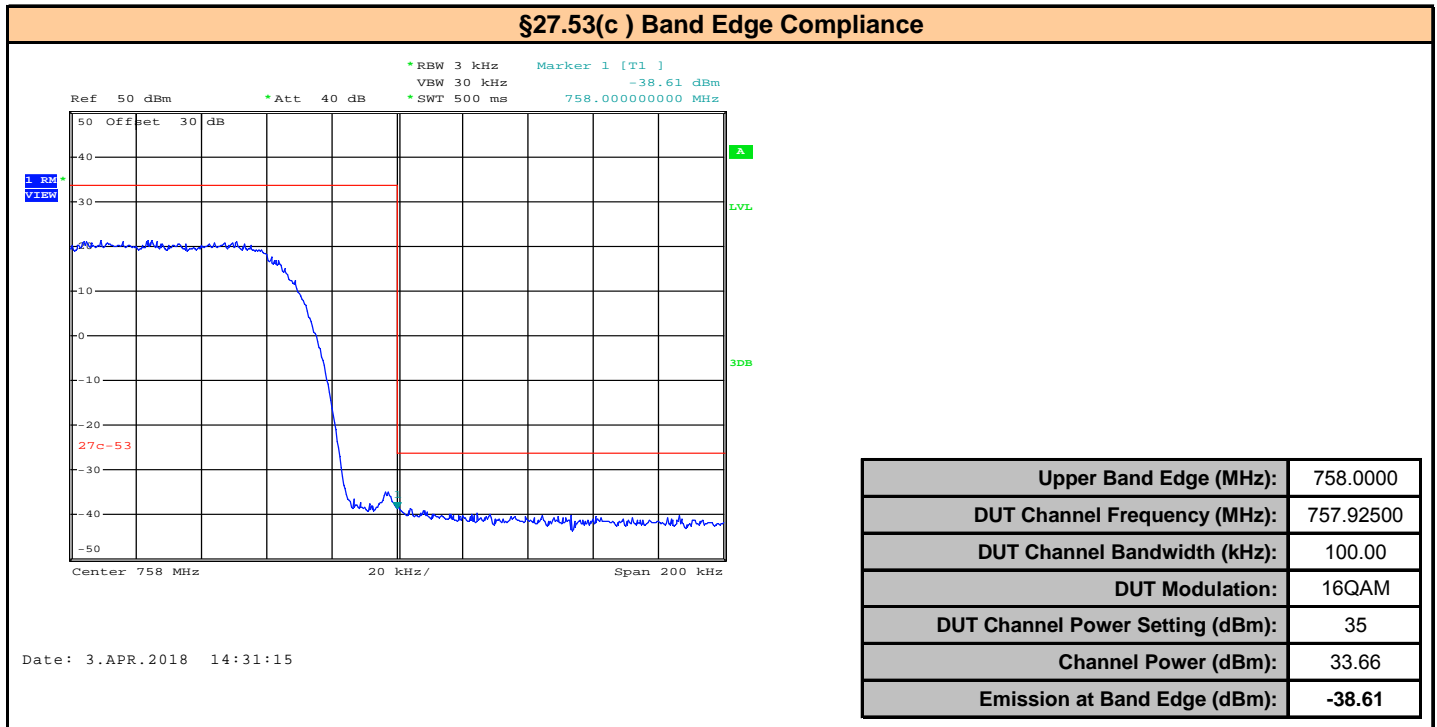
**Plot 9.3 – Lower Band Edge, 757MHz, 100kHz BW, 64QAM**



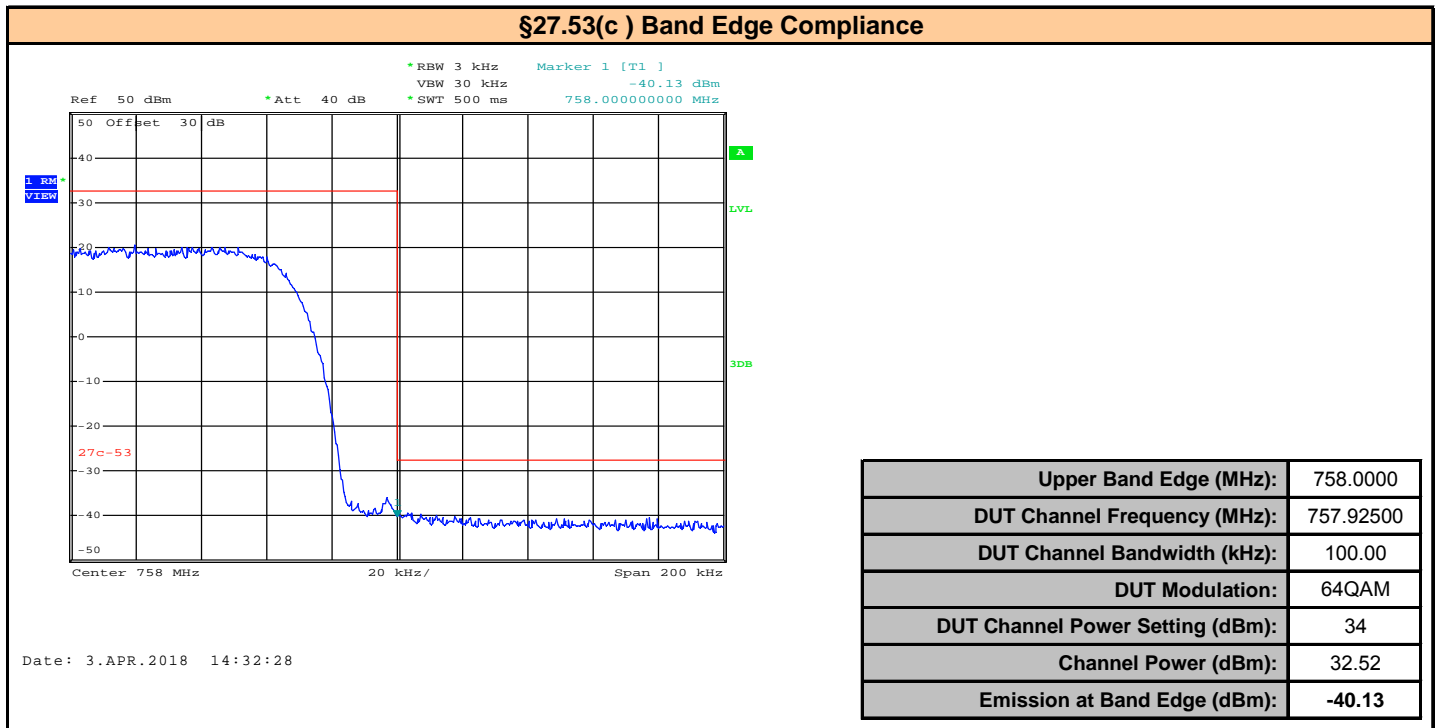
**Plot 9.4 – Upper Band Edge, 758MHz, 100kHz BW, QPSK**



