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FCC PART 87
TEST REPORT

APPLICANT	ROCKWELL COLLINS, INC.
	1300 WILSON BLVD. SUITE 200 ARLINGTON VA 22209 USA
FCC ID	AJKPN822-0336
MODEL NUMBER	TPR-901
PRODUCT DESCRIPTION	AVIATION TRANSPONDER
DATE SAMPLE RECEIVED	11/6/2017
DATE TESTED	11/7/2017
TESTED BY	Tim Royer
APPROVED BY	Sid Sanders
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
1921AUT17TestReport	Rev1	Initial Issue	11/9/2017
1921AUT17TestReport	Rev2	Updated administrative info	3/23/2018

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.

☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Tested by:
Name and Title: Tim Royer, Project Manager/Testing Engineer

Sr. EMC Engineer
EMC-003838-NE

Date: 11/9/2017

Reviewed and approved by: Name and Title: Sid Sanders, Engineer

Date: 11/10/2017

GENERAL INFORMATION

EUT Specification

EUT Description	AVIATION TRANSPONDER
FCC ID	AJKPN822-0336
Model Number	TPR-901
Operating Frequency	1090 MHz-1090 MHz
Test Frequencies	1090 MHz
Emission Designator	14M0M1D
Type of Emission	Pulse
Modulation	PM, DPSK
EUT Power Source	☒ 115Vac/400 Hz
	☐ DC Power
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☐ Pre-Production
	☒ Production
Type of Equipment	☐ Fixed
	☒ Mobile
	☐ Portable
Test Conditions	The temperature was 26ºC with a relative humidity of 50%. Atmospheric Pressure: 30.01”
Revision History to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode running ATCRBS and Mode-S simultaneously.
Applicable Standards	**ANSI/TIA 603-E:2016,** FCC CFR 47 Part 87
Test Facility	**Timco Engineering Inc.** **849 NW State Road 45** **Newberry, FL 32669 USA.** **Designation #: US1070**

RESULTS SUMMARY

FCC Rule Part	Requirement	Result
2.201, 87.137	Emission Types	Pass
2.1047, 87.141	Modulation Characteristics	Pass
2.1046, 87.131	RF Power Output	Pass
2.1049, 87.135, 87.139	Occupied Bandwidth	Pass
2.1051, 87.139	Spurious Emissions at Antenna Terminals	Pass
2.1053, 87.139	Field Strength of Spurious Emissions	Pass
2.1055, 87.133	Frequency Stability	Pass

EMISSION TYPE

Rule Part No.: Part 2.201, Part 87.137

Requirements: The assignable emissions, corresponding emission designators and authorized bandwidths are as listed in the rule part 87.137(a)

Test Data: 14M0M1D Description

Mode S and ATCRBS, avionics transponder

The emission designator is defined in the referenced aviation standards, and defined in part 87.137(a) is 14M0M1D

MODULATION CHARACTERISTICS

Rule Part No.: Part 2.1047**,** Part 87.141,

Requirements: A curve or equivalent data shall be submitted

The EUT complies with the following characteristics which are defined in the aviation standards and regulations referenced above in this report. The requirements of 47CFR 2.1047 and applicable paragraphs of Part 87.141 are met. There are no deviations to the specifications.

Test Data: 14M0M1D Specifications

Pulse Type	Specification	Data	Unit
Mode-A/C	Rise Time (10%/90%)	0.1	us
Mode-A/C	Fall Time (90%/10%)	0.2	us
Mode-A/C	Pulse Width	0.45 ± 0.1	us

