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:	IC Registration Number
UIPSQ757M160	**-**

Product Model Number / HVIN	Product Name / PMN
Aprisa SR	**SX757M160**
Aprisa SR+	**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 **IC Registration 3874A-1** **FCC Registration: CA3874**

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1.0 DOCUMENT CONTROL

Revision History				
Samples Tested By:	Art Voss, P.Eng.	**Date(s) of Evaluation:**		23 Mar - 29 Mar, 2018
Report Prepared By:	Art Voss, P.Eng.	**Report Reviewed By:**		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

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2.0 CLIENT AND DUT INFORMATION

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

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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.

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4.0 TEST SUMMARY

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

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.

Art Voss, P.Eng.
Technical Manager
Celltech Labs Inc.

29 March 2018
Date

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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

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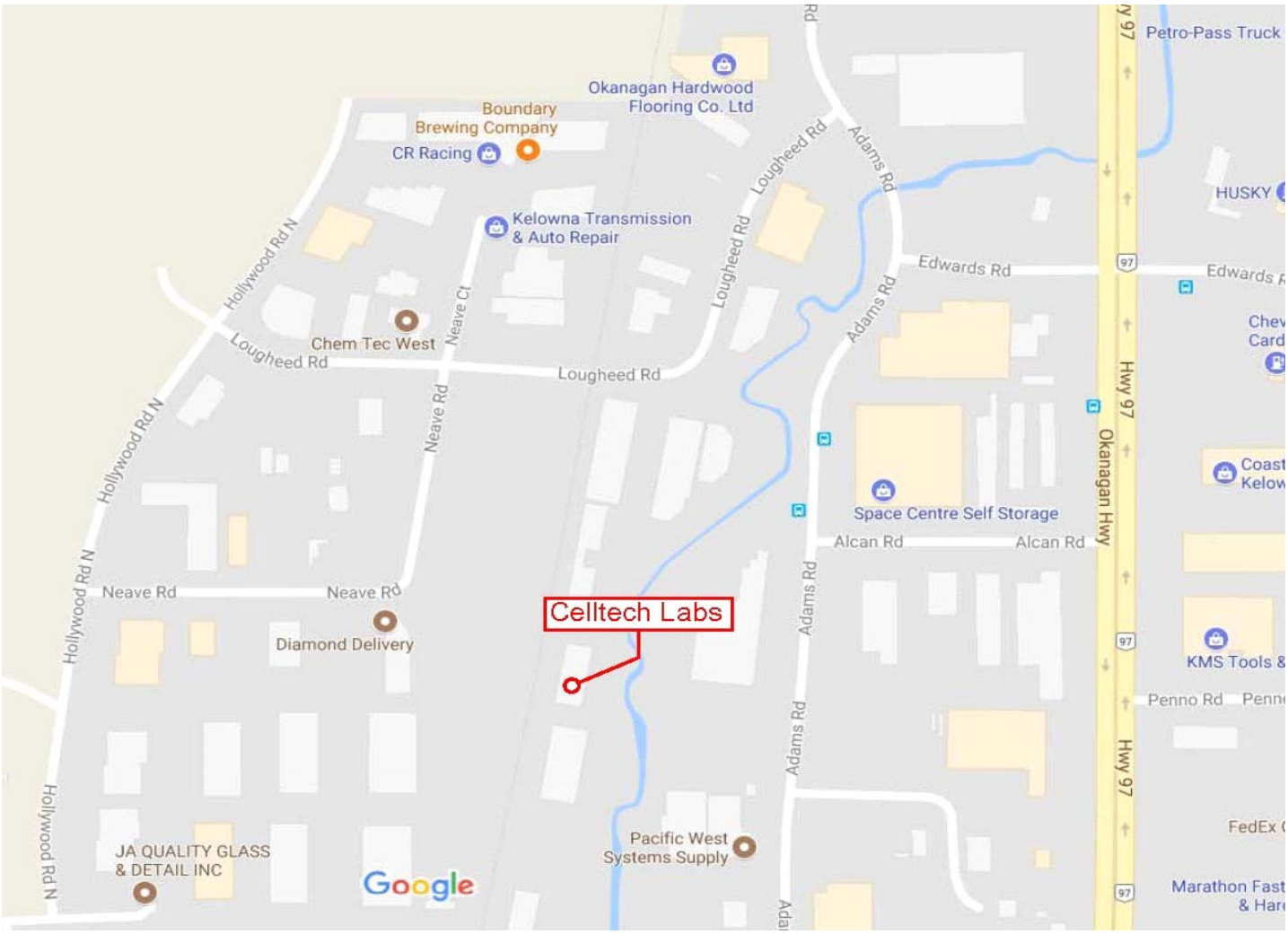
6.0 FACILITIES AND ACCREDITATIONS

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.



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7.0 CONDUCTED POWER

Test Procedure	
Normative Reference	**FCC 47 CFR §2.1046, §27.50(b)(1)**

Limits	
47 CFR §27.50	**§ 27.50 Power Limits and Duty Cycle** (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: (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…

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 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.

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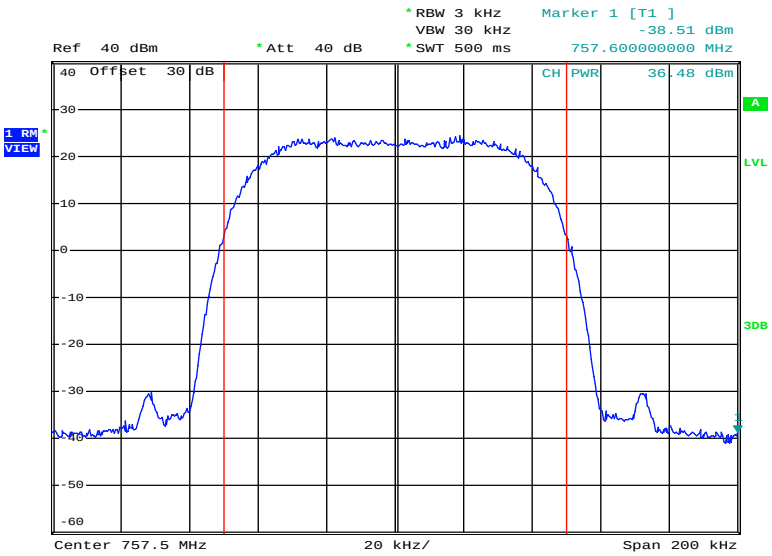
Plot 7.1 – Conducted Power 757.5MHz, 100kHz BW, QPSK

Conducted Power (RMS)

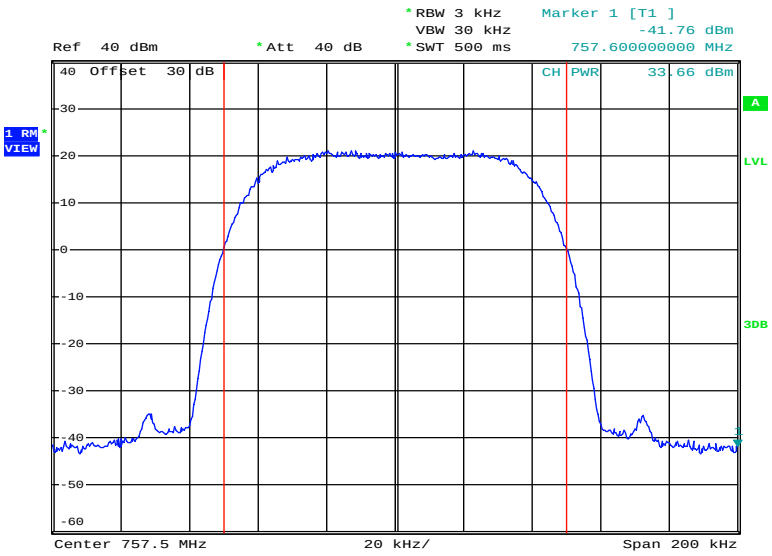


Date: 26.MAR.2018 12:57:50

Channel Frequency (MHz):	757.50
Channel Bandwidth (kHz):	100.00
Modulation:	QPSK
Power Setting (dBm):	37
Measured Channel Power (dBm):	36.48

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

Conducted Power (RMS)



Date: 26.MAR.2018 13:03:11

Channel Frequency (MHz):	757.50
Channel Bandwidth (kHz):	100.00
Modulation:	16QAM
Power Setting (dBm):	35
Measured Channel Power (dBm):	33.66