**Plot 9.5 – Upper Band Edge, 758MHz, 100kHz BW, 16QAM**

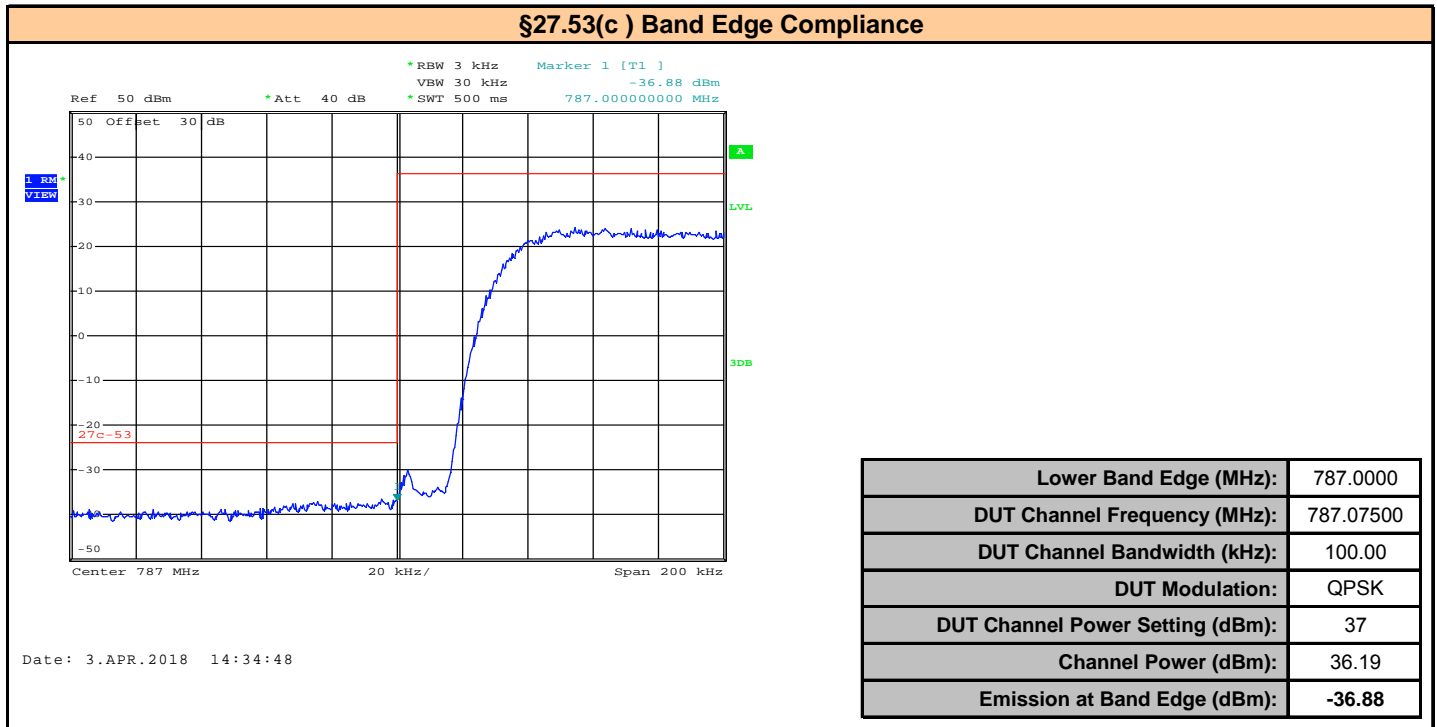


**Plot 9.6 – Upper Band Edge, 758MHz, 100kHz BW, 64QAM**

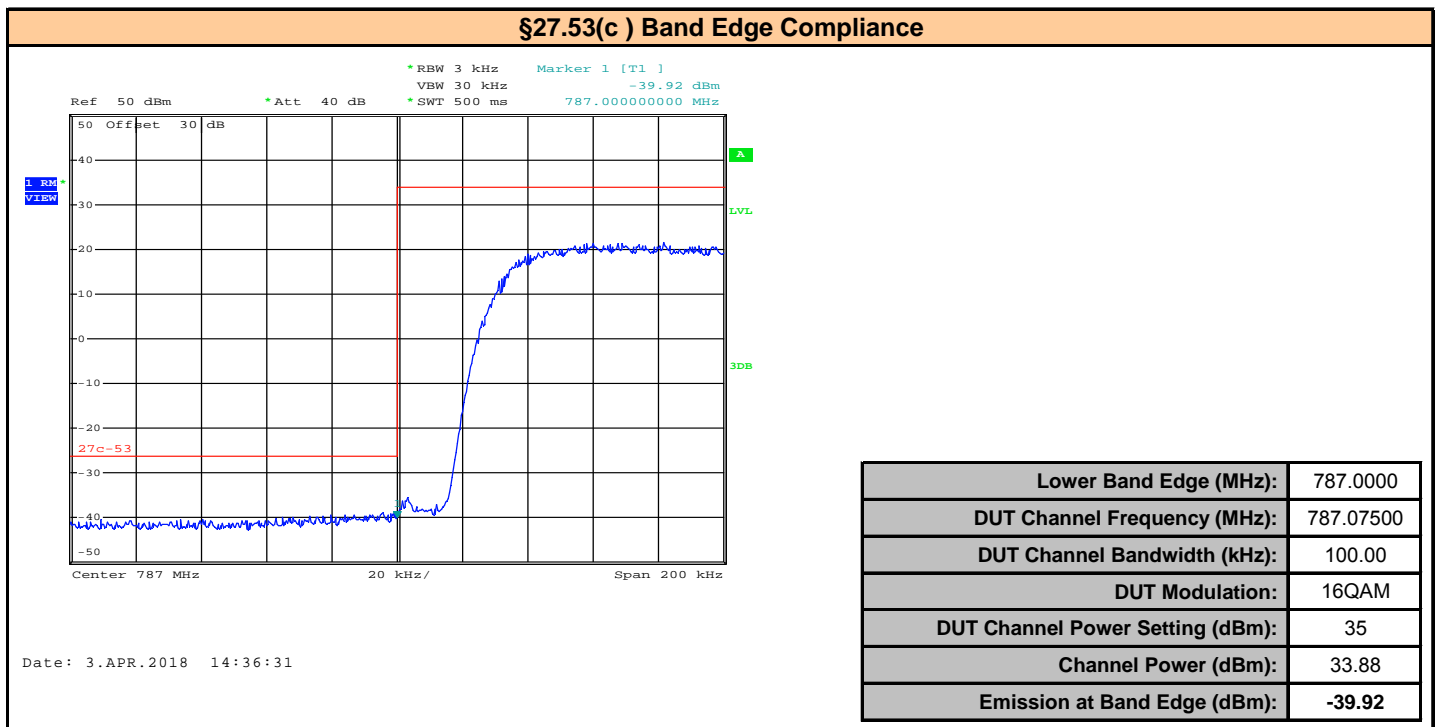




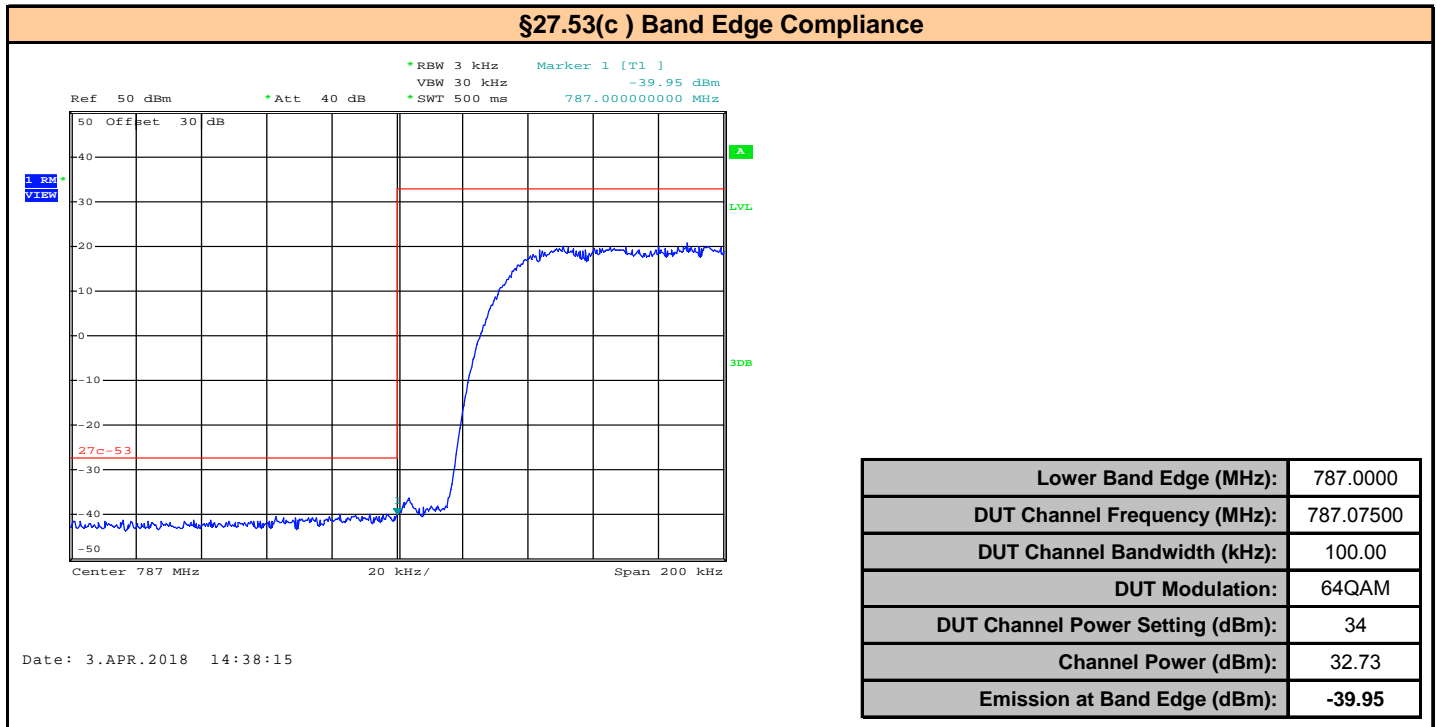
Plot 9.7 – Lower Band Edge, 787MHz, 100kHz BW, QPSK



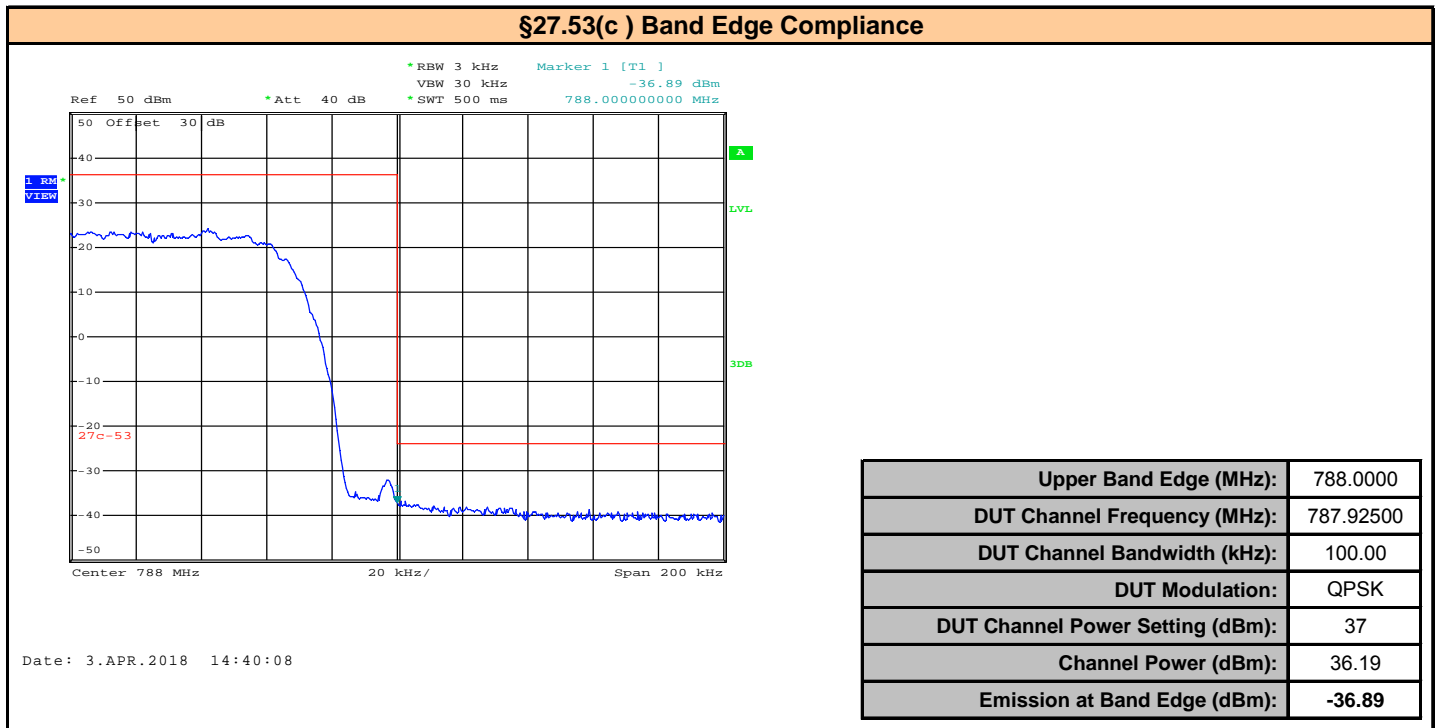
Plot 9.8 – Lower Band Edge, 787MHz, 100kHz BW, 16QAM