Results meet requirements

RF POWER OUTPUT

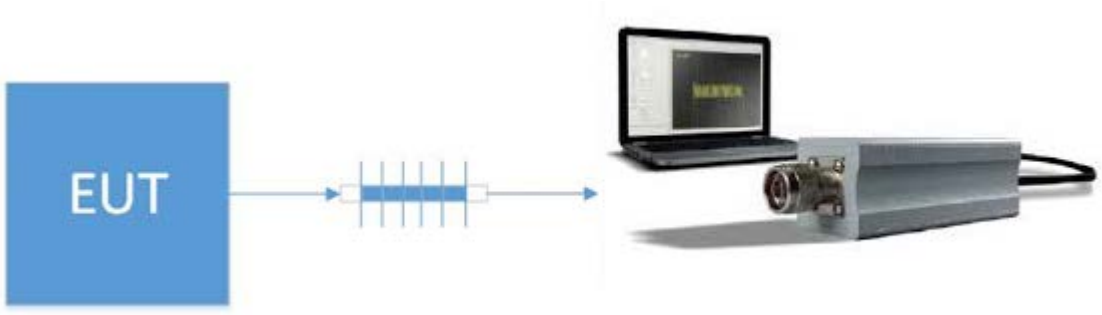
Rule Part No.: Part 2.1046, Part 87.131

Requirements: Manufacturers Specifications

Procedure: RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage and the transmitter properly adjusted the RF output measures:

For the Device has a fixed antenna, RF power is measured as ERP as the antenna is permanently attached. The substitution method was used. With a nominal battery voltage and the transmitter properly adjusted the RF output measures:

Setup Diagram:

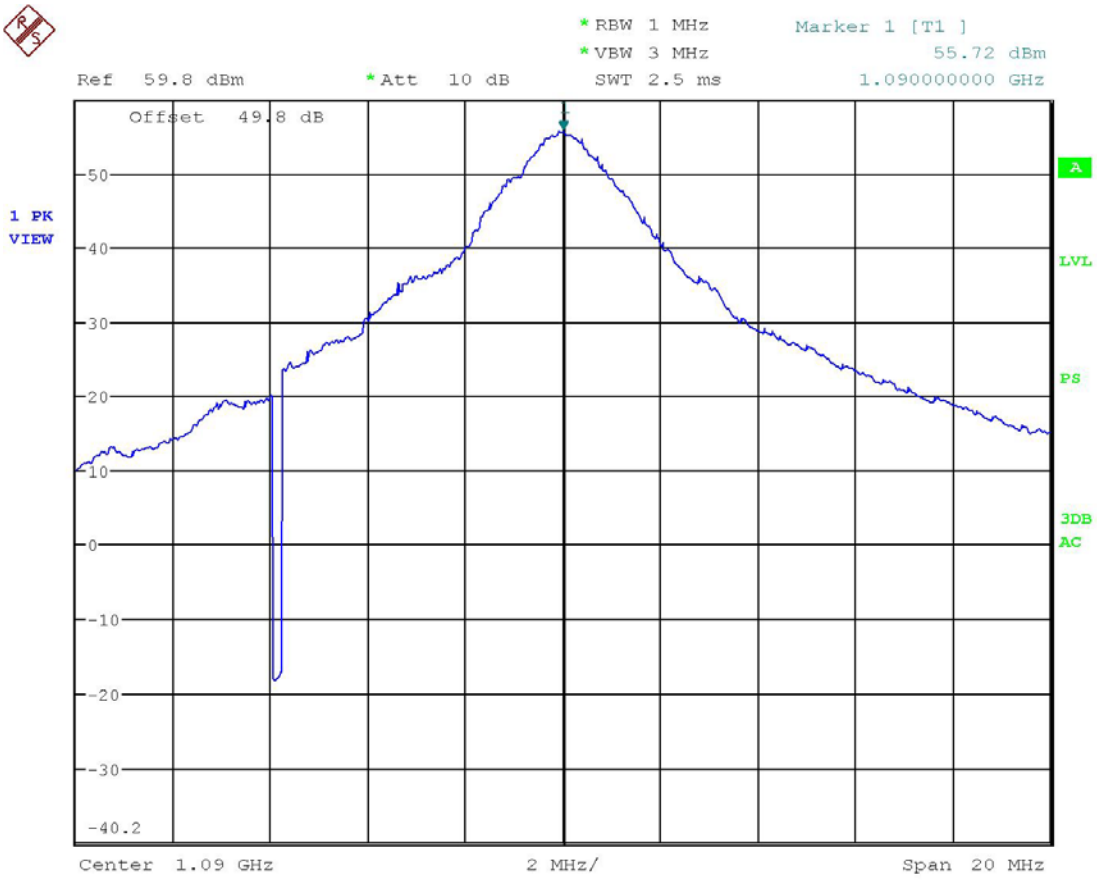


Test Data: Peak Measurement Table

Tuned Freq (MHz)	Pconducted (dBm)	Pconducted (W)
1090	55.72	373.3

RF OUTPUT POWER

Test Data: 14M0M1D Plot



Date: 7.NOV.2017 15:44:11

OCCUPIED BANDWIDTH

Rule Part No.: 2.1049, 87.135, 87.135, 87.139

Test Requirements: see below

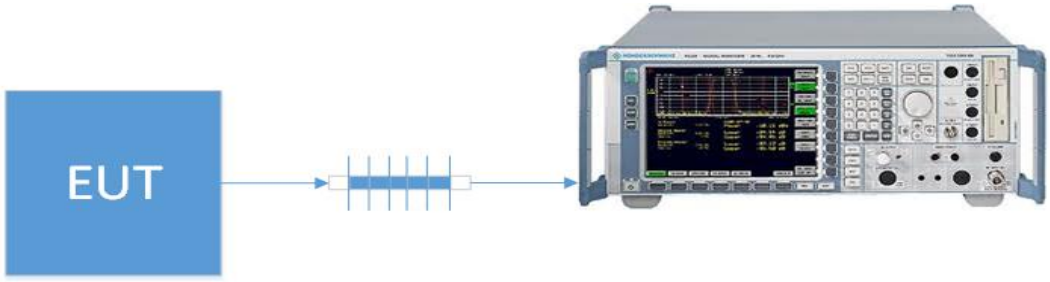
14M0M1D:
(1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth the attenuation must be at least 25 dB;

(2) When the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth the attenuation must be at least 35 dB.

(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 40 dB; and the attenuation for aeronautical station transmitters must be at least 43 + 10 $\log_{10}$ pY dB.

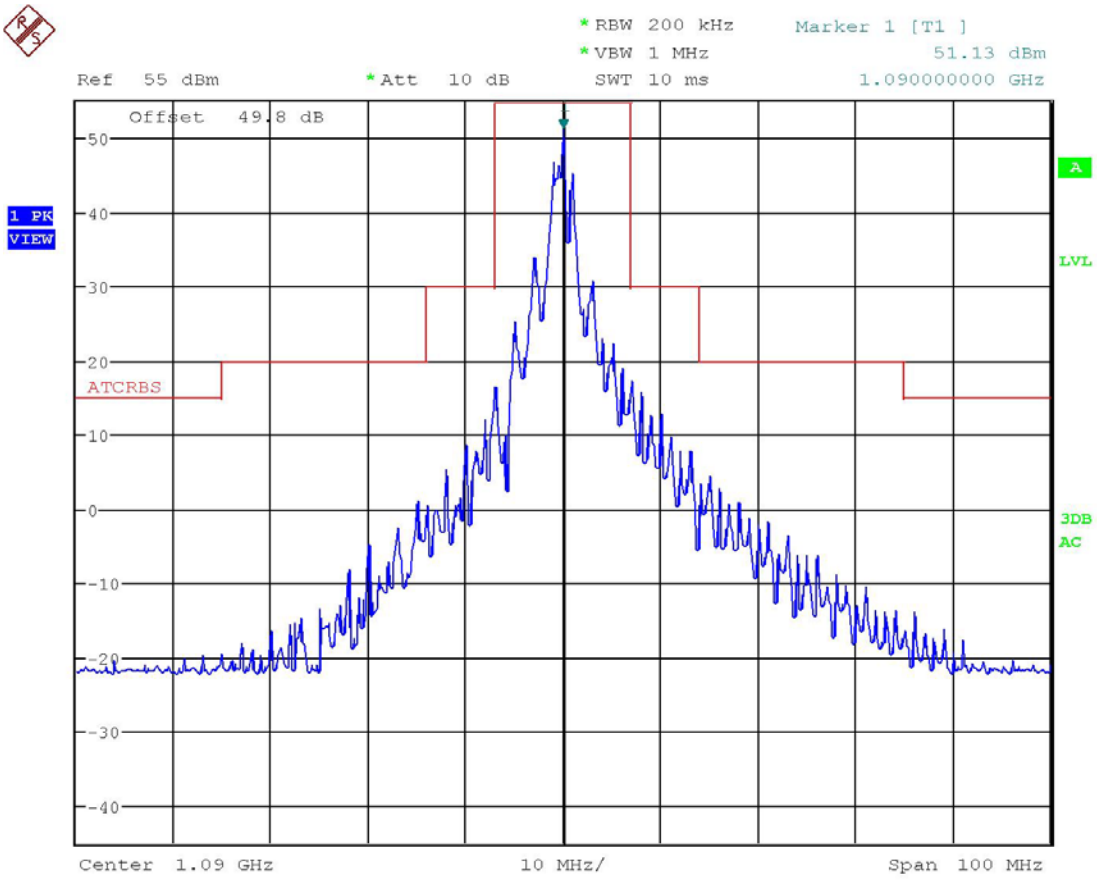
Method of Measurement: as referenced above