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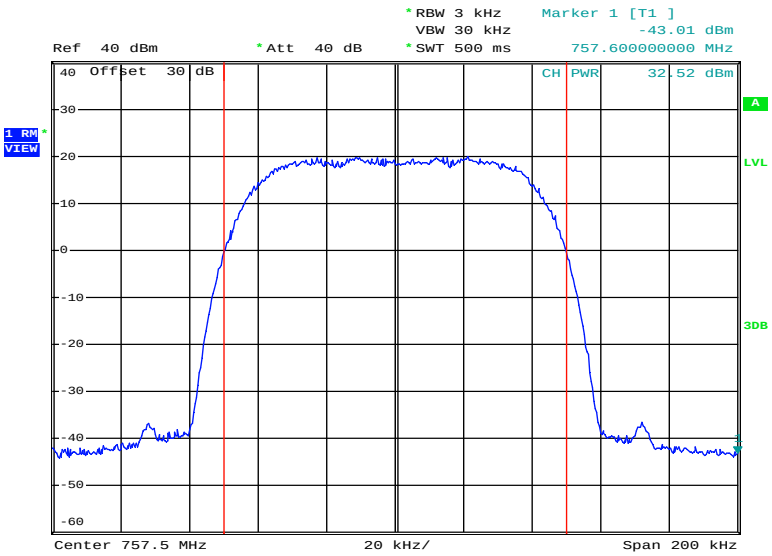
Plot 7.3 – Conducted Power 757.5MHz, 100kHz BW, 64QAM

Conducted Power (RMS)

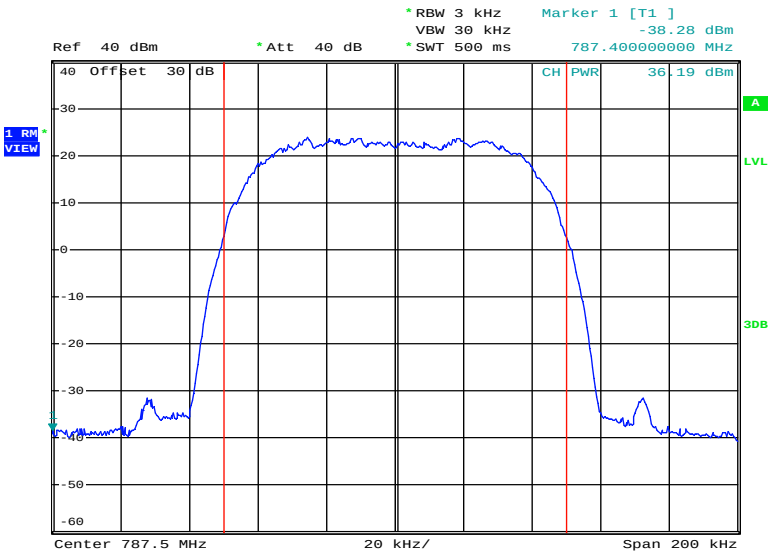


Date: 26.MAR.2018 13:04:58

Channel Frequency (MHz):	757.50
Channel Bandwidth (kHz):	100.00
Modulation:	64QAM
Power Setting (dBm):	34
Measured Channel Power (dBm):	32.52

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

Conducted Power (RMS)



Date: 26.MAR.2018 13:07:08

Channel Frequency (MHz):	787.50
Channel Bandwidth (kHz):	100.00
Modulation:	QPSK
Power Setting (dBm):	37
Measured Channel Power (dBm):	36.19

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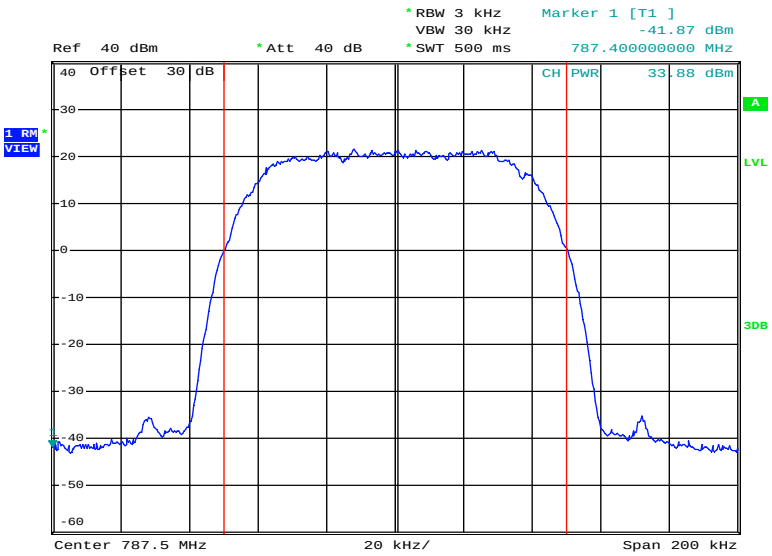
Plot 7.5 – Conducted Power 787.5MHz, 100kHz BW, 16QAM

Conducted Power (RMS)

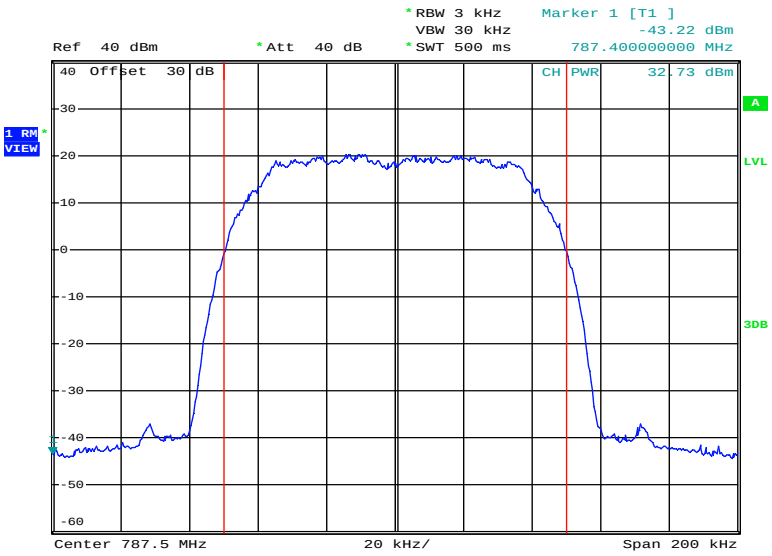


Date: 26.MAR.2018 13:09:01

Channel Frequency (MHz):	787.50
Channel Bandwidth (kHz):	100.00
Modulation:	16QAM
Power Setting (dBm):	35
Measured Channel Power (dBm):	33.88

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

Conducted Power (RMS)



Date: 26.MAR.2018 13:10:43

Channel Frequency (MHz):	787.50
Channel Bandwidth (kHz):	100.00
Modulation:	64QAM
Power Setting (dBm):	34
Measured Channel Power (dBm):	32.73

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Table 7.1 – Summary of Conducted Power Measurements

§27.50 Channel Output Power (RMS)											
Freq (MHz)	BW (kHz)	Modulation	Power Setting(1) (dBm)	Measured Power [E_{Meas}] (dBm)	Antenna Gain(2) [G_T]* (dBi)	Gain Correction [G_C]** (dB)	Cable Loss [L_C] (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**
									Results:		**Complies**

ERP (dBm) = E_{Meas} + GT + GC + LC

Margin = Limit - 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.

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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.

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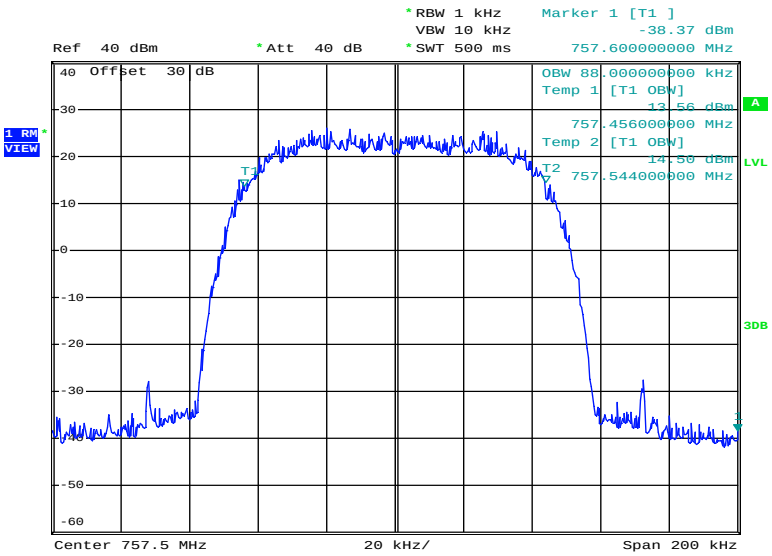
Plot 8.1 – Occupied Bandwidth 757.5MHz, 100kHz BW, QPSK