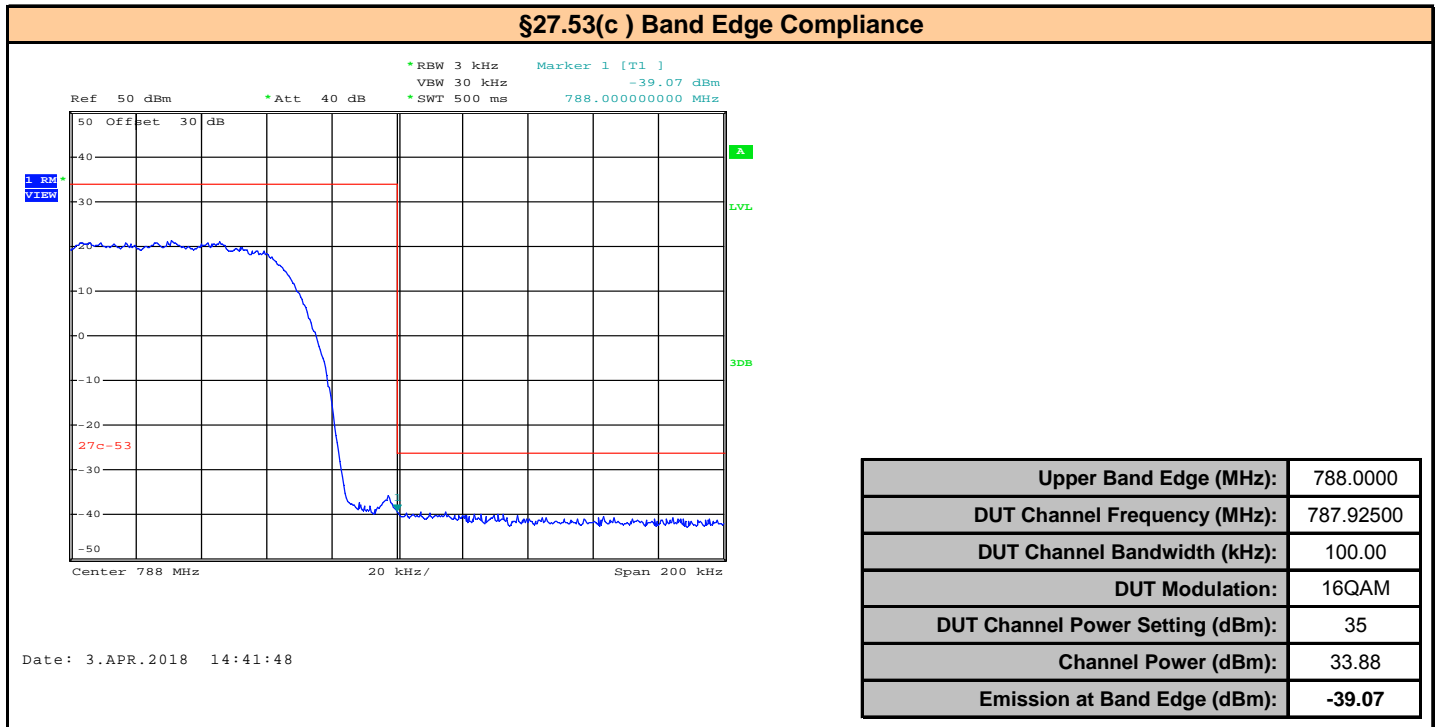
**Plot 9.9 – Lower Band Edge, 787MHz, 100kHz BW, 64QAM**



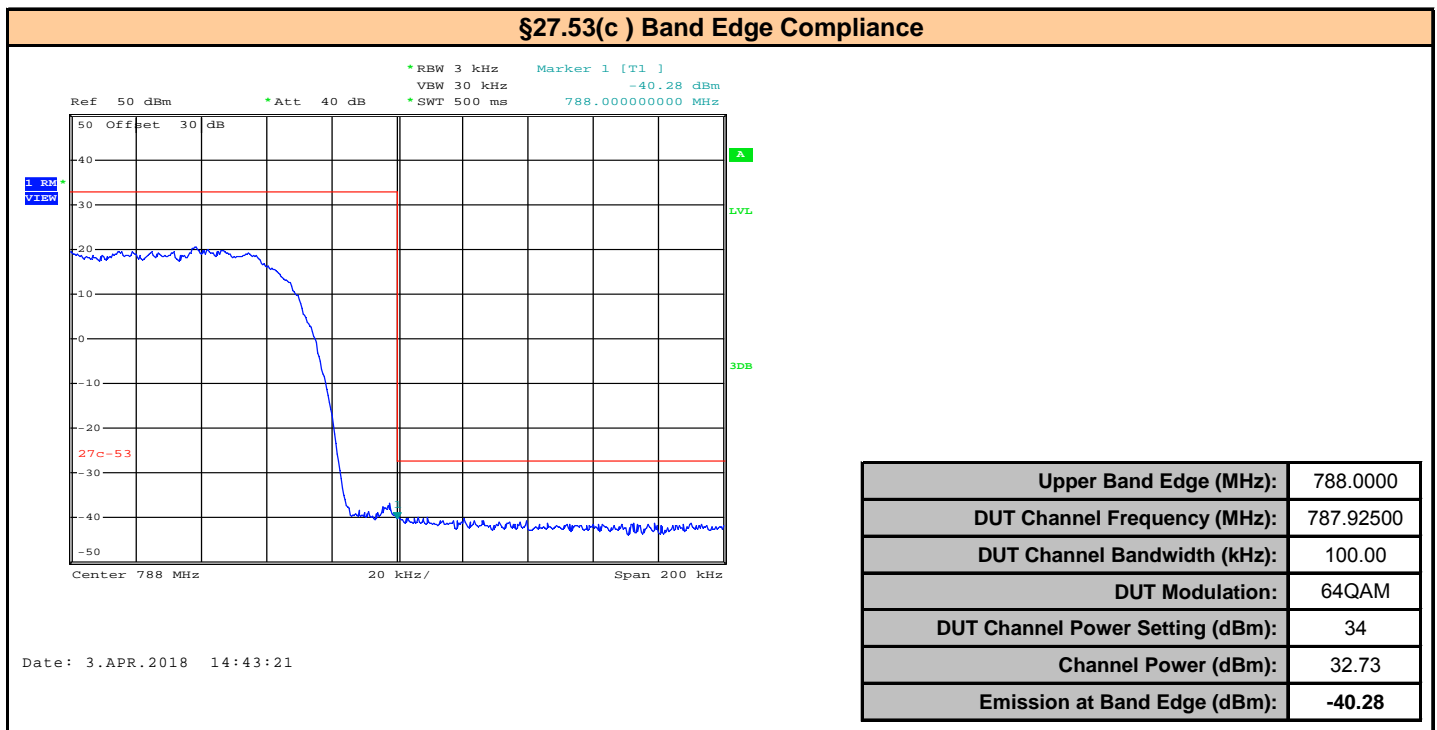
**Plot 9.10 – Upper Band Edge, 788MHz, 100kHz BW, QPSK**



**Plot 9.11 – Upper Band Edge, 788MHz, 100kHz BW, 16QAM**



**Plot 9.12 – Upper Band Edge, 788MHz, 100kHz BW, 64QAM**



**Table 9.1 – Summary of Band Edge Emissions**

<b>§27.53(c) Band Edge Results</b>									
Band Edge (MHz)	DUT Frequency (MHz)	Bandwidth Setting (kHz)	Modulation	Tx Power Setting (dBm)	Channel Power [P <sub>chan</sub> ] (dBm)	Band-Edge Emission @ 3kHz RBW [P <sub>BE</sub> ] (dBm)	Attenuation [A] (dBc)	Limit (dBm)	Margin (dB)
757.000	757.075	100	QPSK	37	36.48	-35.51	71.99	59.48	12.51
			16QAM	35	33.66	-38.45	72.11	56.66	15.45
			64QAM	34	32.52	-40.51	73.03	55.52	17.51
758.000	757.925		QPSK	37	36.48	-36.08	72.56	59.48	13.08
			16QAM	35	33.66	-38.61	72.27	56.66	15.61
			64QAM	34	32.52	-40.13	72.65	55.52	17.13
787.000	787.025		QPSK	37	36.19	-36.88	73.07	59.19	13.88
			16QAM	35	33.88	-39.92	73.80	56.88	16.92
			64QAM	34	32.73	-39.95	72.68	55.73	16.95
788.000	787.925		QPSK	37	36.19	-36.89	73.08	59.19	13.89
		16QAM	35	33.88	-39.07	72.95	56.88	16.07	
		64QAM	34	32.73	-40.28	73.01	55.73	17.28	