Test Setup Diagram:



The authorized BW is 14 kHz.

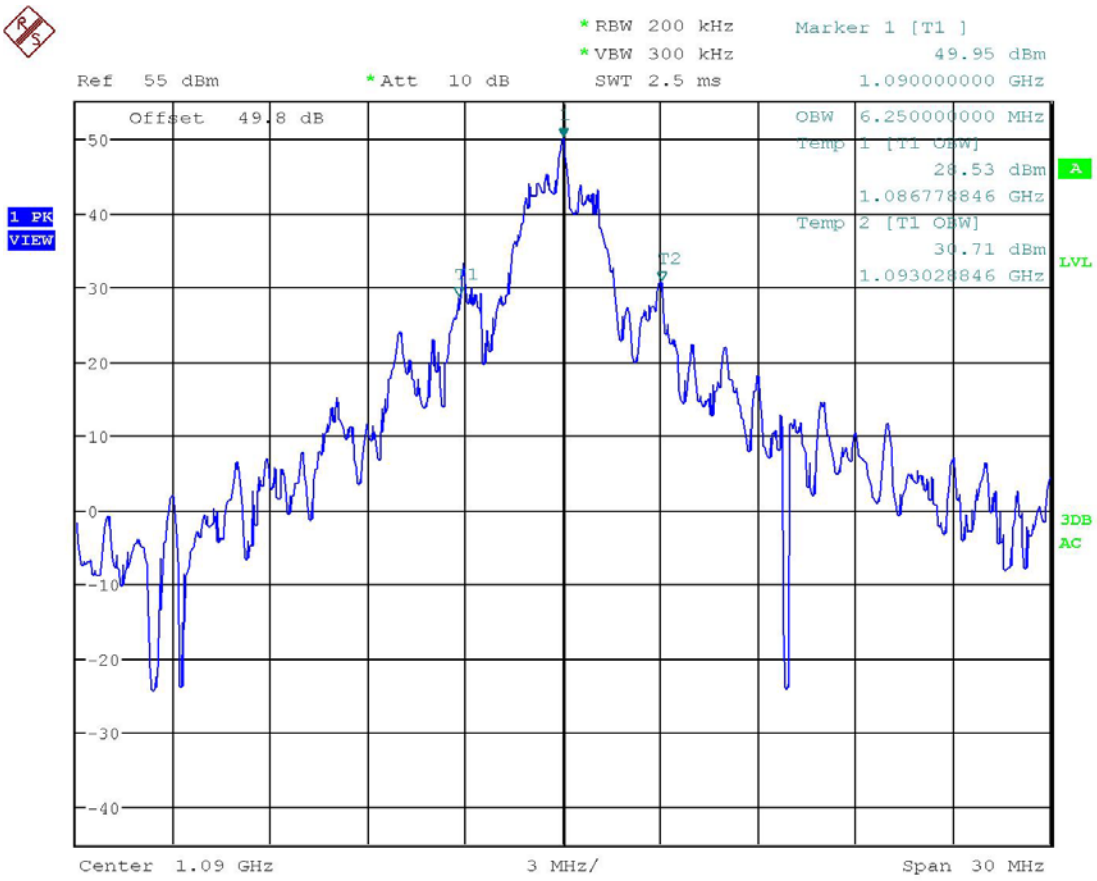
Test Data:



Date: 8.NOV.2017 10:00:41

OCCUPIED BANDWIDTH

Test Data: 14M0M1D 99% OBW Plot



Date: 8.NOV.2017 11:18:59

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051, 87.139

Requirements: see below

14M0M1D:
When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 40 dB; and the attenuation for aeronautical station transmitters must be at least 43 + 10 $\log_{10}$ pY dB.