Occupied Bandwidth

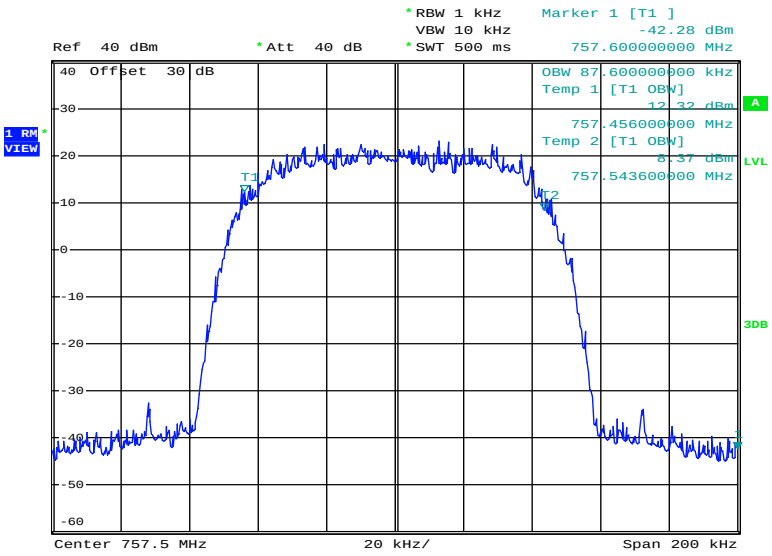


Date: 26.MAR.2018 12:35:26

Channel Frequency (MHz):	757.50
Channel Bandwidth (kHz):	100.00
Modulation:	QPSK
Power Setting (dBm):	37
Measured OBW (kHz):	88.00

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

Occupied Bandwidth



Date: 26.MAR.2018 12:38:12

Channel Frequency (MHz):	757.50
Channel Bandwidth (kHz):	100.00
Modulation:	16QAM
Power Setting (dBm):	35
Measured OBW (kHz):	87.60

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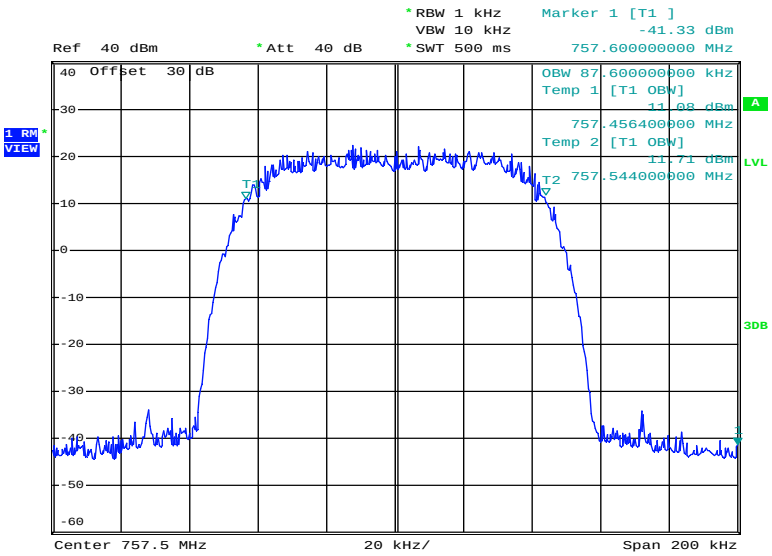
Plot 8.3 – Occupied Bandwidth 757.5MHz, 100kHz BW, 64QAM

Occupied Bandwidth

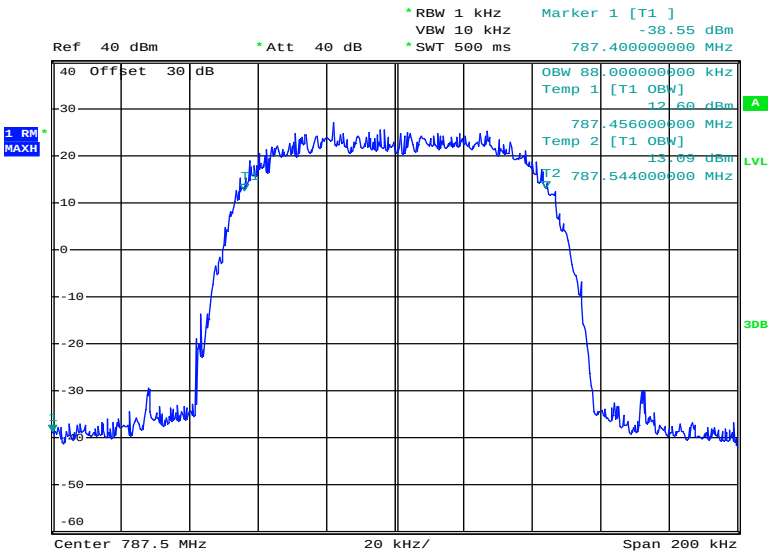


Date: 26.MAR.2018 12:39:30

Channel Frequency (MHz):	757.50
Channel Bandwidth (kHz):	100.00
Modulation:	64QAM
Power Setting (dBm):	34
Measured OBW (kHz):	87.60

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

Occupied Bandwidth



Date: 26.MAR.2018 12:29:12

Channel Frequency (MHz):	787.50
Channel Bandwidth (kHz):	100.00
Modulation:	QPSK
Power Setting (dBm):	37
Measured OBW (kHz):	88.00

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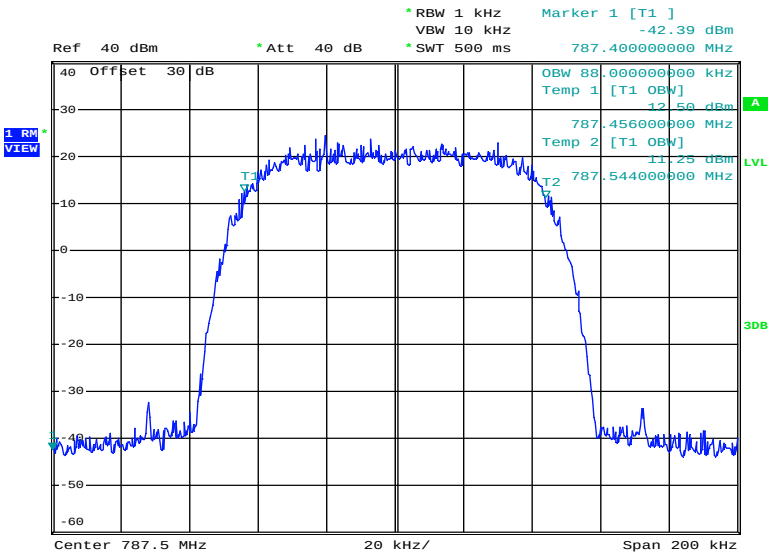
Plot 8.5 – Occupied Bandwidth 787.5MHz, 100kHz BW, 16QAM

Occupied Bandwidth

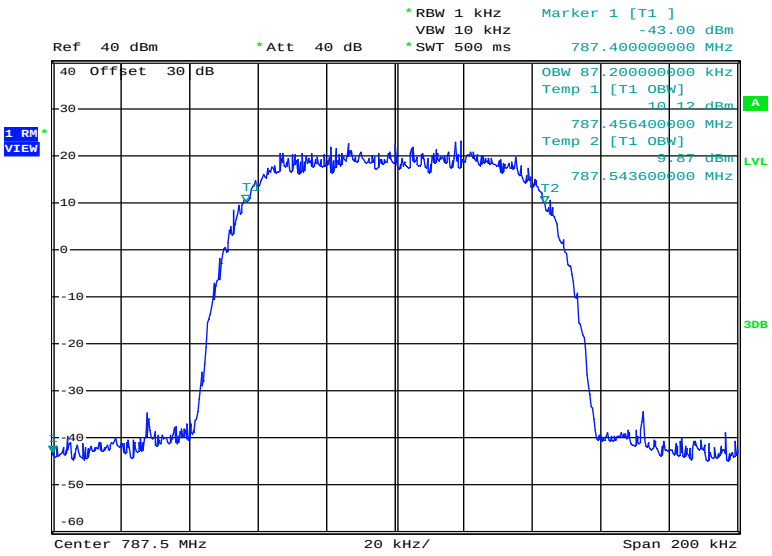


Date: 26.MAR.2018 12:32:10

Channel Frequency (MHz):	787.50
Channel Bandwidth (kHz):	100.00
Modulation:	16QAM
Power Setting (dBm):	35
Measured OBW (kHz):	88.00

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

Occupied Bandwidth



Date: 26.MAR.2018 12:33:25

Channel Frequency (MHz):	787.50
Channel Bandwidth (kHz):	100.00
Modulation:	64QAM
Power Setting (dBm):	34
Measured OBW (kHz):	87.20

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Table 8.1 – Summary of Occupied Bandwidth Measurements

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

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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	**§ 27.53(c) Emission Limits** (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: (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; (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; (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; (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; (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.
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.