Attenuation [A] = [P<sub>chan</sub>] - [P<sub>BE</sub>]  
 For 3kHz Instrument RBW, Limit = 43 + 10Log(P) + 10Log(30kHz/3kHz) = 53 + 10Log(P)  
 Margin = Attenuation [A] - Limit

<b>Result:</b>	<b>Complies</b>
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**10.0 CONDUCTED SPURIOUS EMISSIONS – ANTENNA PORT**

**Test Procedure**

<b>Normative Reference</b>	<b>FCC 47 CFR §2.1046, §27.53(c )</b>
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**Limits**

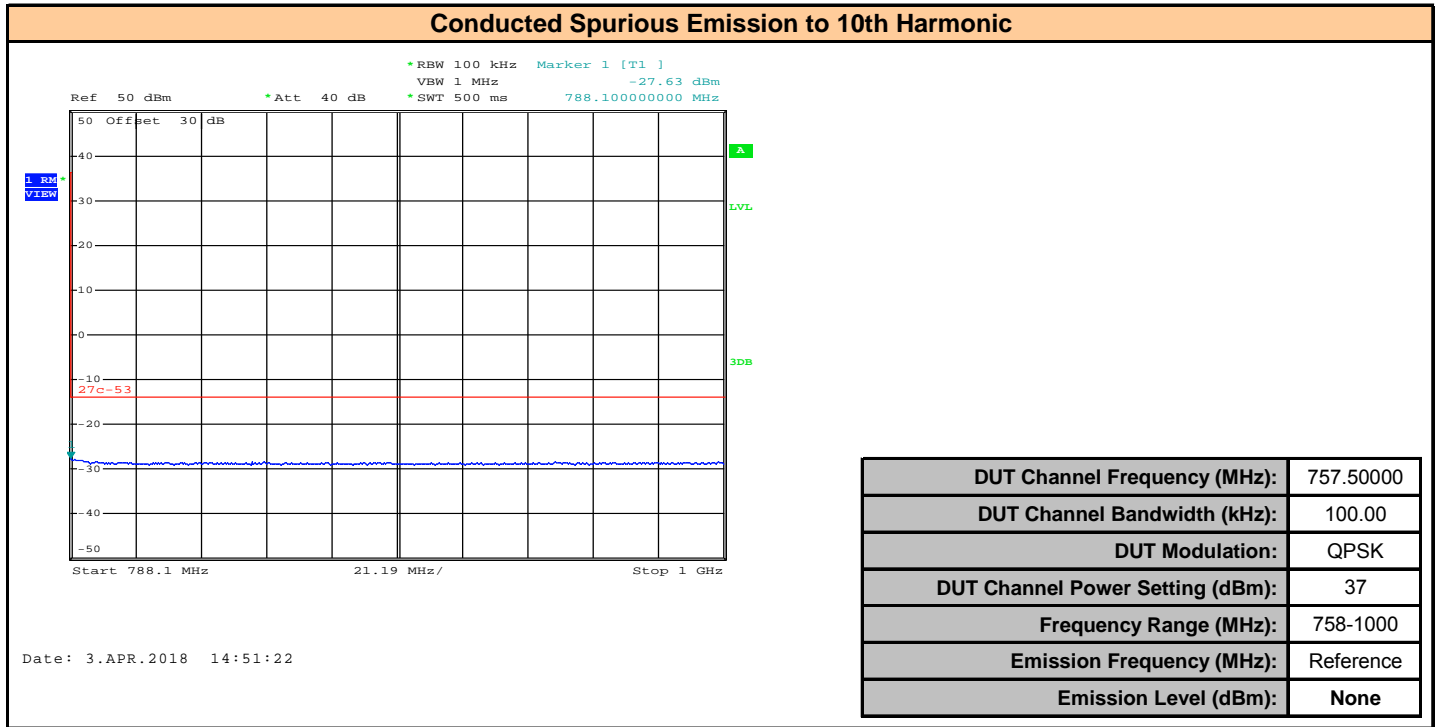
47 CFR §27.53	<p><b>§ 27.53(c ) Emission Limits</b></p> <p>(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:</p> <p>(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;</p> <p>(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;</p> <p>(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;</p>
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<b>Test Setup</b>	<b>Appendix A</b>	<b>Figure A.1</b>
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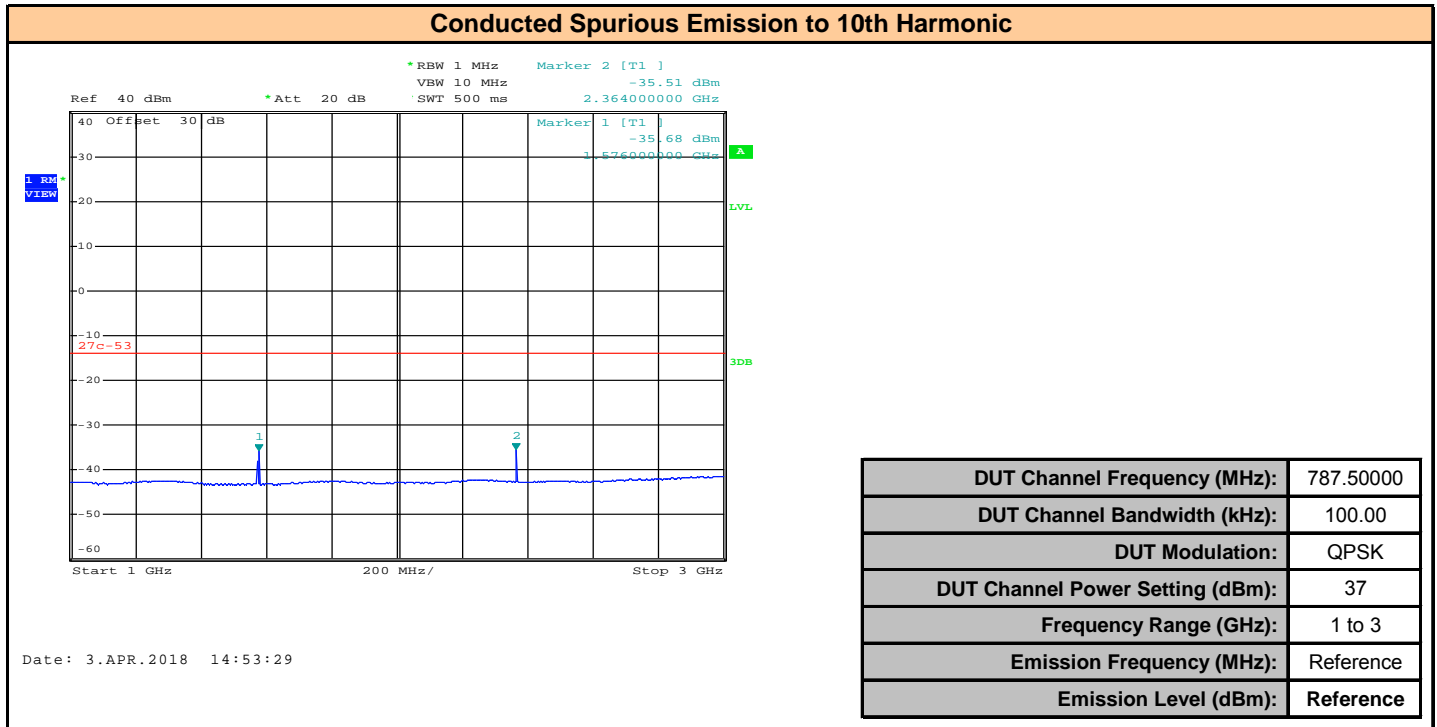
**Measurement Procedure**

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA Detector was set to RMS with the RBW set to 100kHz for frequencies below 1GHz and 1MHz for frequencies above 1GHz. The output power of the DUT was set to the manufacturer's highest rated power setting. The spectrum was evaluated to the 10th harmonic.