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

Test Data: 14M0M1D Measurement Table

Power Output	dBm	Watts	Limit (dBc)
	55.72	373.25	68.72

Frequency		dBc	Margin
(fundamental)	1090.000	0.00	0.00
*	2180.000	87.89	19.17
*	3270.000	86.57	17.85
*	4360.000	86.57	17.85
*	5450.000	86.57	17.85
*	6540.000	87.42	18.70
*	7630.000	87.42	18.70
*	8720.000	88.17	19.45
*	9810.000	88.17	19.45
*	10900.000	88.17	19.45

* Indicates Noise Floor

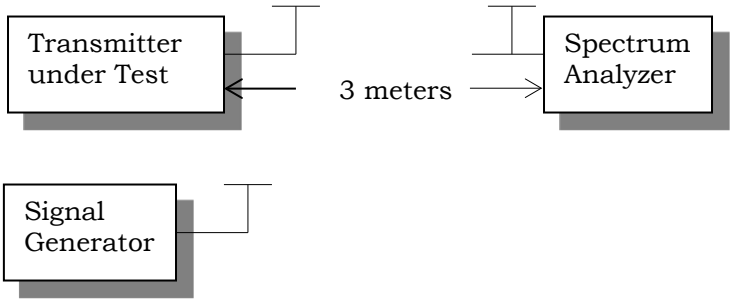
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

Test Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

Method of Measurements: The spectrum was scanned from 9 KHz to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method.

Test Setup Diagram:



Test Data:

Power Output	dBm		Watts	Limit (dBc)
	50.18		104.23	70.18
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	erp (dBmW)	Margin
1090.00	2180.00	V	-55.0592	35.06
1090.00	3270.00	H	-52.8452	32.85
1090.00	4360.00	H	-52.8752	32.88
1090.00	5450.00	H	-50.6672	30.67
1090.00	6540.00	H	-50.4212	30.42
1090.00	7630.00	H	-48.9632	28.96
1090.00	8720.00	H	-48.3092	28.31
1090.00	9810.00	H	-45.6022	25.60
1090.00	10900.00	H	-44.6372	24.64

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 87.133

Requirements: Temperature range requirements: -30 to +50º C.
Voltage Variation +, -15% ±1000 PPM

Method of Measurements: TIA/EIA Specification 603

Test Data: **Measurement Table**

Temperature	Frequency MHz	Hz	PPM
25°C (reference)	1090040.064		
-30°C	1090016.064	-24000000	-22.018
-20°C	1090016.025	-24039000	-22.053
-10°C	1090016.026	-24038000	-22.052
0°C	1090016.026	-24038000	-22.052
10°C	1090016.026	-24038000	-22.052
20°C	1090017.628	-22436000	-20.583
30°C	1090011.218	-28846000	-26.463
40°C	1090001.603	-38461000	-35.284
50°C	1089995.192	-44872000	-41.165
Battery Voltage	Frequency	Hz	PPM
-15%	1090040.064	0	0.000
15%	1090040.064	0	0.000

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Coaxial Cable - BMBM-0065-01 Black DC-2G	Belden		BMBM-0065-01	07/18/16	07/18/18
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	09/01/16	09/01/18
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 ; KMKM-0670-01; KFKF-0197-00	NA	NA
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Sweep/Signal Generator	Anritsu	68369B	985112	10/28/15	11/28/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/19
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	NA	NA
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Non Radiating 50 OHM Load	Sierra Elec	160B-600X	1038	09/13/16	09/13/18
Attenuator N 20dB 2W DC-13G	Narda	777C	36124	05/24/17	05/23/19
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	NA	NA
High Pass Filter 980MHz	Microlab	HA-20N		06/17/15	11/17/17

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

STATE OF THE MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Audio Frequency Response	±1.86dB	
Modulation limiting	±1.88%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. Within 6kHz and 25kHz of audio Freq.	 ±1.88% ±2.04%	
Rad Emissions Sub Meth up to 26.5GHz	±2.14dB	
Adjacent channel power	±1.47dB	(1)
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

END OF REPORT