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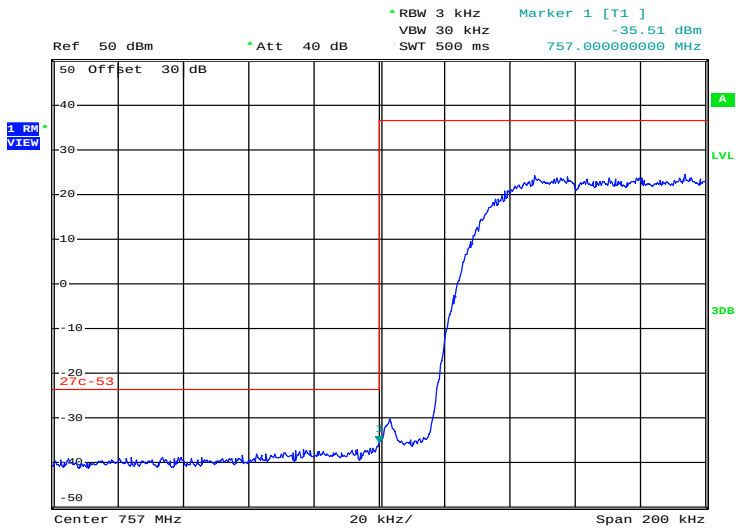
Plot 9.1 – Lower Band Edge, 757MHz, 100kHz BW, QPSK

§27.53(c) Band Edge Compliance

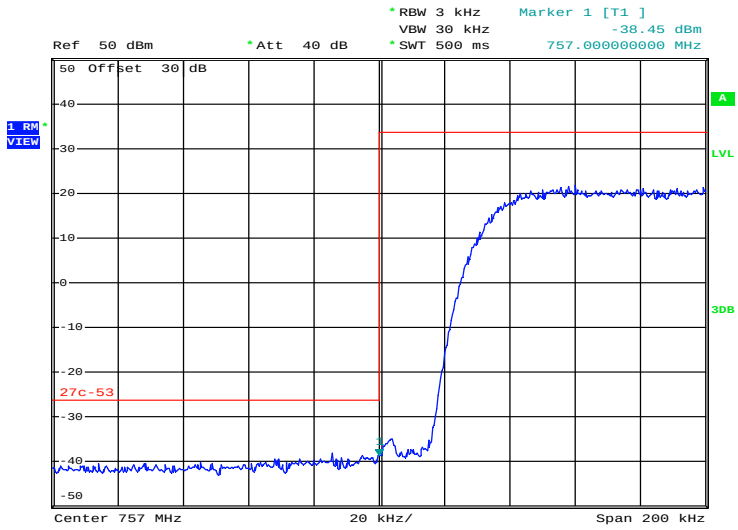


Date: 3.APR.2018 14:22:02

Lower Band Edge (MHz):	757.0000
DUT Channel Frequency (MHz):	757.07500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Channel Power (dBm):	36.48
Emission at Band Edge (dBm):	**-35.51**

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

§27.53(c) Band Edge Compliance



Date: 3.APR.2018 14:24:00

Lower Band Edge (MHz):	757.0000
DUT Channel Frequency (MHz):	757.07500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	16QAM
DUT Channel Power Setting (dBm):	35
Channel Power (dBm):	33.66
Emission at Band Edge (dBm):	**-38.45**

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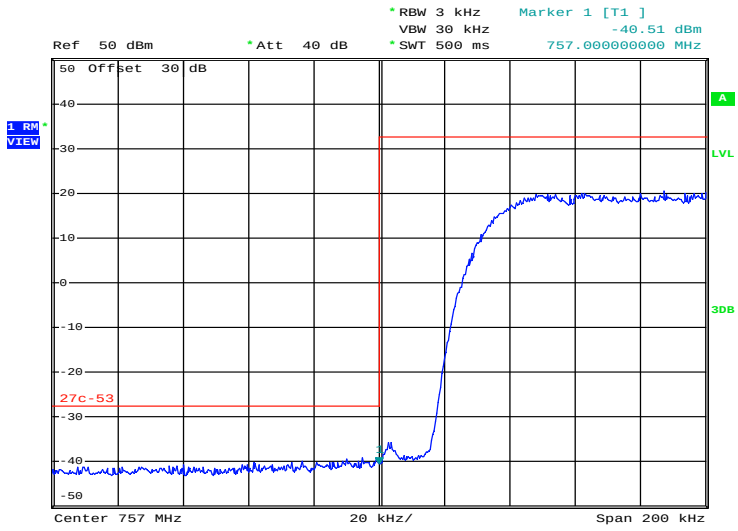
Plot 9.3 – Lower Band Edge, 757MHz, 100kHz BW, 64QAM

§27.53(c) Band Edge Compliance

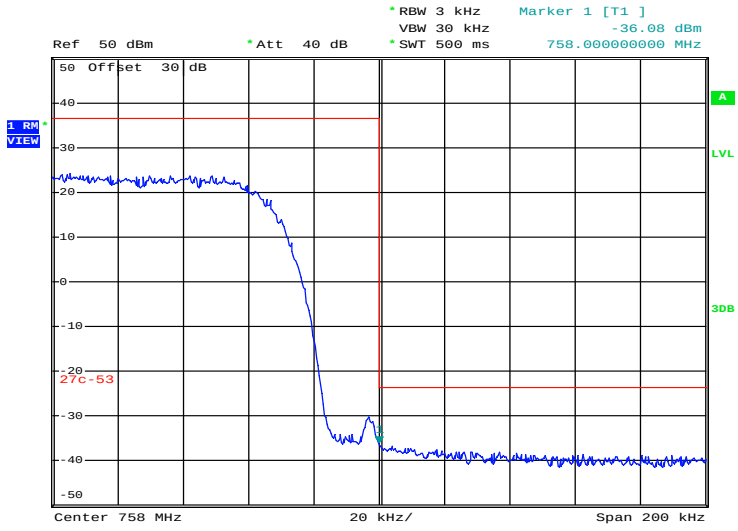


Date: 3.APR.2018 14:26:05

Lower Band Edge (MHz):	757.0000
DUT Channel Frequency (MHz):	757.07500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	64QAM
DUT Channel Power Setting (dBm):	34
Channel Power (dBm):	32.52
Emission at Band Edge (dBm):	**-40.51**

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

§27.53(c) Band Edge Compliance



Date: 3.APR.2018 14:29:51

Upper Band Edge (MHz):	758.0000
DUT Channel Frequency (MHz):	757.92500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Channel Power (dBm):	36.48
Emission at Band Edge (dBm):	**-36.08**

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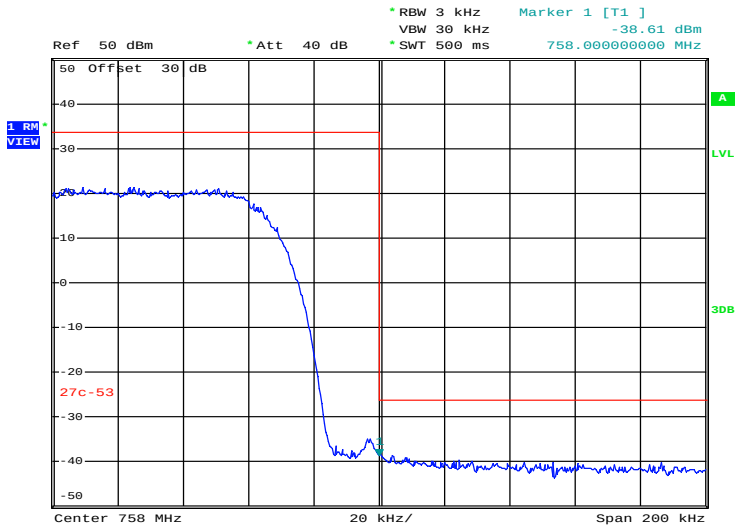
Plot 9.5 – Upper Band Edge, 758MHz, 100kHz BW, 16QAM

§27.53(c) Band Edge Compliance

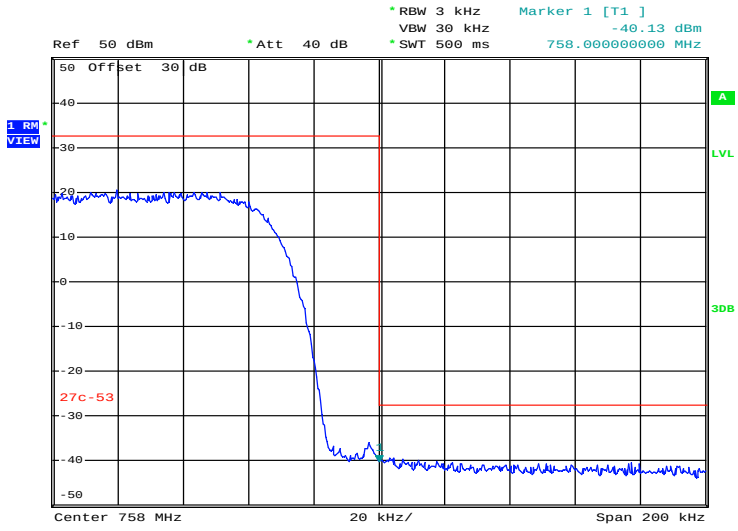


Date: 3.APR.2018 14:31:15

Upper Band Edge (MHz):	758.0000
DUT Channel Frequency (MHz):	757.92500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	16QAM
DUT Channel Power Setting (dBm):	35
Channel Power (dBm):	33.66
Emission at Band Edge (dBm):	**-38.61**