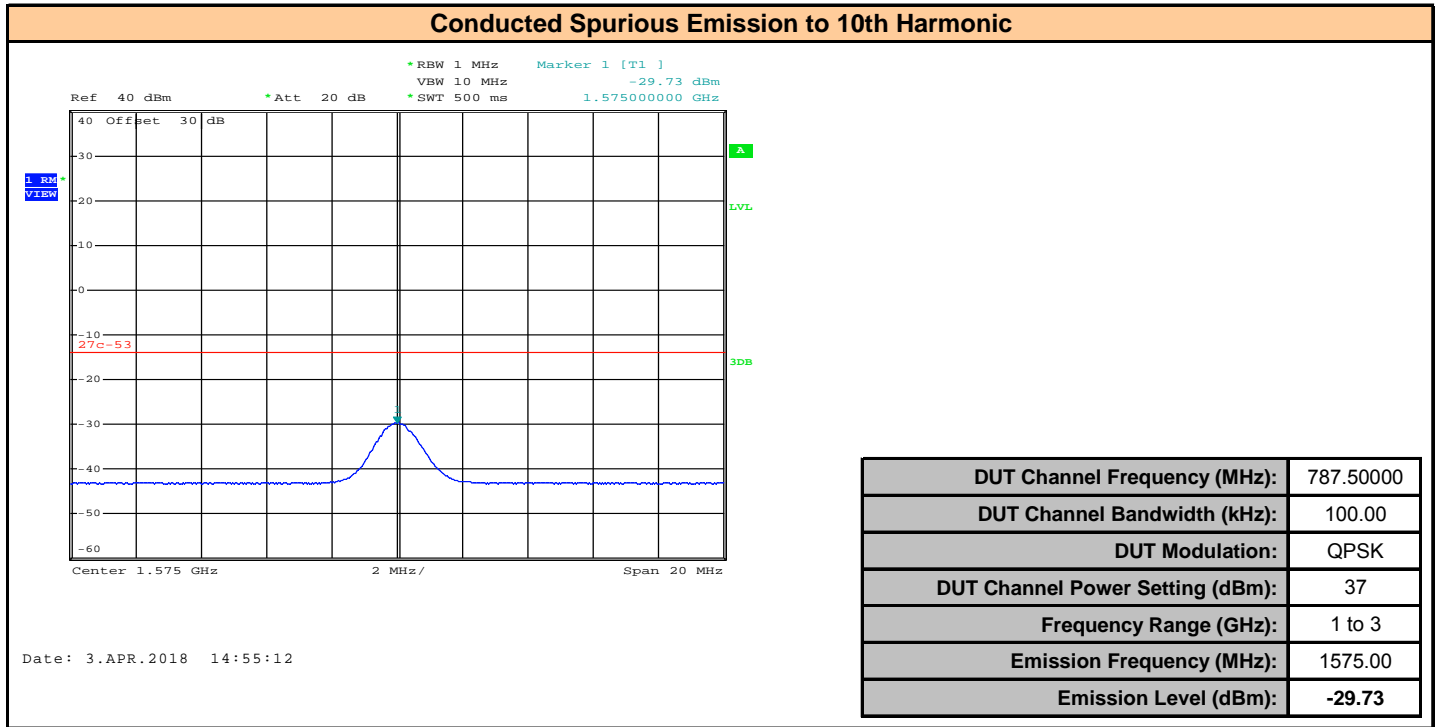
**Plot 10.1 – Conducted Spurious Emissions, 758 - 1000MHz, 100kHz BW, QPSK**



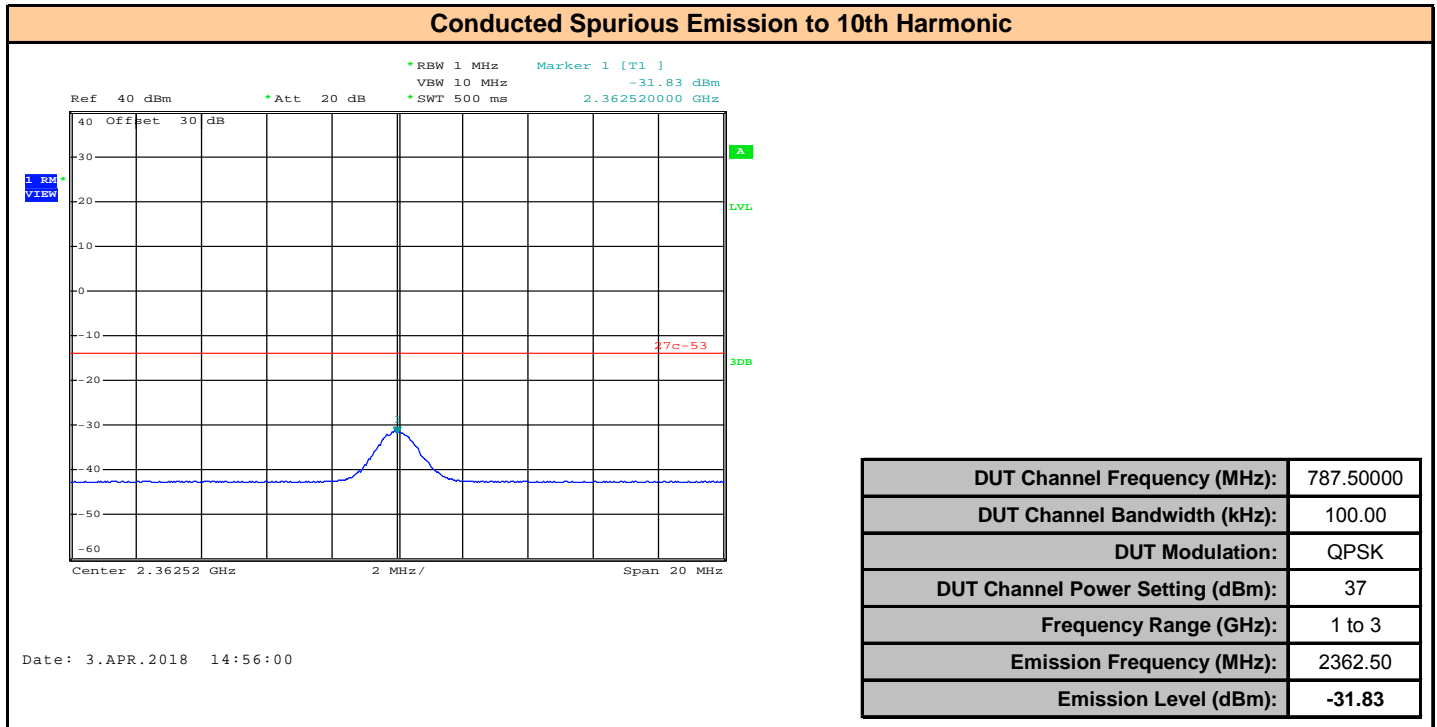
**Plot 10.2 – Conducted Spurious Emissions, 1 – 3 GHz, 100kHz BW, QPSK**



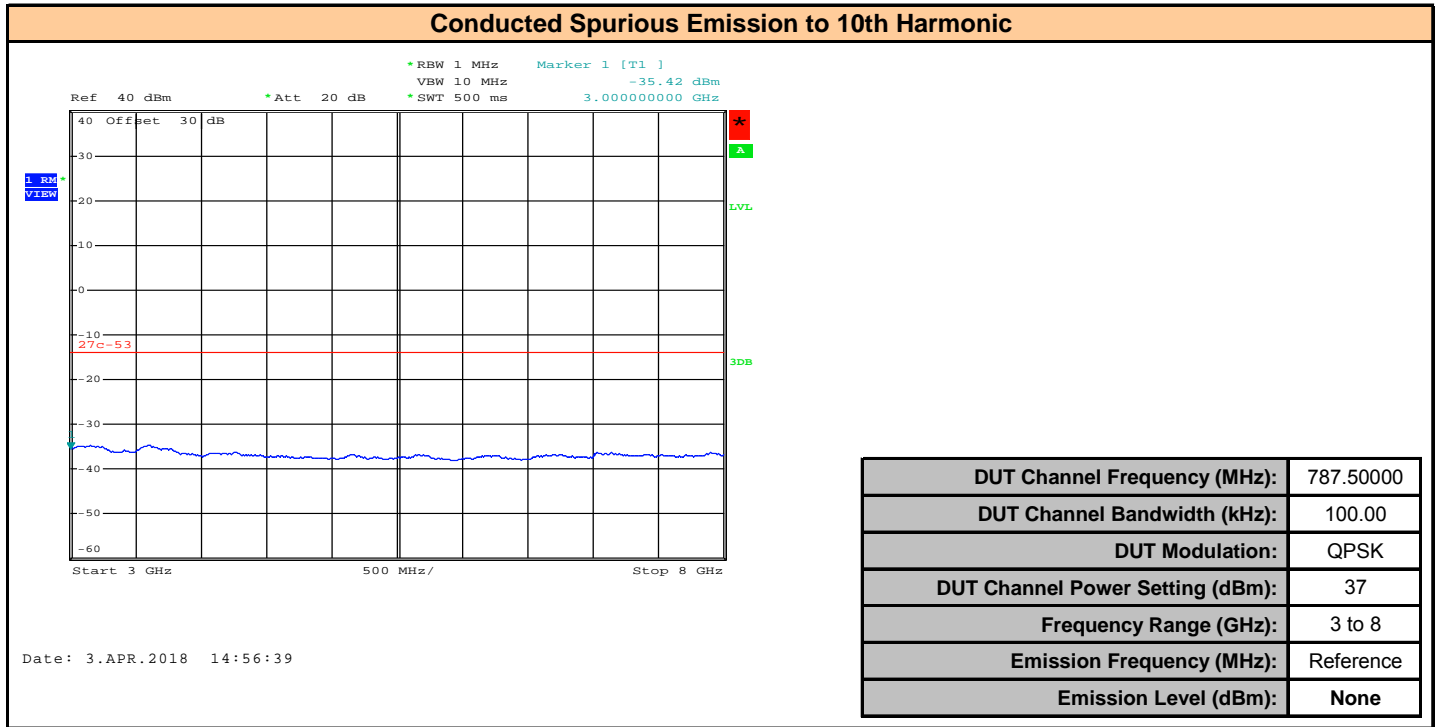
**Plot 10.3 – Conducted Spurious Emissions, 1 – 3 GHz, 100kHz BW, QPSK**



**Plot 10.4 – Conducted Spurious Emissions, 1 – 3 GHz, 100kHz BW, QPSK**



**Plot 10.5 – Conducted Spurious Emissions, 3 – 8 GHz, 100kHz BW, QPSK**



**Table 10.1 – Summary of Conducted Spurious Emissions**

Conducted Spurious Emissions Summary									
DUT Freq (MHz)	BW (kHz)	Modulation	Power Setting (dBm)	Measured Power [E <sub>Meas</sub> ] (dBm)	Emission Frequency (MHz)	Measured Emission [E <sub>EM</sub> ] (dBm)	Attenuation [A] (dBc)	Limit (dBm)	Margin (dB)
787.5	100	QPSK	37	36.19	1575	-29.73	65.92	50.0	15.9
					2362.5	-31.83	68.02		18.0
<b>Results:</b>								<b>Complies</b>	

Attenuation [A] = E<sub>Meas</sub> - E<sub>EM</sub>

Margin = [A] - Limit

No other spurious emissions were observed.