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

§27.53(c) Band Edge Compliance



Date: 3.APR.2018 14:32:28

Upper Band Edge (MHz):	758.0000
DUT Channel Frequency (MHz):	757.92500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	64QAM
DUT Channel Power Setting (dBm):	34
Channel Power (dBm):	32.52
Emission at Band Edge (dBm):	**-40.13**

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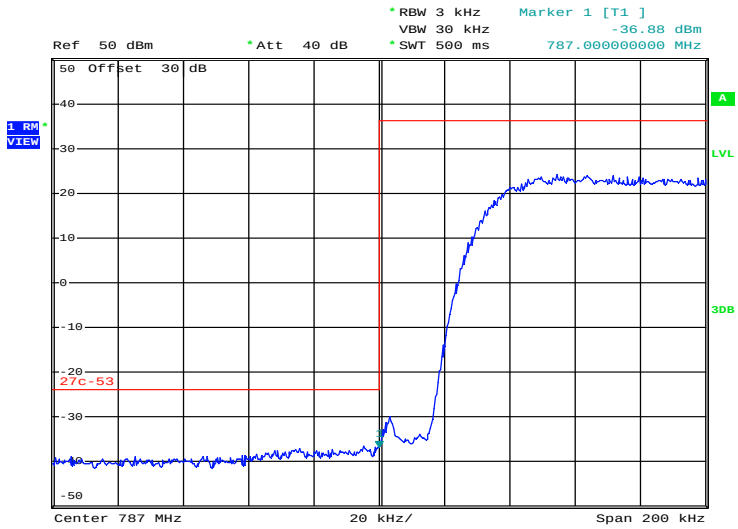
Plot 9.7 – Lower Band Edge, 787MHz, 100kHz BW, QPSK

§27.53(c) Band Edge Compliance

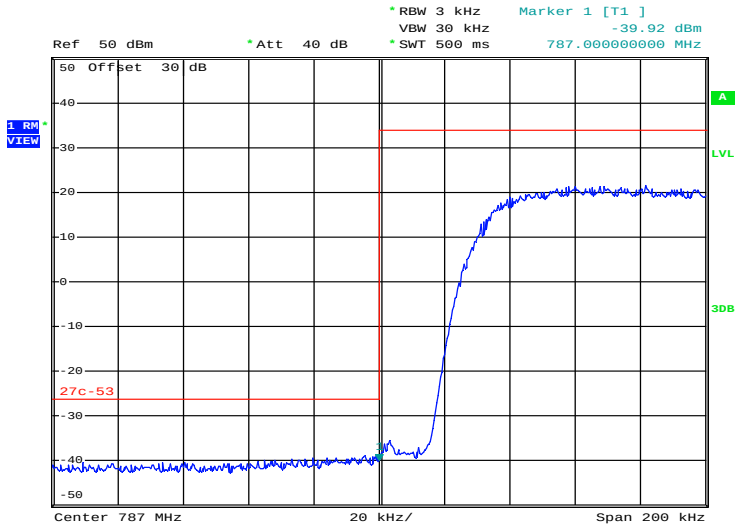


Date: 3.APR.2018 14:34:48

Lower Band Edge (MHz):	787.0000
DUT Channel Frequency (MHz):	787.07500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Channel Power (dBm):	36.19
Emission at Band Edge (dBm):	**-36.88**

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

§27.53(c) Band Edge Compliance



Date: 3.APR.2018 14:36:31

Lower Band Edge (MHz):	787.0000
DUT Channel Frequency (MHz):	787.07500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	16QAM
DUT Channel Power Setting (dBm):	35
Channel Power (dBm):	33.88
Emission at Band Edge (dBm):	**-39.92**

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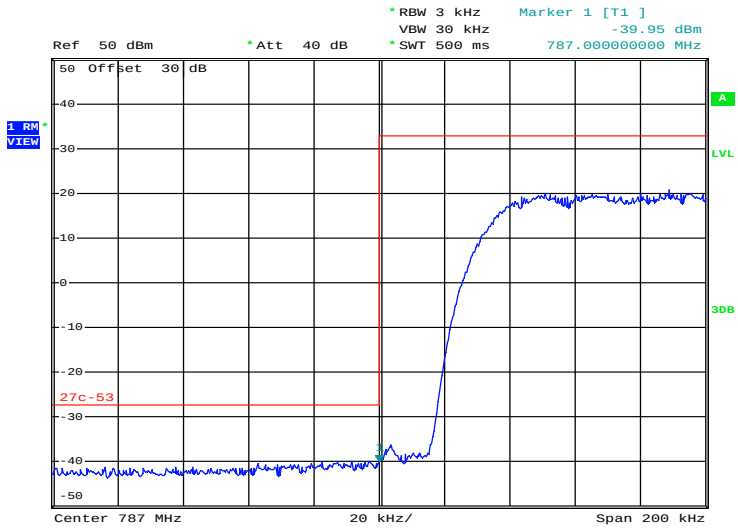
Plot 9.9 – Lower Band Edge, 787MHz, 100kHz BW, 64QAM

§27.53(c) Band Edge Compliance

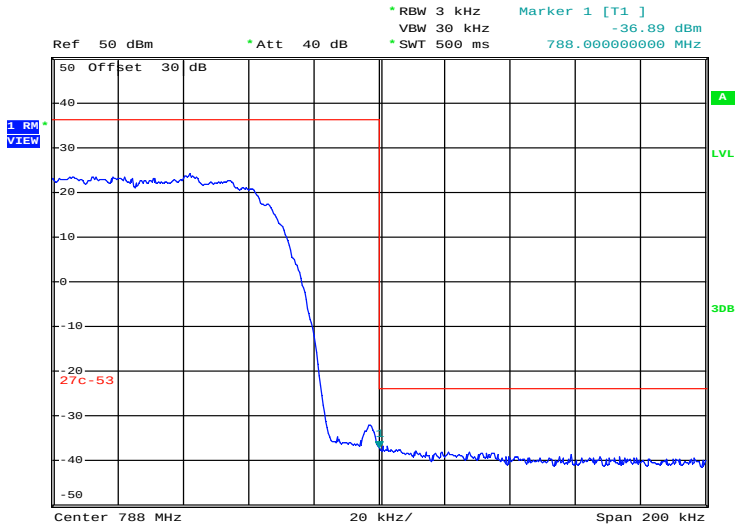


Date: 3.APR.2018 14:38:15

Lower Band Edge (MHz):	787.0000
DUT Channel Frequency (MHz):	787.07500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	64QAM
DUT Channel Power Setting (dBm):	34
Channel Power (dBm):	32.73
Emission at Band Edge (dBm):	**-39.95**

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

§27.53(c) Band Edge Compliance



Date: 3.APR.2018 14:40:08

Upper Band Edge (MHz):	788.0000
DUT Channel Frequency (MHz):	787.92500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Channel Power (dBm):	36.19
Emission at Band Edge (dBm):	**-36.89**

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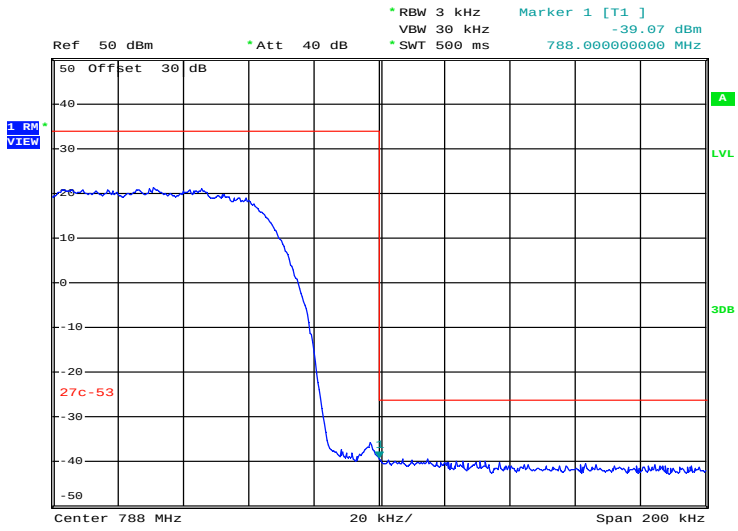
Plot 9.11 – Upper Band Edge, 788MHz, 100kHz BW, 16QAM

§27.53(c) Band Edge Compliance

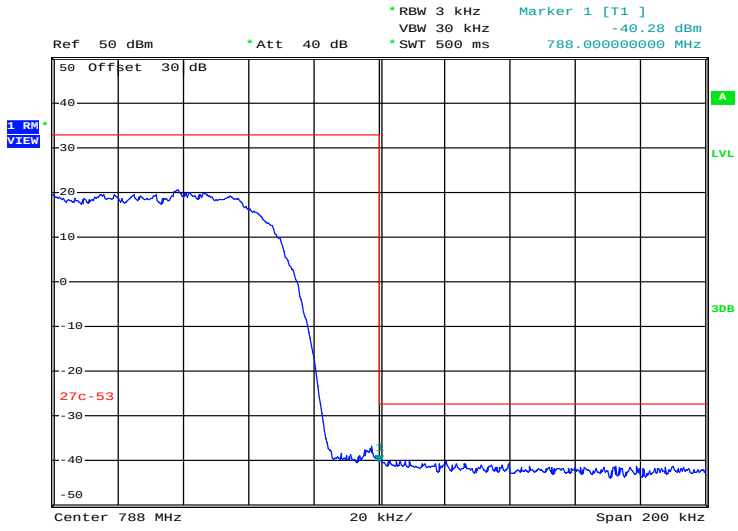


Date: 3.APR.2018 14:41:48

Upper Band Edge (MHz):	788.0000
DUT Channel Frequency (MHz):	787.92500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	16QAM
DUT Channel Power Setting (dBm):	35
Channel Power (dBm):	33.88
Emission at Band Edge (dBm):	**-39.07**

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

§27.53(c) Band Edge Compliance



Date: 3.APR.2018 14:43:21

Upper Band Edge (MHz):	788.0000
DUT Channel Frequency (MHz):	787.92500
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	64QAM
DUT Channel Power Setting (dBm):	34
Channel Power (dBm):	32.73
Emission at Band Edge (dBm):	**-40.28**

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Table 9.1 – Summary of Band Edge Emissions

§27.53(c) Band Edge Results									
Band Edge (MHz)	DUT Frequency (MHz)	Bandwidth Setting (kHz)	Modulation	Tx Power Setting (dBm)	Channel Power [P_{Chan}] (dBm)	Band-Edge Emission @ 3kHz RBW [P_{BE}] (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_{chan}] - [P_{BE}]

For 3kHz Instrument RBW, Limit = 43 + 10Log(P) + 10Log(30kHz/3kHz) = 53 + 10Log(P)

Margin = Attenuation [A] - Limit

Result: Complies

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10.0 CONDUCTED SPURIOUS EMISSIONS – ANTENNA PORT

Test Procedure	
Normative Reference	**FCC 47 CFR §2.1046, §27.53(c)**

Limits	
47 CFR §27.53	**§ 27.53(c) Emission Limits** (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: (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; (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; (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;

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 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.

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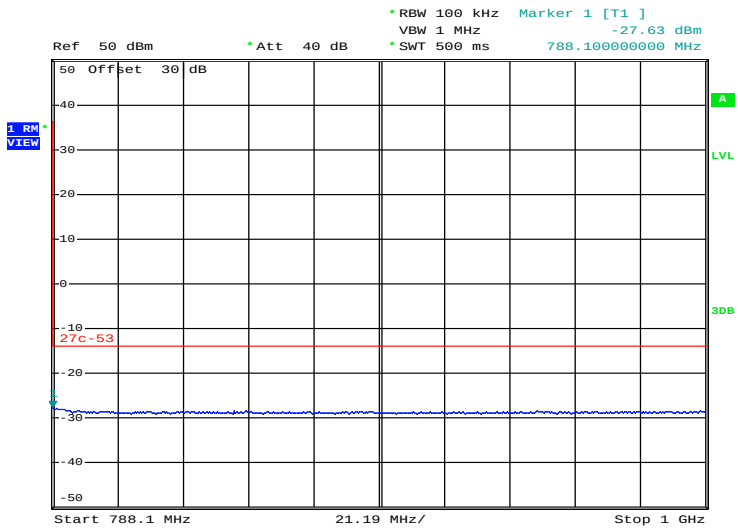
Plot 10.1 – Conducted Spurious Emissions, 758 - 1000MHz, 100kHz BW, QPSK

Conducted Spurious Emission to 10th Harmonic

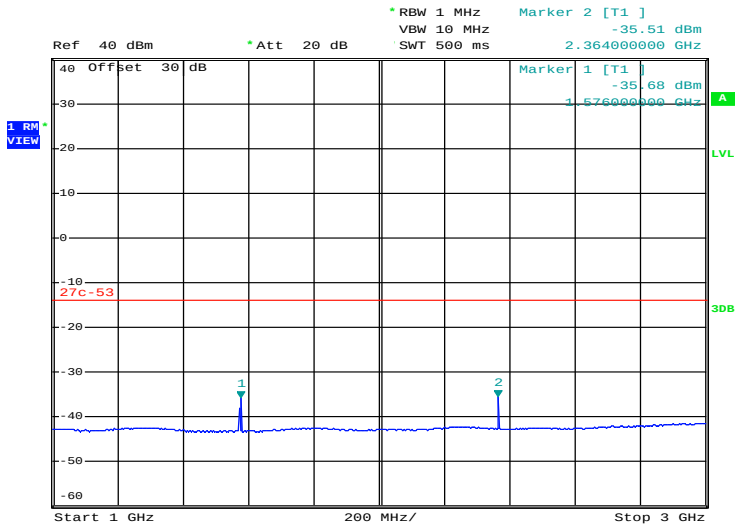


Date: 3.APR.2018 14:51:22

DUT Channel Frequency (MHz):	757.50000
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Frequency Range (MHz):	758-1000
Emission Frequency (MHz):	Reference
Emission Level (dBm):	**None**

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

Conducted Spurious Emission to 10th Harmonic



Date: 3.APR.2018 14:53:29

DUT Channel Frequency (MHz):	787.50000
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Frequency Range (GHz):	1 to 3
Emission Frequency (MHz):	Reference
Emission Level (dBm):	**Reference**

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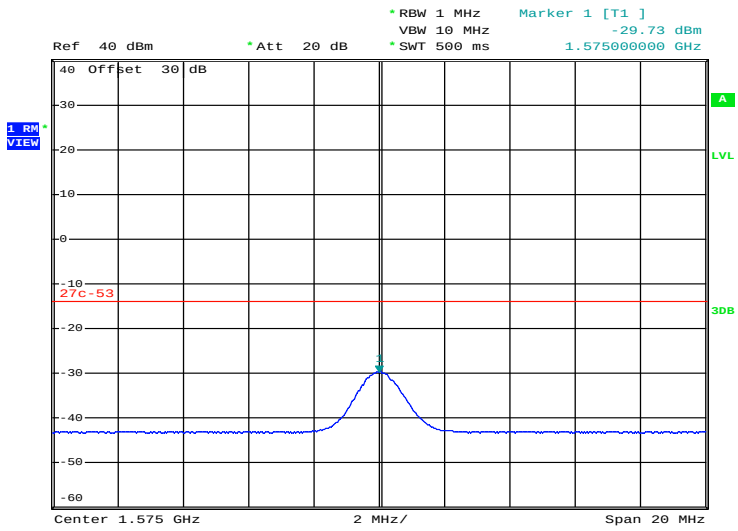
Plot 10.3 – Conducted Spurious Emissions, 1 – 3 GH, 100kHz BW, QPSK

Conducted Spurious Emission to 10th Harmonic

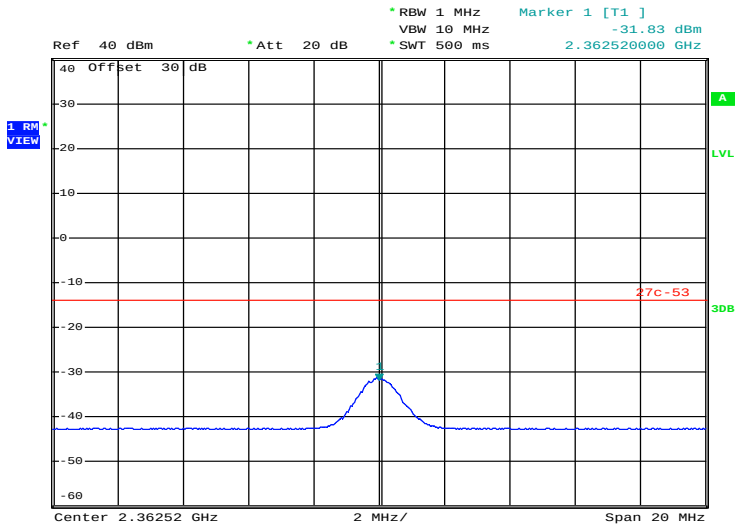


Date: 3.APR.2018 14:55:12

DUT Channel Frequency (MHz):	787.50000
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Frequency Range (GHz):	1 to 3
Emission Frequency (MHz):	1575.00
Emission Level (dBm):	**-29.73**