**11.0 CONDUCTED EMISSIONS 763-775MHZ, 793-805MHZ**

**Test Procedure**

<b>Normative Reference</b>	<b>FCC 47 CFR §2.1046, §27.53(c )</b>
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**Limits**

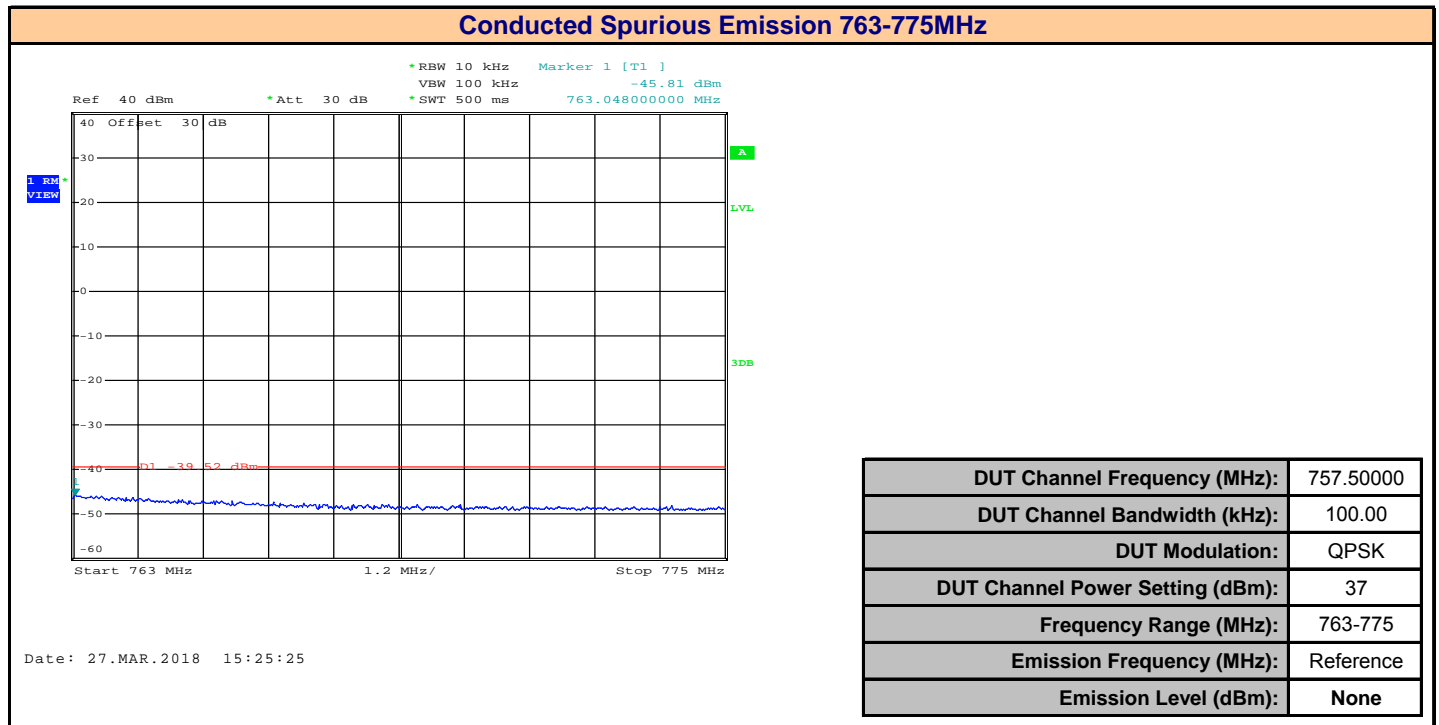
47 CFR §27.53	<p><b>§ 27.53(c ) Emission Limits</b></p> <p>(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:</p> <p>(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least <math>43 + 10 \log (P)</math> dB;</p> <p>(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least <math>43 + 10 \log (P)</math> dB;</p> <p>(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than <math>76 + 10 \log (P)</math> dB in a 6.25 kHz band segment, for base and fixed stations;</p> <p>(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.</p>
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<b>Test Setup</b>	<b>Appendix A</b>	<b>Figure A.1</b>
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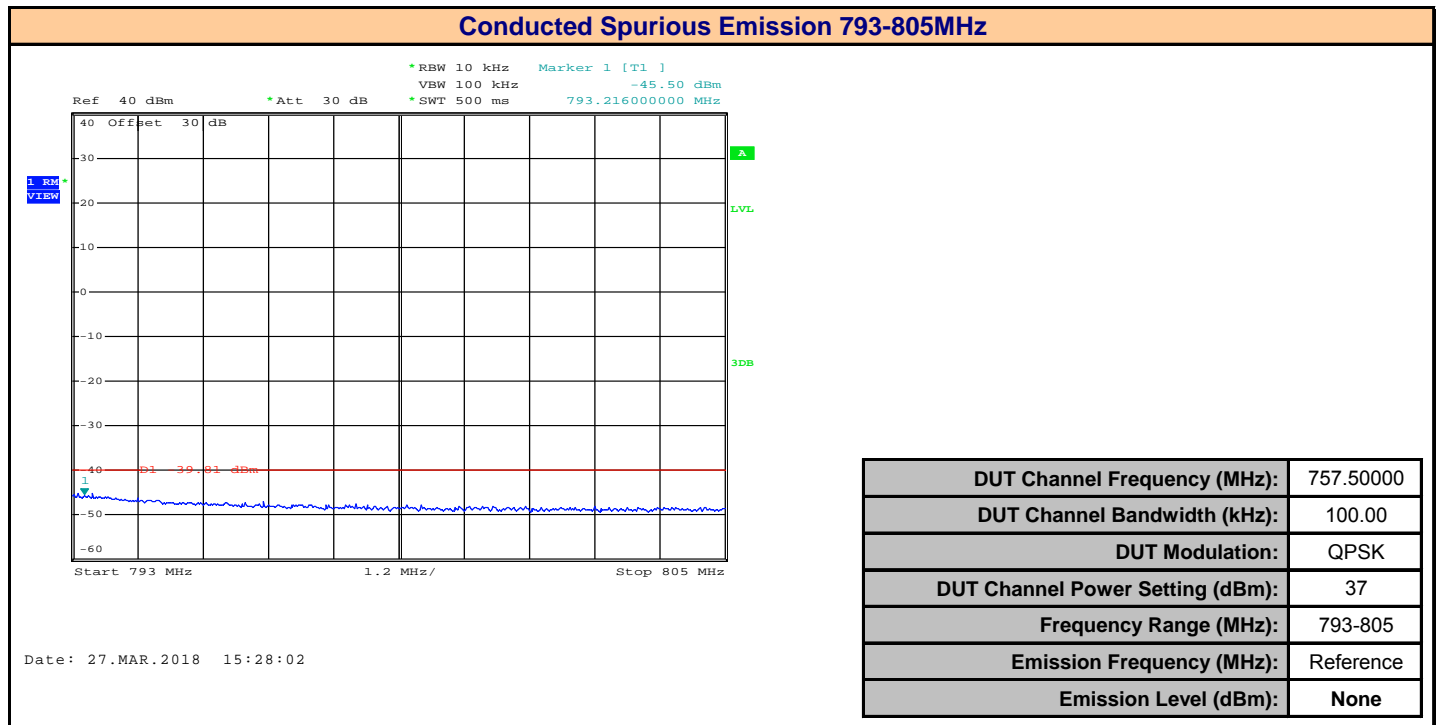
**Measurement Procedure**

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA Detector was set to RMS with the RBW set to 10kHz. The output power of the DUT was set to the manufacturer's highest rated setting.

**Plot 11.1 – Conducted Emissions 763-775MHz, 100kHz BW, QPSK**



**Plot 11.2 – Conducted Emissions 793-805MHz, 100kHz BW, QPSK**



**Table 11.1 – Summary of Conducted Emissions, 763-775MHz, 793-805MHz**

<b>Conducted Spurious Emissions Summary</b>									
DUT Freq (MHz)	BW (kHz)	Modulation	Power Setting (dBm)	Measured Power [E <sub>Meas</sub> ] (dBm)	Emission Frequency (MHz)	Measured Emission [E <sub>EM</sub> ] (dBm)	Attenuation [A] (dB)	Limit (dBm)	Margin (dB)
757.5	100	QPSK	37	36.48	n/a	n/a	n/a	46.0	n/a
787.5				36.19	n/a	n/a	n/a		n/a
<b>Results:</b>								<b>Complies</b>	

Attenuation [A] = E<sub>Meas</sub> - E<sub>EM</sub>

Margin = [A] - Limit

No spurious emissions were observed.