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

Conducted Spurious Emission to 10th Harmonic



Date: 3.APR.2018 14:56:00

DUT Channel Frequency (MHz):	787.50000
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Frequency Range (GHz):	1 to 3
Emission Frequency (MHz):	2362.50
Emission Level (dBm):	**-31.83**

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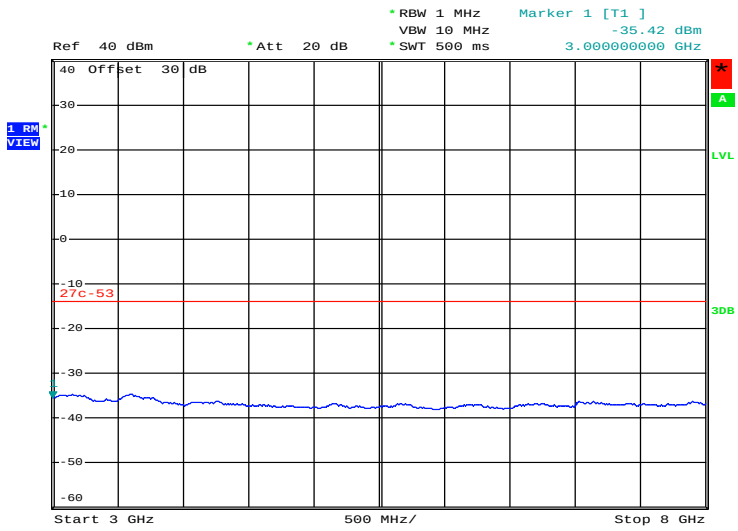
Plot 10.5 – Conducted Spurious Emissions, 3 – 8 GH, 100kHz BW, QPSK

Conducted Spurious Emission to 10th Harmonic



DUT Channel Frequency (MHz):	787.50000
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Frequency Range (GHz):	3 to 8
Emission Frequency (MHz):	Reference
Emission Level (dBm):	None

Table 10.1 – Summary of Conducted Spurious Emissions

Conducted Spurious Emissions Summary

DUT Freq (MHz)	BW (kHz)	Modulation	Power Setting (dBm)	Measured Power [E_{Meas}] (dBm)	Emission Frequency (MHz)	Measured Emission [E_{EM}] (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**
							Results:		**Complies**

Attenuation [A] = E_{Meas} - E_{EM}

Margin = [A] - Limit

No other spurious emissions were observed.

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

Test Procedure	
Normative Reference	**FCC 47 CFR §2.1046, §27.53(c)**

Limits	
47 CFR §27.53	**§ 27.53(c) Emission Limits** (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: (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; (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; (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; (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.

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 10kHz. The output power of the DUT was set to the manufacturer's highest rated setting.

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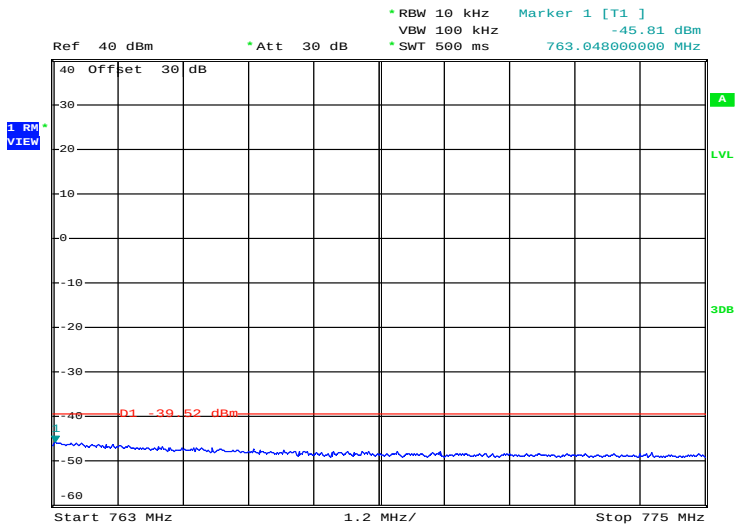
Plot 11.1 – Conducted Emissions 763-775MHz, 100kHz BW, QPSK

Conducted Spurious Emission 763-775MHz

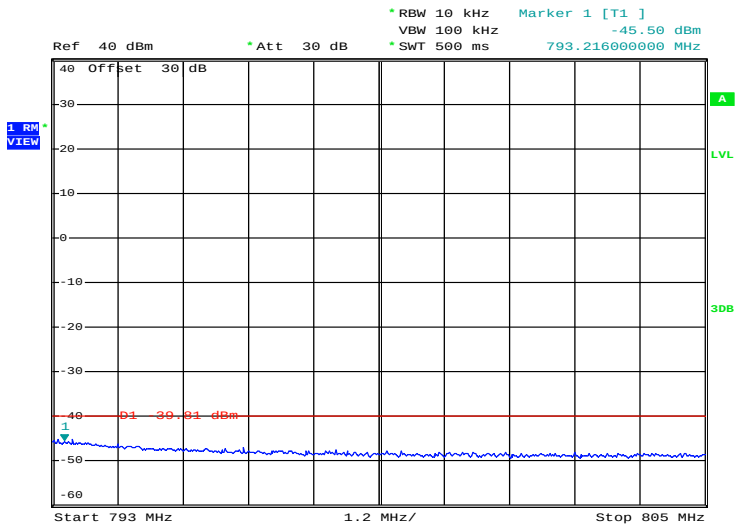


Date: 27.MAR.2018 15:25:25

DUT Channel Frequency (MHz):	757.50000
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Frequency Range (MHz):	763-775
Emission Frequency (MHz):	Reference
Emission Level (dBm):	**None**

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

Conducted Spurious Emission 793-805MHz



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

DUT Channel Frequency (MHz):	757.50000
DUT Channel Bandwidth (kHz):	100.00
DUT Modulation:	QPSK
DUT Channel Power Setting (dBm):	37
Frequency Range (MHz):	793-805
Emission Frequency (MHz):	Reference
Emission Level (dBm):	**None**

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

Conducted Spurious Emissions Summary									
DUT Freq (MHz)	BW (kHz)	Modulation	Power Setting (dBm)	Measured Power [E_{Meas}] (dBm)	Emission Frequency (MHz)	Measured Emission [E_{EM}] (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**
							Results:		**Complies**

Attenuation [A] = E_{Meas} - E_{EM}

Margin = [A] - Limit

No spurious emissions were observed.

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12.0 COMPLIANCE TO §27.53(F)

Test Procedure	
Normative Reference	**FCC 47 CFR §2.1046, §27.53(f)**

Limits	
47 CFR §27.53	**§ 27.53(f) Emission Limits** (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.

Test Setup	Appendix A Figure A.2

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.

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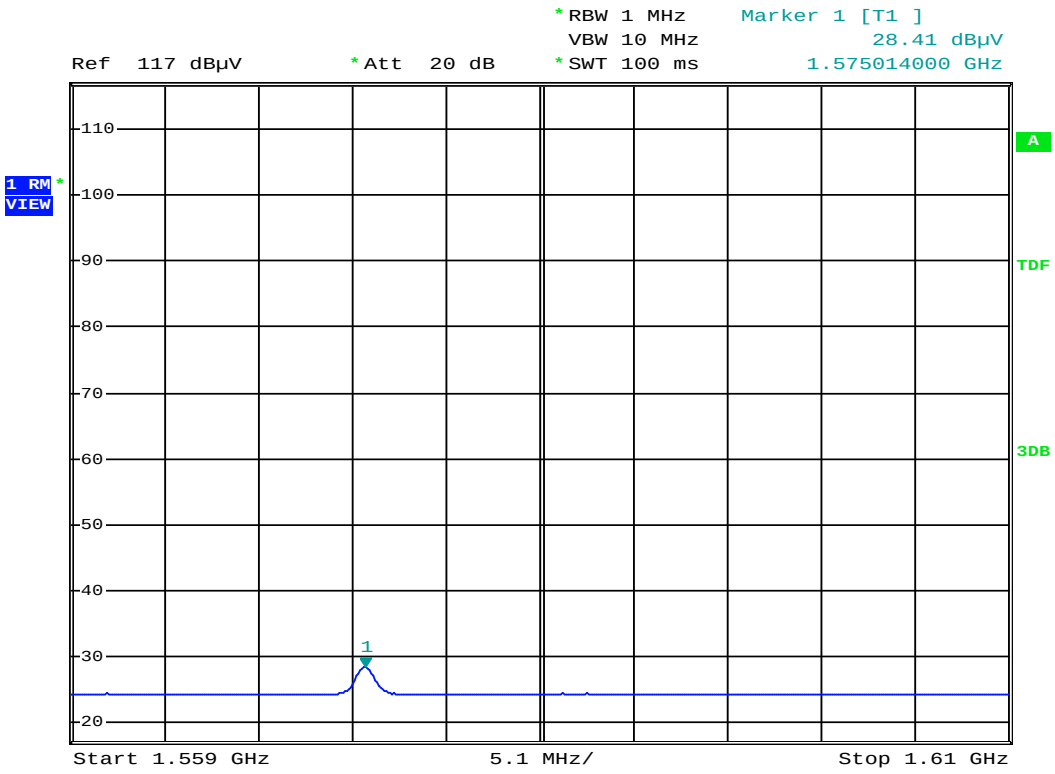
Plot 12.1 – Spurious Emissions 1559 – 1610MHz, 100kHz BW, QPSK, Horizontal