**12.0 COMPLIANCE TO §27.53(F)**

**Test Procedure**

<b>Normative Reference</b>	<b>FCC 47 CFR §2.1046, §27.53(f)</b>
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**Limits**

47 CFR §27.53	<p><b>§ 27.53(f) Emission Limits</b></p> <p>(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.</p>
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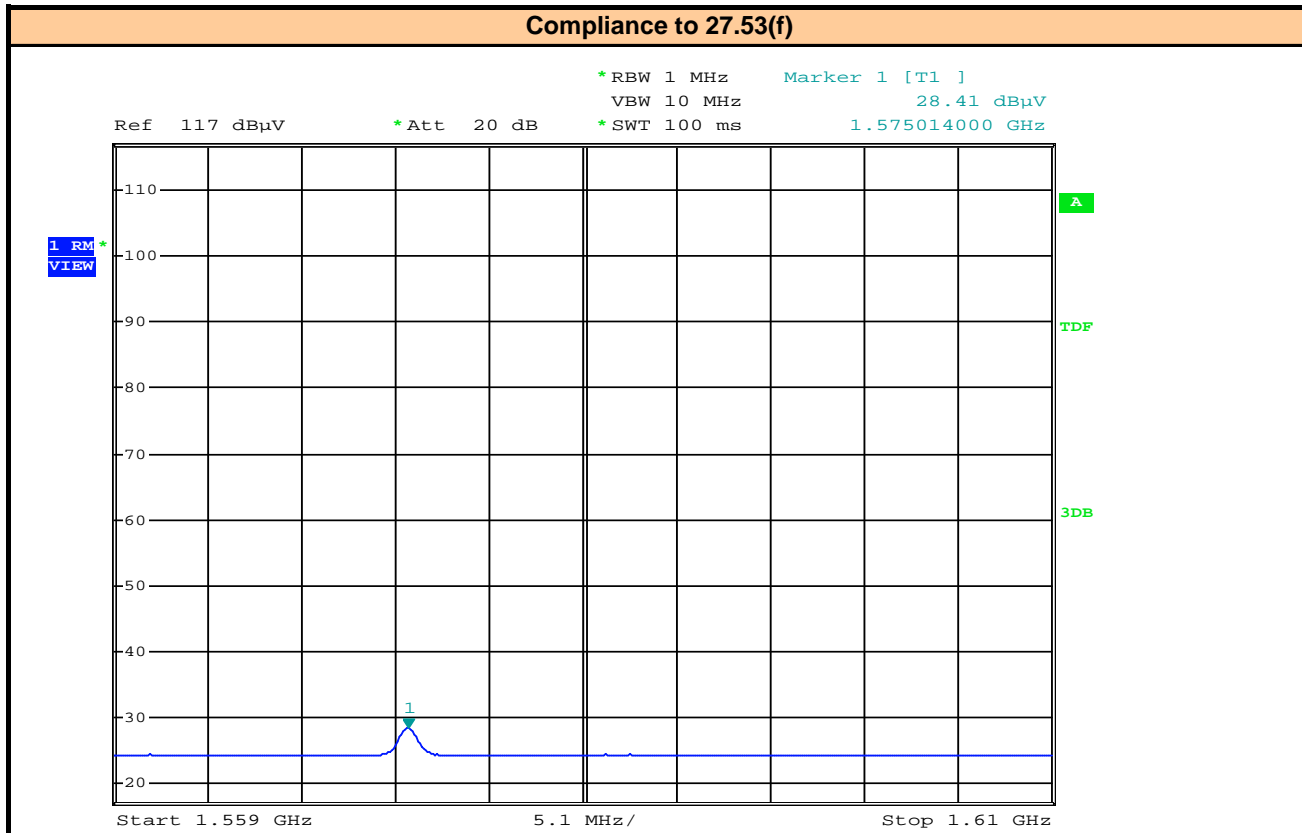
**Test Setup**

<b>Appendix A</b>	<b>Figure A.2</b>
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**Measurement Procedure**

The DUT was connected to a ZDA Communications US LLC M/N ZDAFP750-10-60D antenna. The output power of the DUT was set to the manufacturer's highest rated setting. The spectrum between 1559 to 1610 MHz was evaluated with the transmit antenna in the horizontal polarization and the receive antenna in the horizontal and vertical polarizations.

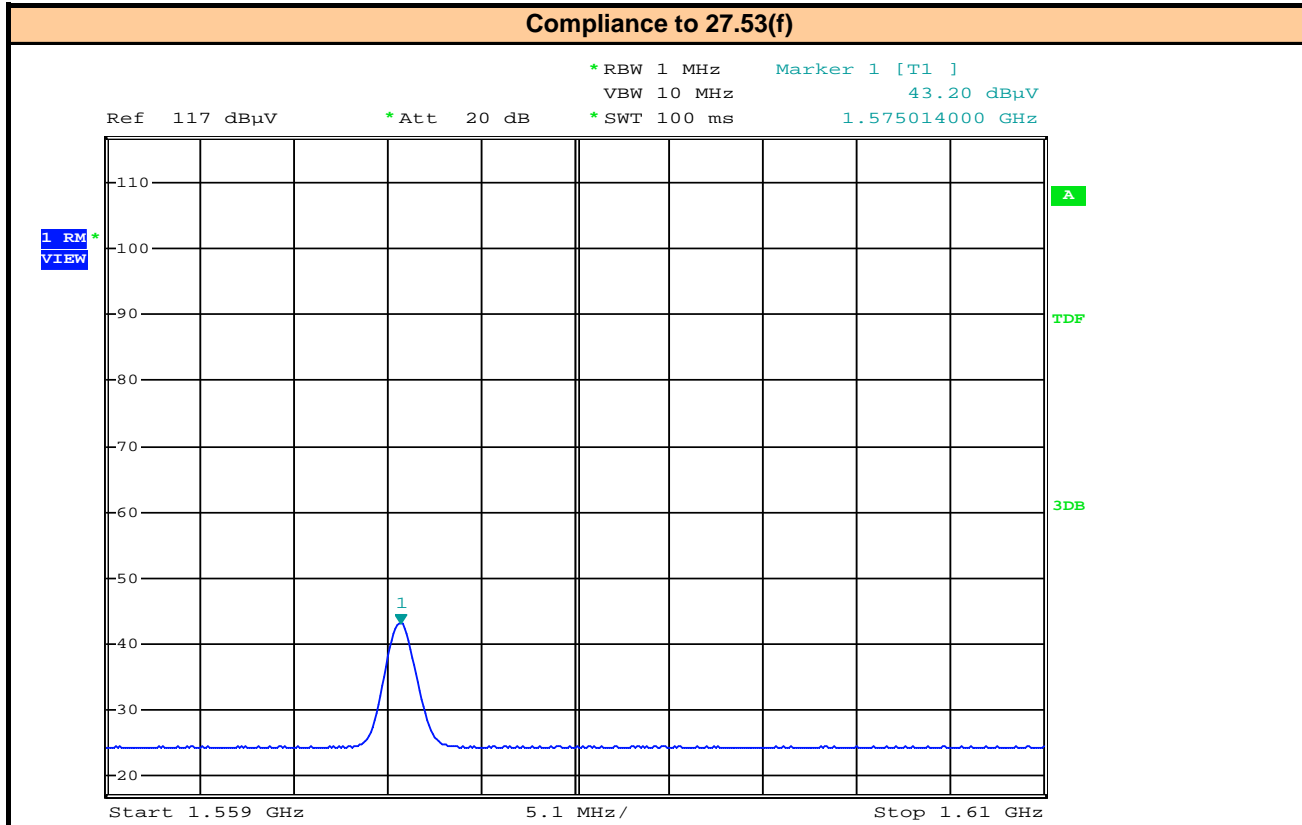
**Plot 12.1 – Spurious Emissions 1559 – 1610MHz, 100kHz BW, QPSK, Horizontal**



Date: 28.MAR.2018 15:02:27

<b>Transmit Frequency:</b>	<b>787.5MHz</b>
<b>Modulation:</b>	<b>QPSK</b>
<b>Transmit Antenna:</b>	<b>ZDAFP750-10-60D</b>
<b>Transmit Antenna Polarization:</b>	<b>Horizontal</b>
<b>Receive Antenna Polarization:</b>	<b>Horizontal</b>
<b>Emission Frequency (MHz):</b>	<b>1575</b>
<b>Emission Level (dBuV):</b>	<b>28.41</b>

**Plot 12.2 – Spurious Emissions 1559 – 1610MHz, 100kHz BW, QPSK, Vertical**



Date: 28.MAR.2018 15:16:19

<b>Transmit Frequency:</b>	<b>787.5MHz</b>
<b>Modulation:</b>	<b>QPSK</b>
<b>Transmit Antenna:</b>	<b>ZDAFP750-10-60D</b>
<b>Transmit Antenna Polarization:</b>	<b>Horizontal</b>
<b>Receive Antenna Polarization:</b>	<b>Vertical</b>
<b>Emission Frequency (MHz):</b>	<b>1575</b>
<b>Emission Level (dBuV):</b>	<b>43.2</b>

**Table 12.1 – Summary of Conducted Emissions, 1559 – 1610MHz**

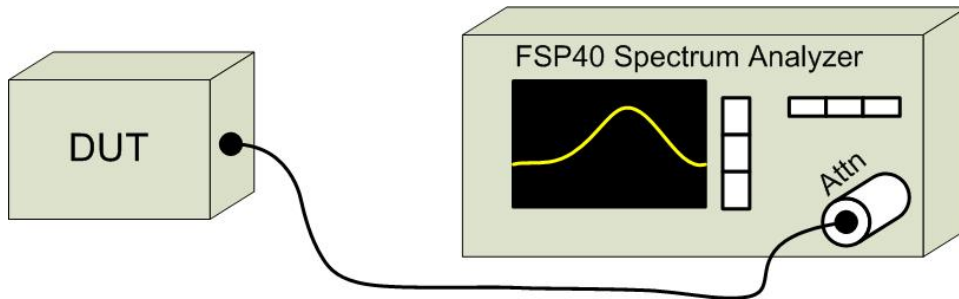
§27.53(f) Emissions within 1559 to 1610MHz Band													
Freq (MHz)	DUT Freq (MHz)	DUT Modulation	Transmit Antenna	Transmit Antenna Polarization	Receive Antenna Polarization	Measured Emission [E <sub>Meas</sub> ] (dBuV)	Measured Distance [D] (m)	Receive** Antenna Factor [AF] (dB)	Cable Loss [L <sub>c</sub> ] (dB)	Transmit Antenna Gain [G <sub>T</sub> ] (dBi)	EIRP (dBW/MHz)	Limit (dBW/MHz)	Margin (dB)
1575	787.5	QPSK	ZDAFP750-10-60D	Vertical	Vertical	43.2	3.0	25.5	4.1	10.0	-72.00	-70.00	2.00
		QPSK			Horizontal	28.4	3.0	25.5	4.1	10.0	-86.79	-70.00	16.79
** Calibrated at 3m $E(\text{dBuV/m}) = E_{\text{Meas}} + L_c + AF - G_T$ $\text{EIRP}(\text{dBm}) = E(\text{dBuV/m}) + 20\text{Log}(D)^{***} - 104.8$ $\text{EIRP}(\text{dBW}) = \text{EIRP}(\text{dBm}) - 30$ *** This term = 0, receive antenna calibrated at 3m													
<b>Result:</b>												<b>Complies</b>	