Compliance to 27.53(f)



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

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

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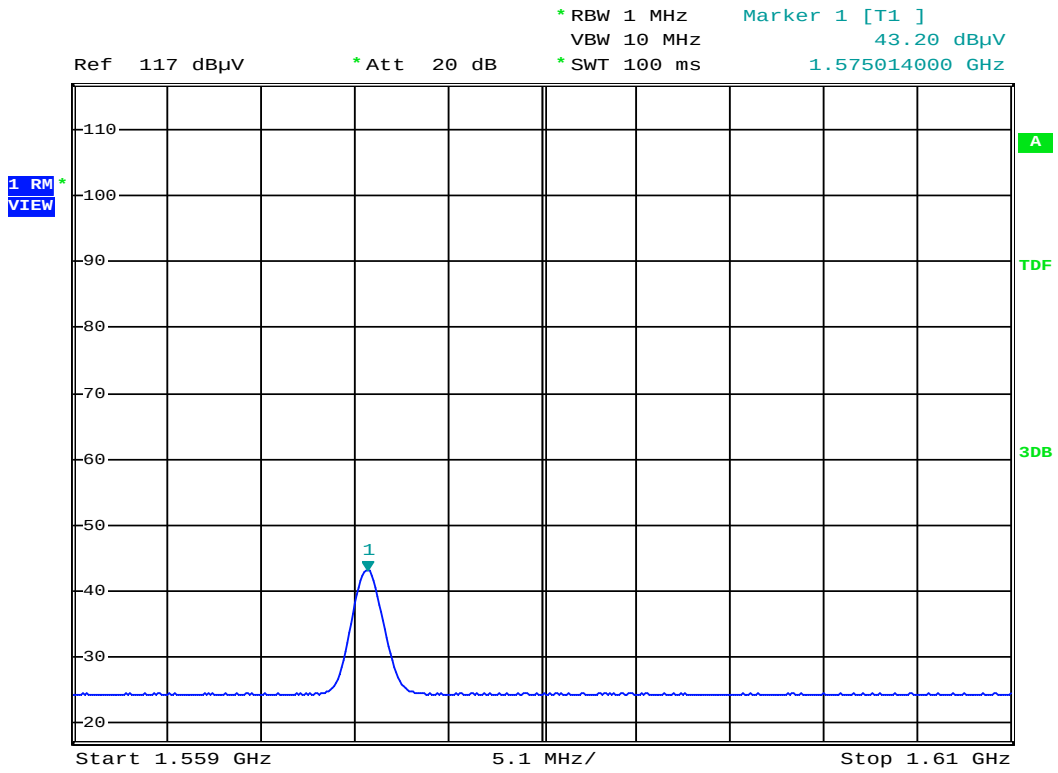
Plot 12.2 – Spurious Emissions 1559 – 1610MHz, 100kHz BW, QPSK, Vertical

Compliance to 27.53(f)



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

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

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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_{Meas}] (dBuV)	Measured Distance [D] (m)	Receive** Antenna Factor [AF] (dB)	Cable Loss [L_C] (dB)	Transmit Antenna Gain [G_T] (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(dBuV/m) = $E_{Meas} + L_C + AF - G_T$

EIRP(dBm) = E(dBuV/m) +20Log(D)*** -104.8

EIRP(dBW) = EIRP(dBm) - 30

*** This term = 0, receive antenna calibrated at 3m

Result: Complies

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APPENDIX A – TEST SETUP DRAWINGS AND CONDITIONS

Table A.1 – Conducted Measurement Setup and Environmental

Environmental Conditions (Typical)	
Temperature	25°C
Humidity	<60%
Barometric Pressure	101 +/- 3kPa

Equipment List			
Asset Number	Manufacturer	Model Number	Description
00241	R&S	FSU40	Spectrum Analyzer

Figure A.1 – Test Setup – Conducted Measurements

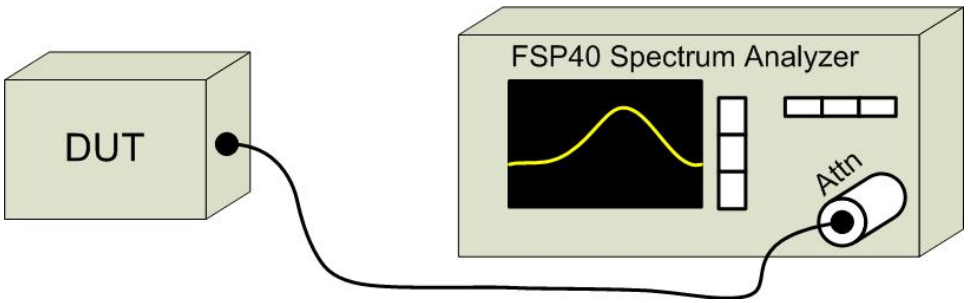

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Table A.2 – Radiated Emissions Measurement Equipment and Environmental

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

Equipment List

Asset Number	Manufacturer	Model Number	Description
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

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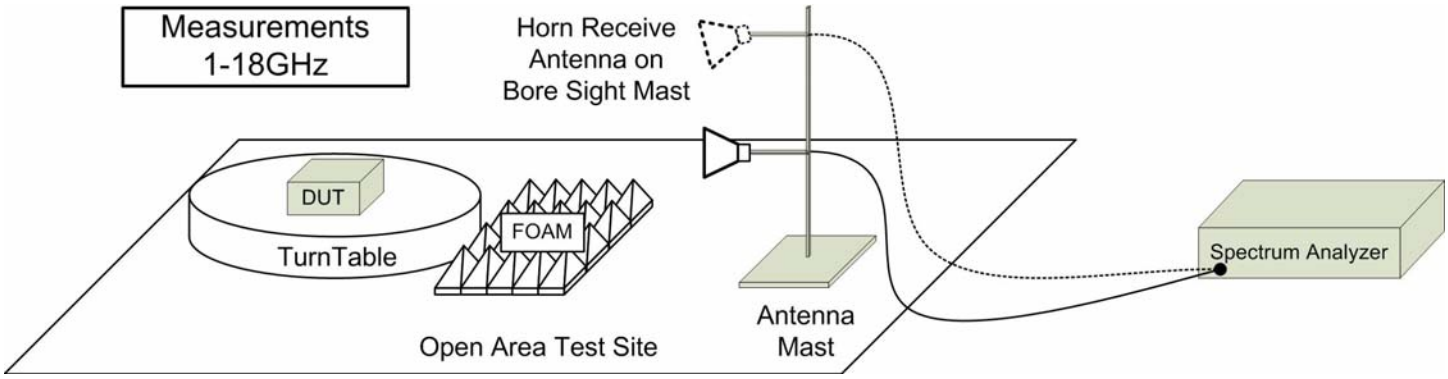
Figure A.3 – Test Setup Radiated Measurements Above 1GHz



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APPENDIX B – EQUIPMENT LIST AND CALIBRATION

Equipment List							
(*)	Asset Number	Manufacturer	Model Number	Serial Number	Description	Last Calibrated	Calibration Interval
*	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
Rented Equipment							
	-						-

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

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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} = 5.14dB U_{CISPR} = 6.3dB	
200MHz - 1000MHz	
U_{LAB} = 5.90dB U_{CISPR} = 6.3dB	
1GHz - 6GHz	
U_{LAB} = 4.80dB U_{CISPR} = 5.2dB	
6GHz - 18GHz	
U_{LAB} = 5.1dB U_{CISPR} = 5.5dB	
If the calculated uncertainty **U_{lab}** is **less** than **U_{CISPR}** then:	
1	Compliance is deemed to occur if **NO** measured disturbance exceeds the disturbance limit
2	Non-Compliance is deemed to occur if **ANY** measured disturbance **EXCEEDS** the disturbance limit
If the calculated uncertainty **U_{lab}** is **greater** than **U_{CISPR}** then:	
3	Compliance is deemed to occur if **NO** measured disturbance, increased by (**U_{lab} - U_{CISPR}**), exceeds the disturbance limit
4	Non-Compliance is deemed to occur if **ANY** measured disturbance, increased by (**U_{lab} - U_{CISPR}**), **EXCEEDS** the disturbance limit

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