**APPENDIX A – TEST SETUP DRAWINGS AND CONDITIONS**

**Table A.1 – Conducted Measurement Setup and Environmental**

Environmental Conditions (Typical)			
<b>Temperature</b>	25°C		
<b>Humidity</b>	<60%		
<b>Barometric Pressure</b>	101 +/- 3kPa		
Equipment List			
Asset Number	Manufacturer	Model Number	Description
00241	R&S	FSU40	Spectrum Analyzer

**Figure A.1 – Test Setup – Conducted Measurements**





**Table A.2 – Radiated Emissions Measurement Equipment and Environmental**

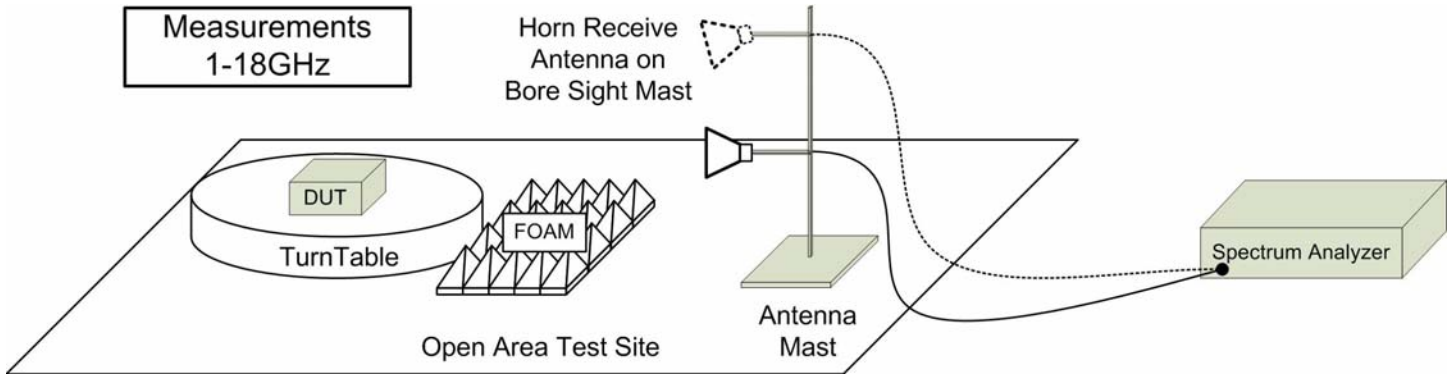
<b>Environmental Conditions (Typical)</b>	
<b>Temperature</b>	10°C
<b>Humidity</b>	<60%
<b>Barometric Pressure</b>	101 +/- 3kPa

<b>Equipment List</b>			
<b>Asset Number</b>	<b>Manufacturer</b>	<b>Model Number</b>	<b>Description</b>
00051	HP	8566B	Spectrum Analyzer
00049	HP	85650A	Quasi-peak Adapter
00047	HP	85685A	RF Preselector
00072	EMCO	2075	Mini-mast
00073	EMCO	2080	Turn Table
00071	EMCO	2090	Multi-Device Controller
00265	Miteq	JS32-00104000-58-5P	Microwave L/N Amplifier
00241	R&S	FSU40	Spectrum Analyzer
00050	Chase	CBL-6111A	Bilog Antenna
00275	Coaxis	LMR400	25m Cable
00276	Coaxis	LMR400	4m Cable
00278	TILE	34G3	TILE Test Software
00034	ETS	3115	Double Ridged Guide Horn

CNR: Calibration Not Required

COU: Calibrate On Use

**Figure A.3 – Test Setup Radiated Measurements Above 1GHz**



**APPENDIX B – EQUIPMENT LIST AND CALIBRATION**

<b>Equipment List</b>							
<b>(*)</b>	<b>Asset Number</b>	<b>Manufacturer</b>	<b>Model Number</b>	<b>Serial Number</b>	<b>Description</b>	<b>Last Calibrated</b>	<b>Calibration Interval</b>
*	00050	Chase	CBL-6111A	1607	Bilog Antenna	23 Jun 2017	Triennial
*	00034	ETS	3115	6267	Double Ridged Guide Horn	02 Dec 2015	Triennial
	00035	ETS	3115	6276	Double Ridged Guide Horn	02 Dec 2015	Triennial
*	00047	HP	85685A	2837A00826	RF Preselector	23 Jun 2017	Triennial
*	00049	HP	85650A	2043A00162	Quasi-peak Adapter	23 Jun 2017	Triennial
*	00051	HP	8566B	2747A05510	Spectrum Analyzer	23 Jun 2017	Triennial
	00223	HP	8901A	3749A07154	Modulation Analyzer	27 Dec 2017	Triennial
	00224	HP	8903B	3729A18691	Audio Analyzer	28 Dec 2017	Triennial
*	00241	R&S	FSU40	100500	Spectrum Analyzer	23 Apr 2015	Triennial
*	00005	HP	8648D	3847A00611	Signal Generator	21 Jun 2017	Triennial
	00006	R&S	SMR20	100104	Signal Generator	29 May 2017	Triennial
	00243	Rigol	DS1102E	DS1ET150502164	Oscilloscope	7 Nov 2017	Triennial
	00254	LeCroy	WM8600A	532	Oscilloscope	NCR	n/a
	00110	Gigatronics	8652A	1875801	Power Meter	29 Feb 2016	Triennial
	00237	Gigatronics	80334A	1837001	Power Sensor	23 Jun 2014	Triennial
	00232	ETS Lindgren	HI-6005	91440	Isotropic E-Field Probe	18 Dec 2017	Triennial
*	00003	HP	53181A	3736A05175	Frequency Counter	21 Jun 2017	Triennial
	00257	Com-Power	LI-215A	191934	LISN	5 Jan 2018	Triennial
	00041	AR	10W1000C	27887	Power Amplifier	NCR	n/a
	00106	AR	5SIG4	26235	Power Amplifier	NCR	n/a
	00280	AR	25A250AM6	22702	Power Amplifier	NCR	n/a
	00265	Miteq	JS32-00104000-58-5P	1939850	Microwave L/N Amplifier	COU	n/a
	00071	EMCO	2090	9912-1484	Multi-Device Controller	n/a	n/a
	00072	EMCO	2075	0001-2277	Mini-mast	n/a	n/a
	00073	EMCO	2080	0002-1002	Turn Table	n/a	n/a
*	00081	ESPEC	ECT-2	0510154-B	Environmental Chamber	CNR	n/a
	00234	VWR	61161-378	140320430	Temp/Humidity Meter	New	Triennial
	00236	Nokia	-	236	ESD Table	NCR	n/a
	00255	Expert ESD	A4001	A4001-155	ESD Target	COU	n/a
	00064	NARDA	3020A	n/a	Bi-Directional Coupler	COU	n/a
	00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a
*	00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable	COU	n/a
	00264	Koaxis	KP10-7.00M-TD	264	1m Armoured Cable	COU	n/a
*	00275	TMS	LMR400	n/a	25m Cable	COU	n/a
*	00276	TMS	LMR400	n/a	4m Cable	COU	n/a
	00277	TMS	LMR400	n/a	4m Cable	COU	n/a
*	00278	TILE	34G3	n/a	TILE Test Software	NCR	n/a
<b>Rented Equipment</b>							
	-						-

\* Used during the course of this investigation  
 CNR: Calibration Not Required  
 COU: Calibrate On Use

**APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY**

**CISPR 16-4 Measurement Uncertainty (  $U_{LAB}$  )**

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence interval using a coverage factor of  $k=2$

**30MHz - 200MHz**

$U_{LAB} = 5.14\text{dB}$      $U_{CISPR} = 6.3\text{dB}$

**200MHz - 1000MHz**

$U_{LAB} = 5.90\text{dB}$      $U_{CISPR} = 6.3\text{dB}$

**1GHz - 6GHz**

$U_{LAB} = 4.80\text{dB}$      $U_{CISPR} = 5.2\text{dB}$

**6GHz - 18GHz**

$U_{LAB} = 5.1\text{dB}$      $U_{CISPR} = 5.5\text{dB}$

If the calculated uncertainty  $U_{lab}$  is **less** than  $U_{CISPR}$  then:

- |   |   |
|---|---|
| 1 | Compliance is deemed to occur if <b>NO</b> measured disturbance exceeds the disturbance limit             |
| 2 | Non-Compliance is deemed to occur if <b>ANY</b> measured disturbance <b>EXCEEDS</b> the disturbance limit |

If the calculated uncertainty  $U_{lab}$  is **greater** than  $U_{CISPR}$  then:

- |   |  |
|---|--|
| 3 | Compliance is deemed to occur if <b>NO</b> measured disturbance, increased by ( $U_{lab} - U_{CISPR}$ ), exceeds the disturbance limit             |
| 4 | Non-Compliance is deemed to occur if <b>ANY</b> measured disturbance, increased by ( $U_{lab} - U_{CISPR}$ ), <b>EXCEEDS</b> the disturbance limit |